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Event and Comment.

Anzac.

ON 25th April the thirtieth Anzac anniversary was commemorated fittingly throughout the Commonwealth. In a critical study of the Gallipoli campaign, an English historian, John North, wrote of Australians and New Zealanders: "Let it be said that, had not these Anzacs been ordered away from the Peninsula, all the forces of darkness would never have availed to push them back into the sea." The Anzacs "were an unconquerable strain."

For Australia and New Zealand, Anzac has become a national tradition—a tradition enhanced greatly by the fighting forces of both countries in the present world war. "The heroic tradition springing from the Anzac legend is now bedded in the race. It is the race itself. It is national and enduring."

Food Production is Still a Grave Problem.

FAMINE always follows in the wake of war, and in the next European winter many millions of people will be faced with varying degrees of famine—in some cases total famine. Mr. Churchill predicted that in the British Parliament more than a month ago, and added that that was the reason military operations were being accelerated to the utmost extent. The British people had then just become aware that some of the countries on which Britain had relied to sustain their weekly one-and-twopenny meat ration for six winters of war were for various reasons finding it difficult to continue supplies.

Food difficulties have multiplied as peace in Europe approaches. Seasonal adversity in Australia and other countries has reduced the volume of food exports to Britain, where flood and frost also reduced last year's harvest, and where even potatoes are in short supply for the first time since the war began. Shipping also has been over-strained because a peak load in European waters has coincided with a peak load in the Pacific. The food situation in Britain is as grave as it was at any time during the last six years. All these points have been emphasised by the British Ministry of Food and also by the United Kingdom Food Mission to Australia.

Disregarding all sentimental considerations, it is obvious that the British worker must continue to be fed as well as possible so that he may have the necessary strength to go on maintaining munition output for war requirements in the Pacific and South-eastern Asia. His weekly domestic meat ration is about 14 oz. and his butter allowance 2 oz., so it is hardly a fair thing now to give him less. His food has been skimpy, but at least it has been enough to keep him in good health, if not always in good temper. Then in Europe there are the millions of people in small countries who not only resisted the enemy with all their might, but also continued their defiance through five years of defeat, destruction, disaster, and death.

The food position in the devastated countries is desperate, and other conditions, especially transport, are chaotic and will continue so until some semblance of order is restored. The future of these countries depends largely on what more happily situated countries can do in the way of food relief. Europe has been described as a vast outworn farm, requiring several years to bring back into production. Whatever crops are now in cannot be harvested before the European autumn, and in many places, in Holland particularly, there can be no local crop this year. Not only ordinary food, but special food is needed, milk products above all.

Britain, with that generosity which is a national characteristic, is now drawing on her food reserves—her security stocks—and has already sent nearly a million tons to feed her starving neighbours. It is asked, can Britain do more? She organised all her food resources during the war and by prudent management, foresight, and self-denial accumulated these reserves which may soon become a diminishing quantity.

The onus then is on the food-producing countries to do everything possible to relieve the present world food situation, and on Australia particularly to increase essential food production to the limit of her means and opportunity. Apart from all other considerations, on the score of our common humanity we cannot do less.

Maize Seed Selection.

C. J. McKEON, Director of Agriculture.

THE importance of careful seed selection cannot be too strongly stressed because growers who practice such selection are more than compensated for the little extra work it entails.

As maize cross-fertilizes very readily, the pollen being borne for a considerable distance by wind and insects, difficulty is frequently experienced in keeping varieties pure in some closely settled districts. Cross-fertilization can only occur when both crops tassel at the same time, and a difference of a few weeks between plantings is usually sufficient to prevent this. It is not always practicable, however, to arrange a time interval between plantings owing to advantage having to be taken of suitable rains. Hence a neighbouring crop of another variety may tassel at the same time as the crop from which it is intended to select seed; in such a case, selection should be confined to that portion of the crop which is furthest from the other crop and, if possible, away from the direction from which the prevailing winds blow. Where growers are compelled to secure their seed requirements from an outside source, they should be sure that the seed is obtained from a reliable grower, otherwise the resultant crop may prove to be a mixture of types. Selection of seed should be carried out in the field (Plate 99), and should be done before the plants are thoroughly dry, so as to be able to distinguish between the early and late maturing plants. By selecting ears of even ripeness the resultant crop will tassel more evenly, and good fertilization and consequently well-filled ears will result. In crops in which tasselling extends over a very lengthy period, many of the plants have to depend very largely on their own supply of pollen for fertilization, and the ears are accordingly frequently poorly filled.

In selecting for early maturity, care must be taken to see that the plants have ripened naturally and that ripening has not been hastened by insect attack, disease, or mechanical injury. A common cause of forced ripening is infestation by the corn ear worm, and it will frequently be found on examination of maize so ripened that the insect has bored into the shank and caused the ear to ripen prematurely.

Selections should be made only from strong healthy plants with a good root system and from those which are growing in an average stand and not in an isolated or favoured position. A good root system is very important, for a plