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.

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Event and Comment

Queensland's Agricultural and Pastoral Year.

GENERALLY, the year in agriculture and animal husbandry was one of high production and sound progress, as set out by the Under Secretary of the Department of Agriculture and Stock, Mr. R. P. M. Short, in his annual report to the Minister, Hon. Frank W. Bulcock, for the year ended 30th June last, which was presented to Parliament in the course of the month. In the course of his review, Mr. Short stated that the estimated number of sheep is slightly below the record total of the previous year, but it is higher than the total for any other year. The estimated number of cattle is the highest total recorded since 1st January, 1926.

Fat lamb production is making satisfactory progress. Numbers have increased and quality has improved.

The natural grasses over large tracts of Central and Western Queensland have made an excellent recovery, and pastures, although mostly dry at the close of the year, are sufficient to maintain sheep for several months to come.

Registrations of horse and cattle brands show an increase for the year, but there was a slight decrease in the number of sheep brands and earmarks registered.

It has been possible during the year to consolidate and improve the veterinary services supplied to stockowners of the State, and all departmental activities in connection with animal diseases are now co-ordinated by the office of the Director of Veterinary Services.

There have been no major outbreaks of animal disease, but the buffalo fly spread to some extent owing to the particularly favourable climatic factors operating in the Gulf country. Because of the risk of the spread of this pest to areas of dense cattle population on the coast, vigorous preventive measures are being adopted, and spraying plants have been erected at selected centres on the Northern railways.

To ascertain the position more exactly and to enable proper investigations to be carried out, several important stock diseases have been the subject of special survey and inquiry.

The Animal Health Stations at Yeerongpilly and Oonoonba have continued to render valuable service to stockowners of Queensland. Vaccine and other materials prepared by these stations have given excellent results to users. Work has been continued in conjunction with the Poison Plants Committee into the testing of suspected poisonous plants, and a number of plants were submitted during the year for feeding purposes.

The output of 759,000 tons of sugar manufactured from 5,180,000 tons of cane was 132,000 tons below the record yield of the previous year. The full crop was satisfactorily disposed of at a gross value of just over £13,000,000. The average price per ton was the best since that of the 1932 season. The preliminary estimates for the 1941 season suggest that a similar crop to that of 1940 will be available for harvest. The Government has acquired the full 1939 peak quotas for each mill which, if filled, would provide 737,000 tons. The actual production within these limits is likely to be something slightly less than the full quota. Greater difficulty is anticipated in regulating overseas shipments, and it is probable that much of the production of the current season will have to be stored.

Good early rains were experienced and wheat sowings were completed under excellent conditions. The quantity of wheat harvested for grain totalled 5,600,000 bushels from an area of 302,003 acres. For the third year in succession the yield was considerably above the average, and the grain was of high quality. Queensland-bred wheats continue to increase in cultivation, and now constitute approximately 77 per cent. of the total acreage sown.

Returns from the maize districts indicate that both the total area sown and the total yield of grain will be above the average for the State. Because of prolonged wet weather during the ripening of the crop and during the harvesting period, yields on the Atherton Tableland were not as heavy as were earlier anticipated.

Climatic conditions in the cotton-growing districts were variable and, as a whole, were generally unfavourable for the production of satisfactory yields. In spite of this fact, a total of 12,262,498 lb. of seed cotton was received by the end of June at the two ginneries operating. This is a substantial increase on the figure for the corresponding period of the previous season—8,605,496 lb.

The area sown to grain sorghums once again showed a very substantial increase, and a keen demand existed for all grain produced. The value of the grain for stock or poultry feeding purposes is now more widely appreciated, and is likely to encourage large-scale production of sorghums for grain purposes.

Because of erratic seasonal conditions and damage by insect pests, results in all tobacco districts were not as good generally as those obtained during the previous year.

Peanut growers generally had satisfactory results, and some very high yields were obtained. The seed selection work conducted by departmental officers for some years past has resulted in a very definite improvement in type of plant and quality of nut.

The potato crop generally was satisfactory, and the total yield for the State is estimated to be above average.

The services of the soil conservation officer have been much in demand during the year, and large areas of eroded land in various districts have been treated. These demonstrations have aroused keen interest and much appreciation by local landowners.

The fact that during the year a record number of requests for information on silage were received from graziers is an indication of the increasing interest which is being taken in fodder conservation.

In spite of difficulties caused by irregular seasonal conditions, the occurrence of pests, and the restriction of export markets, the fruit industry continued to progress steadily throughout the year.

The avocado—a comparatively new fruit to Queensland—has gained a great deal of favour, and the area under trees has more than doubled in two years.

The Division of Plant Industry (Research) has completed another successful year of investigational work on a wide range of problems associated with many crops of major importance. Plant breeding in both agriculture and horticulture is a prominent feature of its activities, pasture investigations are conducted both on the coast and in the far West, and a very considerable amount of attention is also devoted to general horticultural problems, particularly to those of a nutritional nature.

Because of its wartime importance, cotton has received an unusually large share of attention, and numerous plant breeding, entomological, soils, irrigation, and plant physiology problems which have arisen since cotton became an important feature in the rural economy of the State have been dealt with energetically.

Because of unseasonal conditions, the output of dairy produce fell below the figure of the previous season. Butter production for the year was 117,081,269 lb., valued at £7,517,172, compared with 139,795,042 lb., valued at £8,862,037 for 1939-40. Cheese production was 11,731,976 lb., valued at £390,000, compared with 13,841,405 lb., valued at £452,182 for 1939-40.

Butter quality showed an improvement over the results of the previous year. This may be attributed, in some measure, to the fact that considerable progress was made in bringing farm buildings and facilities into conformity with regulation requirements for the production of high-quality milk and cream. A marked improvement in factory hygiene and the manufacture of a butter of more uniform and economical composition have been attained as a result of the butter improvement service which provides for the regular scientific examination of the produce of all factories. A progressive improvement in cheese quality has been achieved over the past three years.

The amount distributed annually to primary producers in respect of products disposed of under producer-controlled organised marketing schemes now exceeds £22,000,000.

Fertilizing Pineapples in War Time.

H. K. LEWCOCK, M.Sc., B.Sc.Agr., Senior Research Officer.

Why Rationing of Fertilizers is Necessary.

IN Australia, as in most other countries, a high level of efficiency in crop production can be maintained only so long as fertilizers in one form or another are available to supplement or correct deficiencies in the store of plant foods contained in the soil. Of the mineral plant foods, those required in greatest amounts are nitrogen, phosphoric acid, and potash. Unfortunately, Australia is dependent on overseas sources for the whole of its supply of potash, a very large proportion of its phosphoric acid, and about half its normal requirement of nitrogen. Realising this, it will not come as a surprise to anybody that shipping difficulties arising out of the war have made it necessary to ration existing stocks of fertilizer in order that they may be used to the best possible advantage. The aim of rationing is to ensure (1) that essential requirements will be met, (2) that distribution will be on an equitable basis, (3) that hoarding will be prevented, (4) that fertilizers will not be wasted or used unnecessarily, and (5) that stocks of ingredients now unobtainable will be conserved to the greatest possible extent, compatible with essential requirements. No one can possibly have any quarrel with these objectives. It is inevitable, however, that rationing of fertilizers must have an effect on those primary industries in which efficient production depends largely on fertilizing practices. The pineapple industry figures prominently in this category; in fact, few crops have been shown to have a higher requirement for nitrogen and potash than pineapples. Furthermore, the kind of nitrogenous fertilizer which is utilised most efficiently by the pineapple plant is sulphate of ammonia, and this is the one of which the supply has been most affected by war conditions. In recent months it has become necessary to divert large quantities of sulphate of ammonia from consumption for agricultural purposes to the manufacture of munitions. With all these considerations in mind, it is almost superfluous to add that it behoves every grower in his own interest to use whatever fertilizer may be made available to him to the utmost advantage. The question arises, however, as to how this may best be accomplished. Obviously, if the amount available is less than that normally used, some modification in existing fertilizing practices will be necessary.

How Rationing will Operate.

Rationing is to apply to both mixed fertilizers and to straight sulphate of ammonia. Potash in any form will not be available as a "straight" fertilizer, as it may be sold only when incorporated with nitrogenous and phosphatic ingredients to form a mixture. Bona fide pineapple growers will still be able to obtain mixtures prepared according to the "10-6-10" formula, though in reduced quantity. It may be added that of all the fertilizer mixtures registered for sale in Queensland the "10-6-10" formula for pineapples is the only one which, under the rationing scheme, has not been reduced in either its nitrogen or potash content, or in both. As previously, the whole of the nitrogen contained in the "10-6-10" mixtures now on sale is in the form of sulphate of ammonia and the whole of the phosphoric acid is in the form of superphosphate. However, because sulphate of potash is no longer obtainable from overseas sources of supply—and will, in fact, be wholly unobtainable until after the war—it has become imperative

to drastically curtail the use of this ingredient in fertilizer mixtures in order to conserve existing stocks, all of which were landed prior to or immediately following the outbreak of war. The whole of these stocks is reserved for use in either the pineapple or tobacco industries, but as the quantity held is insufficient to permit of a rate of consumption greater than 25-30 per cent. of the pre-war level it has been found necessary to supplement the amount of "10-6-10" mixture which this quantity of sulphate of potash provides with a mixture of identical formula, but containing muriate of potash in lieu of the sulphate form. While it has long been known that the muriate form of potash is not as suitable as the sulphate form for application to pineapples, except during the early stages of growth, it is still highly beneficial and, in fact, its use as a supplier of potash is essential for profitable pineapple production on all soils except those containing relatively high amounts of this plant food in an available form. In the recognised pineapple-producing districts of Queensland, potash-rich soils occur only in the Mary Valley, Rockhampton, Bowen, and Burdekin districts, and on Magnetic Island.

For the time being, it is proposed that pineapple-growers will be able to obtain fertilizer in the proportions of $\frac{9}{14}$ of their previous year's purchases of "10-6-10" mixture and $\frac{7}{14}$ of their previous year's purchases of sulphate of ammonia. These amounts represent approximately $\frac{2}{3}$ and $\frac{1}{2}$ respectively of the quantities normally used. Of the "10-6-10" mixture allotted to them, growers will be permitted to take up to $\frac{4}{9}$ in the form of the mixture containing sulphate of potash, but the remaining $\frac{5}{9}$ can be obtained only in the form of the mixture containing muriate. Where no purchasers have been made previously, as in the case of new growers, or where the amount allocated is insufficient to meet requirements, as in the case of a grower who commenced planting during the previous season and who proposes extending his acreage this year in order to build up a living area, an application for a permit to purchase fertilizer must be made on the approved form which can be obtained from the Department of Agriculture and Stock. Each application will be considered on its merits. On potash-rich soils in the Mary Valley and in the other districts mentioned, the use of mixtures containing potassic salts is discouraged. However, as the requirement for nitrogen is generally as high on potash-rich soils as it is on those which are deficient in this plant food, growers cultivating such soils will be permitted to purchase a quantity of sulphate of ammonia additional to the basic ration of $\frac{7}{14}$ of last year's purchases. This additional amount will correspond approximately to the proportion which growers in other districts are able to obtain as an ingredient of "10-6-10" mixture. It should be clearly understood, however, that in no district whatever is the use of any kind of "10-6-10" fertilizer mixture now permitted except on pineapples.

Adjusting Fertilizing Practices to Meet the Curtailment in Supplies.

As the amounts of "10-6-10" mixture and sulphate of ammonia which pineapple-growers will now be able to obtain are, respectively, only $\frac{2}{3}$ and $\frac{1}{2}$ of those which they used in the preceding twelve months, these reduced quantities will need to be applied with discretion if maximum benefits are to accrue from their use. It may be stated at the outset that better results are likely to be obtained from fertilizer applications made during the first two or three years of the crop cycle than from those made subsequently. Plantations which have been adequately

fertilized over the period mentioned can be relied upon to yield a payable second ratoon crop without further fertilizing, even though this may not be quite as heavy as that which would have been obtained had additional fertilizer been employed to produce it. In this connection it is worthy of note that fertilizing of second ratoon crops is rarely practised in Hawaii, where it is the custom to fertilize heavily for the preceding crops. As far as possible, therefore, growers are advised to concentrate on maintaining an adequate supply of plant nutrients for the younger portions of their plantations, even if this can be done only at the expense of the older ratoon fields. Except in areas which are producing exclusively for the fresh fruit trade, the withholding of fertilizer after the first ratoon crop has been harvested is recommended as being the best means of adjusting plantation practices to meet the current fertilizer shortage. If this recommendation is adopted it will be found, in most cases, that the quantity of "10-6-10" mixture which growers are still able to obtain is sufficient to enable existing rates of application to be maintained until the end of the third year from planting. As already mentioned, however, not more than $\frac{1}{3}$ of this amount can be purchased in a form containing sulphate of potash, which, though superior to the muriate form during the bearing period, is no more effective when applied in the early stages of growth. Obviously, then, the muriate form of "10-6-10" mixture should be used exclusively during the first twelve months after planting, and the sulphate form should be reserved for use during the most productive period of the cycle—that is, the second and third years from planting. Normally, three applications of the "10-6-10" mixture containing muriate should be given on newly-planted areas before changing to the sulphate mixture. In the case of spring-planted fields, the first of these applications would be given some two to three weeks after planting, the second in the autumn, and the third in the following spring. Each of these applications would be made at the rate of 40-50 lb. per 1,000 plants. Any "10-6-10" mixture containing muriate of potash which is not required for application to new plantings may be used on the older portions of the plantation in lieu of sulphate mixture. These latter applications, whether of the sulphate or muriate form, should be given twice yearly—that is, in the spring and again in the autumn—up to the end of the third year from planting, and the rate of application should be 40-50 lb. per 1,000 plants as previously. Where it is desired to apply zinc or copper sulphate with "10-6-10" fertilizer mixture, only the muriate form should be used as a carrier because a deficiency of one or the other of these essential elements in the soil is best corrected at either the first or second fertilizing after planting.

On potash-rich soils such as those of the Mary Valley, on which the use of fertilizer mixtures containing potash is discouraged, applications of sulphate of ammonia should be given at the same times as those recommended for "10-6-10" mixture in other districts, but the rate of application should be only half of that suggested for the mixtures. This is because 50 per cent. of a "10-6-10" mixture consists of sulphate of ammonia. An additional application of ammonia may be given during January, just preceding the period of maximum growth when the demand for nitrogen is greatest. This January application of ammonia should also be given in all districts where the use of "10-6-10" mixture is recommended, but the dressing which it has been customary to apply in mid-winter may be omitted while the present shortage lasts, as the nitrogen requirement of the pineapple plant is relatively low during cold weather. If this plan be adopted, it will not be necessary to reduce

the rate at which the January dressing is applied, because the amount of sulphate of ammonia now available, viz., one-half of that previously used, should be sufficient to enable one application per year to be given at the normal rate.

The preceding suggestions have been made in the hope that they will provide a workable basis on which growers may recast their fertilizing schedules to meet the curtailment in supplies occasioned by war conditions. While it is fully recognised that modifications may have to be made to the programme as set out in order to meet individual circumstances, it is strongly urged that these should be based on the principle of adequate fertilizer for the younger portions of a plantation even if some of the older ratoon fields have to go without. In this connection, it may not be out of place to draw attention to a difference between the "10-6-10" mixtures now on the market and those formerly obtainable which necessitates especial care in applying them if injury to the plants is to be avoided. Until recently, the sulphate of ammonia used in compounding these mixtures was mostly the synthetic crystalline form. Since supplies of this product are no longer available from overseas sources, it has become necessary to use sulphate of ammonia of Australian manufacture. Because the latter is prepared only in powdered form, it is not so readily deposited as the crystals, and there is a risk of some of it lodging on tender leaf tissue and thus causing injury, unless the hand is held well down when applying it. This point is mentioned because it has recently been reported that some growers who have inadvertently burnt plants with "10-6-10" muriate mixture are erroneously attributing the cause of the burning to muriate of potash.

Meatworks Fertilizer as a Substitute for Inorganic Mixtures.

One question which is likely to be raised is whether meatworks fertilizer, such as dried blood and bone, can be used as a substitute for, or as a supplement to, "10-6-10" mixture or sulphate of ammonia. While this can be done with little if any loss of efficiency in the case of crops which respond to fertilizer when it is applied in drills or otherwise buried beneath the surface of the soil, meatworks fertilizer cannot be used effectively for pineapples except, possibly, when placed in the bottoms of furrows which have been opened out along the lines of the rows prior to planting. No experimental data is available regarding the value of this method, though there is every reason to believe that it would be successful. The reason why it has not been tried out before is because nitrogen is cheaper in the form of sulphate of ammonia than it is as dried blood. For application subsequent to planting, however, meatworks fertilizer is not suitable for pineapples, since it is only effective when incorporated with the soil. Because of the surface rooting habits of the pineapple plant serious root injury would result from any attempt to place fertilizer in the soil at a distance close enough to the plants for the roots to have access to it. Experiments have shown conclusively that, with pineapples, the maximum benefit from fertilizer is not obtained unless it is taken into the soil immediately around the bases of the plants. This can be accomplished only by using plant foods in a water soluble form, and by applying them directly into the axils of the basal leaves, from where they can be washed into the soil around the stem of the plant. Apart from sulphate of ammonia, the only other fertilizer ingredient containing water soluble nitrogen that has been available in Queensland is nitrate of soda, which is now wholly unobtainable because of munitions priorities.

Supplementing the Nitrogen Supply by the Use of Green Manures.

Horse, cow, and fowl manure are all rich in plant foods, but only in exceptional cases can they be obtained in useful quantities. A similar position exists with regard to wood ashes, which contain large amounts of potash. As far as nitrogen is concerned, however, green manuring during the intercycle period affords a means whereby a store of this element may be built up in the soil for the use of the succeeding crop. This is a practice which should be more widely adopted at the present time, even if it means lengthening the intercycle period, not only because the supply of nitrogenous fertilizers is more affected by war conditions than that of other plant foods, but also because the pineapple plant requires greater quantities of nitrogen than of any other nutrient. Obviously, only leguminous crops should be used for green manuring purposes, since these are the only ones which possess root nodules capable of fixing nitrogen from the air. When the crop is ploughed under, these nodules decompose, and the nitrogen they contain becomes available for the use of the succeeding crop. Of the summer-growing legumes, Poona pea has been found to be one of the most suitable for Southern Queensland conditions because it comes away rapidly and, under favourable growing conditions, makes a dense cover in a very short space of time. A well-grown crop of Gambia pea (*Crotalaria goreensis*) will fix a greater amount of nitrogen than Poona pea, but as it has to be planted in October or November, because of its slow rate of growth in the early stages, it is sometimes difficult to get a satisfactory stand of this legume, particularly in seasons when the summer rains are delayed. Of the winter-growing legumes, the New Zealand blue lupin or the field pea are likely to prove most satisfactory, but, in Queensland, the degree of success which is obtained with these crops is apt to depend very largely on the incidence of winter rains. It should be pointed out, however, that no leguminous cover crop is likely to give wholly satisfactory results unless the seed is inoculated, prior to planting, with its own particular strain of the nitrogen-fixing organism. It is this organism which is responsible for the development of nodules on the roots of plants belonging to the pea family. For a nominal fee, cultures of nodule-forming organisms for various leguminous crops and particulars regarding their use can be obtained on application to the Department of Agriculture and Stock. Now that this service is available, no leguminous crop should be planted without first taking the precaution to pre-inoculate the seed.

ON THE FARM FRONT.

We may talk about man-power and munitions as the essentials of war, but, after all, food for the people as well as for the fighting forces is just as important. Not only does an army fight on its stomach, but the nation behind the army must be fed too—and fed well if national morale is to be maintained.

In these days of mechanised warfare, the nation that is best prepared is the nation which can grow its own food with the smallest fraction of its man-power, so that the men not needed for growing crops can take time off to train for defence or give a hand in making munitions. Farm machinery has made all the difference in a country's capacity to feed its people. A hundred years ago it took about three out of every four men to feed and clothe the people, but now the position is reversed. It is estimated that, with the use of modern farm machinery, only one man in every four is required to provide the primary needs of a nation. So with up-to-date farm machinery and the will and skill to use it, our farmers must be handed a big share in the coming victory.

The Control of Tomato Pests.

W. J. S. SLOAN, B.Agr.Sc., Assistant Research Officer.

THE tomato plant is attacked by many pests, and good crops can seldom be grown without the use of the necessary control measures. To apply these efficiently requires some knowledge of the several pests, so that damage can be correctly diagnosed and appropriate steps taken to reduce losses.

Tomato pests may be grouped as—I. root and seedling pests, II. stem and foliage pests, and III. fruit and flower pests, in accordance with the part of the plant with which they are principally associated. The following key should simplify the identification of the various pests in the field:—

I. Root and Seedling Pests.

1. Plants stunted; lower leaves wilt and die in dry weather; sudden collapse of plants not uncommon after rain; bead-like swellings of varying sizes on roots.

Nematodes.

2. Plants wilt and die; roots eaten; light-brown, thick-bodied beetles about ¾ inch long present in soil.

Brown Scarab Beetle.

3. Seedlings collapse; stem chewed at or near ground level; one or more larvæ found in soil near stem.

   (*a*) Smooth, soft-bodied, greyish-green or grey-brown caterpillar which curls when touched; 1½ inches long when full grown.

Cutworm.

   (*b*) Slender, hard, shiny, light-brown larvæ; about ¾ inch long when full grown; adult beetle about ⅓ inch long.

False Wireworm.

4. Foliage and sometimes the stem eaten; grasshoppers present.

Grasshoppers.

II. Stem and Foliage Pests.

1. Stems rusty brown or smoky-coloured and smooth, leaves wilt and die.

Mites.

2. Lower leaves wilt and die; green leaves show numerous white spots; swarm of green, winged insects about ⅛ inch long on each plant.

Jassids.

3. Small, soft-bodied, green insects, clustering in colonies under leaves and around young growth.

Aphids.

4. Green caterpillar feeding on foliage; 1½ inches long when full grown.

Leaf-eating Looper.

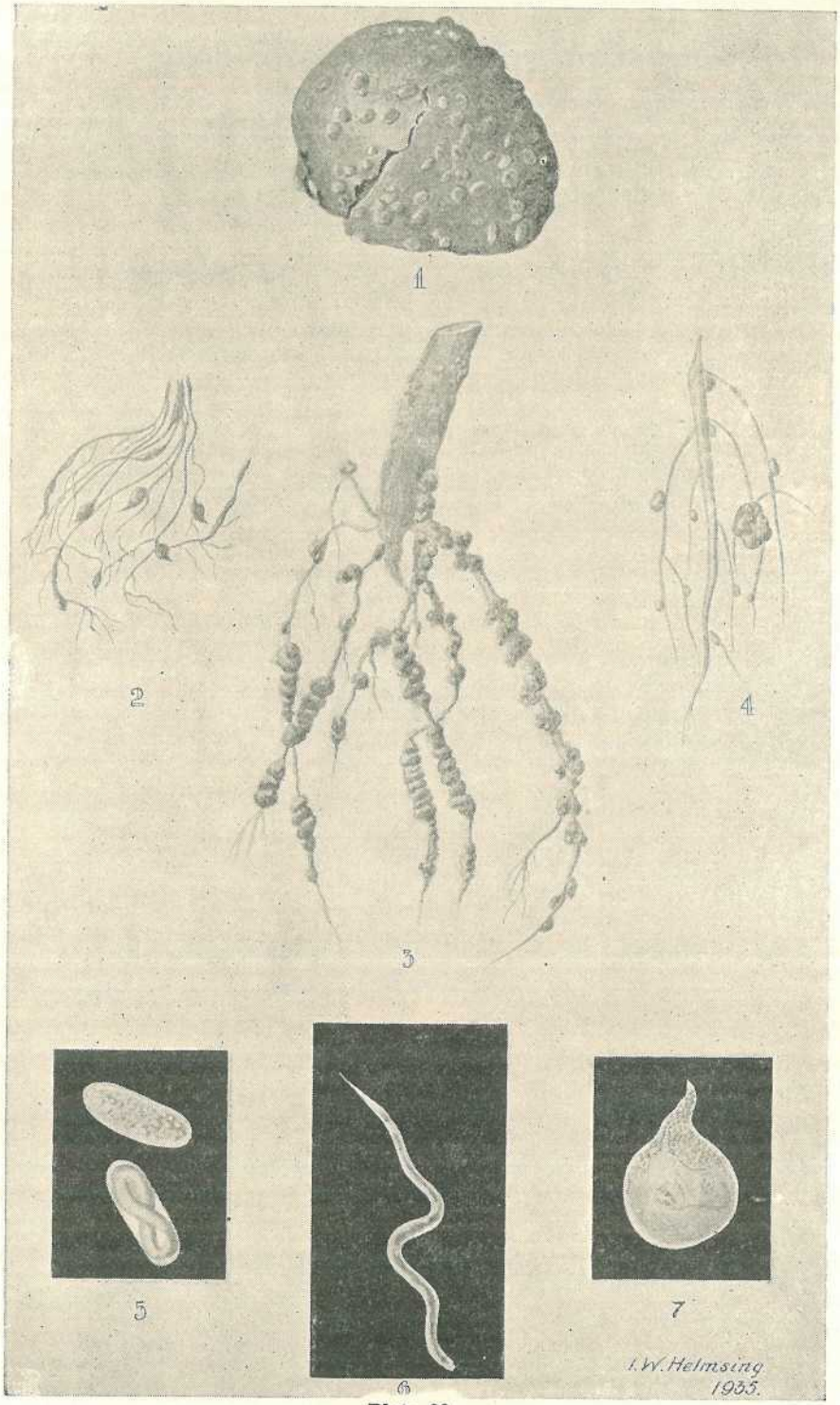

Plate 89.
Root Knot Nematode.

III. Fruit and Flower Pests.

1. Larvæ in or on the fruit.
   (*a*) Caterpillar often conspicuously coloured; 1½ inches long when full-grown.
   Corn Ear Worm.
   (*b*) Dull white or greenish-tinted caterpillar; ½ inch long when full-grown.
   Potato Tuber Moth.
   (*c*) Soft-bodied, greyish-green or grey-brown caterpillar which feeds at night and remains in soil under plant during the day; 1½ inches long when full-grown.
   Cutworm.
   (*d*) Fly maggots living in fruit.
   Fruit Flies.
2. Fruit with discoloured areas on skin; bugs present.
   (*a*) Green shield-shaped bug; ½ inch long.
   Green Vegetable Bug.
   (*b*) Green or green and brown shield-shaped bugs; $\frac{3}{16}$ inch long.
   Shield Bug.
   (*c*) Slender, winged, greyish-brown insects, ⅛ inch long.
   Rutherglen Bug.
3. Cream-coloured insects in blossom; $\frac{1}{16}$ inch long.
   Thrips.

ROOT AND SEEDLING PESTS.

Nematodes.

Nematodes* (Plate 89, figs. 5, 6, and 7) infest the roots of tomato plants of all ages, but their effects may not be obvious until the plants are setting fruit. Severely attacked plants are stunted and unhealthy, the lower foliage wilts and dies, and the fruit does not fill out. After wet weather, affected plants may collapse suddenly. The presence of nematodes is easily determined by examining the roots, which, when infested, are distorted and somewhat beadlike in shape (Plate 89, fig. 3). On seedlings, the swellings may not be very large.

Nematodes live part of their life in plant tissue and part in the soil, where they can persist for a very long time, even in the absence of food plants. The full-grown female nematode (Plate 89, fig. 7) is white, pear-shaped, and about one-twenty-fifth of an inch in length, and may be seen on the exposed surface when one of the larger root swellings is sliced through with a sharp knife. The very small wormlike male also occurs within the roots, but is more difficult to detect. The eggs (Plate 89,

DESCRIPTION OF PLATE 89.

Root Knot Nematode.

Fig. 1.—Nematode-infested potato tuber.
Fig. 2.—Nematode galls on strawberry roots.
Fig. 3.—Nematode galls on tomato roots.
Fig. 4.—Bacterial nodules on lupin roots.
Fig. 5.—Nematode eggs × 150.
Fig. 6.—Larval nematode × 150.
Fig. 7.—Adult female nematode × 30.

Figs. 1 to 4 half natural size.

* *Heterodera marioni* Cornu.

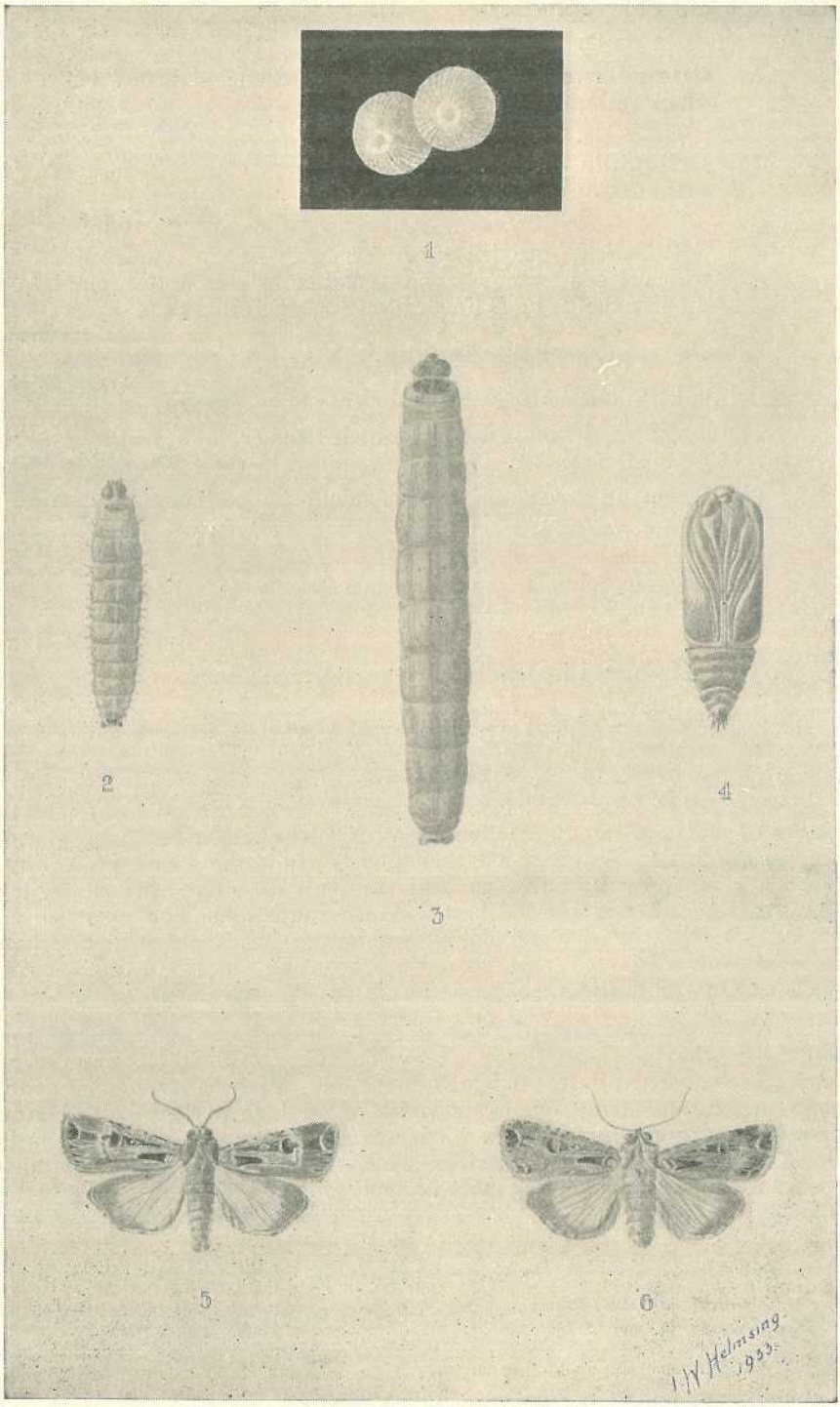

Plate 90.
Brown Cutworm.

fig. 5) are microscopic, and can survive for long periods in the soil. From these emerge young threadlike nematodes, which move about in the soil to a limited extent, and eventually enter plants through the small roots.

Nematodes attack many weeds and crop plants; hence the difficulty in obtaining ground free from infestation. They occur in many soil types, but losses are generally most severe in light sandy loams.

Complete eradication of the pests in infested fields is not practicable. Attention should therefore be directed towards the production of healthy seedlings, and the maintenance of good growing conditions when they are transplanted into the field. The following measures will require attention:—1. Select new ground for seed-beds and fire the bed before planting. This may be done by placing brushwood and branches evenly over the surface to a depth of 6 to 8 inches. The soil should be neither dry nor excessively wet when firing takes place. 2. When removing seedlings for planting, discard any showing swollen roots. 3. Maintain the health of the plants in the field by judicious fertilizing, adequate cultivation, and careful irrigation. 4. Remove and destroy by burning all severely affected plants in the field. 5. Avoid growing tomatoes on the same land for more than two years in succession. Most grasses, maize, wheat, sorghum, peanuts, velvet beans, and certain varieties of cowpeas resist nematode attack, and a suitable rotation including some of these crops, one of which should be a green manure, usually keeps the nematode population at a relatively low level.

Brown Scarab Beetle.

Plants are destroyed by the brown Scarab beetles* which feed on the roots. Outbreaks are sporadic, but very severe. The beetle lives in the soil, and is a typical thick-bodied Scarab, light-brown in colour, and about ¾ inch long. The larvæ are of the white grub type, and occur in soils rich in organic matter or in compost heaps, but so far they have not been recorded as injurious to tomatoes. The use of insecticides is usually not practicable. Thorough cultivation of the field before planting and during the growth of the crop may give some relief.

Cutworm.

The larvæ of several moths are called cutworms because they attack the stems of seedlings at or near ground level, where they can usually be found just below the surface. Feeding takes place at night. Seedlings collapse, but on older plants stem injuries are less important and feeding is then confined mainly to the foliage. On untrellised fruiting bushes large irregular holes may be eaten out of fruit near the ground. Injury to seedlings, which usually takes place shortly after transplanting into an infested field, constitutes the commonest and most serious loss. Severe injury is common in light soils.

DESCRIPTION OF PLATE 90.

Brown Cutworm.

Fig. 1.—Eggs × 20.
Fig. 2.—First-stage larva × 8.
Fig. 3.—Final-stage larva × 1½.
Fig. 4.—Pupa × 2.
Fig. 5.—Adult male, natural size.
Fig. 6.—Adult female, natural size.

* *Isodon puncticollis Macl.*

The moths of the brown cutworm* (Plate 90, figs. 5 and 6), which is a widely distributed pest in Queensland, have greyish-brown or greyish-black forewings with variable markings, and the hind wings are greyish-white, with smoky margins. The wing spread is about 1½ inches. The females lay batches of eggs on or near the soil surface underneath the leaves of a low-growing weeds. After a few days the eggs hatch, and the young caterpillars feed on the plants at night, sheltering in the soil during the day. The soft-bodied, greyish-green or grey-brown larvæ (Plate 90, figs. 2 and 3) become full-grown in four to seven weeks, and are then about 1½ inches long. They make their way into the soil and pupate at a shallow depth in earthen cells. After a further two to three weeks the adult moth emerges from the pupa (Plate 90, fig. 4).

Cutworms feed on numerous weed and crop plants. If land carrying low-growing weeds is cultivated just before planting, any cutworms present attack the tomato seedlings. Losses may therefore occur in patches or be generally distributed through the field—depending on the distribution of the weed growth before cultivation. The presence of cutworms may be detected by examining the top few inches of soil around the base of a destroyed seedling.

Control measures for cutworm outbreaks are very efficient if properly carried out. Thorough preparation of the soil for the crop is necessary, and weed growth should be suppressed for at least four weeks before seedlings are planted.

When seedling losses are noticed, a Paris green-bran bait must be applied immediately. The bait is prepared as follows:—Thoroughly dry-mix 25 lb. bran with 1 lb. Paris green. Dissolve 1 quart of molasses in a pint of boiling water, and make the solution up to 2 gallons with cold water. Pour the solution slowly on to the poisoned bran, and mix to form a uniformly moist crumbly mash.

If the whole field shows signs of infestation before planting, the bait should be broadcast at a rate equivalent to 50 lb. dry weight of bran per acre; after planting, it may be scattered thinly along the rows close to the plants. If the attack is restricted to a small area, only this, together with a marginal strip, need be treated. When cutworms are very numerous, two or more applications of bait may be required. The bait should always be applied in the evening, because cutworms are night feeders, and the bait must be fresh and attractive when they are seeking food. The bait should not come in contact with the stems of the plants, otherwise injury may occur.

Paper collars are used in some districts to protect seedlings from cutworms and other pests. The size of the paper used depends on the size of the seedlings. For seedlings up to 8 inches high, 4-inch by 3-inch pieces are convenient. The paper is wrapped around the stem, and the seedling is placed in the soil so that there is a 2-inch collar of protecting paper above the surface. Papers are carried on a string attached to the planter's belt and flicked off as required. The method slows up planting to some extent, and does not reduce the field population of cutworms, the progeny of which may later cause injury to fruit borne on untrellised vines.

* *Euxoa radians* Gn.

False Wireworm.

Both the false wireworm and the parent beetle* injure tomato seedlings at ground level in a manner similar to that of cutworms. Occasionally the false wireworm tunnels into the stem for a short distance. When these pests are responsible for seedling injury, either the adult beetles will be found on the soil surface or the hard, slender larvæ may be located just below the surface of the soil near the injured seedlings.

The adults are small, stocky beetles, about ⅓ inch long, the apparent colour of which is similar to that of the soil on which they occur. The larvæ are shiny, light-brown, slender, hard, and about ¾ inch long when full-grown. Eggs are laid in the ground.

The Paris green-bran bait recommended for cutworms efficiently controls both the larvæ and adult beetles; paper collars may also be used.

Grasshoppers.

Adults and nymphs of grasshoppers occasionally attack the foliage and stems of young tomato plants in seed beds and in fields, particularly during dry weather. If the pests are numerous, many young plants may be destroyed, and difficulty be experienced in obtaining a satisfactory strike. A number of species are concerned, ranging from 1 inch to 3½ inches in length, but two† are particularly common in Central Queensland.

Handpicking and the lead arsenate spray usually applied for the control of leaf-eating pests will check small populations of grasshoppers in the seed bed. Where these measures are insufficient, the Paris green-bran bait may be broadcast around the beds for a radius of 30 yards or more.

When a field crop has to be protected, the standard grasshopper bait is more economical than the Paris green-bran bait. It contains arsenic pentoxide ½ lb., molasses 4 lb., bran 25 lb., and water 2½ gallons. The arsenic pentoxide is dissolved in 1 pint of boiling water; the molasses is also dissolved in the same quantity of water in a separate vessel. Both solutions are stirred, and half of the remaining water added to each. The two solutions are then mixed, stirred, and added to the bran which has previously been spread out on a mixing board or sheet of iron. The whole is then thoroughly mixed until a loose even-textured moist mash is obtained.

In an infested field, the bait should be distributed along the rows close to the plants and broadcast around the field for a margin of 30 yards. Several applications at three- or four-day intervals may be necessary if there is a persistent inward migration of the pests.

STEM AND FOLIAGE PESTS.

Mites.

Mites‡ affect tomato plants of all ages. The first symptom of injury is the slight curling of the lower leaves which then show a silvery sheen on the under-surface. Later, these leaves become bronze-coloured, droop, and finally die. The lower part of the stem loses its surface hairs,

* *Dasus macleayi* Blkb.

† *Valanga irregularis* Walk. and *Peakesia straminea* Sjost.

‡ *Phyllocoptes lycopersici* Tryon.

becomes smooth, rusty-brown or smoky-coloured, and may later show small superficial cracks. As infestation increases, the mites gradually spread, discolouring the stems and destroying the foliage, until only the young terminal growth remains. Thus the fruit is exposed to sunburn, plant growth is retarded and blossom setting curtailed. In severe attacks where infestation extends to the terminal growth, the young leaves may be distorted. Fruit may also be attacked; the skin is discoloured and numerous small cracks appear, mainly at the stem end, but sometimes all over the surface. Although edible, such fruit is unmarketable. Many of the symptoms associated with mite attacks can be confused with the effects of dry weather or some wilt diseases, but the discolouration of the stem is characteristic of mite infestation and can be used for definite diagnosis.

The tomato mite is extremely small, and although it may occur in large numbers on a plant, it cannot be seen with the naked eye. Therefore growers must be able to recognise the symptoms of injury in order to detect its presence. Under an ordinary hand lens the mites are seen as torpedo-shaped, cream-coloured, slowly moving specks on the stems, leaves or fruit. The eggs are smooth and white, and are laid on the surface of the plant.

The mite occurs on several weeds botanically allied to the tomato, including the green and Cape gooseberries and two varieties of wild black currant. At times it may also be abundant on English potatoes. Infestation spreads quickly through a field of tomatoes, particularly under warm conditions which favour rapid breeding. Carriage by wind appears to be the chief method of dispersal.

Mites are among the simplest of tomato pests to control. Old plants can be a source of infestation of young crops, and therefore should be destroyed when picking has ceased. Weeds which harbour the pest should also be eradicated. Furthermore, it is inadvisable to plant tomatoes near crops of English potatoes or in land from which potatoes have just been harvested.

Complete elimination of sources of infestation is seldom possible, and insecticides must often be used in the field for mite control. Sulphur dusts and sprays give good results. Ground sulphur, or precipitated or sublimed sulphur, diluted with an equal quantity of fine hydrated lime, may be used, at the rate of 5 to 20 lb. per 1,000 plants, depending upon their size. The proportion of sulphur in dusts which are not used exclusively for mite control should be not less than 30 per cent. A spray containing lime sulphur at a strength of 1 gallon of the commercial concentrate to 100 gallons of water, or colloidal sulphur at a strength of 1 lb. to 50 gallons of water is also effective. The amount of spray used will vary with the size of the plants treated, 40 gallons being sufficient for 1,000 plants 1 foot across. Colloidal sulphur may be added to a Bordeaux-lead arsenate combination spray, but on no account should lime sulphur be added to this mixture.

Tomatoes should be treated from the seedling stage onwards in Central and North Queensland, where the mite is particularly important. Sulphur applications should be made once a fortnight, except in mid-winter, when monthly applications are normally adequate. Treatment once a month is usually sufficient in South Queensland; if, however, losses have been experienced in the previous season, more frequent spray or dust applications are desirable.

Jassids.

Numerous small white dots on the older leaves are the first symptom of jassid attack. As injury increases these white dots merge to form larger patches embracing the greater part of the leaf, which then curls and later dies prematurely. Leaf curl may be pronounced in young leaves, but the white spotting is less distinct. Leaf loss begins at the base of the plant and progresses along the stem in a manner similar to that observed in mite injury on tomatoes, but a careful check of the stem and leaf symptoms will prevent any confusion. Fruit may also be attacked, white spots of dead tisue appearing in the skin which is also blemished by dark stains of excreta.

The tomato jassid* is a small green insect about $\frac{1}{6}$ inch in length, possessing wings and sucking mouthparts. It is capable of only limited flight. On shaking an infested bush, a swarm of the winged insects will emerge momentarily. The females lay their elongate eggs within the tissue of the younger parts of the stem and in the leaf petioles. From these emerge the young, which are very similar in appearance to the adults, save that they are smaller and wingless. Like the adults, they usually remain on the undersurfaces of the leaves, where they frequently move with a characteristic side-ways motion. As they grow, they moult several times. During the autumn, eggs hatch in ten to twelve days, the young reaching the adult stage in a further two to three weeks. This rate of development enables jassid populations to increase rapidly under favourable conditions.

Jassids are particularly important in North Queensland, where populations are highest in the late winter and early spring months, most crops having then reached their peak picking period. They are especially abundant after a dry autumn and winter. Young crops planted for late picking soon become infested from old fields, and their commercial bearing period ends prematurely. Injury is generally less severe on well-grown crops. If growth is checked, the pests are particularly destructive, and every attention should therefore be given to the maintenance of good-growing conditions throughout the season. The tomato leafhopper lives on several other plants, including the eggfruit and the potato.

Weekly applications of a 5 per cent. nicotine dust during the warm hours of the day will check the pest, but usually such treatment is too expensive for general use.

Aphids.

Sometimes during cool, cloudy weather, aphids† appear under the leaves of tomatoes, and cluster on the blossoms and young growth. Severe attacks are not uncommon in spring crops grown in South Queensland, where they induce curling in the leaves, distortion or death of shoots, and blossom-fall.

The green, slow-moving aphids on tomatoes are larger than those encountered on many other plants. They suck the sap by means of piercing mouth parts, and can carry and spread virus diseases. The colonies consist of winged and wingless individuals, the relative proportions of which vary with the season. Winged forms can migrate and commence new colonies. Ants are sometimes in attendance, and their activity indicates the presence of aphids.

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* *Empoasca terra-reginae* Paoli.

† *Macrosiphum solanifolii* Ashm.

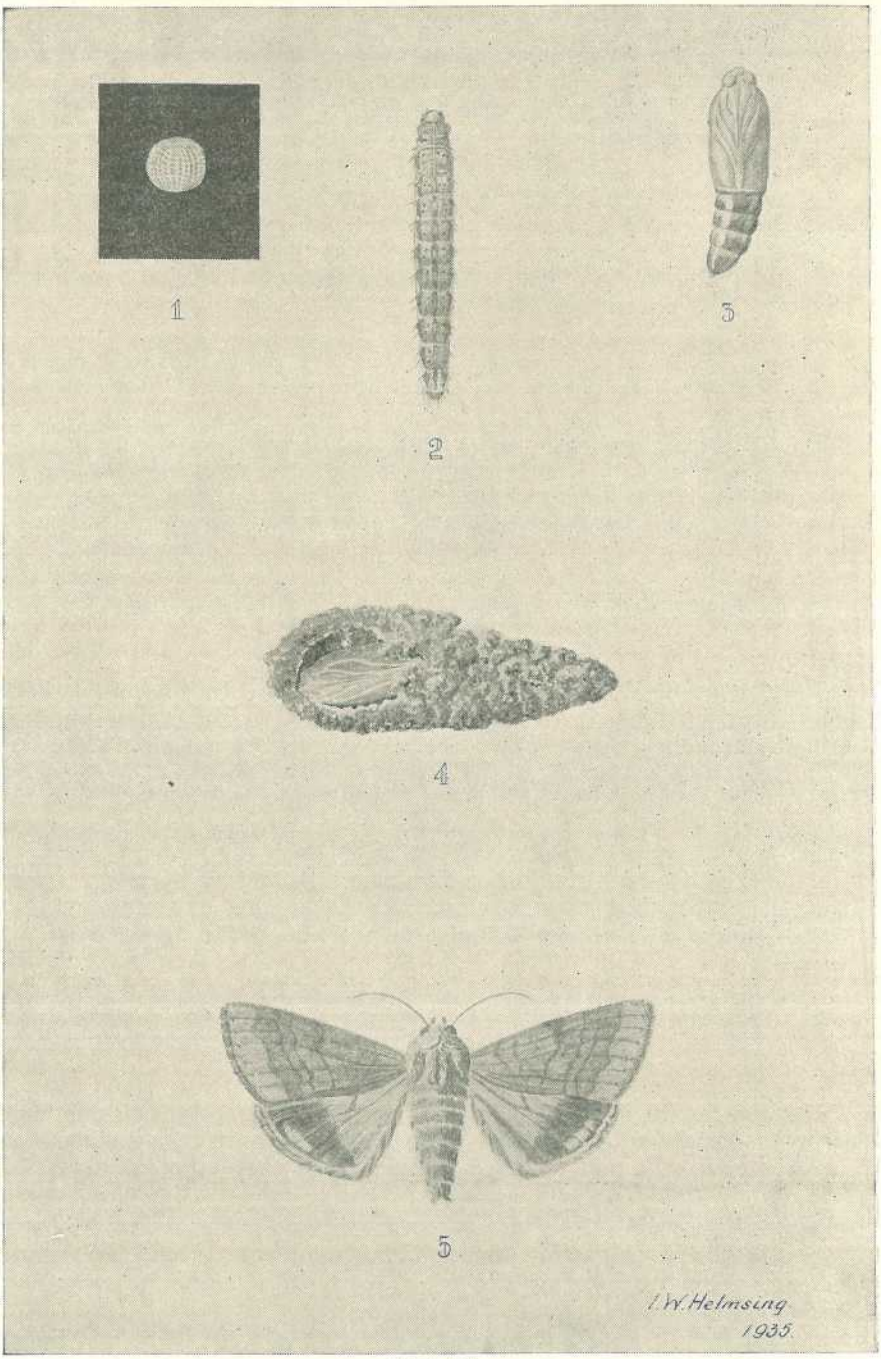

Plate 91.

Corn Ear Worm.

Fig. 1.—Egg × 14.
Fig. 2.—Larva, natural size.
Fig. 3.—Pupa × 1½.
Fig. 4.—Pupa in earthen cell × 1½.
Fig. 5.—Adult × 1½.

Aphids can be controlled by one or more applications of nicotine dusts or sprays. Applications of a 2½ per cent. nicotine dust are adequate for normal requirements. A nicotine spray may be prepared to the following formula:—nicotine sulphate, 1 pint; soft soap, 4 lb.; water, 100 gallons.

Leaf-eating Looper.

Foliage may be eaten by the leaf-eating looper,* a green caterpillar which grows to 1½ inches in length and moves with a looping motion. The adult moth has a wing spread of slightly over 1¼ inches. The forewings are a variegated brown, with two prominent silvery patches in the centre of each, while the hind wings are smoky coloured.

Injury is rarely of importance, except in seedbeds, where lead arsenate dusts or sprays can be applied to control the pest.

FRUIT AND FLOWER PESTS.

Corn Ear Worm.

Corn ear worm† is the most destructive pest of tomatoes in Queensland. Although fruit injury is particularly obvious, blossom damage can also be serious. The caterpillars injure the fruit by piercing the skin and feeding on the fleshy contents. Entrance holes vary in size, being sometimes quite large, though occasionally the small caterpillar enters a half-grown fruit and only emerges when full-grown to pupate in the soil. Unless carefully examined, fruit infested in this way is not detected when packed, and the caterpillar may later eat its way out and attack other fruit in the case. Secondary rots follow, and the fruit may have to be picked over before sale, or discarded altogether. In the field, soft rots usually infect injured fruit, and the flesh inside deteriorates to a watery, slimy consistency. Occasionally, the surface injuries on green tomatoes heal, and the fruit merely shows a superficial blemish. Blossom damage is caused by the feeding of young caterpillars emerging from eggs laid on or near the flowers. These caterpillars may also feed to a limited extent on the foliage, or may make short tunnels in the stems, but these types of injury are of little significance.

The moth (Plate 91, fig. 5) is a stoutly-built, inconspicuously-coloured insect with a wingspread of about 1½ inches. The forewings are greyish-green, often tinted with red; the hindwings are creamy-yellow, with the veins and a broad marginal band smoky. The eggs are laid on all parts of the plant at dusk, the moths remaining among plants during daylight. A female moth may lay as many as 1,000 eggs.

The dome-shaped egg (Plate 91, fig. 1) is cream-coloured when newly-laid, and is about one-sixtieth of an inch in diameter. After an incubation period of three to six days, a small whitish-bodied larva emerges which, when full-grown, is about 1½ inches long and variable in colour, with shades of green, brown, yellow, and red interspersed with black markings. One shade usually predominates, and along each side is a yellowish-white band. The larval stage lasts twelve to twenty-one days in warm weather. When full-grown, the caterpillar (Plate 91, fig. 2) leaves the plant and constructs an earthen cell in the soil, inside which it changes into a dark-brown, smooth pupa (Plate 91, fig. 3),

* *Plusia argentifera* Gn.

† *Heliothis armigera* Hbn.

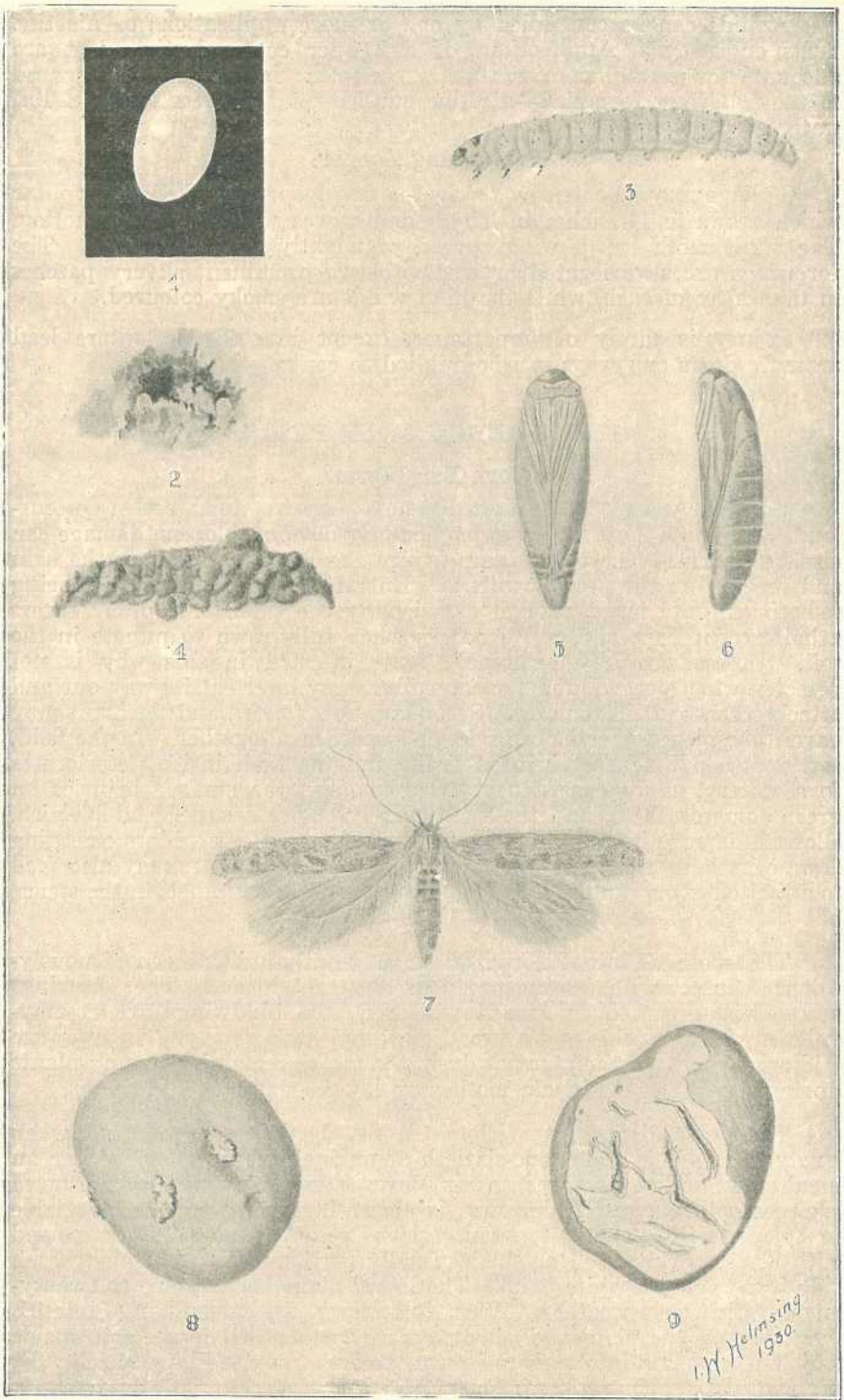

Plate 92.
Potato Tuber Moth.

about ¾ inch long. During summer, the adult moth emerges from the pupa after ten to fourteen days.

The corn ear worm feeds on numerous crops and weeds. Apart from tomatoes, crops attacked include maize, sorghum, lucerne, cotton, tobacco, and many vegetables and flowers. The most important weed hosts are gooseberries and pigweeds. Eggs are laid on plants of all ages, but in greater numbers from the commencement of blossoming until the period of peak bearing. As the plants age, eggs are laid much less freely on them.

Proper preparation of the land, weed control, and the destruction of infested fruit, all help to check the pest, but are seldom sufficient to prevent the infestation of tomato crops in coastal areas. Hence these measures must normally be supplemented by applications of insecticides particularly in the warm dry months of autumn and spring.

The most efficient of the available insecticides is lead arsenate, which can be used either as a dust or spray. Dusts are slightly superior to sprays which, though less expensive, are less suitable for use on the larger areas of tomatoes.

The lead arsenate dust should be diluted with an equal quantity of fine hydrated lime or a similar filler before use. It is frequently necessary to control both corn ear worm and tomato mite at the same time, and a composite dust containing lead arsenate five parts, sulphur four parts, and filler one part, is suitable for this purpose. If copper has to be included in the dust for disease control, a mixture containing lead arsenate 10 parts, sulphur six parts, and copper carbonate four parts will be satisfactory.

Where spraying is preferred, lead arsenate may be used at the rate of 3 to 6 lb. per 100 gallons of water. Lead arsenate may be added to a Bordeaux or a Bordeaux-colloidal sulphur mixture to form a combination spray for pests and diseases.

Treatment at intervals of approximately two weeks is required. More frequent applications may be necessary if the plants are growing rapidly, and the pest is very active. Weekly treatments should then be given to the plants. If rain washes the insecticide off within three days after application, the treatment should be repeated. For 1,000 plants 3 feet across, 20 lb. of dust or 120 gallons of spray will be sufficient. Eggs are laid on all parts of the plant, but especially on the young shoots; the latter should, therefore, receive particular attention when insecticides are being applied. Treatment should commence when flowers first appear on the plants.

When marketed, tomatoes must not carry arsenical deposits in excess of ·01 grains of arsenic trioxide per pound of fruit. Ordinarily, the grower wipes his fruit to remove dirt and stains before marketing. This

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DESCRIPTION OF PLATE 92.

POTATO TUBER MOTH.

Fig. 1.—Egg × 35.
Fig. 2.—Eggs on tuber surface × 10.
Fig. 3.—Larva, lateral view × 4.
Fig. 4.—Cocoon covered with soil particles × 2½.
Fig. 5.—Pupa, ventral view × 7.
Fig. 6.—Pupa, lateral view × 7.
Fig. 7.—Adult × 4.
Fig. 8.—Tuber showing external signs of infestation, half natural size.
Fig. 9.—Tuber showing tunnelling, half natural size.

procedure, however, is not particularly efficient in removing spray and dust residues which tend to lodge in cracks and furrows on the surface of the fruit.

Chemical treatment is much more efficient, and should be in general use. The method entails the use first of an acid solution and then an alkaline solution for neutralising any acid left on the fruit. The acid dip consists of 1 gallon of commercial hydrochloric acid mixed with 99 gallons of water. The alkaline dip is made by adding 2½ lb. of hydrated lime to 100 gallons of water. The containers used to hold the solutions should be large enough to allow easy manipulation of a suitable wooden case within them, and should be equipped with inclined draining boards. The tomatoes are placed in the wooden case, which should have the boards spaced sufficiently to allow rapid penetration of the solution and quick draining, and immersed in the acid dip for one and a-half minutes, moving the case up and down to wet all the fruit. The case is then withdrawn, allowed to drain on the boards for a few minutes, and plunged into the lime dip for a minute. After removal from this dip, the tomatoes are again drained, well sluiced with clean water, and set aside to dry thoroughly before packing.

Eight gallons of the acid dip is sufficient to treat at least 12 bushels of tomatoes carrying heavy spray residues. Sound and scarred tomatoes, whether coloured or green, are not injured by this treatment, nor is cracked fruit affected, provided it is dried quickly after the dipping process.

Potato Tuber Moth.

Potato tuber moth* attacks all parts of the tomato plant, but fruit injury, due to the larvæ entering at the stem end where they tunnel into the core, is most important. They may also penetrate the fruit where adjacent fruits are in contact or through scars caused by hail, wind, rubbing, and spray burn. Often a web is spun across the entrance hole, making detection of the injury difficult during picking, particularly where the caterpillar has entered at the stem end. One or more caterpillars may be found in each infested fruit. If injured fruits do not decay, they ripen prematurely. Leaves and young shoots may also be attacked, typical symptoms being leaf mining and the collapse of young lateral branches.

The adult moth (Plate 92, fig. 7) is an insignificant greyish-brown insect with a wingspread of just over ½ inch. The very small, oval eggs (Plate 92, fig. 1) are laid at night on all parts of the plant. The full-grown caterpillar is slightly less than ⅓ inch long, and is dull white, tinged with green. Pupation takes place in white silken cocoons on the plant, in rubbish on the surface of the soil or in crevices around the packing shed. The pupa (Plate 92, figs. 5 and 6) is dark-brown and ⅓ inch long. The life cycle from egg to moth is completed in about one month in warm weather.

Attacks are most severe in the northern parts of the State, particularly during long periods of dry weather, and may continue throughout the entire bearing period of the crop. The pest attacks several other plants, including English potato, tobacco, egg fruit, and Cape gooseberry.

If potato-tuber moth is known to be present, great care must be exercised when packing to cull injured fruit. Infested tomatoes should be collected and destroyed. Crop residues should be removed and

* *Phthorimaea operculella* Zell.

burnt as soon as harvesting is completed. Tomatoes should not be planted on old potato land nor should they be grown near English potatoes, especially if the latter crop is to be harvested before the main tomato picking period. Insecticides are seldom applied solely for the control of this pest; the dusting or spraying programme adopted for corn ear worm control ordinarily holds the insect in check.

Fruit Flies.

Fly maggots are commonly found in rotting tomatoes, and are sometimes suspected of causing fruit losses. This is rarely the case, because most flies bred from tomatoes have entered through injuries due to other causes. These secondary rot flies include a small metallic green species,* a small reddish-brown species,† and several species of grey, hairy flies.‡ In general, the female lays eggs or maggots in cracks, blemishes, or other places where the skin of the fruit has been broken. The full-grown maggots are dull white or creamy in colour, and live for some days in rotting fruit before pupating in reddish-brown pupal cases in the soil.

The true fruit flies§ are brilliant maroon and yellow-coloured insects. Normally, they are of little or no importance to the tomato-grower, but in some years, usually when other crops are being attacked severely, tomatoes also suffer. Unlike the secondary rot flies, the true fruit flies attack perfectly sound fruit.

Insecticides are of no value for the secondary rot flies. These insects only accelerate the normal process of decay, and when losses occur, cultural methods should be examined with a view to eliminating the injuries which facilitate attacks. When the true fruit flies are involved, the losses may be minimised by applying a bait spray to some of the plants. Suitable bait sprays are (*a*) sodium fluosilicate 1 oz., sugar 2 lb., water 4 gallons; and (*b*) lead arsenate 2½ oz., sugar 2 lb., water 4 gallons. One or other of these bait sprays should be applied to about every tenth plant through a course jet spray. More than one application may be necessary.

Green Vegetable Bug and other Shield Bugs.

The shield bugs which attack tomatoes include the green vegetable bug|| and two smaller insects. The main injury is to the fruit. Both adults and nymphs of shield bugs possess piercing mouth parts through which sap is sucked from the plant tissues. Damaged fruit is mottled and shows white spots, each of which represents a bug puncture. The white spot may extend through the skin and outer rim of flesh. Injured fruit fails to colour evenly, is unpalatable and frequently unmarketable, owing to its abnormal shape and texture.

The adult green vegetable bug measures ½ inch in length by ⅓ inch in breadth, and is green in warm weather but dark brownish-grey in winter. The female lays cylindrical cup-shaped eggs about $\frac{1}{16}$ inch in height under leaves, in batches of 20 to 150. The eggs are at first pale-yellow but change to reddish-brown before hatching. The incubation period is less than a week, and the small newly-emerged nymphs

* *Lonchaea aurea* Maeq.

† *Drosophila* sp.

‡ Fam. Muscidae. Fam. Sarcophagidae.

§ *Strumeta tryoni* Frogg. *Austrodacus cucumis* Fr. *Strumeta dorsalis* Hend.

|| *Nezara viridula* L.

are wingless and bright-orange in colour. They remain near the egg shells for a few days and then scatter over the plant, but are particularly attracted to the fruit. In a few days the nymphs become conspicuously marked with black, green, yellow, and red markings, and after moulting several times reach the adult stage some weeks later.

Both the smaller shield bugs are $\frac{3}{10}$ inch long and about $\frac{1}{5}$ inch wide and have a similar life history to that of the green vegetable bug. One species* is uniformly green with a small horn on each side of the front part of the shield. In the other,† the horns are absent, the head, thorax, and the backwardly pointing wedgeshaped part of the shield are green, while the rest of the body is brown with a greenish tinge.

Some benefit may be obtained if any unparasitised egg masses, nymphs, and adults seen during fruit picking are crushed by hand. If the eggs are black or almost black in colour they are invariably parasitised, and should not be destroyed.

Control by insecticides is unsatisfactory, particularly in large, leafy, untrellised vines, because the bugs cluster on fruit which is well sheltered and protected by foliage. A spray composed of resin 10 lb., caustic soda 2 lb., fish oil 3 lb., and water 40 gallons has given fair results against young bugs. The caustic soda is dissolved in 2 gallons of water and quietly boiled. The finely-ground resin is stirred slowly into this, and the boiling continued until the solution under the surface scum, though dark, is clear. The fish oil is added, and the mixture boiled for a few more minutes. This concentrate is diluted with 38 gallons of water before use. The concentrate containing fish oil does not store well. Hence, if storage is necessary, a concentrate without fish oil should be prepared. After reheating add the oil, boil for a few minutes, and then the spray is ready for dilution and immediate use.

A derris spray containing ·02 per cent. ether extractives prepared from powdered derris-soap or liquid derris proprietary products is also of some value against nymphs. This concentration is about twice as great as that used against thrips. Weekly applications of a dust containing 5 per cent. nicotine will kill some of the young bugs, and exert a deterrent effect against the adults, but as the dust needs to be liberally and frequently applied, its use is costly.

Rutherglen Bug.

Rutherglen bug‡ injury is confined mainly to the fruit, though all parts of the plant may suffer when the infestation is heavy. The blemishes are similar to those caused by shield bugs.

The adult is a greyish-brown, slender, winged insect, about $\frac{1}{6}$ inch long, possessing sucking mouth parts. It flies actively on warm days when disturbed. The eggs are small, elongate, and white when newly-laid, and are commonly found in the hairy seed heads of thistles, ragweeds, and around the buds and flowers of red pigweed. The eggs hatch in about six days in warm weather, the wingless, reddish-brown nymphs reaching the adult stage in a further three weeks. The pest population on tomatoes consists of invading swarms of adults and occasionally nymphs, since Rutherglen bug does not breed on this crop.

* *Cuspicona simplex* Walk.

†* *Plautia affinis* Dall.

‡ *Nysius vinitor* Berg.

Rutherglen bug infests many crops other than tomatoes. Attacks are likely when dry weather follows late winter or early spring rains, which favour the growth of weeds. Heavy rains, which stimulate fresh weed growth, often scatter large swarms.

Constant control of weeds within and around fields should be maintained as far as practicable. Bugs on infested weeds may be destroyed by applications of a calcium cyanide dust, or by spraying with crude oil emulsion or kerosene emulsion at a strength of one part to eight parts of water. Temporary relief may be given to an infested field by lighting smoke fires.

Control by insecticides is not satisfactory, because the bugs fly quickly, and many escape contact with sprays or dusts. Either a dust mixture containing equal quantities of pyrethrum and a 3 per cent. nicotine dust or a spray of 3 lb. pyrethrum powder, 2 lb. soft soap, and 50 gallons water used immediately after preparation may give some relief if several applications are made when the bugs are numerous.

Thrips.

Blossom-fall in tomatoes may be due to a number of factors, but in North Queensland, high thrips* populations are a probable cause of faulty fruit setting, particularly in dry weather. Thrips are very small, active, cream-coloured insects, about $\frac{1}{16}$ inch in length. The thrips cluster inside the flowers, which subsequently fall. Fruit developing after such outbreaks is frequently mis-shapen.

If high thrips populations are observed in the tomato flowers and flower drop, with or without fruit malformation, has previously been reported on the farm, it is suggested that a 5 per cent. nicotine dust be used. More than one application may be necessary to check the pest.

ROUTINE PEST CONTROL MEASURES.

The thorough cultural operations which are essential for the tomato crop also reduce the risks of pest infestation. In this connection the following points are important:—

1. For planting material, use only healthy seedlings, with roots free from nematode nodules.
2. Maintain good-growing conditions in the field by frequent cultivation both before and after transplanting, by the use of fertilizers and by judicious watering when irrigation facilities are available.
3. Collect and destroy all damaged fruit.
4. Exercise care in packing tomatoes in order to avoid the inclusion of fruit infested with pests which may later be the means of spoiling the remainder of the case.
5. Plough out old tomato plants immediately after picking has ceased and burn them if they are infested with nematodes.
6. Do not plant tomatoes after potatoes or near crops subject to attacks by tomato pests.

Growers are seldom faced with a simple problem such as the control of a single pest. For economy in labour and material, therefore, a basic programme which will control pests likely to occur in the crop

* *Frankliniella* sp.

must be adopted, reserving applications of special insecticides for special problems. The requirements of disease control must also be considered. Combined insecticidal and fungicidal treatments are required in the seed bed and the field.

In the seed bed, light but frequent applications of a dust containing arsenate of lead 5 parts, sulphur 6 parts, copper carbonate 3 parts, and filler 6 parts will ensure seedling growth free from most pests and diseases. A proprietary dust of this kind would carry an analysis as follows:—7·75 per cent. arsenic pentoxide (As_2O_5) as lead arsenate, 30 per cent. sulphur as ground (or precipitated or sublimed) sulphur, 7·5 per cent. copper (Cu) as copper carbonate. A combination spray consisting of 2-3-40 Bordeaux (or 1 in 20 cuprous oxide mixture) with colloidal sulphur (1 lb. to 50 gallons) and lead arsenate (1 lb. to 50 gallons) will achieve the same purpose. If aphids appear, they should be treated with a 2½ per cent. nicotine dust or a nicotine spray (1 pint nicotine sulphate, 4 lb. soap, and 100 gallons water).

In the field, an all-purpose dust mixture should contain lead arsenate 10 parts, sulphur 6 parts, and copper carbonate 4 parts. Such a proprietary dust would carry the following analysis:—15·5 per cent. arsenic pentoxide (As_2O_5) as arsenate of lead; 30 per cent. sulphur as ground (or precipitated or sublimed) sulphur; 10 per cent. copper (Cu) as copper carbonate. If desired, a combination spray of 4-4-40 Bordeaux (or 1 in 10 cuprous oxide mixture), to which lead arsenate 3-6 lb. and colloidal sulphur 2 lb. are added to each 100 gallons of the spray may be used. A nicotine dust or spray similar to that used in the seed beds should be applied if aphids become numerous. Treatment in the field should commence when flowering begins and continue at approximately fortnightly intervals at least until picking tallies are at their maximum.

Mixed dusts containing insecticides and fungicides in similar proportions to those stated in the recommended formulæ are prepared by several firms. Although mixing on the farm cheapens the cost, it is preferable for the grower to purchase dust mixtures already prepared, unless he has facilities for accurately weighing the ingredients and thoroughly mixing them.

CHEESE FLAVOUR PHOTOGRAPHED.

Wonders, of course, will never cease! Cheese flavour has had its picture taken for the first time. Science workers are now using X-rays to photograph the flavour of cheese. They want to find out what gives cheese its appetising taste.

Flavour is one of the best things about meal time. Physiologists and psychologists point out that food must be palatable to be eaten in quantity and to be digested properly. A monotonous menu may upset any normal digestion. The careful choice and application of flavour—and every good cook knows this—is important in relieving this monotony. Flavour needn't be a luxury, but it may be provided in daily meals by everyday foods, such as cheese. With a large selection of 400 varieties, each with a different agreeable flavour, cheese makes an outstanding contribution to our dairly bills of fare.

The high nutritive value of cheese, as well as its usefulness in economical meal-planning, are other reasons for including cheese in our daily rations. Experiments have shown that cheese is nearly 100 per cent. digestible. That is another top mark for our dairy industry. There is this about cheese, too—there is little or no waste in preparing it for the table. For an appetising combination, just think of cheese and spring onions!

Fodder Conservation in Queensland.

I. SILAGE AND SILOS.

C. J. McKEON, Director of Agriculture.

The making of silage is not a complicated process calling for considerable skill and experience. The reverse is the case, less skill and experience being required than for the making of good hay. Furthermore, the best quality silage can be made during weather conditions which would make the curing of hay impossible. Once a crop has reached the correct stage for converting into silage a start can be made regardless of the weather and, providing a few simple rules are observed, silage of good quality can be made by anyone who has had no previous experience.

A silo is a definite asset on any farm, and it is doubtful if the outlay involved could be expended on any other improvement with greater financial benefit. The increased butter production alone resulting when dairy cows are fed on silage during the winter months of normal seasons would soon compensate for the expenditure involved. In addition, a well-filled silo would be the means of saving at least a portion of a herd during drought periods, when the cost of fodder precludes its purchase by many stockowners.

ALTHOUGH conservation of fodder in the form of silage has been practised in Queensland for many years, the total quantity stored annually in this way has been far below ordinary winter requirements, apart altogether from the drought reserves which should, as a matter of prudence, be stored in seasons of abundance. Soil and climatic conditions throughout the agricultural districts are generally very favourable for the production of many summer fodder crops, which provide a great bulk of material suitable for silage making. Hence, if full advantage were taken of the bounty of nature in this regard, stock losses during seasons of scarcity would be greatly reduced. In addition to its drought insurance value, however, silage provides a succulent and nutritious stock food during the winter months, when natural pastures are usually dry, unpalatable, and lacking in nutritive value. It has been proved that the feeding value of silage is little, if at all, inferior to that of the green material from which it was made, and this, coupled with the fact that its succulence and laxative properties promote a better functioning of the digestive system than dry feed, makes it a very valuable fodder.

Winter rainfall is usually unreliable in most districts in this State; consequently the planting of seasonal crops for grazing purposes cannot

be undertaken with any certainty that they will provide sufficient food to enable stock to winter well. Summer fodder crops, however, can be sown with far greater confidence, and from them a much greater bulk of green material can be produced.

During the early years of the development of dairy farming in Queensland, especially on the fertile soils of the rain-forest districts, the growth of sown pastures was so luxuriant that the need for fodder conservation was not felt. The rate of stocking was then considerably higher than that of later years. The gradual decline in the carrying capacity of even the richest lands through the lowering of soil fertility, through soil impaction caused by heavy stocking, and through the old swards becoming root-bound has since made fodder conservation a necessity in the majority of holdings in every dairying district.

The same serious reduction in carrying capacity has also occurred in native pastures largely as a result of over-stocking. The stock naturally show a preference for the more nutritious and more palatable native grasses, with the result that they have been kept in a closely-grazed condition and been prevented from seeding. The inferior species have been neglected to a large extent, and, consequently, have seeded freely and ultimately predominated in some cases.

For the reasons just given, a silo is really a necessity on most properties in agricultural areas. It is a very definite asset, and it is doubtful if the outlay involved could be expended on any other improvement with greater financial benefit. The increased butter production alone resulting when dairy cows are fed on silage during the winter months of normal seasons would soon compensate for the expenditure involved. In addition, a well-filled silo would be the means of saving at least a portion of a herd during drought periods, when the cost of fodder precludes its purchase by many stockowners.

Admittedly many are not in a financial position to build the more costly types of silo, but if it were more widely appreciated how effectively and cheaply silage can be conserved in the less costly silos it would be used to a much greater extent than it is at present.

The making of silage is not a complicated process calling for considerable skill and experience. The reverse is the case, less skill and experience being required than for the making of good hay. Furthermore, the best quality silage can be made during weather conditions which would make the curing of hay impossible. Once a crop has reached the correct stage for converting into silage a start can be made regardless of the weather and, providing a few simple rules are observed, silage of good quality can be made by anyone who has had no previous experience.

THE MAKING OF SILAGE.

Good quality silage can be made only from material which has been cut and stored in a fresh, green state, the aim being to conserve the fodder in a succulent condition. This is brought about by acid fermentation which occurs when the air is excluded from the mass; consequently, the quality of the silage will be very largely influenced by the extent to which the air has been expelled and excluded from the material. It is therefore necessary that the silo be as airtight as possible.

The best quality silage is that known as "acid" silage, which is light-brown to yellow-brown in colour and possesses a distinctly pleasant

acid smell—hence the name. Silage of this kind can be made only from suitable types of crops, and then only when these have been cut at the right stage of growth and handled in the correct manner. If crops have been allowed to reach an advanced stage of maturity, or if they have been allowed to dry out in the field after being cut, normal fermentation will not occur, moulds will develop, and an inferior silage, known as "mouldy" or "musty" silage, will be the result. Crops which would otherwise be suitable, but which have been cut when very immature, or which are naturally of a very soft succulent nature, also make an inferior silage when used alone, for the soft, sappy material packs so closely that little heating takes place. Silage made under these conditions possesses an objectionable smell and is known as "sour" silage. Immature material or material of too succulent a nature may be used, however, to advantage by blending with material of a coarse and more fibrous nature, such as maize or sorghum. The proportions in which it should be blended, with either of the latter crops, depend upon its degree of immaturity or succulence, but, as a general rule, it should not be mixed in more than equal proportions.

The material should be cut when in a green, but not immature, stage, and should be carted from the field and placed in a silo as soon as possible after being cut. On no account should it be allowed to lie in the hot sun and become badly wilted. Should this occur for some unavoidable reason, it is advisable to sprinkle the material with water as it is being conveyed to the silo from the cutter. If, however, the quantity of material so affected is large, it should be mixed in equal proportions with freshly-cut material when being stored, and, if necessary, also sprinkled with water.

Silage which has been properly made will keep for many years without deteriorating in any way if stored under airtight conditions. It is not damaged in any way by insects or vermin, nor is there any risk of loss by fire as is the case with hay.

THE FEEDING OF SILAGE.

If required, silage may be fed from eight to ten weeks after being made. Stock quickly acquire a taste for it and greatly relish silage, and rarely is any trouble experienced in getting them accustomed to it. When it is intended to feed it to dairy cows that have not previously had silage, it is a good practice to place a small quantity in feed boxes at the head of each bail for a few days before commencing regular feeding. When this is done, the cows almost invariably acquire a taste for it within a few days.

Silage is not only a nutritious and palatable food for dairy cows but it is also excellent for sheep, and, during winter months or dry periods, it is of particular value for breeding ewes. It is not generally regarded as being suitable for horses; they will eat it, but it should be fed sparingly to them.

It is advisable to commence feeding a small ration, gradually increasing the quantity until the full ration is being fed. This particularly applies to stock which have been on dry feed and which are likely to be affected by scouring if a full ration were fed from the commencement. The amount of silage to be fed daily is governed by the weight of the animal and the quantity and quality of milk produced, in the case of dairy cattle, as well as by the amount of natural feed available.

Silage made from crops such as maize and sorghum, which are those most widely used for this purpose, contains a high proportion of carbohydrates, but it does not contain sufficient protein to constitute a balanced ration. Therefore, when fed to dairy cows with a view to maintaining or increasing milk production, silage should be supplemented by protein rich food, such as lucerne, cowpea, field pea, seed cake preparations, and meat meals.

SUITABLE SILAGE CROPS.

The best silage is made from crops with a high sugar concentration, as these form sufficient acid to ensure the desired state of preservation. Legumes are unsuitable for silage-making alone unless strong preserving acid or fermenting molasses is added. As a general rule, these crops are better conserved as hay. The chief crops produced in Queensland for silage purposes possess the desired sugar content and, in addition, produce a large quantity of green material.

Maize is the most popular and also the most suitable of all crops for silage purposes. To facilitate harvesting and also to promote good cob growth, it should be sown in rows just sufficiently wide to permit of inter-row cultivation. It may also be spaced closer in the rows than when the crop is grown for grain. The crop should be cut when the grain is well formed but before it has commenced to harden. The ideal stage is when the grain reaches the late dough stage. The cheapest and most efficient method of harvesting maize for silage-making is with a maize binder, but few of these very efficient labour-saving machines are now to be seen and the crop is usually harvested by hand, using a cane knife or other suitable tool.

Improved Yellow Dent, also known as Fitzroy, Golden Beauty, and Star Leaming are varieties which can be recommended as silage crops. The first mentioned is suitable only for coastal districts where the rainfall is generous and reliable, whereas the other two varieties can be

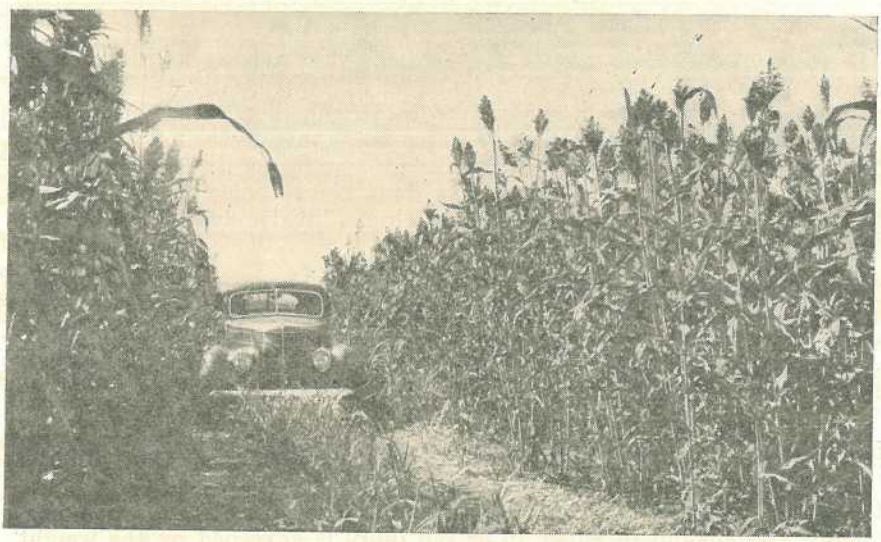


Plate 93.

Saccharine Sorghum Crop suitable for Silage.

grown both on the coast and inland. On good soils and under favourable seasonal conditions, yields of from 12 to 15 tons of green material to the acre may be expected.

Sorghums (Plate 93) are next in favour for silage-making and are particularly suitable for districts in which the rainfall is light or unreliable. They can also be grown successfully on poorer types of soil, which are not suitable for maize. The saccharine types are recommended in preference to the grain types, as the stalks of the latter are of a pithy nature and have a low sugar content.

The commonest practice is to sow these silage sorghums broadcast, but many arguments can be advanced in favour of sowing them in rows, spaced either just wide enough apart to permit of inter-row cultivation or sufficiently close to enable the plants to suppress weed growth. When the closer spacing is adopted, a seed drill should be used for sowing the seed, and a very satisfactory row spacing can be attained by blocking every second grain run, thus spacing the drills 14 inches apart.

Crops sown in rows are handled with greater ease and celerity and are less likely to lodge and become a tangled mass than when sown broadcast. This is particularly important when the full length stalks are to be used, as in trench silos and stack silage, because bent and twisted stalks cannot be stored so compactly as straight stalked material. The crop should be cut when the grain is in the same condition as that recommended for maize silage. The same methods of cutting the crop are also usually adopted.

The most widely-grown varieties are Imphee or Planter's Friend, Saccaline, and Honey. Other varieties are White African, Sugardrip, Orange, Italian, Colman, and Sumac. Under favourable conditions, yields of up to 20 tons to the acre may be expected, and this figure may be exceeded under very favourable conditions.

Sudan grass also makes excellent silage and is a crop which is particularly suitable for inland districts. It may be used alone or in conjunction with the coarser stalked crops, such as maize. When made into silage with full length maize stalks in either trenches or stacks, the fine stalks of the Sudan grass pack closely between the coarser maize stalks, thereby assisting in expelling the air as the mass of material settles.

If available, a seed drill should be used for sowing Sudan grass, but, if not, the seed should be sown broadcast. The best method of cutting the crop is with an ordinary reaper and binder, as material so cut is more easily handled, both in the field and when being placed in the silo, than crops which are cut with a horse mower. The correct stage for cutting is when the grain is just forming. Given favourable weather conditions, two or more cuttings of Sudan grass may be expected. From a well-grown crop a first cut of 8 to 10 tons of green material to the acre may be produced. Any subsequent cutting is usually much lighter.

White panicum and Japanese millet, which are fairly extensively grown for hay and grazing, are also of considerable value for silage-making, being converted into silage either alone or as a mixture with maize or sorghum. They can be grown successfully on a fairly large range of soils but are not so well suited to such districts as the Darling Downs and the Maranoa as is Sudan grass. For coastal districts the

reverse is the case. They are sown and cut in the same way as Sudan grass, but the yields of green fodder are somewhat lighter. Cutting should be carried out before the grain has developed. They are free seeders and shed their seed readily and should, therefore, not be allowed to produce mature seed; otherwise a considerable amount of trouble will be experienced in dealing with the volunteer growth which will appear the following season.

The foregoing crops are the most widely grown and also the most suitable for silage purposes, but, in addition, other summer-growing crops, such as cow cane and elephant grass, produce a great bulk of fodder and may be successfully used if cut before the stalks become too woody, particularly if a light-stalked crop is mixed with them. Pasture grasses, such as paspalum and Rhodes grass and others of a similar habit of growth, may also be cut for silage, but when these are being used alone., i.e., not as a mixture with heavier-stalked crops, they should be cut when in a fairly mature, but not dry, stage, and on no account should they be used for silage in a young stage. If this were done, the best that could be expected would be sour silage, and very often the resultant material would turn out an almost worthless sodden mass.

Legumes such as lucerne, Poona, Black, and Groit cowpeas are rarely used alone in Queensland for silage-making but are frequently mixed with non-leguminous crops, thereby increasing the feeding value of the silage. Lucerne is easily cut and handled and presents no difficulties in this respect, but owing to their habit of growth, cowpeas are much more difficult to cut and handle, and, consequently, they are not used to the extent they might otherwise be. Some success has been met with when cowpeas and maize or sorghum have been grown together, but such a combined crop is usually difficult to handle, and furthermore, a heavier yield is generally obtained when the two crops are grown separately. Nevertheless, a combination of Groit cowpea and maize has proved promising on the Atherton Tableland. A light sowing of the cowpeas can be made, the seed being sown in the same drills and at the same time as the maize. No general recommendation can be made regarding cowpea varieties for silage, as soil fertility and seasonal conditions have such a marked influence on the growth and period of maturity. The aim should be to select a variety of cowpea that will produce the desired amount of foliage and reach the correct stage for cutting at the same time as the maize. It should not, however, be a variety which will produce a crop of vines sufficiently heavy to restrict the growth of the maize or weigh the plants down and thus add to the cutting and handling costs.

Winter-growing crops which may be used for silage-making are wheat, barley, oats, and field pea. Florence wheat and Dun field pea, when sown together at the rate of 40 lb. of the former and 20 lb. of the latter to the acre, provide an excellent mixture, as both crops reach the correct stage for cutting, i.e., the flowering stage, at the same time. Other winter cereals, when sown in conjunction with field pea, also give very good results. The growing of winter crops cannot be undertaken with the same degree of certainty as in the case of summer crops, nor are their yields of green material comparable with those from summer crops, such as maize or sorghum. Hence the growing of these or other suitable summer crops, in preference to winter crops, is recommended.

TOWER SILO.

The reinforced concrete tower silo (Plate 94) is usually the most costly type to construct, and, in addition, a more expensive plant is required to fill it than is necessary for an underground silo. The points in favour of the tower silo, however, outweigh those objections, and for anyone who is in a financial position to build one, this type of silo is strongly recommended. If properly constructed it is practically everlasting.

Plate 94.
Reinforced Concrete Twin Tower Silo.

The best results are obtained when the silo has been so constructed that the height is considerably greater than the diameter, thereby ensuring sufficient pressure to consolidate the materials properly. The usual practice is to make the height of the silo approximately double the diameter of the silo, e.g., a silo 14 feet in diameter should be 28 feet in height. Should it be desired to reduce the height of the silo above ground, this can be done by excavating and building a portion underground. The cost of construction varies very considerably, and is influenced largely by the distance that materials, particularly sand and metal or river gravel, have to be carted and the amount of outside labour required.

In addition to an engine and cutter, which is required for chaffing the material to be converted into silage, either a blower or an elevator is necessary to convey the chaffed material to the silo. The latter calls for additional power, and an engine of at least 5 horse-power is required to drive the cutter and at the same time provide the necessary power to work the blower or elevator.

Filling the Tower Silo.

During the whole time filling operations are in progress one person should be stationed inside the silo to keep the chaffed material evenly distributed and well trampled, paying particular attention to the material adjacent to the wall. As the chaffed material is falling from

the top of the silo, the heavier particles drop in the centre, and the light, leafy portions drift towards the wall. It is therefore essential that constant attention be paid to the even distribution of the material. On no account should this be done at lengthy intervals, as it will not then be possible to get an even mixing, with the result that an uneven consolidation will occur and the quality of the silage will be adversely affected.

As a greater settling occurs in the centre of the silo than elsewhere, it is advisable to keep the material slightly higher in the centre. When filling has ceased for the day, all who are assisting with the work should enter the silo and thoroughly trample the material. Filling should be continued each day until the silo has been filled. Should operations be unavoidably held up, the top layers of material will quickly deteriorate if left exposed to the air, and should it be evident that any more than a few days will elapse before it will be possible to resume filling operations, it is advisable to cover the material with a layer, several inches in depth, of finely-chopped succulent grass or something equally suitable. The covering layer should be removed immediately prior to filling being resumed, care being taken to see that no material showing signs of mould is left. The same care is necessary where a protective covering has not been used, as it will then be necessary to remove the top layers of the material which is being converted into silage and which have become dry or are showing signs of moulds.

When the silo has been filled, a layer of approximately 12 inches in depth of some fine-stalked, succulent material should then be added and spread evenly over the surface as soon as possible. When well trampled, this forms a dense, mouldy mass and prevents the entry of air. When suitable green material is not available, wet chaff may be used.

Weighting material is of great assistance in bringing about the desired consolidation of the top few feet of material, but it is not an easy matter to convey the required amount of earth or stones to the top of the silo and, rather than do so, many prefer to devote more time to the trampling of the top few feet of silage and also of the material which is used as a protective covering.

Emptying the Tower Silo.

When it is intended to commence feeding the silage to stock, the covering material and with it the top layer of silage which has been in contact with the mass of mouldy covering material should be removed. If the material has been thoroughly trampled, the quantity of silage which has become mouldy will be negligible, and usually the removal of a layer an inch or two in depth is all that is necessary. Silage deteriorates when exposed to the air for any length of time, and each day's requirements should be taken from the whole of the surface to a depth of at least 2 inches. This prevents any remaining exposed for more than twenty-four hours. An ordinary garden rake is very suitable for removing the silage, as the surface can be maintained in an even condition and the layer below is not disturbed, as would be the case were a fork or other long-pronged tool used.

So little time is required each day in removing and replacing a cover that the use of one is recommended. This can be made from canvas or any other suitable material, and will assist very materially in keeping the silage in a succulent condition.

CIRCULAR PIT SILO.

The circular pit silo (Plate 95) is becoming increasingly popular, and during recent years a very large number have been constructed. Providing a suitable site is available, it is not necessary to concrete the whole of the silo, and in such a case all that is required is a concrete collar 4 inches in width and 5 feet 6 inches in depth. The usual practice is to have portion of the collar projecting above ground level, and thus all risk of storm water finding its way into the silo is eliminated and considerable protection is afforded against accident to human beings and straying stock. The collar type of circular pit silo would be unsatisfactory in many locations and, in such cases, it will be necessary for the whole of the pit to be concrete lined.

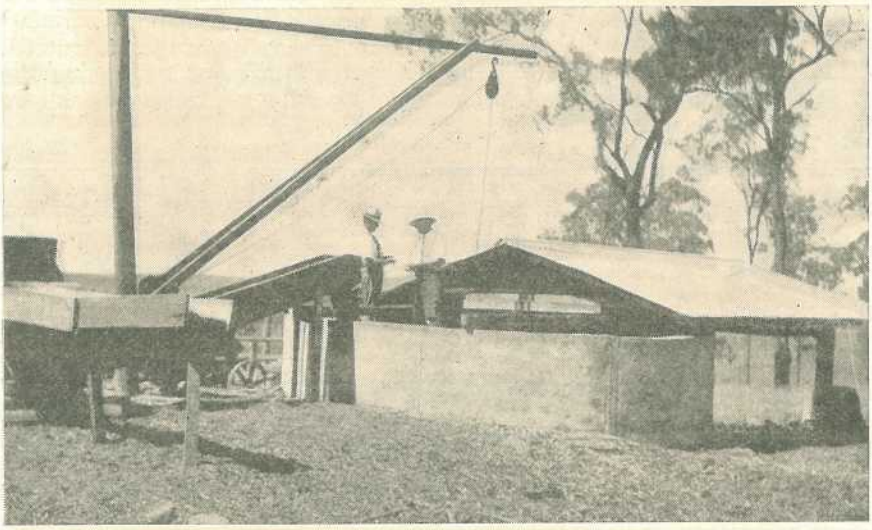


Plate 95.
Circular Pit Silo showing Concrete Collar and Sliding Roof.

It is essential that the wall of the collar type of circular pit silo be kept plumb, and also that, below the collar, it be smoothly trimmed to ensure even settling of the material. Cavities in the wall will be the means of causing the silage adjacent to them to become mouldy or of inferior quality. By using an iron rod and batten, no difficulty should be experienced in keeping the wall plumb.

Providing the silo has been properly constructed on a site where there is no danger from water seepage, silage of the best quality can be made in the collar type of circular pit silo and kept for many years in splendid condition. The concrete collar type of circular pit silo can be more cheaply constructed than either the tower type or the completely concrete-lined circular pit silo, and the additional saving of the cost of a blower or elevator is effected, as compared with the tower type. The completely concrete-lined circular pit silo costs about the same as the tower silo, but here again the cost of a blower or elevator has not to be incurred. The removal of the silage from either type of circular pit silo, however, requires a little more time and labour than is the case with a tower silo, but for those who do not feel disposed to construct the latter type, the pit can be recommended as an efficient substitute.

Filling the Pit Silo.

The same methods should be adopted in every detail in filling a circular pit silo as when filling a tower silo. Weighting material to provide additional pressure may be applied with less inconvenience to the pit than to the tower silo. Furthermore, as the pit silo is covered either by a high shed or a low sliding roof, it is possible to thoroughly trample the material at a higher level in the silo than is the case with the tower silo, which of necessity has a fixed roof with little clearance between the top of the silo and the lowest portion of the roof.

Emptying the Pit Silo.

A hoist is necessary for the removal of the silage. The type of hoist, together with the self-emptying drum, which is recommended for use when excavating the pit (Plate 101) has also proved highly satisfactory for the removal of the silage, and can be very cheaply constructed. The silage should be collected for removal in the same way as in the tower silo, and the same precautions should be adopted to keep the silage in a fresh, succulent condition.

TRENCH SILO.

The trench silo (Plate 96) is a cheap and very efficient type, and is particularly suitable for inland districts where prolonged rainy periods are not generally experienced, and consequently the risk of seepage water gaining access to the trench is slight. Care is necessary in selecting a site, and one in which seepage is likely to occur should be avoided. The only cost involved in constructing a trench silo is for labour, and when the usual practice of excavating by means of a plough and scoop is adopted, the cost is small. Under normal conditions, and with a suitable plant, two men can excavate a trench of at least 50 tons capacity in two or three days. The excavation is usually 10 feet wide, approximately 8 feet deep, and whatever length is necessary to accommodate the material to be made into silage. The ends are sloped sufficiently to permit of the trucks or wagons being driven through the trench when unloading. The sides should be trimmed as evenly and as smoothly as possible. If logs are

Plate 96.
Excavating a Trench Silo.

available, these should be laid along each side of the trench and the excavated earth banked over them to a height of approximately 2 feet. A gradual taper away from the trench should be allowed to prevent storm water gaining entry to the silage.

Filling the Trench Silo.

The material in a trench silo is usually made into silage in a whole or unchaffed state, and, in doing so, care should be taken to lay the stalks in one direction only. This applies particularly to thick, long-stalked crops, such as maize or sorghum, as the best results cannot be obtained with them when too much air is admitted as a result of careless spreading or laying the material in transverse layers. It should be spread in even layers, lengthwise along the trench.

The truck or wagon may be driven through the trench as each load is being spread. This allows the material to be handled more easily and more expeditiously than if it were unloaded from the side of the trench, and it also consolidates the silage. Filling (Plate 97) should be continued until the material is well above the top of the trench to allow for subsidence. Should the material be likely to subside to such an extent that more is required, this may be added a week or ten days later. In the interval, a covering of green grass should be provided to prevent the formation of mould on the top layer. When the trench has been filled, a thick layer of green grass should be spread over the top of the silage material, and this in turn should be covered by earth excavated from the trench. The earth covering should be formed in such a manner that when the silage material has completely subsided there will be sufficient camber to turn rain water away from the trench.

Plate 97.
Partly-filled Trench Silo showing Tractor Consolidating the Material.

Emptying the Trench Silo.

The silage should be removed from one end of the trench, and only that section of the covering material which will allow the required amount of silage to be removed should be disturbed. A sharp hay knife or broad axe is very suitable for the cutting of the silage. It should be removed in vertical sections, thus exposing the minimum amount of silage to the air.

STACK SILAGE.

Silage may be easily and cheaply conserved in stacks, but this method is only recommended when the silage is to be used within a few months after being made. Even when most carefully built, exposure to the atmosphere causes wastage on the sides and ends of the stack, and this increases with time. The stack should be erected in a well-drained situation, and in a position handy for feeding. A further point to be considered in selecting the site is the proximity of the stack to the field in which the crop to be used is growing. A rectangular-shaped stack is to be preferred to a square stack, one of the main advantages being the reduction in the surface of silage exposed when the end of the stack is opened for feeding.

Framework.

The framework consists of bush timber from 4 inches to 6 inches in diameter at the butt end, erected in the manner shown in Plate 98. The poles are sunk in the ground to a depth of approximately 20 inches, and should be at least 15 feet above ground. The top plates and the brace at each permanent end of the stack should be fastened to the uprights with a wire twitch. Where a stack of large dimensions is being built, or where a light framework is used, it is advisable to provide one or more cross braces for the framework. When only one cross brace is used, it should be fastened to the central upright on either side, and provision made for the central uprights to be at least 3 feet higher than the others. It is then possible to have the central brace much higher than the top of the framework, and thus offering less obstruction when stacking the material as the stack is nearing completion. Any other cross braces used should be handled in the same manner as the central brace. In addition to the uprights required for the framework, a pair should be erected at each end of the stack to bear the cross piece which is used to support the ends of the fodder until they are trimmed off level with the permanent end of the stack. The uprights along the side should be spaced 3 feet apart when long-stalked crops are being stacked. The distance is reduced to 2 feet 6 inches or, if necessary, to 2 feet for shorter-stalked crops like white panicum or Sudan grass. Where possible, the framework should be erected close to a tree, which can be used to support the whip for lifting the material when the height of the stack calls for its use.

Stacking.

Before commencing the stack, a layer of green grass, at least 6 inches in depth, should be spread evenly over the ground to prevent the silage from coming in contact with the earth.

When stacking maize or sorghum, the farmer should begin by laying the material in such a way that the heads of the plants extend 3 feet to 3 feet 6 inches beyond the permanent end of the stack, the distance being reduced to suit shorter-stalked crops. He should continue to lay the material evenly, with the heads facing the one way, until the butts of the plants extend a similar distance beyond the opposite permanent end. The material should not be laid end to end, but should be laid in such a manner that it overlaps for about one-third of its length. After placing a layer along the entire length of the stack, the next layer should be commenced by laying the material in the reverse manner—i.e., the butts should be facing the direction in which the heads are facing in the previous layer. The work should be continued in this manner to the

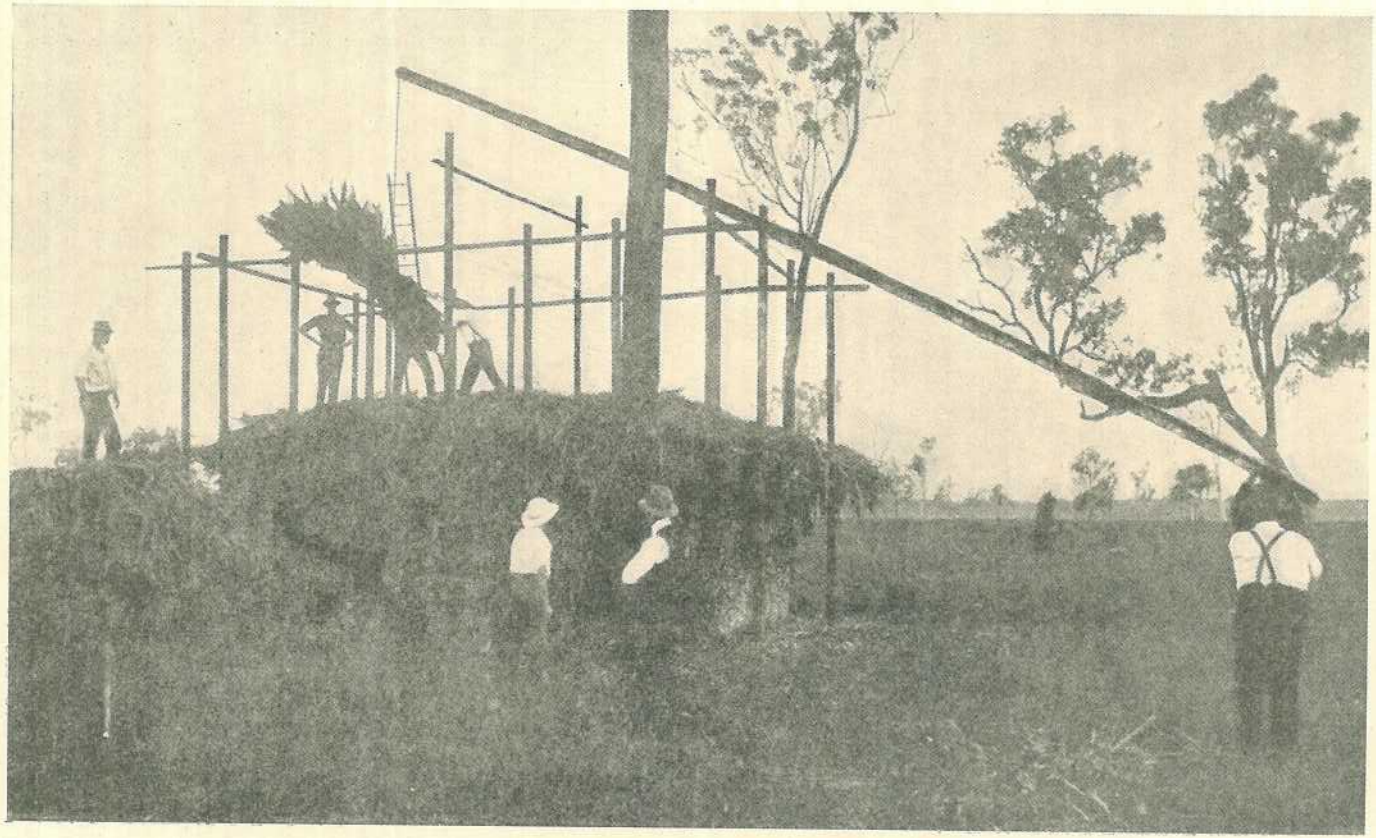


Plate 98.
SILAGE STACK IN COURSE OF ERECTION.

opposite end of the stack. By reversing the layers in the manner described it is possible to maintain an even surface, particularly when heavy-stalked crops are being stacked. When the material has been stacked to a height of 2 feet 6 inches, the projecting ends of the material being stacked should be trimmed off flush with the uprights which are to form the true end of the stack. A sharp cane knife will be found very suitable for trimming the ends. Before stacking is resumed, the cross piece which is used to support the projecting ends of the material should be raised level with the top of the stacked material and fastened to the additional uprights which have been provided for that purpose. Each time a similar quantity of material has been added to the stack the projecting ends are trimmed as previously described, and the cross piece again raised level with the top of the stack. The trimmings should be laid along the centre of the stack. During the whole time stacking is in progress, the material should be well trampled along the sides.

When the material is carted by dray or lorry, it is not necessary to use a whip or hoist until the stack is nearing completion, as the material may be handed from the vehicle to the person on the stack. In this case it is very necessary that the material be received from both sides of the stack, for if received from one side only, the extra trampling will cause a much more rapid settling on that side. As a consequence, the material on the opposite side of the stack will not consolidate sufficiently to permit of the production of good silage.

After stacking has been finished at the end of each day, it is a good plan to add weight to the stack. An easy and effective way of doing so is by passing lengths of fencing wire over the stack and suspending a long pole from these on either side of the stack. These poles should be suspended well clear of the ground, as a considerable amount of settling takes place during the night. Very little additional time is required in applying the weight each evening and releasing it the following morning.

When the whole of the material has been placed in the stack, a layer of green grass at least 6 inches in depth should be spread over the top of the stack. Earth, stones, or other weighting material should then be placed on this, forming a camber along the length of the stack. When earth is used, it is advisable to lay light logs along each side and end on the top of the stack to form a bed to keep the earth in position. To provide the required pressure, a layer of earth at least 1 foot in depth is necessary. After placing the weighting material in position, a covering of dry grass should be placed on top of this, and as it is very necessary that water should not gain access to the silage, the earth and grass should be placed in such a way that rain water is turned over either side of the stack. This means that, when completed, the stack will be appreciably higher along the centre than at the sides.

Opening the Stack.

The silage should be removed from one end of the stack only, using a hay knife or broad axe to cut a shelf from top to bottom. Only sufficient of the covering should be removed to permit of each day's requirements being taken out, and as small a surface as possible should be exposed to the air. A certain amount of wastage will inevitably occur on the ends and sides, but, providing the material has been carefully stacked at the right stage of growth, and the silage has not been kept for more than four or five months, the wastage should not be great.

II. SILO CONSTRUCTION.

L. WOOD, Field Officer, Agricultural Branch.

The tower, the circular pit, and the trench are the three types of silo used in Queensland, and each was therefore mentioned in the notes dealing with silage and silos. The construction of the trench type of silo is so simple that the description already given therein requires no amplification. The construction of the other two types, however, is more complicated and, in the case of the tower silo, calls for the use of reinforced concrete; the circular pit silo may have only a concrete collar, but it is preferable to have it completely lined with concrete. It therefore seems appropriate to deal firstly with the mixing of concrete, and then to discuss the construction of the tower and the circular pit types of silo in such detail as is requisite.

SELECTION OF CONCRETE-MAKING MATERIALS.

Due care should be exercised in the selection and measuring of the sand, metal or river gravel, and water to be used in making the concrete mixture. The quality and proportions of the materials used have a definite influence on the strength of the concrete made from them. The sand should be clean and sharp and free from all vegetable matter, such as leaves and grass roots, as well as from any other foreign matter. It may be tested by rubbing a small quantity between the hands, and should doing so cause them to become dirty, the sand must be washed. It may be washed in a small trough 6 feet long and 1 foot 6 inches wide, a small cut being made at one end through which the foreign matter is carried off by a flow of water. The sand should be stirred round with a shovel, and the flow of water maintained until all foreign matter has been removed. Very fine sand is not as suitable as that which is classed as medium fine. If fine screenings from crushed rock are procurable they may be used instead of sand. The term metal is applied to the coarse aggregate which is actually crushed rock, and for general concrete work any hard rock may be used; it should range in size from about 1½ inches in diameter to small screenings about half that size. It is sometimes imagined that very large stones tend to strengthen concrete but, while they may be used in thick walls and foundations with a view to saving cement, they should not be used where the thickness of the concrete is not sufficient to give at least 1½ inches of material between the "plums," as they are called, and the outer face of the concrete. Where river gravel is used instead of metal, the sand naturally occurring with it will have to be screened from it because river-run gravel usually contains a large percentage of sand. The correct quantity of sand required for the concrete mixture will then have to be added to the river gravel which has been freed from the unknown proportion of sand which it contained when it was dug from its bed. It is important that only clean water, free from oil and dirt, be used.

PROPORTIONS, MIXING, AND PLACING OF MATERIALS.

A measuring-box should be employed to ensure that the correct proportions of the materials for the concrete mixture are used. When the proportions in which they are to be mixed are 4-2-1—i.e., 4 parts of metal or river gravel, 2 parts of sand, and 1 part of cement—a bottomless box with sides measuring 2 feet 1 inch by 2 feet and 1 foot deep, inside measurements, should be constructed with a division in the middle.

This will hold exactly 4 cubic feet of metal when the whole of the box is filled level. Two cubic feet of sand is then measured out, by filling one-half of the box, and one paper bag of cement is added to the other two materials. This gives a conveniently sized batch to mix by hand. Cement is now supplied in paper bags which hold 1 cubic foot, twenty-four of which weigh 1 ton.

When mixing by hand the work is facilitated by constructing a proper mixing board, which should be about 10 feet by 10 feet. The dry material should be mixed thoroughly until it is all of a uniform colour. The water should be added by using a watering-can with a rose attached, the dry materials being gradually wetted as the mass is being turned. The water should not be allowed to run off the mixing board because, if it does so, it carries away a large proportion of the cement with it. The materials should be thoroughly mixed after the water has been added, and the concrete placed in position as soon as possible after mixing. It should be well rammed as it is being placed in the moulds, and the surface should be roughened before finishing the layer off in order to form a key, and so ensure a good bind for the next layer. The joint must be strengthened with cream of cement before adding fresh concrete to that which is set; this can be prepared by adding sufficient water to some neat cement to bring it to the consistency of thick cream. Green concrete will not stand a bump, and care and patience is necessary when removing the moulds. All working tools, such as buckets and shovels, and the mixing board should always be attended to when mixing is finished, and should be thoroughly washed before the concrete sets on them.

REINFORCEMENT OF CONCRETE.

It is sometimes necessary—and, indeed, in the case of a tower silo it is essential—to strengthen the concrete by embedding within it steel in the form of rods, wire-netting, or some other type of metal mesh. The steel is elastic and extremely strong in tension, while concrete is strong in compression, but comparatively weak in tension. The combination of the two materials with their opposite characteristics, therefore, gives an ideal product, known as reinforced concrete.

SIZE OF SILO.

One of the first points to be considered when preparing to build a tower or circular pit silo is the size that will meet the requirements of the farm on which it is to be erected. In determining the required size, consideration must be given to the number of head of stock it is intended to feed, and to the duration of the feeding period. As each cow is fed at the rate of approximately 30 lb. of silage daily, it is a simple matter to arrive at the required size on a dairy farm. The following table of capacities will be useful in determining the size to build, allowing 51 to 56 cubic feet of silage to the ton, the smaller figures being applicable to the larger silos. These calculations are based on the assumption that the silos are completely full of consolidated silage, which, of course, is rarely possible as some allowance must be made for subsidence. However, if the material is well trampled during the whole time filling operations are in progress, only a small allowance need be made for subsidence.

Approximate Capacity of Round Silo in Tons.

Inside Height.	Inside Diameter of Silo.						Cubic Feet of Silage to the Ton.
Feet.	10 Feet.	11 Feet.	12 Feet.	13 Feet.	14 Feet.	15 Feet.	
20	28	34	40	47	55	63	56
21	29	36	42	50	58	66	56
22	31	38	45	53	61	71	55
23	33	40	47	55	64	74	55
24	35	42	50	59	68	78	54
25	36	44	52	61	71	82	54
26	38	46	56	65	76	87	53
27	40	48	58	68	78	90	53
28	42	51	61	71	83	95	52
29	44	53	63	74	86	99	52
30	46	56	67	78	91	104	51

The following table shows the quantities of materials required in the construction of each foot of a concrete silo wall of 4-inch thickness when using a 4-2-1 mixture; it also gives the materials required for the foundations of a tower silo:—

Diameter in Feet.	Portion of Silo.	Metal or River Gravel.	Sand.	Cement.
		Cubic Feet.	Cubic Feet.	Cubic Feet.
10	Wall	9·36	4·68	2·34
	Floor..	23·12	11·56	5·78
	Foundations ..	49·20	24·60	12·30
11	Wall	10·28	5·14	2·57
	Floor..	27·40	13·70	6·85
	Foundations ..	54·12	27·06	13·53
12	Wall	11·00	5·50	2·75
	Floor..	32·00	16·00	8·00
	Foundations ..	58·80	29·40	14·70
13	Wall	11·92	5·96	2·98
	Floor..	38·20	19·10	9·55
	Foundations ..	63·52	31·76	15·88
14	Wall	12·88	6·44	3·22
	Floor..	44·52	22·26	11·13
	Foundations ..	68·20	34·10	17·05
15	Wall	13·80	6·90	3·45
	Floor..	51·08	25·54	12·77
	Foundations ..	72·64	36·32	18·16

TOWER SILO CONSTRUCTION.

Details for the construction of a tower silo are given in the following paragraphs, quantities of materials, moulds, and construction being discussed in considerable detail.

Quantities of Materials.

The following materials are required for the construction of a tower silo 14 feet in diameter and 28 feet in height, with walls and floor 4 inches thick, and designed to hold approximately 83 tons of silage:—

Concrete—	£	s.	d.
Metal or river gravel, 17½ cub. yds., at 12s. 6d. per yd.	10	15	0
Sand, 8⅝ cub. yds., at 10s. per yd.	4	6	0
Cement, 116 bags, at £4 14s. per ton	22	17	4
Reinforcement, comprising—			
Round bars, ⅜ in., 6 cwt. at 17s. per cwt.	5	2	0
Tie wire, 5 lb., at 6d. per lb.	0	2	6

Door Frames (3)—			
5 in. x 4 in.—6/2 ft. 10 in. to cut 12 bevelled pieces, 3 in. x 2 in. x 4 in. 2 in. x 2 in.—12/2ft. 6 in. .. 4 in. x 1 in.—14/2 ft. 6 in. ..		1	7 0
6 lengths ⅝ in. x 1 ft. spikes with end hooked for holding frame in position		0	1 6
Roof Timber—			
Rough Hardwood—			
Bearers, 5 in. x 3 in.—2/12 ft. 6 in., 2/17 ft. Collar ties, 4 in. x 2 in., 4/8 ft.	98 super. ft., at 43s. per 100	2	1 4
Rough Pine—			
Rafters, 4 in. x 2 in.—14/9 ft. .. Braces, 3 in. x 1½ in.—2/18 ft. .. Battens, 3 in. x 1½ in.—8/17 ft. .. Ridge Board, 7 in. x 1 in.—1/17 ft. .. Fascias, 7 in. x 1 in.—2/9 ft.; 2/17 ft. ..	184 super. ft., at 35s. per 100	3	4 0
Bolts, Corrugated Iron, &c.—			
Anchor bolts and screws, 8/1 ft. 6 in. x ½ in., for securing plates to top of wall, at 2s. each		0	16 0
Bolts for collar ties, 6/4½ in. x ⅝ in. at 3d.		0	1 6
Hoop iron strips, 14/1 ft. 6 in. long, to strap rafters to bearers, at 2d. per lb.		0	4 5
18 sheets 9-ft. iron, at 5s. 5d. per sheet		4	17 6
3 lengths ridge capping, at 1s. 9d. each		0	5 3
3 lb. springhead screws, at 2s. lb.		0	6 0
Nails—			
3 in. x 9 gauge (5 lb.) 4 in. x 8 gauge (3 lb.) 2 in. x 11 gauge (2 lb.)	at 4d. lb.	0	3 4
Ladder—			
Rough pine, 3 in. x 2 in., 2/30 ft., at 35s. per 100 super. ft.		0	10 6
Rungs—			
Bolts, 4/1 ft. 6in. x ½ in., at 1s. 6d. each		0	6 0
21 lengths iron, 14 in. long, at 2d. per length		0	3 6
Paint		0	5 0
Cost of materials		£57	15 8
Cost of labour—			
Excavation for foundation, &c., approximately 3 ft. below ground level, 26 cub. yds., at 4s. per yd.		5	4 0
Mixing and placing all concrete, &c., 1 man 10 days at £1 2s. 8d. and 3 men 10 days at 17s. 8d.		37	16 8
Constructing roof, doors, ladder, &c., 1 man 2 days at £1 2s. 8d. and 2 men 2 days at 17s. 8d.		5	16 0
Cartage, &c., on moulds, timber, &c.		3	0 0
Cost of labour		51	16 8

The total cost is thus £109 12s. 4d., but this figure will naturally be subject to considerable fluctuation from year to year and from locality to locality.

Moulds.

In the construction of the tower silo it is necessary to use moulds or forms of some description when placing the concrete mixture in position in the gradually rising wall of the silo. These moulds are made in sections and usually consist of eight inside and eight outside sections about 3 feet high (Plate 99). If the moulds are set up level at the commencement of construction little difficulty is experienced in keeping the wall of the silo plumb and in a true circle. A wooden frame covered with flat galvanised iron is the type of mould recommended as the most suitable, because it is light and easily handled. The galvanised iron facing gives a smooth finish to the work, which is necessary on the inner surface of the silo to prevent settling of the silage being retarded.

With a view to assisting farmers in the construction of silos the Department of Agriculture and Stock has made a number of sets of moulds of this type, which are lent to farmers on application.

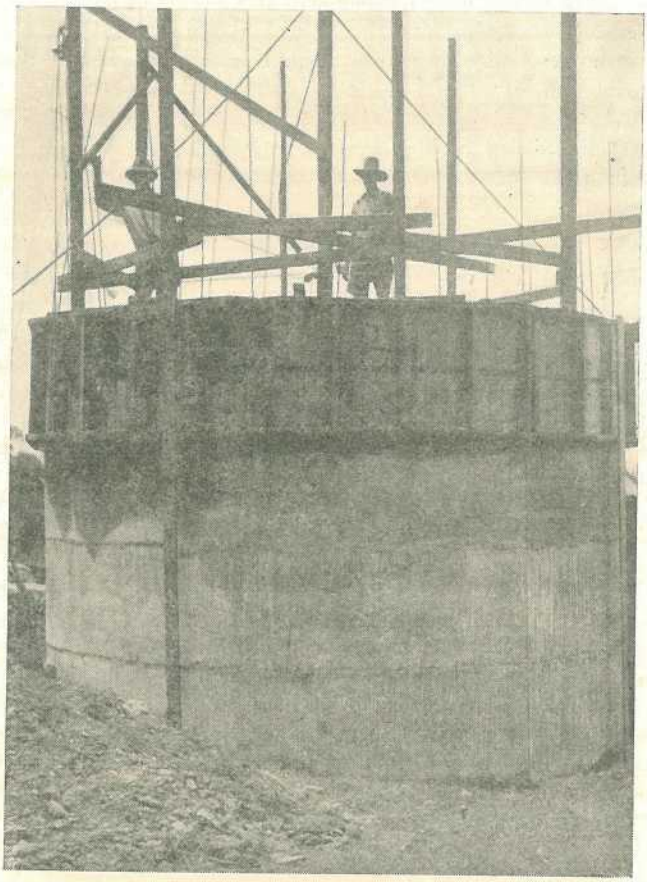


Plate 99.

Tower Silo in Course of Construction.—Showing Moulds in Position for Filling.

Marking Out the Site.

All that is required to mark out the site for the silo is a piece of string and two pegs. One peg is driven into the ground at the spot which is to be the centre of the silo. A piece of string is then fastened to this by a loop, the other peg being attached to the string at a distance from the centre peg equal to half the outside diameter of the foundations. A circle is then described, which will be the outside circumference of the silo.

Foundations.

The weight of the materials required to build a tower silo of the dimensions given amounts to approximately 30 tons, and it is therefore evident that a solid foundation is necessary; otherwise settling will occur which will have the effect of cracking the wall and causing considerable damage to the structure. The foundations should be 2 feet wide and

1 foot deep, and every care should be taken to ensure that the wall is constructed in the middle of the foundations so that the weight of the wall will be evenly distributed. The soil should be excavated to a depth of approximately 3 feet, and deeper still if a compact soil is not reached at this depth. By excavating, the height above ground is reduced and a solid foundation below the frost line is assured. If in doubt about the soil formation, it is advisable to obtain advice from some person experienced in concrete construction so that sound foundations will be laid. Steel reinforcing rods $\frac{3}{8}$ inch in diameter should be placed in the foundations spaced about 9 inches apart and connected by No. 8 fencing wire.

Floor and Reinforcement.

The floor, which is usually 4 inches thick, should also be reinforced with $\frac{3}{8}$-inch diameter rods, placed at 1 foot 6 inch centres, hooked and tied to the rods of the foundations. In placing the concrete, the foundations and floor are laid in the one operation, but before pouring the concrete, provision should be made to place the vertical reinforcing rods in position. These rods, which should be placed at intervals of 2 feet, are hooked and tied to the reinforcement in the foundations. Horizontal reinforcement should be wired to the vertical rods already set when the concrete is placed for the foundations. Where it is necessary to join horizontal reinforcement, the rods should be lapped at least 1 foot 3 inches and tied together with tie wire. For vertical reinforcement a lap of 1 foot 6 inches is necessary. The first horizontal ring of rods should be placed about 3 inches above the floor, and from there upwards to a height of 8 feet 3 inches the rods should be spaced at foot intervals; for the next 7 feet 6 inches they should be spaced at 1 foot 6 inches intervals, and from that height to the top of the silo every 2 feet. The closer spacing towards the bottom of the silo is necessary to withstand the pressure exerted by the settling of the silage. Provision should be made in placing the rods in position to allow for doors, which are spaced 5 feet apart, the first being at $2\frac{1}{2}$ feet from the ground and the other two at 5 feet intervals, one above the other. All reinforcing should be well covered with concrete, as any rusting due to exposure of the steel will weaken the structure.

Building the Wall.

The moulds should be well greased before use in order to prevent adhesion of the concrete and to facilitate their removal. Crude oil or soft soap is generally used for this purpose and is applied with a swab. Each time the moulds are removed they should be scraped to remove any adhering concrete and then regreased before being placed in the next position. Each inside mould is held in position by the 4-inch by 3-inch or other suitable upright which passes through a mortice provided in the mould for that purpose. The uprights should be plumbed and well braced to ensure that the wall is true. As the outside moulds have no uprights to support them it is necessary that they be bolted to the inner circle using long bolts for this purpose. These bolts should be greased before use to enable them to be withdrawn easily. The small holes which are left after their removal are then plugged up with fine mortar.

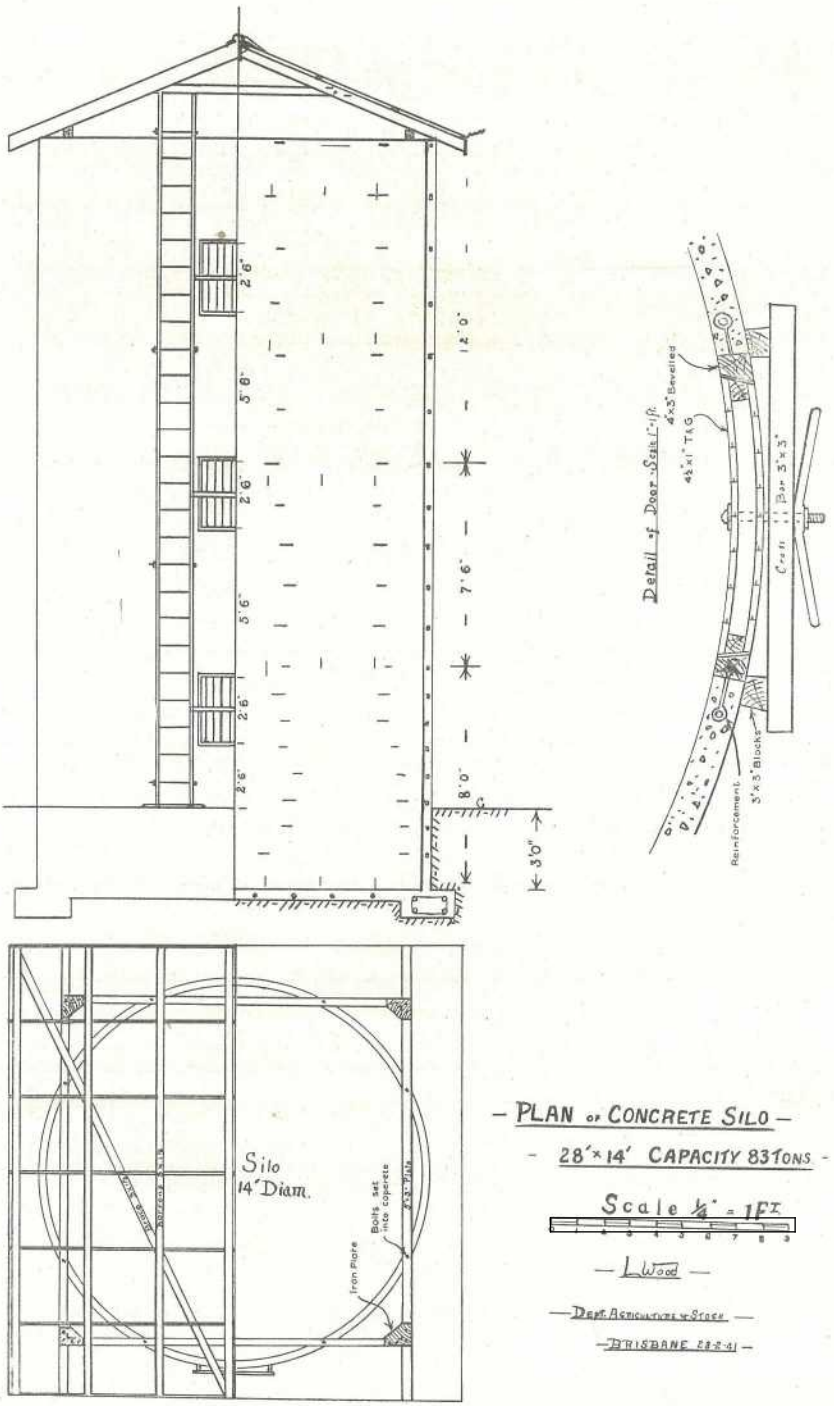


Plate 100.
PLAN OF TOWER SILO.

Another method of supporting the outside moulds and scaffolding is to place eight slightly tapered blocks, 4½ inches by 3½ inches and 4 inches long, in between each section of the moulds about 2 inches below the top, before the moulds are filled with concrete. After the moulds have been removed, the blocks are taken out by tapping the smaller end lightly. Their removal in each case leaves a hole in the wall through which a bearer or "pudlock" about 8 feet 6 inches long is inserted, allowing one end to project about 1 foot 3 inches on the outside of the wall. The other end is supported on a cleat bolted around a 4-inch by 4-inch upright placed in the centre of the silo. The blocks are placed in position for each rise and the cleat is moved up the 4-inch by 4-inch upright to carry the ends of the bearers which support the moulds and scaffolding planks. The holes in the wall are usually filled in while the scaffolding is at a suitable height. This is done by inserting small concrete blocks, cast to the required size, which are then plastered over.

Before placing a fresh batch of concrete, the previous layer should be well cleared of any loose material and moistened, and to it there should be applied a thin covering of cream of cement. Only small quantities of the latter should be mixed at a time and care should be taken to ensure that it has been spread over the whole surface before adding a fresh layer of concrete.

The concrete should be well rammed into the moulds in order to secure a smooth dense wall which will be airtight and impervious to water. A spading tool made from a piece of ½-inch iron about 6 feet long with a fish tail at the lower end, or a piece of thin board bevelled at one end and run off to form a handle at the other end may be used. The use of this tool forces the coarse material away from the mould, allowing the finer mortar to come to the face of the wall and produce a smooth surface. Each day the moulds are lifted, allowing for about 2 inches of a lap on the previous ring of concrete.

Door Frames.

The frames for the doors, which should be 2 feet 6 inches square, should be constructed with 5-inch by 4-inch hardwood sawn lengthways to make bevelled pieces 3 inches by 2 inches by 4 inches. The frames are made with the bevelled edges towards the inside of the silo (Plate 100) on the same principle as that of a refrigerator door so that when the doors are placed in position they may be screwed up tightly, to exclude the air, with a hand screw and bolt. The doors are constructed on bevelled frames to suit the opening, lined on both sides with 4-inch by 1-inch tongue and groove, the space between being filled with sawdust or some other insulating material; if required, the doors can be packed with felt or bagging to ensure a tight fit.

Difficulty is often experienced in keeping the silage in good condition around these doors, but if the instructions are carried out as detailed, little trouble will be encountered. Before setting the frames in position a few pieces of ⅜-inch iron about 1 foot in length should be driven into the frames at the sides, top and bottom, and connected to the reinforcing rods.

Roof.

The bearers to which the roof is fastened on the silo should be of heavy timber 5 inches by 3 inches and fastened to the top of the wall by bolts which have been set in the concrete. Anchor plates also should be bolted at each corner of these bearers; the two side bearers project 1 foot past the line of the side to allow for an overhang on the roof. Rafters 4 inches by 2 inches, spaced at 2 feet 9 inch intervals, should be securely nailed and strapped down to the bearers by 1½-inch hoop-iron straps. Four 4-inch by 2-inch collar ties are secured to every second pair of rafters about half way up. Roof braces 3-inch by 1½-inch should be nailed diagonally across on the underside of the rafters, and 3-inch by 1½-inch battens should be spaced every 3 feet. To give a finished appearance and make the silo weather-proof 7-inch by 1-inch fascias and barge boards should be securely nailed to the ends of the rafters before placing the iron in position. For securing the corrugated iron, springhead screws are preferable to nails as they withstand the elements better.

Ladder.

It is necessary that a long ladder be constructed and fixed to the silo alongside the doors. This can be made with 3-inch by 2-inch sides using lengths of ½-inch iron about 14 inches long for rungs. Four ½-inch bolts 1 foot 6 inches long should be placed about 10 feet apart to prevent the sides spreading. The inside width of the ladder should be 12 inches, thus allowing the rungs to be sunk 1 inch. Rungs should be spaced every 15 inches. The ladder is secured in position by placing it on to a sill piece and cleating the bottom, and bolting it to the roof timbers by a "bracket" or piece of timber on the top.

Scaffolding.

In the construction of the silo it is necessary that some kind of scaffolding be used and the timber required for the construction of the roof is generally made use of for this purpose. There are several methods of erecting this scaffolding, a very simple one being to place four uprights about 7 feet apart on the inside of the silo to which cross rails are secured at the height at which it is desired to erect the scaffolding. The rails are allowed to project past the uprights to about 9 inches from the wall and these projections carry the scaffolding planks, or if, as previously described, pudlock bearers are used, the planks may be placed both on the inside and outside of the silo. If a piece of heavy timber is bolted across the uprights about 8 feet above the scaffolding and allowed to project over the outside wall about 3 feet, the pulley blocks can be attached to this projection, thereby greatly assisting in the hoisting of materials.

CIRCULAR PIT SILO CONSTRUCTION.

As stated earlier, a circular pit silo may be either wholly concrete lined or the concrete lining may be confined to a collar 5 feet 6 inches in depth, the former type of silo being regarded as the better of the two.

The site of the circular pit silo is marked out in the same manner as adopted in the case of the tower silo, and a precisely similar type of mould is used for both. The details of the mixing and pouring of the concrete have already been fully dealt with when considering tower silo construction and further reference to them is unnecessary.

Sinking the Pit.

The sinking of the pit calls for the use of a considerable amount of labour, but much of the cost involved therein can be saved if the farmer does the work himself. To facilitate the digging of the pit, and the removal of the silage, as required, when the pit is completed and filled, a hoist (Plate 101) is so constructed as to allow it to swing over the pit. When sinking the pit, the earth or spoil is hoisted out of it in a large drum with a hinged bottom and a lever

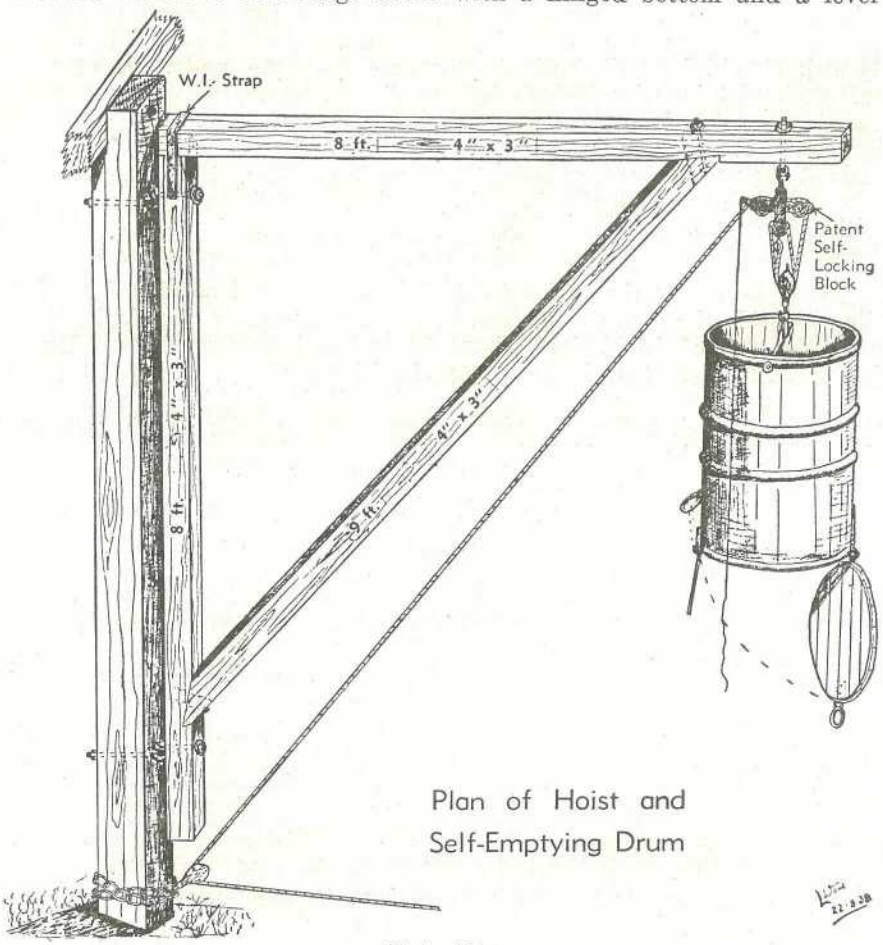


Plate 101.
Hoist.

catch attachment. The drum, full of spoil, is pulled to the surface by a horse, swung clear of the pit and, while the drum is suspended in the air, the catch is released, the hinged bottom of the drum drops, and the contents are deposited on a dray or where they may be readily removed afterwards by a horse and scoop. The hoisting gear should be provided with a patent self-locking pulley, which locks and keeps the load in any position without tying or holding the hoisting rope, the locking device coming into action the moment the rope is slackened. This self-locking block ensures the safety of the man working in the pit.

When trimming the wall of the pit, a piece of timber is placed across the diameter of the excavation, and held in position by means of pegs. Through this piece, a hole is bored to allow a length of piping to be placed vertically in the centre of the pit. A board equal in length to half the diameter of the desired excavation is then made to revolve around the pipe, which is kept plumb. This board acts as a guide or indicator, so that the wall may be trimmed perfectly true with a sharp mattock or old adze (Plate 102).

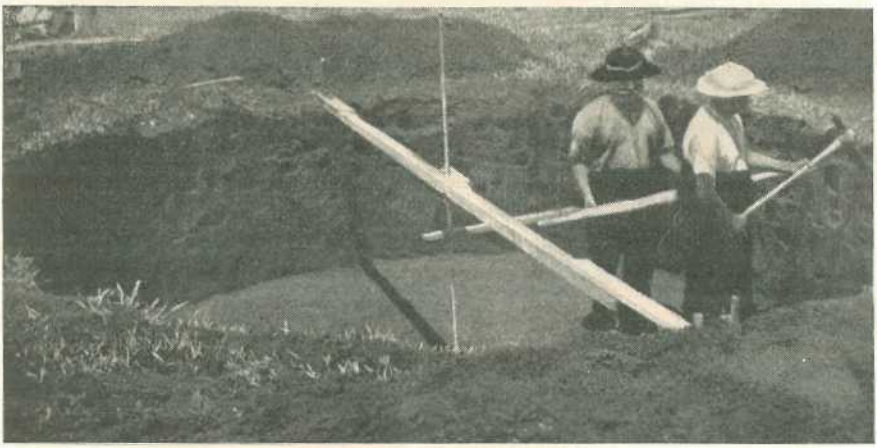


Plate 102.
Trimming the Pit.

Building the Concrete Wall.

When the wall has been trimmed and the bottom of the pit levelled, the inside set of moulds is placed in position and filled with concrete. If carefully handled, the moulds may be removed the following day and set up for the next lift and filled again. It is not necessary to use the outside set of moulds until the top of the pit is reached. When both sets of moulds are used, spacing pieces must be placed between them to ensure that the correct thickness of wall is maintained. The concrete wall should be continued to a height of 2½ feet above ground level.

It is here necessary to refer to the fact that, in marking out a site for a circular pit silo with an inside measurement of 14 feet, allowance must be made for the 4-inch wall and the final excavation must therefore be 14 feet 8 inches in diameter. It is, however, thought preferable to initially excavate only 14 feet, thus leaving 4 inches all round to be removed in the trimming of the wall. This trimming is carried out every few feet as sinking progresses and enables the excavator to obtain a nice even surface.

Covering the Silo.

A shed covering is as essential in a circular pit silo as in the case of a tower. It may be a permanent fixture, providing ample head room to work under (Plate 103) or it may be a sliding roof (Plate 95). The former is preferable, as its cost of construction is little in excess of the latter, and it affords protection from the elements when emptying or filling the pit.

24' x 18' SHED OVER SILO.

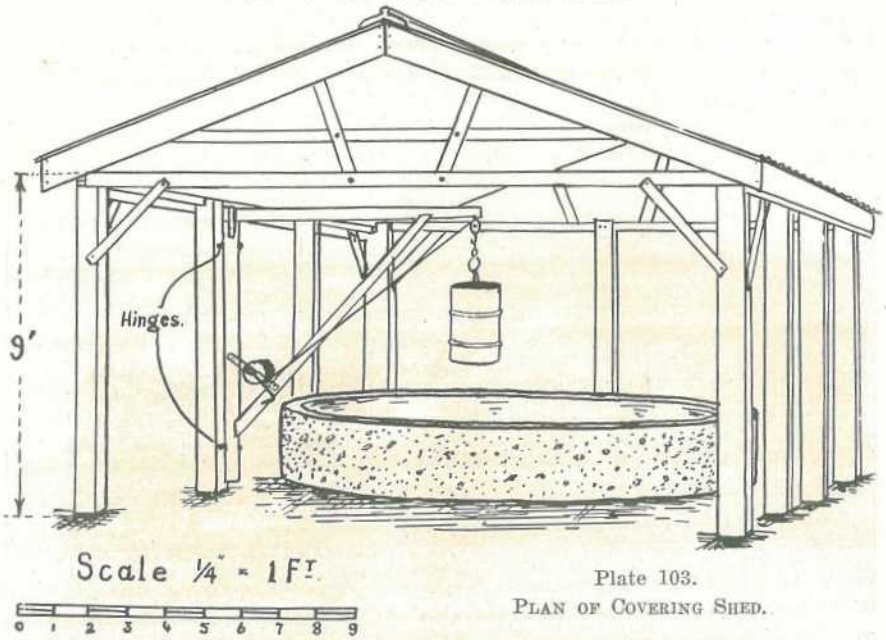


Plate 103.
PLAN OF COVERING SHED.

Quantities of Materials.

The following materials are required for a 28-foot pit silo with 25 feet 6 inches below ground level and 2 feet 6 inches above ground level, the silo to be concreted to the full depth with a 4-inch wall and floor. A 4-2-1 concrete mixture is allowed for. Provision is made for a shed 24 feet by 18 feet with a clearance of 9 feet, and for a hoist erected to assist in emptying operations, the hoist to be fixed to a convenient post by hook and eyebolt hinges.

		£	s.	d.
Concrete—				
Metal or river gravel, 15¼ cub. yds., at 12s. 6d. per yd.		9	10	7
Sand, 7 5/9 cub. yds., at 10s. per yd.		3	15	6
Cement, 102 bags, at £4 14s. per ton		19	19	6
Reinforcement (floor and portion of wall above ground level only), 32 yds. K wire		0	18	0
Shed and Hoist—				
Posts, 5 in. x 5 in., or round bush timber—9/11 ft., at 9d. per ft.		3	14	3
Rough Hardwood—				
Plates, 4 in. x 3 in.—2/24 ft., 2/18 ft.				
Corner, 4 in. x 2 in.—4/6 ft.	at 43s. per 100 super. ft.	2	3	0
Post bracers				
Rough Pine—				
Rafters, 4 in. x 2 in.—14/10 ft.				
Collar ties for roof, 4 in. x 2 in.—3/12 ft.				
Struts for roof, 4 in. x 2 in.—4/3 ft.				
Braces for roof, 3 in. x 1½ in.—4/15 ft.	at 35s. per 100 super. ft.	5	1	6
Battens for roof, 3 in. x 1½ in.—8/25 ft.				
Fascias for roof, 7 in. x 1 in.—2/25 ft., 4/10 ft.				
Ridge Board, 7 in. x 1 in.—1/25 ft.				
Rough Hardwood—Hoist, 4 in. x 3 in.—2/8 ft., 1/9 ft., at 43s.		0	10	9
Iron, 28/10 ft. sheets, at 5s. 8d. sheet		7	18	8
Ridge Capping—5/6 ft. lengths, at 1s. 9d. per length		0	8	9

Nails—			
3 in. x 9 gauge (5 lb.), at 4d.; 4 in. x 8 gauge (3 lb.), at 4d.; Springheads (5 lb.), at 1s. 2d.	0	8	6
Bolts for posts, 9/8½ in. x ½ in., at 6d.	0	4	6
Bolts for collar ties, 6/4½ in. x ⅝ in., at 3d.	0	1	6
Hinges for hoist—2/4½ in. x ⅝ in. eyebolts and 2/8½ in. x ⅝ in. hooks for same, at 4s. 6d. pair	0	4	6
Cost of materials	£54	19	6
Labour—			
Erecting shed and hoist, &c., 1 man 3 days at £1 2s. 8d. and 1 man 3 days at 17s. 8d.	6	1	0
Excavating pit 25 ft. 6 in., at £1 per ft.	25	10	0
Setting up moulds and filling same—2 men 10 days at 17s. 8d. 1 man 10 days at £1 2s. 8d.	29	0	0
Cost of labour	£60	11	0

The total cost of this type of silo is therefore £115 10s. 6d., but, as in the case of the tower silo, costs will fluctuate from year to year and from district to district.

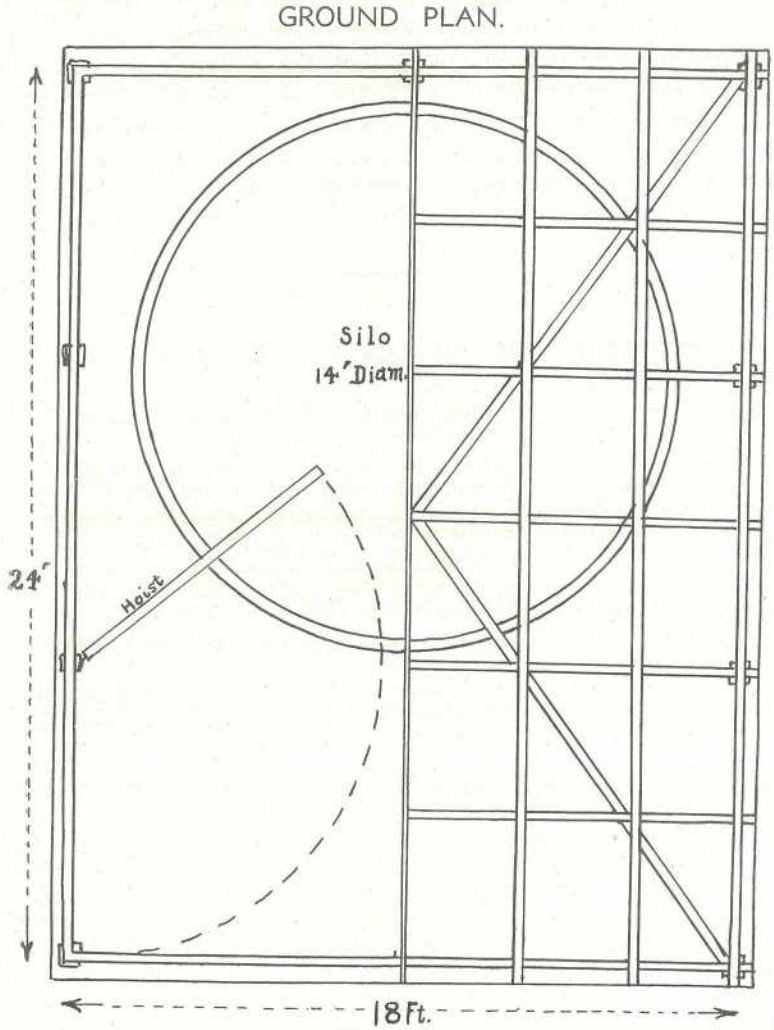


Plate 104.
Ground Plan of Covering Shed.

Collar Type of Circular Pit Silo.

The discussion of the circular pit silo has so far been confined to the type which is wholly concrete lined, but much of the information supplied for that type is equally applicable to the circular pit silo in which the concrete lining is confined to a collar 5 feet 6 inches in depth. In the case of the collar type, however, the diameter of the excavation is 14 feet 8 inches only until a depth of 3 feet below ground level is reached, for at that depth the concrete collar ceases, and from there on the excavation should be only 14 feet in diameter. When the pit has been excavated to a depth of 3 feet, the concrete collar is constructed, the shed is built, and then the pit is excavated until the full depth is reached.

Circular pit silos of other dimensions may, of course, be constructed, but the dimensions given are those most likely to meet the requirements of the average farmer and are the dimensions for which departmental moulds are available on loan.

It has previously been stated that the approximate cost of the fully-lined circular pit silo is £115 10s. 6d., and this compares with an approximate figure of £75 for the collar type. The combined cost of the shed, the hoist, and the excavation are virtually identical, the difference in price being due to the lesser quantity of concrete used.

WE HAVE MUCH TO LEARN ABOUT THE SOIL.

Men have tilled the soil for thousands of years. Millions of farmers have spent practically all their lives at this work and many of them have observed closely the response of soil to different kinds of treatment. Thousands of agricultural scientists have studied the soil intensively and carried on countless experiments to find out just what makes the soil fertile and under what kind of treatment it will give the highest crop yields over a period of years. Under these conditions it would seem as though the secrets of the soil should have been discovered long before this and that more or less standard formulae for handling any particular soil to obtain best results should be available. It is true that many facts about the soil have been learnt, but it also seems true that the more we find out about it the more we realize how much more there is still to be learnt. It is amazing and, to the farmer, perhaps rather discouraging, how many beliefs about the soil which have for years been accepted as facts have been proved wrong in recent investigations. For example, take humus. For years we have been told that a fertile soil depends upon keeping an abundance of humus—decayed vegetable matter—in it, but now we are being told that the kind of humus present is very important and that the wrong kind may reduce rather than increase crop yields. At least, this is held to be true in certain soils and in some localities. Even the method and amount of tillage and cultivation seems to be open to a lot of argument. Some farmers hold that very thorough cultivation is the most profitable. Others maintain that just enough to control weed growth is all that should be given. These are only two of the many instances to show what a wide difference of opinion exists in the matter of soil fertility and soil management, but they certainly indicate that we have much yet to learn about soil in spite of the fact that the human race has always depended upon it for existence.—*From the "New Zealand Farmer Weekly."*

Poultry Farming in Queensland.

(*Continued from page* 231, *September*, 1941.)

FEEDING OF POULTRY.

THE success of poultry-farming depends more upon the feeding of the stock than upon any other single factor. By far the biggest charge against the industry is the cost of feed. This involves the expenditure of more than 50 per cent. of the gross income from the farm. Other factors being equal, the real test of the value of a poultry ration is the resultant profit. While feeding is not an exact science (*e.g.*, it cannot be stated that so much of certain ingredients will give certain results), carefully controlled experiments have indicated what are the essential constituents of rations, and, broadly speaking, how much of these constituents are essential in poultry rations. With this information, it is possible to make a combination of foods that will contain all the constituents essential for growth and production. It is stressed, however, that the ultimate success of feeding depends on the poultry-keeper himself, and his ability to judge the value of a food and its effect on the health and production of the flock.

Every penny saved in the cost of feeding is so much more profit, providing the health of the birds and the production is maintained. Poultry feeds vary in price, and the poultry-farmer is chiefly interested in the cheapest combination of foods which will maintain production. It is not a good practice to select at random a combination of the lowest-priced foods on the market, for such a combination may not maintain production. In order to select the cheapest suitable ration, whether it be a food already mixed or a combination of foods, a knowledge of the ingredients of foods and the requirements of poultry is necessary.

CLASSIFICATION OF FOOD INGREDIENTS.

The food groups or constituents are generally classified as follows:—Proteins, carbohydrates, fibre, fats (which include oils), minerals (ash), vitamins, and moisture. Each is essential in varying amounts; although moisture may be absent from a food, it must be given in the form of water. Some foods contain all these ingredients to a greater or lesser amount, but often one or more of the ingredients are absent.

Protein.

Proteins are complex substances formed by a combination of amino-acids. Amino-acids are made up of carbon, hydrogen, oxygen, and nitrogen, and, in a few cases, small amounts of other elements. There are about twenty amino-acids. Some of these can be manufactured by the fowl, but others cannot, and must, therefore, be included in the diet.

During the process of digestion, the proteins are broken down into amino-acids, and then absorbed into the system. These amino-acids are carried by the blood stream to wherever they are required to build protein in the body of the fowl, but any amino-acid will not suffice. Take a protein built up of the amino-acids which may be termed A, B, C, D, and E. Now suppose that the fowl can build up the amino-acids A and B, but not C, D, or E. Then, if the fowl is fed a protein containing amino-acids C and D only, the protein in the fowl cannot be built because, although it can manufacture the amino-acids A and B, the

amino-acid E is missing. If this protein is required by the fowl for growth, the fowl will not grow, and if required for producton of eggs, then the fowl cannot produce eggs. The ideal protein to feed would be one which contained all the amino-acids in their correct proportion to build all the various proteins in the fowl. Proteins derived from animals (animal proteins) come closest to this ideal—*e.g.*, meat meal, fish meal, and milk. Cereals, particularly maize, are low in some of the essential amino-acids, but what is lacking in one cereal may be made up by the use of another. Therefore, a combination of grains is most desirable.

Protein constitutes 20 per cent. of the body of the fowl and 12 per cent. of the egg. While growth and production can be retarded by a diet that is deficient in protein, feeding in excess of bodily and egg-producing requirements is wasteful, and may be harmful. Table I. showing the composition of foodstuffs indicates those which are high in protein. The excess amino-acids which are absorbed are not stored as such, but are converted in the liver into carbohydrates for energy production, or into fats which are stored.

Carbohydrates.

Carbohydrates are made up of carbon, hydrogen, and oxygen. The energy for movement, which comes from the burning of carbohydrates, includes the pumping of blood by the heart, breathing, movement of the intestines during digestion, and hunting for food, &c. Carbohydrates are also burnt to maintain body temperature.

Starches and sugars are the most common forms of carbohydrates in poultry foods. During digestion the starches and sugars are broken down to simple sugars which, in turn, are burnt to produce energy and heat in the body. The excess sugars are stored in the liver as glycogen, and the remaining surplus is then converted into fats and stored as such.

Fats.

Fats are also compounds of carbon, hydrogen, and oxygen, but the proportion of the three constituents in fats and carbohydrates is such that, given equal weights of fat and carbohydrate, there is about two and a-quarter times as much energy in fat as in carbohydrate. There is a large variety of fats (oil is liquid fat), most of which can be manufactured in the animal body. A few must be included in the diet; otherwise growth and production are retarded. On the other hand, too much fat in the ration will interfere with digestion so that the bird will be unable to make the best use of the ration supplied. The fat content of the ration should not exceed 5 per cent.

Minerals.

Minerals are often referred to as ash. Ash is that portion of plant or animal life which is left after burning. There are many mineral elements in ash, all of which are essential for normal growth and production. Generally speaking, the only minerals in which normal rations may be deficient are calcium and phosphorus and sodium and chlorine. As the fowl cannot store any appreciable amount of mineral matter, a constant supply must come from the feed.

Fibre.

Fibre comes largely from the bulky portion of a ration and is almost indigestible. If there is very much fibre in the ration it will

not only reduce the amount of food eaten, but will irritate the intestines and impair digestion. A ration too low in fibre also interferes with the health of the fowl.

Vitamins.

Vitamins are complicated chemical substances essential in minute quantities for normal life. A ration otherwise perfect, but lacking certain of these vitamins, will lead to disastrous results. Vitamins are known by the letters of the alphabet—A, B, C, &c. *Vitamin A* is probably the most important vitamin in poultry foods. It is concerned with the health of the respiratory and digestive systems, the eyes, and the reproductive organs. A fowl fed on a ration low in vitamin A is more susceptible to a number of diseases. A common symptom is nutritional roup, but long before this develops there is an increased susceptibility to disease and parasitic infestation, and a reduction in the efficiency of digestion and reproduction. A ration law in vitamin A will reduce the hatchability of eggs.

All green growing plants, particularly fresh green lucerne, are rich in vitamin A. Fresh green lucerne hay has about five times as much vitamin A as yellow corn—another good source of this vitamin. Lucerne hay—chaff or meal—loses its vitamin A content on being stored. Bran and whole wheat contain very small amounts of this vitamin. Some fish liver oils are an excellent source of vitamin A. The amount of green colouring in fresh cured fodder crops is an indication of the vitamin A content.

Fresh green feed is by far the most economical source of vitamin A; failing that, a ration containing 30 per cent. of yellow maize and 5 per cent. of choice fine-cut lucerne chaff or lucerne meal. If no yellow maize is available, then up to 10 per cent. of lucerne should be fed. Cod or other approved fish liver oil is at times unprocurable, but when available 1 per cent. of a good grade may be added to the ration to supply the vitamin A. This, however, is generally costly compared with fresh green feed or lucerne chaff. Further, the lucerne or green feed also provides other valuable food factors.

Vitamin B.—Most poultry rations contain an adequate amount of this vitamin.

Vitamin C is of little importance in poultry-feeding.

Vitamin D is associated with the absorption and utilization of calcium and phosphorus in the animal body and is therefore of greatest importance during the growth of the skeleton. Excess of this vitamin can cause trouble, but in practice this rarely occurs. Direct sunlight by its action develops vitamin D in the living animal. Ten minutes of sunlight each day would be quite sufficient to prevent any possibility of a vitamin D deficiency.

Where poultry (chickens or adult birds) cannot get sufficient sunlight, it is necessary to provide vitamin D in some other form. The oils rich in vitamin A are also rich in vitamin D and may be included in the ration if the birds do not have access to sunlight.

Vitamin E is associated with reproduction. Lack of this vitamin is said to cause infertility. Most poultry rations contain an adequate supply.

Vitamin K is usually supplied in adequate amounts when good grain is used in the ration.

OTHER ATTRIBUTES OF A FOOD WHICH MUST BE CONSIDERED.

Palatability.

No matter how well balanced a ration, it must also be attractive to the birds if sufficient is to be consumed for normal life functions. For example, barley as the grain portion of a ration contains almost the right quantities of protein and carbohydrate essential for egg production, but in practice it is found that fowls do not relish the grain and have to become accustomed to it. It may be as well to mention here that any alteration in the ration to laying stock should be made gradually, as sudden changes often cause a reduction in consumption with a consequent fall in egg yield. If this change is made in the autumn when young pullets are just coming into production, it may result in a false moult.

Digestibility.

The chemical composition of a food will give only a rough indication of its value, since no more than a percentage of the crude protein, carbohydrates, and fats and minerals is digested. In the graph prepared for comparing food values (Plate 105), allowance is made for this factor.

METHODS OF FEEDING.

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

The methods are known as (1) wet mash and grain, (2) dry mash and grain, (3) all-mash, and (4) free choice.

Wet Mash and Grain.

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

With this type of feeding the mash must be prepared daily for distribution to the birds, care being taken to provide sufficient without allowing any to remain unconsumed half an hour after feeding. The mash should be placed in shallow, narrow tins or troughs, and as the food should be consumed within about half an hour, there should be no lack of feeding space, as the more timid birds will not procure all they require for maximum production.

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

Dry Mash and Grain.

A mash similar to that used for a wet mash is prepared dry and placed in hoppers. Birds are at liberty to consume the food at will, and although certain feeding space has been found necessary for best results, the more timid fowl has a better chance of securing its requirements from a limited space than is the case in wet-mash feeding. The advantage of this system of feeding is that instead of mixing and feeding mash daily, a quantity can be prepared and distributed once a week,

thus reducing the labour of feeding. A serious drawback, however, is that the constant supply of feed encourages rats to harbour in the poultry pens. With this system of feeding, grain is usually fed about 4 p.m.

All-Mash.

As the name suggests, nothing but mash is fed. A suitable mixture is made and placed in hoppers, to which the birds have access at all times throughout the day. With the all-mash system, quantities of food can be placed out once a week, thereby saving the daily attention of feeding. The birds are also compelled to consume a ration suitably balanced, and practical experience has shown that there is a possibility of preventing breeds of the heavy variety putting on excessive internal fat. Fowls do not take kindly to radical changes in grain-feeding, but with the all-mash system the meal of various grains may be substituted without any appreciable easing in production. Naturally, the conversion of grain into meals slightly increases the cost of feeding.

Free Choice.

Under this system of feeding, various kinds of foods are placed in hoppers or receptacles, and the birds allowed to select their own requirements. The range of foodstuffs must be sufficiently wide to supply all the food constituents essential to health and production. It has been noted that birds placed on this system of feeding, after being fed by other methods, have gorged on certain foods, but this gorging is only temporary. The birds soon adjust their feeding habits and consume only as much of the various foods as is necessary for health and production.

Feeding Systems Tested.

Experiments conducted in the United States of America have indicated that the free choice system of feeding is very satisfactory, although there was little difference between it and the mash and grain system; and that the all-mash system of feeding was the most costly. Therefore, the all-mash system is not advocated for the feeding of laying stock, although with chickens under the age of eight weeks where consumption is not great, it has given the most satisfactory results and proved economic.

FOOD REQUIREMENTS.

The first call made on the food digested is for maintenance of vital functions, such as the beating of the heart, breathing, repair of tissues, &c. Only after these requirements are met is digested food used for production. If fowls are not "full-fed" production suffers. "Full-fed" means as much as the birds will eat of a balanced ration. A hen in lay will consume approximately 4 oz. of food daily.

Proteins.

Extensive experiments have shown that the best rations for egg production contain about 15 per cent. of crude protein. A ration composed entirely of cereals and their pro-products is not only low in protein, but low in the quality of the protein. Some rich source of protein should be included, and part, if not all, should be of animal origin.

Fibre.

The maximum fibre that poultry rations should contain is 9 to 10 per cent. A ration of cereals and their by-products balanced with protein-rich foods will rarely exceed 6 per cent. fibre.

Good lucerne chaff contains about 30 per cent. of fibre. Hence 10 per cent. of such lucerne in the ration will meet the fibre position. More may be used, but only when the ration contains no yellow maize or vitamin-rich oils. In such cases only the choicest lucerne is good enough. Choice lucerne fed either as chaff in the ration or as green feed separately, will ensure adequate vitamin A.

Minerals.

It is necessary to add salt at the rate of ½ lb. to each 100 lb. of mash to supply the requirements of the fowl. Large amounts of calcium are also needed for the production of the egg shell. This requirement varies with production, hence it is best to supply the calcium needs in the form of limestone or shell grit, to which the birds should have access at all times. This should be placed in a separate receptacle.

To meet the normal calcium and phosphorus requirements of grown birds, 1½ lb. of sterilised bone meal should be added to each 100 lb. of mash when the animal protein-rich food does not include bone.

TABLE I.—SOME POULTRY FOODS.

Food.	Average Protein per cent.	Fibre per cent.	Maximum Percentage of Total Ration to Feed.	
			All-Mash.	Grain and Mash.
Group I.—Cereals.				
Maize and maize meal	9·5	3·0	60	60
Wheat and wheat meal	12·5	4·0	60	60
Barley and barley meal	10·6	5·0	30	30
Oats	10·0	11·0	30	30
Rolled or hulled oats	16·0	2·0	50	50
Wheat bran	14·7	11·0	30	15
Pollard	14·5	7·4	50	35
Sorghum	10·0	4·0	60	60
Whole rice	7·3	10·0	30	30
Millet	11·6	8·0	40	40
Group II.—Animal Proteins.				
Meat and bone meal	37 to 65	..	10	7
Buttermilk, dried	35	..	10	5
Buttermilk protein	68	..	10	5
Skim milk, dried	37	..	10	5
Skim milk, fresh	3·8	..	*ad lib.*	*ad lib.*
Group III.—Vegetable Proteins.				
Linseed meal	28	12	2	2
Cottonseed meal	40	10	5	2·5
Cottonseed meal, standard	30	25	5	2·5
Soybean meal	40	6	6	2·5
Peanut meal	48	6	5	5
Bean and pea meal	25	7	5	2·5
Coconut meal	18·5	12	5	5
Group IV.—Legumes.				
Lucerne chaff or meal	17	30	10	5
Lucerne leaf meal	22	15	15	7·5
Group V.—Supplements.				
Salt	..	..	0·5	0·5
Sterilized bone meal	13 to 20	..	1·5	1·5

FORMULATING RATIONS.

To prepare an all-mash ration, select at least three of the foods from Group I. in Table I. (no more than two to be of wheat origin if only three are selected). This group comprises from 70 to 90 per cent. of the ration.

Select at least one food from Group II., this to make up from 5 to 10 per cent. of the ration unless skim milk is available. If skim milk is fed at the rate of 4 gallons per 100 birds daily, there will be no need to include any feeds from Group II. Also, if the milk is fed at this rate, the protein content of the ration can be reduced by 3 lb. per 100 lb.

If the feeds of Group II. are much more costly than those in Group III., include one food from Group III.

If no green feed is fed, include 5 lb. to 10 lb. per 100 lb. of either of the feeds in Group IV., depending on whether yellow maize is being fed. Whatever the ration, include ½ lb. of salt. The full ration should contain approximately 15 lb. of protein and 8 lb. of fibre per 100 lb.

Where mash and grain are fed, the ration may be made up as with the all-mash ration, but allowance must be made for the fact that half of the ration will be fed separately as grain. In this case, the mash will have to be higher in protein in order to balance the low protein content of the grain portion of the ration, but the total of the two should supply the same amount of protein per 100 lb. of food fed.

In feeding laying hens, the effect of the foods upon the colour of the yolk of eggs should also receive consideration. Commercially, yolk colour does not appear to have caused any concern, but the consuming public do not favour pale-yolked eggs. To overcome this, green feed and yellow maize should form a part of a laying ration. In the absence of green feed, lucerne chaff or meal should be used.

Example.—To make a mash to be fed in conjunction with grain as an evening feed to laying hens requiring 14 to 15 per cent. of crude protein in the total ration:—

Ingredients.	Quantity	Protein.	Fibre.
As Grain—	Lb.	Lb.	Lb.
Sorghum	25	2·50	1·00
Maize	25	2·37	0·75
As Mash—			
Maize meal	15·0	1·42	0·45
Sorghum meal	12·5	1·25	0·30
Bran	10	1·47	1·10
Meat meal (63% protein)	5	3·15	..
Cottonseed meal	2·5	1·00	0·37
Lucerne chaff	5	0·85	1·50
Total	100	14·01	5·37

This ration is slightly deficient in protein. As the maximum amount of cottonseed meal has been used and the ration is still deficient in protein, peanut meal (a protein-rich food which can be used to a greater degree than cottonseed meal) will serve the purpose, displacing

cottonseed meal and 2½ per cent. of maize meal. The corrected ration will then be as follows:—

Ingredients.	Quantity	Protein.	Fibre.
As Grain—	Lb.	Lb.	Lb.
Sorghum	25	2·50	1·00
Maize	25	2·37	0·75
As Mash—			
Maize meal	12·5	1·18	0·37
Sorghum meal	12·5	1·25	0·50
Bran	10	1·47	1·10
Meat meal (63% protein)	5	3·15	..
Peanut meal	5	2·40	0·30
Lucerne chaff	5	0·85	1·50
Total	100	15·19	5·47

The protein level of this ration is almost as recommended, and the fibre is under the maximum.

COST OF FEEDS.

If all feeds were on the market at the same price, it would be more economic to buy some feeds than others. In other words, foods have different values when fed to poultry. For instance, bran has 15 per cent. of protein and maize has only 9·5 per cent., so on protein content bran is worth more; but maize has a total of 80 per cent. of digestible material and bran has only 50 per cent. The accompanying graph (Plate 105) gives a rough method of comparing the values of foods, allowing for the greater value of protein, as well as the total amount of digestible nutrients present.

Other factors which cannot be represented on the graph, but which have to be considered in computing the values of foods, are the attractiveness of a food, its vitamin content, the value of a food in improving the consistency of a mash, &c. These advantages or disadvantages must be carefully considered before arriving at the true value of a food.

TABLE OF WEIGHTS AND MEASURES.

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

Kerosene Tin.

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

Quart Measure.

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

Bushels to Short Ton.

Maize	35.7	Bran, Pollard	100
Barley	40	Oats	50
Sorghum	33.3		
Wheat	33.3		

GRAPH SHOWING RELATIVE MONETARY VALUES OF FEEDS BASED ON DIGESTIVE NUTRIENTS AND PROTEIN CONTENT.

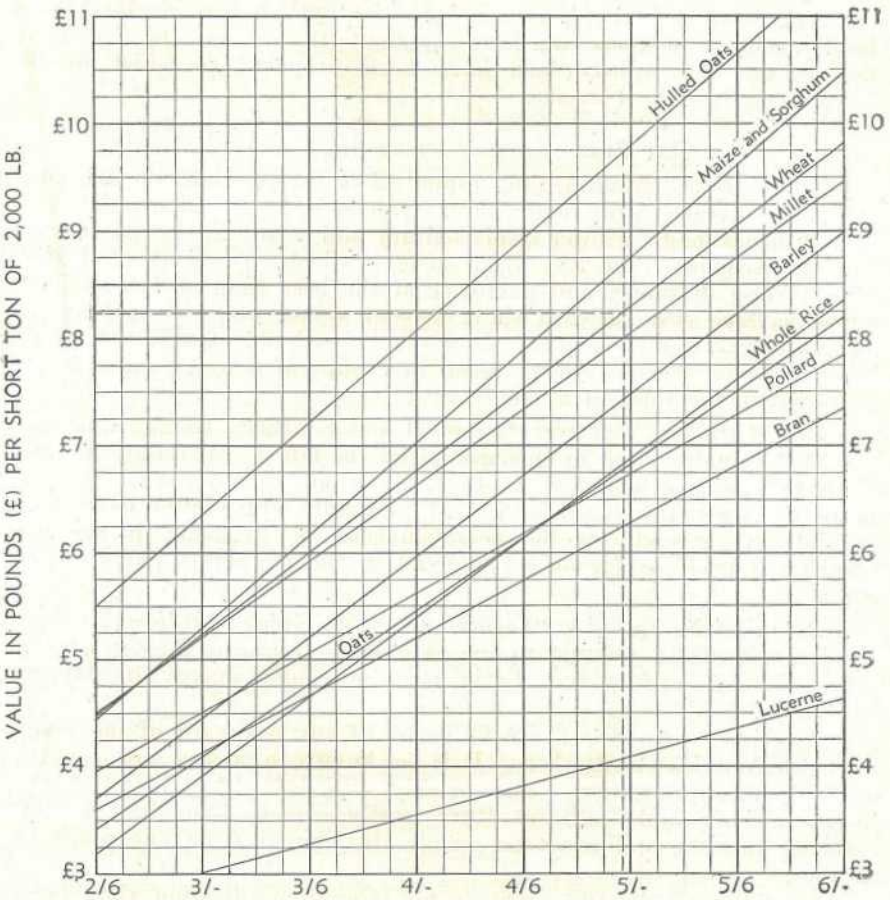


Plate 105.

The price of maize per bushel is used as a base. The feeds are compared vertically and the price for short ton is at the side. Thus, when the price of maize is 5s. per bushel wheat meal or wheat is worth £8 5s. per ton, as indicated by the dotted lines, and barley £7 10s. per ton. Again, if bran is at £6 per ton maize is worth 4s. 9d. bushel, or £8 6s. per short ton.

[TO BE CONTINUED.]

Noxious Weeds.

C. T. WHITE, Government Botanist.

AS the three plants, Star Burr (*Acanthospermum hispidum*), the Yellow-flowered Devil's Claw (*Martynia lutea*), and the Purple-flowered Devil's Claw (*Martynia louisiana*, syn. *M. proboscidea*) have been declared noxious weeds throughout the State, the following descriptions and illustrations have been prepared to assist in the identification of these weeds:—

Star Burr (*Acanthospermum hispidum.*)

Description.—A branching annual, 2 to 3 feet high, the branches and leaves covered with rough hairs. Leaves opposite, from under 1 to over 2 inches long. Flower heads solitary and sessile in the axils of the leaves. Achenes 5 to 10. Each achene when ripe is about ¼ inch long, oblong in shape, and narrower at the base than at the top; the whole surface covered with short hooked spines and crowned at the apex with two slender hooked spines, one on each side, and about ¼ inch long; the ripe achenes are arranged in groups of 5 to 10, and radiate outwards in the form of a star.

Distribution.—A native of Central and Southern Brazil; was first recorded as naturalised in Queensland by the late F. M. Bailey in 1904 (*vide* this Journal, vol. XV., p. 493). It is now one of the worst weed pests in Northern Queensland, and although odd plants have been noticed as far south as the neighbourhood of Brisbane, it has not manifested itself so far as a bad weed in the temperate parts of the State.

Botanical Name.—Acanthospermum, from Greek *akanthos,* a spine; *sperma,* a seed; in relation to the two sharp spines at the top of the achene ("seed"); *hispidum,* Latin, meaning rough, shaggy, prickly, or bristly.

Properties.—No record can be found of any use made of the plant in South America or elsewhere. It is not known to possess any harmful or poisonous properties. The prickly "seeds," like those of the Noogoora burr and Bathurst Burr, easily attach themselves to the coats of animals, and are thus widely distributed from one place to another.

Eradication.—As the plant is an annual, eradication should be attempted, if possible, by hand-pulling or hoe-chipping before the plants have had time to ripen their seeds. Spraying with an arsenical weed-killing solution should prove satisfactory where the plants are growing thickly together and stock can be kept away from them.

Yellow-flowered Devil's Claw (*Martynia lutea*).

Description.—A rank growing weed with a rather foetid smell, stems and leaves with short hairs clammy to the touch; stems and leaf stalks hollow; leaves large (pumpkin like), round, broader than long, 8 inches or more across, on stalks slightly longer than the breadth of the leaf; flowers in crowded racemes at the end of a long stalk; corolla deep yellow, 1¼ inches across, the throat, mouth and lower lobe of the corolla dotted and streaked with reddish and purplish spots and short

lines. Seed-capsule about 6 inches long, ending in a long curved beak, the outer green covering disappearing and leaving a dry, hard, woody seed vessel covered with sharp prickles and opening in two valves, each valve ending in a long curved hook.

Distribution.—A native of South America. Naturalised in Eastern Australia. In Queensland it is now common on some parts of the Darling Downs.

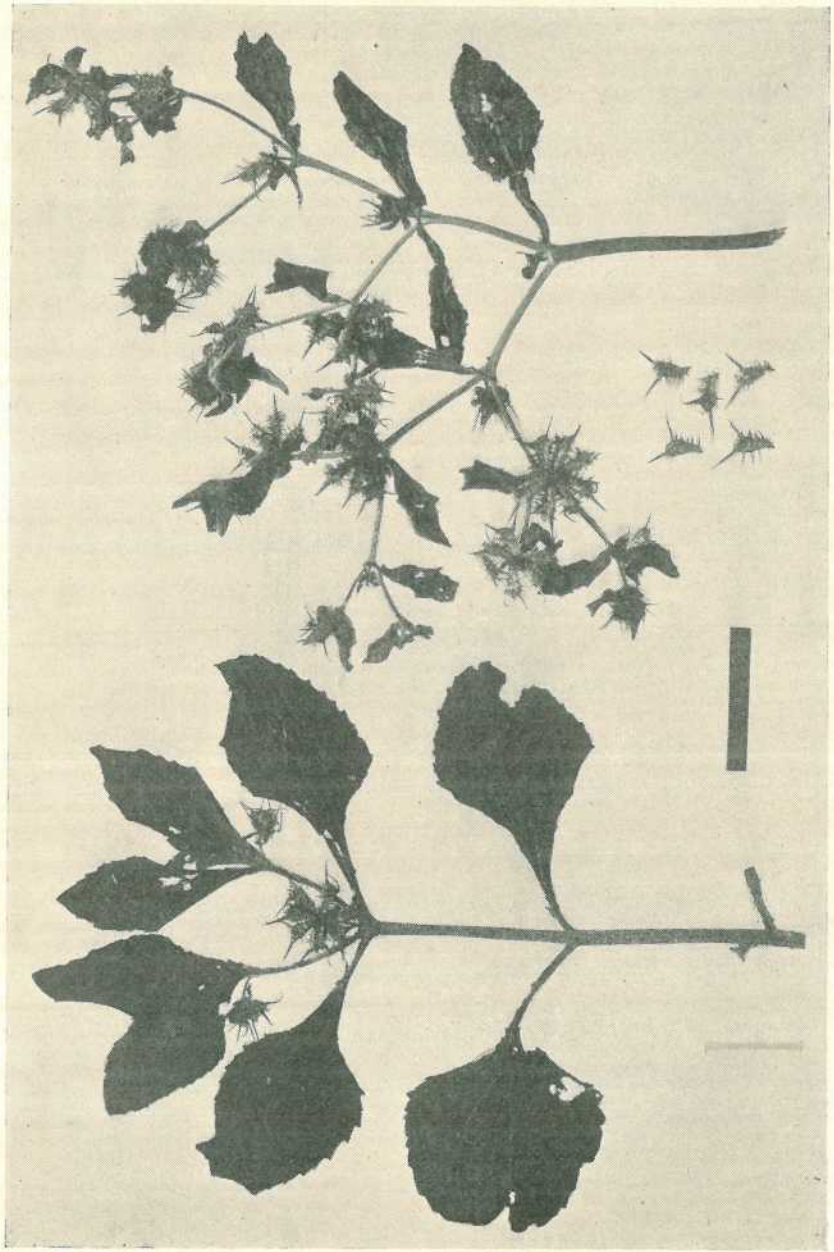


Plate 106.

Star Burr (*Acanthospermum hispidum*).—A. Shoot from comparatively young vigorous plant just commencing to carry burrs. B. Shoot from an older plant more branched, bearing smaller leaves and carrying numerous burrs. C. Achene or "seeds."

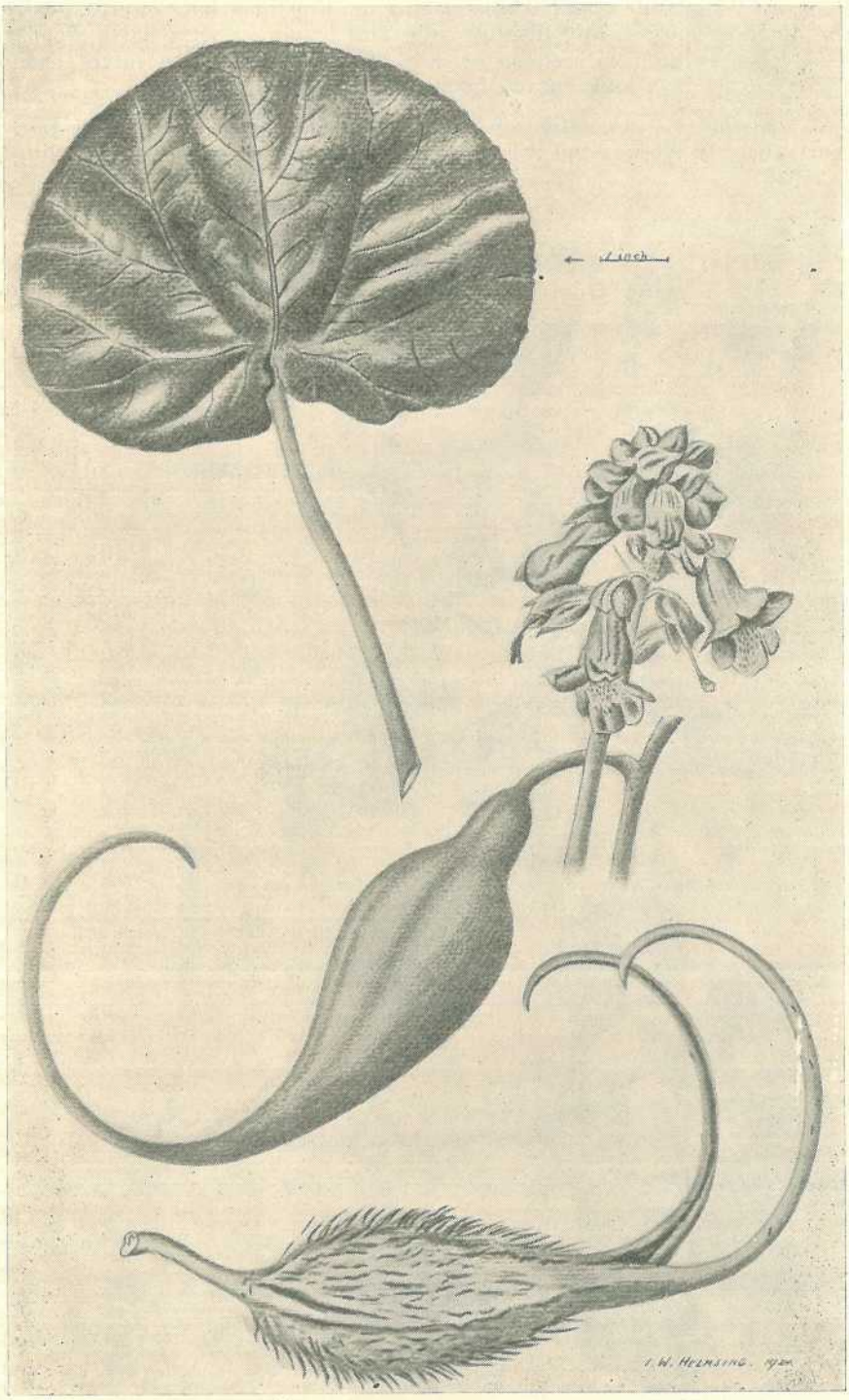


Plate 107.
DEVIL'S CLAW (*Martynia lutea*).

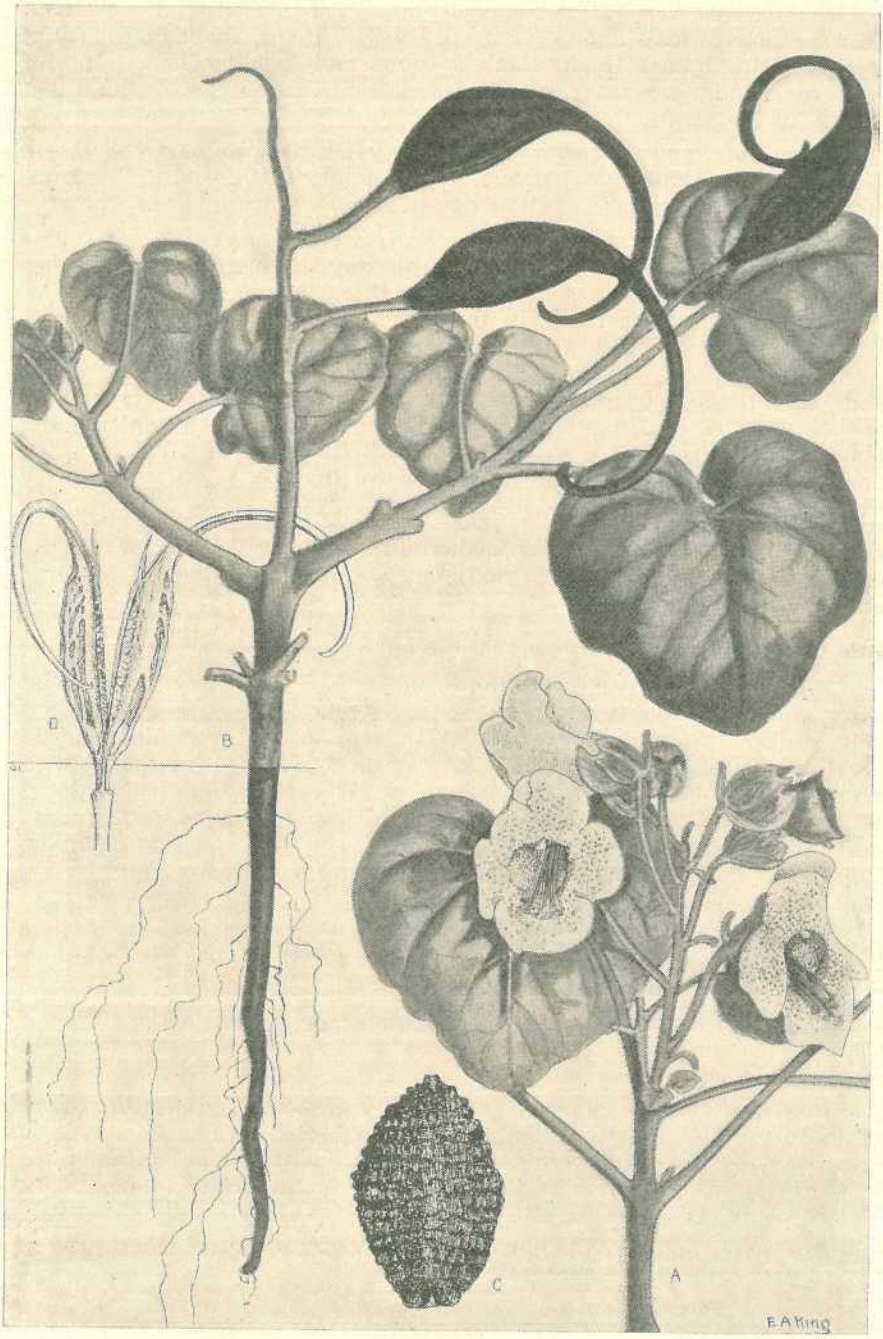


Plate 108.

[Reproduced from Booklet "Control of Weeds," issued by New South Wales Department of Agriculture in association with New South Wales Rural Bank.

Devil's Claw (*Martynia louisiana*, syn. *M. proboscidea*).—A. Portion of plant, showing inflorescence. B. Lower part of plant, showing root-system and unopened fruits. C. Seed fully matured, showing ridges. D. Ripe fruit, opened out, with outer cuticle peeled off.

Common Names.—Most commonly known in Queensland as Devil's Claw. Other popular names for it are Unicorn Plant, Elephant's Trunk, Devil's Grip, Ram's Horn, Eagle's Claw, and Double Claw. It also often goes under the name of "Pumpkin Vine," from the pumpkin-like growth of the plants.

Botanical Name.—*Martynia,* after John Martyn, an early professor of botany at Cambridge University, England; *lutea,* Latin, meaning yellow, in reference to the yellow flowers.

Properties.—The spiny, clawed seed vessels become entangled round the hocks of horses and cattle, and in this way the plant is spread from one district to another. The seed vessels often become entangled in the thick wool of sheep, particularly under the neck, and their presence may not be discovered until shearing time, with consequential breakages of the teeth of the shears. The weed is also naturalised in New South Wales, and W. F. Blakely, writing in the "Agricultural Gazette" of New South Wales (Vol. 34, p. 579, 1923), states that men employed in cutting the plant become dizzy after working on it for any length of time. The plant apparently is left quite untouched by stock.

Eradication.—Fortunately, the weed is not very difficult to eradicate, and the usual method of hoe-cutting below the soil level is the most satisfactory one; as the plant is an annual, this should be done prior to the seeding stage.

Purple-flowered Devil's Claw (*Martynia louisiana,* syn. *M. proboscidea*).

Description.—A rank-growing weed, stems and leaves with short hairs, clammy to the touch. Leaves large, round, 3-9 inches across, on long stalks. Flowers in racemes at the end of a long stalk, corolla narrowly bell-shaped, 1½-2 inches long, yellowish white, variegated with green, pale-purple, and violet spots. Seed capsule 5-6 inches long, the outer green covering disappearing, and leaving a hard, dry, woody, seed vessel, with a row of spines along the lower side, and a few shallow depressions on the sides, opening in two valves, each valve ending in a long curved hook.

Distribution.—A native of the Southern United States and Mexico. In Australia it is a naturalised weed in New South Wales, Victoria, and Southern Queensland.

Common Names.—Most commonly known in Queensland as Devil's Claw. The same local names are given to it as to the yellow-flowered *Martynia lutea.*

Botanical Name.—*Martynia,* see under previous species; *louisiana* refers to the fact that the plant was first collected in Louisiana. It is often referred to as *Martynia proboscidea,* but as the name *louisiana* has a number of years priority, it must be used according to the international laws of botanical nomenclature.

Properties and Eradication.—The same as for the previous species.

The Sugar Banana.

THE sugar banana has been grown profitably for all the "bunch" trade markets in Queensland. Small, sweet, and delicately flavoured, this fruit claims many staunch supporters.

For the production of this banana deep, warm alluvial flats, favoured with a generous rainfall or watered by irrigation, are most suitable. As with other varieties, good drainage is essential. As the sugar banana possesses a slender stem, damage by wind must be guarded against, and where there is no permanent windbreak it is worth while establishing one at the time of planting. For this purpose double border rows of lady fingers or sugar banana plants may be planted 7 feet apart in the row and 7 feet between the rows. The spacings in the inner row should actually lie between the spacings in the outside row—i.e., planted according to the septuple system. These two rows close quickly in towards each other and rapidly form an effective windbreak. Of course, the planting of a permanent windbreak of suitable trees would be far more valuable on account of their permanency, provided the cultivated area is reconditioned from time to time.

Prior to planting, the soil should be worked to a depth of at least 12 inches and reduced to as fine a tilth as possible. The holes for the young plants in the plantation area should be 14 feet apart, 15 inches deep, and 18 inches square. The rows should be lined out as straight as possible each way, thus allowing the greatest convenience in working horse-drawn cultivating implements.

Opinions differ somewhat in the matter of selection of planting material, but generally a vigorous young sucker about 4 feet high dug from a matured stool is most favoured. The top portion of the sucker should be removed, leaving a plant of 3 feet in height to place in the hole. The plant is placed in position within the hole and sufficient surface soil placed in around it to fill approximately two-thirds of the actual cavity. The rest of the cavity is filled in gradually as the ground is cultivated during the ensuing year. According to the quality of the soil, one or two followers are allowed to come away, and, normally, the first bunches will be harvested seventeen or eighteen months after planting.

Farmyard manure applied judiciously to sugar banana plantations will repay the grower handsomely. Light horse-drawn implements are satisfactory for cultivating, and green crops, such as Poona and field peas, are excellent soil invigorators, provided they can be turned back into the soil at the correct time—i.e., when still very soft and succulent.

As the sugar banana is usually marketed in the bunch and the fruit possesses a thin, delicate skin, special care in handling is necessary in order to obtain the best market returns.

THE FRUIT MARKET.

JAS. H. GREGORY, Instructor in Fruit Packing.

DRY conditions prevailed throughout September. The first of the stone fruits—China flat peaches—arrived on the market. New season fruits will soon be offering in abundance. Now is the time for growers to give the final touch-up to the spring cleaning of packing-sheds and equipment. The use of a one-in-twenty (1 in 20) solution of formalin will go a long way towards freeing walls, floors, and shed equipment from possible fungous infection. The time is opportune, too, for full co-operation in marketing methods and procedure. Growers should certainly consider the advice given to them on the careful double-branding of cases, and on having fruit ready in good time for picking up by the carriers, and for delivery at rail sidings, so facilitating checking and stacking. Attention to every detail is worth while, especially from a monetary point of view.

Prices have continued on high levels, and towards the end of September were:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Cavendish: Sixes, 8s. to 12s.; Sevens, 9s. to 12s. 6d.; Eights and Nines, 10s. to 14s.; bunch, 1d. to 10d. dozen.

Sydney.—Cavendish: Sixes, 8s. to 12s.; Sevens, 12s. to 15s.; Eights and Nines, 15s. to 18s.

Melbourne.—Cavendish: Sixes, 7s. to 10s.; Sevens, 8s. to 12s.; Eights and Nines, 11s. to 14s.; small grades hard of sale.

Adelaide.—Cavendish: Sixes, 11s. to 15s.

Brisbane.—Lady Fingers, 3½d. to 7d. dozen.

Pineapples.

Brisbane.—Smooths, 1s. 6d. to 6s. dozen; 4s. to 8s. case. Roughs, 1s. to 4s. dozen; 5s. to 8s. case.

Sydney.—7s. to 10s. Quality improving.

Melbourne.—7s. to 10s.

Adelaide.—10s. to 13s.

Papaws.

Brisbane.—Yarwun, 5s. to 8s. tropical case; Locals, 2s. to 4s. bushel; Gunalda, 4s. to 5s. bushel.

Sydney.—5s. to 10s.; specials higher; some lines specky.

Melbourne.—8s. to 12s.; specials higher.

CITRUS FRUITS.

Oranges.

Brisbane.—4s. to 8s.; specials higher.

Sydney.—8s. to 10s. 6d.

Lemons.

Brisbane.—4s. to 10s. bushel.

OTHER FRUITS.

Avocados.

Brisbane.—7s. to 9s.

Sydney.—11s. to 13s.; specials higher.

Strawberries.

Brisbane.—7s. to 14s. dozen boxes.

Sydney.—9s. to 18s. dozen boxes.

Passion Fruit.

Brisbane.—Firsts, 11s. to 14s. half bushel; Inferior, 7s. to 10s.

Sydney.—10s. to 14s.

Melbourne.—12s. to 14s.

Tomatoes.

Brisbane.—Coloured: Redland's Choice, 11s. to 14s.; small, 6s. to 10s.; Ripe, 6s. to 10s.; Green—Bowen, Yarwun, 7s. to 12s.

Sydney.—South Queensland, 10s. to 18s. half bushel; Bowen, 6s. to 12s.; some specials higher.

VEGETABLES.

(Brisbane prices only, unless otherwise stated.)

Beans.—Brisbane, 5s. to 12s. bag; Sydney, 4s. to 12s. bushel; new crop, South Queensland, to 16s.

Peas.—Brisbane, 10s. to 12s.; inferior lower.

Cauliflower.—8s. to 12s. dozen.

Cabbage.—2s. to 8s. dozen.

Carrots.—3d. to 1s. 6d. bundle.

Beetroot.—4d. to 1s. bundle.

English Potatoes.—Small, 3s. to 3s. 6d.; quality to 5s. 6d.

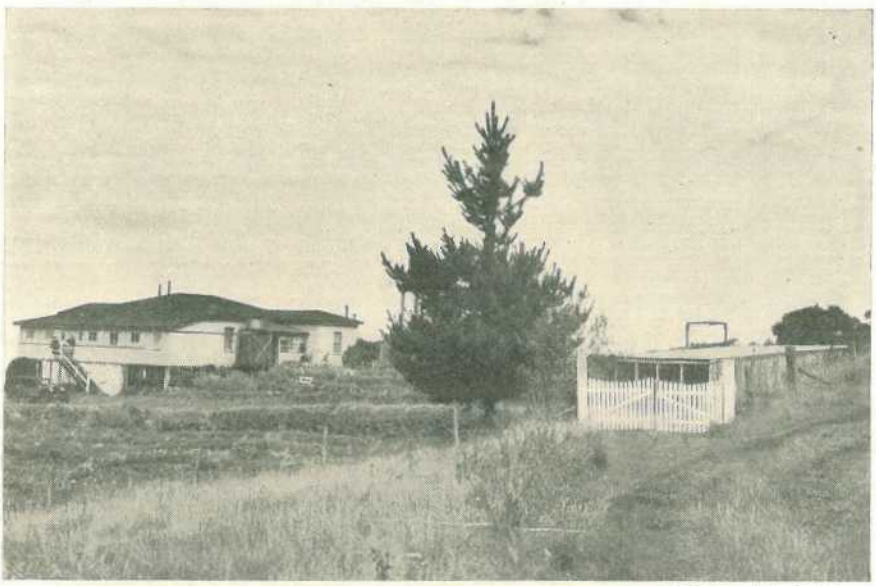
Sweet Potatoes.—2s. to 3s. 6d. bag.

Cucumbers.—12s. to 18s. bushel.

Rhubarb.—9d. to 1s. bundle.

Marrows.—1s. to 5s. dozen.

Pumpkins.—5s. to 7s. bag.



[*Photo: Mrs. Green.*

Plate 109.

Mowbullan House, Bunya Mountains.—The Bunya Range, of which Mount Mowbullan is the highest peak (3,604 feet), divides the river systems of the Burnett and the Condamine and other streams in South-eastern Queensland, which form the headwaters of the great Darling River System. From Mowbullan spreads what is probably the widest panorama on the Continent of Australia, embracing the whole of the Darling Downs and the North-eastern border ranges of New South Wales. Looking northward, the view extends over the whole of the South Burnett to the Kinbombi and coastal range. North-westward, parts of the Dawson Divide may be seen in clear weather. The Bunya Mountain Reserve—beautiful jungle-covered country containing age-old stands of Bunya Pine—is one of the scenic glories of Queensland.

Plate 110.

MOUNT TYSON CHEESE FACTORY.—Equipped completely with a modern plant, this Darling Downs factory has set a very high standard in cheese manufacture and general co-operative dairy organization.

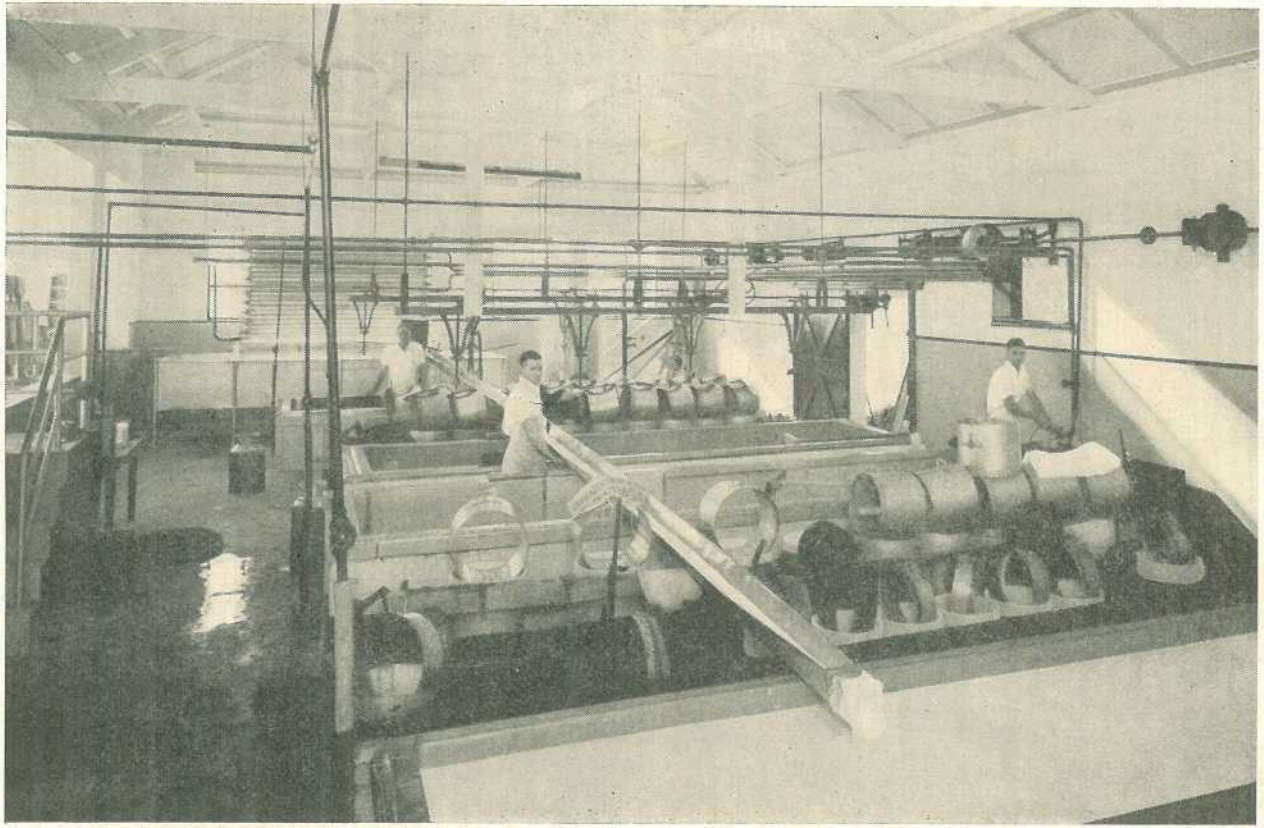


Plate 111.

FILLING THE VATS, MOUNT TYSON CHEESE FACTORY.—High quality milk supply, coupled with factory efficiency, and, consequently, sound hygienic practice in cheese-making ensures the maintenance of a high standard of production at Mount Tyson, the centre of one of Queensland's most progressive dairying districts.

General Notes

Staff Changes and Appointments.

The following transfers of inspectors under *The Diseases in Stock Acts, The Slaughtering Act,* and *The Dairy Produce Acts,* have been approved:—

Mr. J. P. Dowling, from Dalby to Bowen;
Mr. A. G. Smyrell, from Bowen to Dalby;
Mr. G. R. Sigley, from Biggenden to Toowoomba;
Mr. G. F. E. Clarke, from Kingaroy to Biggenden;
Mr. D. A. Bacon, from Mareeba to Woodbine;
Mr. E. E. Prenzler, from Doboy Bacon Factory to Mareeba;
Mr. W. F. L. Snewin, from Oxley Bacon Factory to Helidon;
Mr. W. Kleinschmidt, from Oxley Bacon Factory to Ravensbourne.

Mr. K. D. Hoffman, inspector, *Diseases in Plants Acts,* and agent, *Banana Industry Protection Acts,* has been transferred from Nambour to Gympie.

Mr. O. C. Baumgart (Island Plantation, Maryborough) has been appointed canegrowers' representative on the Maryborough Local Sugar Cane Prices Board. Mr. B. A. Ernest has been given a similar appointment on the Rocky Point Local Board. The former appointment has been made in the place of Mr. G. J. Briggs, resigned, and the latter in place of Mr. T. W. Bray, also resigned.

Messrs. G. Hall and D. Sanders, Mount Isa, have been appointed honorary protectors of fauna.

Constable R. W. Brown, Yungaburra, has been appointed also an inspector under *The Slaughtering Act.*

Butter and Cheese Boards.

Orders in Council have been issued under *The Primary Producers' Organisation and Marketing Acts* giving notice of intention to extend the operations of the Butter and Cheese Boards for the period from 1st January, 1942, to the 31st December, 1944. A petition for a poll on the question of whether or not the Boards shall be extended for such period may be lodged by growers on or before the 13th October, 1941.

Pool Boards.

Regulations issued under *The Primary Producers' Organisation and Marketing Acts* provide for optional preferential voting at any referendum or election held in connection with commodity boards.

Sugar Levies.

Regulations issued under *The Primary Producers' Organisation and Marketing Acts* empower the Cattle Creek Mill Suppliers' Committee to make a levy at the rate of ¼d. per ton on suppliers of sugar-cane to the Cattle Creek Mill, such levy to be used for the purpose of meeting the cost incurred by such Committee in connection with Farm Peak appeals and the costs incidental thereto; 50 per cent. of the growers concerned may, on or before 1st September, 1941, make a petition for a poll on the question of whether or not the levy should be made.

Additional Regulations under the abovementioned Acts empower the Innisfail District Cane Growers' Executive to make a levy at the rate of ½d. per ton on suppliers of sugar-cane to the mills in its district, such levy to be used for building fund purposes by the Innisfail Executive. At least 50 per cent. of the growers concerned may, on or before 1st September next, make a petition for a poll on the question of whether or not the levy should be made.

Margarine Regulations.

Regulations have been issued under "*The Margarine Acts,* 1910 *to* 1939," which rescind all existing regulations. The new regulations provide, amongst other things, for the registration of factories, the issue of licenses to prepare, manufacture, or pack margarine, the disposal of condemned margarine, the taking of samples for analysis, the registration of marks used by owners for margarine, and the construction of factories.

Answers to Correspondents

BOTANY.

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

"Flaveria."

N.M. (Winton)—

Your specimen represents *Flaveria australasica*, a plant that is very widely spread over the black soil plains of Queensland. It finds its greatest development in Western Queensland, but is also seen on the Darling Downs, in the Dawson Valley, and a few other places near the coast where patches of black soil country occur. We have not heard a common name applied to it, but the generic one "Flaveria" is short enough for general usage. The plant is not known to possess any poisonous or harmful properties, though we cannot say we have ever seen it eaten by stock.

Maté—Vinca Rosea.

J.G. (Kunwarara)—

The Maté Plant, so far as we know, is not found in Queensland, either wild or in cultivation. We have imported seeds at odd times from South America, but have had no success with them. There are one or two smallish bushes, we think, in the Botanic Gardens, Sydney. The plant is confined to Paraguay, Uruguay, Argentine, and Chile in South America. It is the national beverage of that continent in much the same way as tea is here. It is exported and sold, and is obtainable in Brisbane at the larger department stores.

The plant mentioned by you as a cure for diabetes and common in North Queensland is probably *Vinca rosea*. It is probably quite common with you on Marble Island. It grows wild on most of the sea beaches from Bundaberg northwards. A pamphlet on it has been sent to you.

A Native Millet. Tassel Blue Grass. A Gulf Country Grass.

W.W. (Gilliat)—

The stout grass with large panicum-like "seeds" is *Echinochloa Turneriana*, a Native Millet. It is closely allied to, and in many respects resembles, the well-known cultivated crops Japanese Millet and White Panicum. In the Gulf country, Native Millet is fairly common around waterholes, and in other similar situations. It becomes less common southward, although it has been recorded from as far south as Charleville. It is generally regarded as a good fodder species, and, in fact, you would expect this from its close affinity to the previously-mentioned cultivated fodders.

The next specimen, with a hairy, much-branched seed head, is *Dichanthium superciliatum*, Tassel Blue Grass. The individual rays of the seed head resemble those of the ordinary Blue Grass, but there are many more of them in the seed head, hence the Tassel Blue Grass. It is also a much taller and more robust grass than the common Blue Grass. It is fairly common in the Gulf country and extends southwards into the Central-West to some extent. We have no information regarding its palatability, but it should be quite a good grass, though rather coarse at maturity.

The third specimen, a short grass only about 1-1½ feet high, and with the seed head composed of a single, fragile spike, is *Uranthoecium truncatum*. We have no common name for it. This generally grows on lower lying flats, and at times is very thick, though often it is mixed with one of the Star Grasses and Button Grass. It is mainly a Gulf country grass, but does extend slightly into the Central-West. A report from the Hughenden district suggests that it should be quite a useful grass in the depressions and flats, but we have no definite information on its fodder value.

Rural Topics

Disease Costs Money.

If each of us could have presented a bill for disease among our live stock over a period of years, we should probably have the shock of our lives, for the fact is that farmers, as individual business men, do not realise what disease among animals is costing them (says an English farming journal). What we pay the "vet" is the smallest part of the bill. The greater proportion is that which we cannot always see in terms of hard cash—short herd life, empty cows, slipped calves, and diseased quarters. We have been content in peace time with a productive life of only three years in our dairy herds—three years when there are individual cows in certain herds that have given yields of 1,000 gallons a year for ten years. Disease is computed to cost £19,000,000 a year over the whole country. Interpreted to the individual herd, that means that disease is costing the ordinary milk producer nearly as much as labour or feeding stuffs. The toll of disease is, in fact, one of the penalties of bad farming. No man may claim to be a good farmer unless he takes every possible step to safeguard the health of his cattle. And if he is wise he will do that by preventive rather than by remedial measures. Prevention is always better than cure, and in this case it is far more economical.—*The New Zealand Farmer Weekly.*

What a Giant Toad will Swallow.

Some years ago some giant toads—*Bufo marinus* is the scientific name—were brought to Queensland from the West Indies to help in settling the cane beetle problem in the North Queensland sugar areas. They were let go around Gordonvale, Babinda, and Innisfail, where they found local conditions very agreeable, and multiplied exceedingly. Their appetite for cane beetles soon proved prodigious, but they developed an appetite for other insects and pests as well. To find out how the giant toads had extended their menu, over a hundred of them were collected recently in the Hambledon canegrowing area and opened up for inspection. The examination of the stomach contents of the toads showed that, while a few greyback cane beetles had been swallowed, the number of Frenchi beetles counted encourages the belief that the toad is doing a useful job in controlling the beetle pest. Not only that, but some canegrowers say that the giant toad has developed a huge appetite for beetle borers and for garden pests generally. And here is a very interesting discovery—where the toad is numerous there has been a remarkable decrease in snakes and death adders, and this is believed to be because by swallowing a toad the reptiles commit suicide. Evidently, the toad, good on the swallow himself, is too tough for digestion when swallowed by a snake. Perhaps, in the jargon of the day, snakes are allergic to toads.

A Farmer's Philosophy.

"You know," said one of our readers recently, "there is a stability and sanity about the land. The farmer has his full share of problems and anxieties—especially the dairy farmer who is faced with the necessity of changing over from butter to cheese manufacture—but he has his compensations, and never were these compensations to be valued more than in these hectic days. In a world of tumbling standards, it is well to be daily reminded of the eternal verities, and nowhere is the rhythm of things eternal so accented as in the places where men are quietly busy with their crops and sheep and cattle; nowhere, surely, are there more within reach the makings of a worth-while way of life." There is certainly something fine in that philosophic viewpoint.

Shipping Dairy Produce without Refrigeration.

A small experimental shipment of Australian butter and cheese is now on the way to England as part of a joint Australian and New Zealand policy for testing methods of sending dairy produce to distant markets by ships without any very large refrigerated space. Under this scheme, a consignment of butter and cheese from New Zealand was recently delivered in London. While it was found that the butter was not of the required quality, the cheese opened up well, both from the viewpoints of analysis and expert grader's taste. The cheese was sent, firstly, in crates, and, secondly, packed in sawdust. The sawdust packing gave the best results. There is not enough evidence yet, however, on which to build up any great hopes of similar success with bulk consignments, but the science men are continuing with the good work.

Farm Notes

NOVEMBER.

WHEAT-HARVESTING will become general this month, and now is the time to see that all field equipment—header-harvesters, tractors, and other machinery —is in thorough working order. All working parts should be oiled and examined and necessary readjustments made so as to avoid the risk of stoppages in busy times.

Rust is not the menace that it used to be, now that more or less rust-resistant wheats are in general cultivation. Three Seas and Seafoam wheats are moderately resistant, while other varieties—such as Flora and Florence—usually ripen early enough to escape rust.

November is regarded as the best time for the establishment of the main maize crop, because the tasselling period coincides usually with normal summer rains. Too much attention cannot be given to the preparation of land for maize, which should now be well advanced, for no amount of inter-row cultivation will overcome the retarding influence of faulty initial preparation. Inter-row cultivation should become progressively shallower as growth proceeds, and may be discontinued at the cobbing stage.

Increased attention is being given to the growing of grain sorghums, chiefly in districts where the rainfall is insufficient to assure profitable yields from maize. Yields up to 12 bags to the acre have been obtained under conditions fatal to maize, while the capacity of header-harvesters to deal with the new dwarf-growing varieties is a big factor in economical production.

For intermediate crops, the rapidly maturing millets, Japanese millet and white panicum, can be recommended for present sowing, being suitable for grazing, silage, or hay. If seed production is desired, preference should be given to the variety known as Giant Panicum or Giant Setaria, and to the French millet.

Local potatoes and onions will now be arriving on the market, and, in order to obtain the best possible returns, attention should be given to grading, and to marketing produce in good, clean bags. To retard infestation by the potato tuber moth, the potatoes should be bagged and removed from the field without delay, for if exposed overnight, some infestation may occur during storage.

The planting of peanuts will be continued in the main South Burnett districts, where Virginia Bunch and Red Spanish are the principal varieties grown. Growers are reminded of the better germination obtainable if seed is treated with a fungicide before sowing.

In addition to the crops mentioned, seasonal sowings of Sudan grass, broom millet, buckwheat, pumpkins, and melons can be made, and cow cane and sweet potatoes planted out.

Where broom millet is grown as a sideline, it is sometimes preferable to make small successive sowings so as to spread the harvesting over a long period.

Orchard Notes

NOVEMBER.

THE COASTAL DISTRICTS.

Citrus Fruits.

In the citrus orchard increasing temperature and the possibility of a dry period call for the utmost attention to soil conditions, particularly aeration and moisture conservation. At the slightest sign of distress because of lack of moisture, trees should be irrigated thoroughly whenever water is available. At the same time attention should be given to cultivation, particularly on hillside orchards. In the coastal districts, the possibility of the approach of storms will prompt growers to consider the completion of each cultivation by forming shallow drains for running off excess water and preventing soil loss.

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

Under certain weather conditions scale movement may be expected.

Detailed information regarding insect control may be obtained from departmental publications on the subject. Every fruit and vegetable grower should have the Agricultural and Pastoral Handbook, Vol. III. (Insect Pests and their Control, Plant Diseases and their Control), obtainable from the Department of Agriculture and Stock. Price 3s., post free.

Pineapples.

Continue planting pineapples as discussed in these notes last month, always remembering that the modern practice is smaller areas, close planting with more pineapples to the acre, quicker, better, and healthier growth, and finally better fruit by liberal fertilizing through the leaf bases with 10-6-10. Collectively, these practices tend towards the elimination of wilt.

Bananas.

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

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

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

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

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

Keep the orchards and vineyards in a thorough state of cultivation, so as to keep down all weed growth and conserve moisture in the soil. This is important, for if a long spell of dry weather sets in, the crop of summer fruit will suffer severely from lack of moisture. Citrus trees should be irrigated where necessary, and the land kept in a state of perfect tilth.

Spraying for codling moth should be continued, and all pip fruit trees should be bandaged by the beginning of the month; further, the bandages should be examined at frequent intervals and all larvæ contained in them destroyed. The neglect to spray thoroughly and to attend to the bandages properly is a cause of the increase in this serious pest in the Granite Belt, and growers are warned that they should pay more attention to the destruction of this pest if they wish to grow pip fruit profitably.

Fruit fly may make its appearance in the cherry crop; if so, every effort should be made to stamp out the infestation at once. Unless this is done, and if the fly is allowed to breed unchecked, the later ripening crops of plums, peaches, apples, pears, apricots, and Japanese plums are bound to become more or less badly infested. Combined action should be taken to combat this—the most serious—pest of the Granite Belt, and growers should realise that, unless they take this action and see that careless growers do not breed the fly wholesale, they will never keep it in check, and it will always be a very heavy tax on their industry.

A sharp lookout should be kept for brown rot in fruit, and, on its first appearance in a district, all ripening fruit should be sprayed with lime sulphur 1 in 120.

All grape vines, potatoes, and tomatoes should be sprayed with Bordeaux or Burgundy mixture, as required, for the control of downy mildew and anthracnose of the grapes, and Irish blight and target spot of the potato and tomato.

CARE OF THE YOUNG FRUIT TREE.

Many failures are observed where replacements are made in a bearing deciduous fruit orchard. Frequently, the young tree remains like an unwanted orphan and shows only stunted growth. If it is to catch up to the other trees and fill in an unsightly and unprofitable blank space in the orchard, careful attention must be given to all details in its management.

The main causes of failure are:—

1. The lack of natural plant food for the young tree.
2. If the old replaced tree died from the attacks of some particular diseases, the replant may be attacked in turn and suffer an initial setback.
3. Searching roots of adjacent trees may compete successfully with those of the young tree for the available plant food.
4. Lack of attention.

When digging out the unhealthy tree, carefully remove and burn all the roots together with the tree. Leave the hole open and exposed throughout the winter, and just prior to planting in spring fill with a load of virgin soil to which may be added some well-rotted animal manure. Virgin soil is obviously richer in plant nutrients than soil which has been cropped exhaustively for some considerable time.

The young tree is very often forgotten and does not get the necessary attention at the right time. Weed growth may tend to choke it, but this difficulty can be simply overcome by the use of an old fertilizer bag. The bag is opened out and, after making a cut in the middle, is slipped over the young tree. This makes an excellent mulch which keeps down weed growth in the vicinity of the tree and conserves the moisture so necessary for its progress.

NOTICE TO READERS.

Because of the present necessity for strict economy in the use of paper, readers are requested to renew their subscriptions promptly. If renewals are unduly delayed, it may be impossible to supply back numbers of the Journal.

Address all renewals and other correspondence to the Under Secretary, Department of Agriculture and Stock, Brisbane.

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.

BABY'S HEALTH: NATION'S WEALTH.

THE VALUE OF SUNLIGHT.

IN our talk last month we told you what a great asset our wonderful Queensland sunshine is in helping to keep children well and making them grow straight and strong. We explained that the sunshine acts in two ways—by destroying the germs of disease and by helping the body to make use of the necessary minerals which build up bones and teeth. This month we are going to talk about sun-bathing, and discuss various special points in connection with it.

In the last few years there has been a great craze for sun-bathing, or sun-baking as some people call it. We see it going on everywhere on our beaches during the summer months. This is a good thing, but, like every other good thing, one can have too much of it, and, like every other medicine, it should be taken in moderation.

This is especially so with babies and young children, and we have seen many babies badly sunburnt because mothers had not been properly instructed in the management of sun-bathing.

The most valuable part of the sunlight is what we call the ultra-violet rays—just too high in pitch for our eyes to see. Ordinary glass, which does not arrest the visible rays, stops the ultra-violet. Therefore, we cannot get the best effects of the sunlight if the windows are closed. Unfortunately, smoke acts like glass, and cuts off the very rays we need the most. So the best way to use the sunlight is in the garden, on a well-protected verandah, or in a room with the windows wide open and in a clear atmosphere.

How to Use the Sunlight.

The best time to begin sunbaths is now—in the first warm weather and before the sun reaches its full summer heat. The early morning hours are best, because it is the light and not the heat which is important. As we know, too much heat can be enervating and depressing.

Sun-bathing may be commenced when baby is quite young, but it is difficult to give definite directions as to the extent of the body surface that can be exposed to the sun or the best time allowance. In babies, as in grown-ups, there are very great differences in the sensitiveness of the skin to the sun's rays. The safest and best plan in this, as in all other matters affecting baby, is to go slowly and err on the side of advancing too slowly rather than risk going too quickly.

When a normal healthy baby is about a week old he may be taken out into the sunshine for a short time if the weather is mild. His eyes should be shaded from the glare by turning him on his side in his cot and shading his head without putting a covering near his face. Remember that the ideal sunshade is a tree, shrub, or hedge, such as animals instinctively seek on hot days. Next best is a verandah or wall.

When the temperature of the day is fairly warm a healthy baby who has been properly reared should become accustomed towards the end of his second month to having his arms and legs bared to the sun for, say, five to ten minutes before the 10 a.m. feeding, and in the course of another week or two before the 2 p.m. feed also. By degrees his sunbath may extend to the waist, and later to the armpits.

The mother should hold the baby on her knee if possible, so that while he is being sun-baked she can give him stimulation and passive exercise by stroking his legs and arms gently but firmly, starting at the hands and feet and working towards the trunk. This increases the activity of the circulation. It is not wise to leave baby in his cot for his sunbath, particularly in the beginning, as a busy mother may easily lose count of the time.

In hot weather a healthy baby in his third month may have his morning bath on the open verandah, where the sunshine can play on his body.

When he is old enough to crawl and run about, exposure of the whole body to the sunlight from ten to fifteen minutes or more may be allowed.

During the holidays or if baby lives by the seaside and has been accustomed to sunbaths, mother may safely let him run about the beach for a time in a very scanty sun suit or loin cloth.

Be careful in all cases to protect the head and eyes.—The best head covering is a loose, white, perforated soft-linen hat, which may be lined with green. This keeps the head reasonably cool and shades the eyes and the back of the neck.

Warning.

While the normal baby benefits to a considerable extent by a gradual exposure to the sunlight, parents must realise that the sun's rays can do more harm than good if any attempt is made to proceed too quickly or if the sunbaths are commenced in really hot weather. Watch baby carefully. The faster the skin tans the more you can expose it, but the baby with the fine sensitive skin, which reddens or freckles instead of tanning, must be taken very slowly indeed—commencing with perhaps only one or two minutes until the skin can be educated to react properly.

Sunlight is Essential.

We know now that during the last few years a series of very important investigations has definitely proved that failure to expose the skin surface to direct sunlight is one of the principal causes of debility and disease. Seeing what wonders direct sunlight can do for children in general, it is becoming more and more apparent that we have all been to sparing of sunlight for babies. We are proving every day that they benefit as much as the older children of the family from exposure of the skin to the sun's rays. Babies accustomed to daily exposure of the skin to open air and sunshine do not "catch cold" easily. If, in addition to their sun and air baths, they are given a sufficiency of all the foods necessary for good health they become practically weatherproof and almost diseaseproof. Such children are a joy to themselves and to everyone connected with them. Their circulation will be good and they will glow with warmth even on cold days.

In our centres we find that many babies living in flats and apartments become very pale owing to lack of sunshine. Mothers who are compelled to bring up their children in these limited surroundings must use every means of getting them into the fresh air and sunshine, and if it is not possible in the house and no garden is available, there are always the public parks and gardens which may be utilised. Remember, babies and children—in fact, all living things—need the sunshine. Spare no effort to obtain it for your children.

You can obtain information on this or any other matter relating to the feeding and management of children up to school age by writing to "Baby Clinic, Brisbane." Such letters need not be stamped.

IN THE FARM KITCHEN.

A MIXED MENU.

Buttered Eggs.

Parboil 1 or 2 large potatoes and cut into slices about ¼ inch thick. Dip in beaten egg and fry in boiling fat until a golden brown. Drain and place in a moderate oven to keep hot and to cook a little longer while the eggs are being prepared. Break eggs into a saucepan with 1 tablespoon top milk, allowing 2 eggs per person. Add 1 dessertspoon butter, pepper, salt, and a little finely-chopped parsley. Stir over gas until mixture thickens, but on no account allow eggs to become hard. Pile on to prepared potato slices, sprinkle top with shredded and fried bacon, and serve at once.

Salmon Loaf with Lemon Sauce.

Skin and flake 1 large tin salmon, add 1 cup fine white breadcrumbs, 4 chopped gherkins, 1 teaspoon minced onion, the grated rind of 1 lemon, 1 teaspoon finely-chopped parsley, 1 cup thick white sauce, 2 well-beaten eggs, ½ cup milk, salt, pepper, and a little paprika or a wash of cayenne to taste. Press into a well-greased loaf pan and bake in a moderate oven for about 30 minutes. Turn out and serve with lemon sauce.

Vegetable Puff.

Mix together ½ cup each cooked and diced carrots, celery, and cooked peas, 1 cup diced and fried onions, 1 tablespoon each finely-chopped green pepper and parsley, pepper and salt to taste, 2 cups very finely-mashed potato, 1 tablespoon melted butter, and the yolks of three eggs. Mix well together without breaking the vegetables, and lastly add the whites of the 3 eggs, beaten to a stiff froth. Pile lightly in a casserole or any fireproof dish and bake in a moderate oven for about 45 minutes. This is an excellent way to use up left-overs such as fish, chicken, cold meat, &c.

Sweet Potato Loaf.

Sift 2 level cups plain flour with 2 heaped teaspoons baking powder, ¼ level teaspoon bicarbonate of soda, ½ level each teaspoon salt, ground cinnamon, and ground nutmeg; add 2 cups fine wheatmeal, 1 cup each chopped walnuts and sultanas or raisins, ½ cup coconut. Cream ½ cup butter well, add 1 cup honey, and 1½ cups grated sweet potato, then 2 well-beaten eggs. Lastly add dry ingredients and mix well. Turn into a well-buttered and lightly-floured loaf pan and bake for about 1½ hours in a moderate oven.

Fish Loaf.

Boil as many potatoes as required and mash well with a little butter, milk, and the yolk of 1 egg, but do not make too sloppy. Grease a flat tin or oven slide and place on potato, forming it into a neat oblong shape and rather high. Scoop out the centre, leaving a case, but take care to have potato rather thick on the bottom. Now mix together 1 lb. flaked cooked fish, 1 cup well-flavoured white sauce, tomato or lemon sauce, 1 tablespoon chopped parsley. Fill hollow and cover with potato. The potato may be forced through a pipe in a design on top, but care must be taken that all the fish mixture is well covered. Brush over with a little beaten egg and bake in moderate oven to get thoroughly hot and well browned. Lift carefully on to a hot dish and serve. This may be cooked in a flat casserole dish and served in the same dish in which it was cooked.

Macaroni and Fish Cutlets.

Cook and flake fish and measure about 1 lb. Cook 4 oz. macaroni or spaghetti in plenty of boiling salted water until tender, drain well and chop finely. Melt 2 oz. butter or margarine in a saucepan, add 2 oz. butter, cook a little, and gradually add a little more than 1 cup milk and stir until very thick. Remove from gas and add pepper, salt, the grated rind of 1 lemon, a dash of paprika, and 1 tablespoon lemon juice. Add fish and macaroni and mix well together without breaking the fish too much. Form into cutlet or pear shapes, roll in flour, then in egg and breadcrumbs. Fry in boiling fat until a golden brown, then drain and serve with a well-flavoured lemon sauce. Lobster or prawns may be used in the same way.

IN THE FARM GARDEN.

FOLIAGE PLANTS FOR THE GARDEN.

Dr. D. A. HERBERT.

At certain seasons of the year when flowers are scarce, the full merit of plants whose ornamental value lies in their foliage is realised. There is a tremendous range of plants of this type; some of them, such as the Coleus, are so common that their worth is not fully appreciated, while others, such as Aucuba, the gold-dust tree, have to be coddled if they are to survive in the average Queensland garden. Some idea of the effective use of foliage is given by the bank of Monstera and tree-ferns along the Adelaide street frontage of the Brisbane City Hall. *Monstera deliciosa* is a noble vine with great perforated leaves of jungle green, and is at its best climbing on a building or up a tree trunk, and contrasts well with the feathery foliage of the ferns. In a small garden a display of this sort must be on a reduced scale, but there are many ferns and shrubs which can give just as pleasant an effect by a blending of forms of leaf and shades of green. The most satisfactory alternative to a flower display is, however, provided by plants with coloured foliage. One of the finest coloured foliage plants is the Croton, which is seen at its best in the North. There is something intensely alive in its vivid colouration, and though at its best in the tropics, it does remarkably well in the south of the State, especially if it is protected from drying winds, Cuttings strike readily in water or in soil.

Another fine foliage plant is the Acalypha, but here again the full beauty of the numerous varieties is best seen in the North. In Flinders street, Townsville, there is a splendid range of colours and leaf shapes, but, unfortunately, in South Queensland there are far too many poor varieties grown, and they bring discredit on the good ones. Many of them should have been discarded long ago. A row of good Acalypha varieties makes a fine show against a fence or along a drive. If they are kept clipped, they make a good hedge, but cannot show the full beauty of their foliage.

The Coleus is very hardy and strikes so easily that most gardeners are content to raise their plants from cuttings. It grows readily from seed, and it is worth while raising a batch of seedlings occasionally, because in that way new colours and leaf shapes are obtained. Old plants become leggy and, apart from that, are liable to the attacks of eelworms, which make lumps on the roots; so it is advisable to start new plants from cuttings each year. The best species is that familiar in Queensland—*Coleus Blumei*—but from time to time other species find their way on to the market, and none of them is as good as the old type. A plant which can be grown like a Coleus and which makes a bright splash of colour is Iresine, a native of South America, sometimes locally known as Bull's Foot. It has round leaves notched at the apex and highly coloured. One variety has purplish red stems and leaves the colour of beetroot, and another has one side of the leaf purplish red and the other green and yellow. Cuttings from branches which occasionally sport different colour markings will give plants with the new character. Iresine is very hardy and will stand drought but not frost. If it is kept cut it makes a dense bush, and overseas is used for carpet bedding, the plants being put out 6 to 10 inches apart and kept cut.

A very hardy foliage plant is Sansevieria, the Bowstring hemp, a plant with a very strong fibre. It has a creeping stem from which arise stiff, erect, sword-shaped leaves, mottled with transverse bands of greyish white. It grows well in rockeries. If leaves are cut and the pieces put in sand they root in the course of a few weeks, but it is quicker to divide up an old clump.

The Dracaenas are one of the finest of the groups of foliage plants. Most of them have slender woody stems bearing a palm-like crown of broad leaves, often highly coloured or variegated. We are fortunate in Queensland in being able to grow them in the open garden, whereas in many countries they must have artificial heat. Most of the Dracaenas of gardens are really members of the genus Cordyline, but the difference is not great. *Cordyline terminalis*, the palm lily of our scrubs, a tall plant with green leaves, is not commonly cultivated, but it has a number of varieties, some with purple leaves, others with white, pink, or rose variegation. The purple varieties are specially popular, and there is no difficulty in getting them to strike. When the plants get too tall they can be cut down, the top divided into small slips and planted, while the stump grows out again. A New Zealand species, *Cordyline australis*, the cabbage-tree palm (a name also given to some of the true palms) is distinguished from *Cordyline terminalis* by absence of a leaf stalk. Its leaves are often striped with yellow. These so-called Dracaenas make good pot plants in their early stages, and when they get too tall they can be transplanted to the open garden bed, or cut back for cuttings.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF AUGUST IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1941 AND 1940, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Aug.	No. of years' records.	Aug., 1941.	Aug., 1940.		Aug.	No. of years' records	Aug., 1941.	Aug., 1940.
North Coast.	In.		In.	In.	*South Coast—contd.*	In.		In.	In.
Atherton	0·86	40	0·59	0·64	Gatton College ..	1·08	42	0·23	0·21
Cairns	1·67	59	1·63	0·61	Gayndah	1·16	70	0·12	0·06
Cardwell ..	1·23	69	1·02	0·38	Gympie	1·69	71	0·28	0·76
Cooktown ..	1·17	65	2·13	1·16	Kilkivan	1·39	60	0·20	0·25
Herberton ..	0·62	55	1·18	0·30	Maryborough ..	1·65	70	0·57	1·24
Ingham	1·44	49	0·75	1·86	Nambour ..	1·92	45	0·62	3·35
Innisfail	4·90	60	2·67	3·52	Nanango	1·30	59	0·60	0·41
Mossman Mill ..	1·23	28	1·24	0·35	Rockhampton ..	0·84	70	0·01	2·17
Townsville ..	0·51	70	0·02	2·32	Woodford ..	1·64	54	0·40	1·35
Central Coast.					*Central Highlands.*				
Ayr	0·59	54	0·04	3.65	Clermont ..	0·72	70	Nil	2·92
Bowen	0·73	70	0·76	7·84	Gindie	0·65	42	..	1·40
Charters Towers ..	0·52	59	0·07	1·44	Springsure ..	1·02	72	Nil	1·62
Mackay P.O. ..	1·09	70	0·27	7·09	*Darling Downs.*				
Mackay Sugar Experiment Station	0·98	44	0·15	6·76	Dalby	1·17	71	0·03	0·04
Proserpine ..	1·49	38	1·14	6·68	Emu Vale ..	1·09	45	0·30	0·28
St. Lawrence ..	0·81	70	Nil	2·81	Hermitage ..	1·12	36	..	Nil
South Coast.					Jimbour	1·12	62	Nil	Nil
					Miles	1·11	56	0·09	Nil
					Stanthorpe ..	1·76	68	0·48	0·17
Biggenden ..	1·08	42	0·18	0·29	Toowoomba ..	1·61	69	0·27	0·43
Bundaberg ..	1·30	58	0·42	0·93	Warwick ..	1·43	76	0·18	0·07
Brisbane ..	1·93	89	0·75	0·40					
Caboolture ..	1·66	65	0·25	1·24	*Maranoa.*				
Childers	1·25	46	0·63	0·79					
Crohamhurst ..	2·21	48	1·37	4·01	Bungeworgorai ..	0·68	27	..	0·08
Esk	1·41	54	0·25	0·24	Roma	0·88	67	0·03	0·09

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—AUGUST, 1941.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Mean Atmospheric Pressure, at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	..	76	61	79	26	51	16	213	8
Herberton	..	69	44	77	20, 22, 23	28	14	118	6
Rockhampton	30·18	76	49	81	20	39	14, 15	1	1
Brisbane	30·19	71	48	75	19	40	9	75	3
Darling Downs.									
Dalby	..	69	37	76	21, 22	25	7	3	1
Stanthorpe	..	60	31	68	22	17	14	48	4
Toowoomba	..	63	42	69	22	30	14	27	3
Mid-Interior.									
Georgetown	30·10	82	49	88	22	35	15	Nil	..
Longreach	30·20	77	41	86	21, 22	31	8	Nil	..
Mitchell	30·22	69	33	79	22	21	14	22	1
Western.									
Burketown	..	82	54	88	20	45	14, 15	Nil	..
Boulia	30·18	77	45	89	21	37	15	Nil	..
Thargomindah ..	30·20	71	40	80	31	31	14	1	1

ASTRONOMICAL DATA FOR QUEENSLAND

NOVEMBER, 1941.

By A. K. CHAPMAN, F.R.A.S.

SUN AND MOON.
AT WARWICK.

Nov.	SUN.		MOON.	
	Rises.	Sets.	Rises.	Sets.
	a.m.	p.m.	p.m.	a.m.
1	5.1	6.11	3.43	3.18
2	5.0	6.11	4.35	3.53
3	5.0	6.12	5.27	4.29
4	5.0	6.13	6.19	5.6
5	4.59	6.13	7.10	5.43
6	4.58	6.14	8.0	6.24
7	4.57	6.15	8.50	7.7
8	4.56	6.15	9.39	7.52
9	4.55	6.16	10.26	8.39
10	4.55	6.17	11.11	9.30
11	4.55	6.18	11.54	10.23
12	4.54	6.19	nil	11.17
			a.m.	p.m.
13	4.54	6.19	12.36	12.14
14	4.53	6.20	1.17	1.12
15	4.52	6.21	1.58	2.13
16	4.52	6.22	2.39	3.16
17	4.52	6.22	3.23	4.21
18	4.52	6.23	4.10	5.28
19	4.51	6.24	5.1	6.36
20	4.51	6.25	5.55	7.42
21	4.51	6.26	6.54	8.46
22	4.51	6.27	7.54	9.44
23	4.50	6.27	8.56	10.36
24	4.49	6.28	9.57	11.23
25	4.49	6.29	10.56	nil
				a.m.
26	4.49	6.30	11.52	12.5
			p.m.	
27	4.49	6.31	12.46	12.44
28	4.49	6.31	1.40	1.20
29	4.48	6.32	2.32	1.55
30	4.48	6.32	3.23	2.31

Phases of the Moon.

4th November, Full Moon, 12 noon
12th ,, Last Quarter, 2.53 p.m.
19th ,, New Moon, 8.4 a.m.
26th ,, First Quarter, 3.52 a.m.

THE EVENING STAR.

A GOOD deal of interest is now being taken in Venus, the Evening Star, or Hesperus, as it is sometimes called. We shall have to wait, however, until after full moon to see the stars at their best. Venus, the earth's twin-sister planet, now appears bright and high in the western sky at dusk; indeed, it will reach its highest altitude above the western horizon at sunset on 23rd November, when it will be 47 degrees east of the sun. In a telescope Venus appears half-moon shape, but it is beginning to move into a position between us and the sun and, therefore, its shape gradually becomes crescented as its night side is slowly presented toward the earth. After it has reached its greatest altitude, its size and brillancy will appear to grow for another month or so as it approaches the earth. After that, the bright crescent will become too slender to give as much light and, ultimately, the crescent Venus will entirely disappear as the planet passes between us and the sun. It is not because of the planet's great size that it appears the brightest of stars, but because of its nearness and the sunlight which is reflected from its mantle of cloud.

VENUS COMING NEARER.

Venus is at present nearly 77,600,000 miles away, but it is coming nearer and will be nearer than either of the other worlds ever come early in the new year. However, we shall not then see it as it will be between us and the sun.

Mars was at its nearest last month. The earth is now passing on and leaving the Red Planet behind. Mars will gradually lose its prominent place among the host of heaven and subside to the size of an ordinary star. It will be nearly twenty-six months before we shall see Mars as bright as it was last month. However, for some time its ruddy gleam will attract attention as it reaches the meridian earlier and earlier in the evenings.

About 7.30 p.m. the Pleiades rise, and a little south of them the planet Saturn shines with its yellow light, strongly contrasting with red Mars. Saturn will be at its best this month, as it will be in opposition to the sun on 17th November. At that date it will be at its nearest to us, if 756,000,000 miles can be called near. However, many great telescopes will point Saturnward to see what changes have taken place since last opposition. As the planet is always enshrouded in dense clouds, no surface markings can be seen; but large spots sometimes appear, which seem to indicate activity. Besides the great ring system, which has a spread of 171,000 miles, Saturn has a family of ten moons.

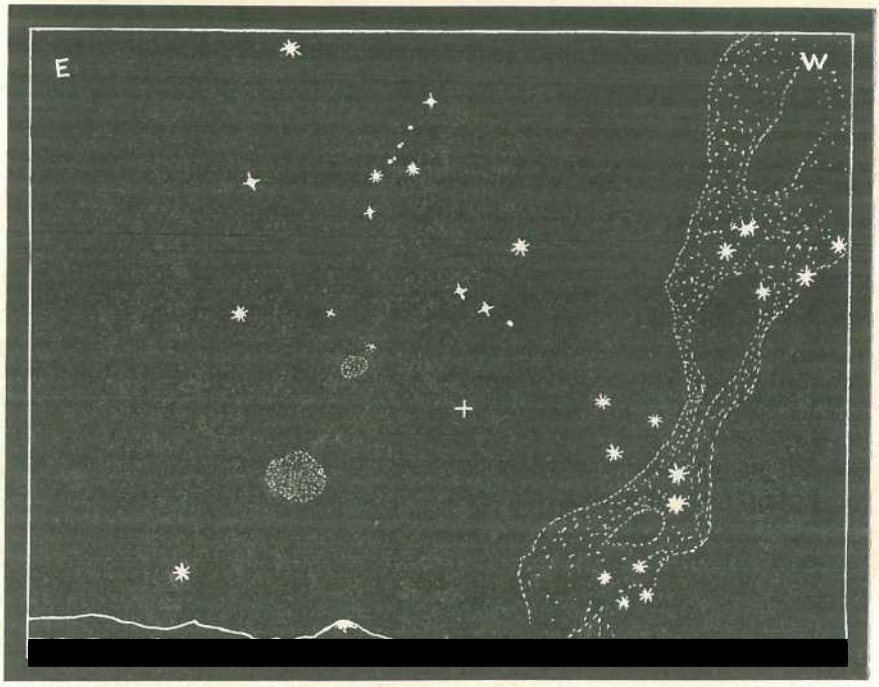
A world still farther away than Saturn is Uranus. This planet will also be in opposition this month—on the 21st.

COULD SWALLOW SIXTY EARTHS.

Uranus is one of the giant planets. Though smaller than Saturn, it is 30,900 miles in diameter and could swallow nearly sixty earths without appearing any larger. Its distance, at its nearest approach to the earth, will be 1,719,000,000 miles. Is it any wonder that this world, although 30,900 miles in diameter, cannot be seen by the naked eye? Although, it may be just possible to glimpse it for a week or two while at its nearest, if one knows exactly where to find it among the multitude of small stars in its neighbourhood. Uranus, at the beginning of November, is just a little east of Saturn and almost as far south as the width of Orion's belt.

About two hours after Saturn rises the greatest of the planets, Jupiter, comes up over the horizon. Jupiter rises with Orion, it being the bright "star" north of the giant Hunter; Jupiter is approaching the earth and is now showing at its best. It only requires a small telescope to see four of its eleven moons, which look down upon its great cloud-girt globe. These moons are interesting as they are in motion, even in a few hours their positions are seen to change.

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.



LOOKING SOUTH ABOUT DARK.

Now that summer is with us there is more water vapour in the atmosphere and, therefore, even on clear nights the stars do not shine as clearly as they do in winter. However, our summer skies are far more resplendent with brilliant stars than at any time of the year. Looking toward the south we see the same stars through the year, for all those within about 28 degrees of the South Celestial Pole, marked by a small cross in the picture, never set at Warwick but continue circling the pole year after year. Therefore, the bright star at the foot of the Southern Cross never sets, but just skims the southern horizon at Warwick. Although there is no bright star to mark the South Celestial Pole, its position is easily found. The Southern Cross, with its two bright "Pointers," is seen low in the Milky Way. From the Pointer nearest the Cross, draw a line upward toward the east until the bright star Achernar is reached. Half-way along that line is the position of the South Pole, around which all the southern stars appear to revolve every twenty-four hours and also once every year. Those who have followed these star pictures will have noticed how the Southern Cross circles the pole; six months ago it was on the opposite side of the cross which marks the pole. Soon, the Cross will set and its well-known figure will be missing from our evening skies until the circling year brings it up again in the south-south-east, where a bright star is shown above the mountains. This star is Canopus, the chief star of the Ship, Argo. In common with the other stars, it is circling the pole clockwise; therefore, Canopus will be seen for almost a year, until it sinks to the south-south-west horizon, where the Cross now appears. Canopus must be a sun of tremendous size and brilliancy. It is the second brightest star in the heavens. Sirius is the brightest, but Sirius is but 9 light years away, while Canopus is probably about 652 light years away. As it appears so bright at so great a distance it must be tremendously large. It is whiter and hotter than our sun, its surface temperature being about 13,000 degrees Fahr. while the sun is but 10,000 degrees. Returning to the Cross and its Pointers, which are Alpha and Beta Centauri, it is interesting to note that Alpha, the star farthest from the Cross, is the nearest bright star to the earth, its distance being only 4½ light years—26 millions of millions of miles!

Near Alpha Centauri is a well-shaped triangle of stars, which is known as the Southern Triangle. A much larger triangle, and a more useful one, is made up of three bright stars in the upper half of the picture. The star at the top is Fomalhaut, in the Southern Fish. The base of the triangle is marked by Achernar, which is on the opposite side of the pole from the Southern Cross, and Alpha Pavonis, the chief star in Pavo, the Peacock, the tail of which is marked by three faint stars in a row, a little below. When this great triangle is once found it becomes a prominent sky sign. In its west side is Grus, the flying Crane; at this time of the year it is flying upward. The two bright stars mark the upraised wings, a long line of small stars, some of them naked eye doubles, form the outstretched neck, while a brighter one forms the head. On the other side of the wings a few small stars form the tail. The two wing stars point across to the other side of the triangle, where is the faint constellation of the Phoenix, and in the base of the triangle are some small stars of Toucan, a South American bird. Below the base of the great triangle are the two clouds of Magellon, appearing like patches of the Milky Way.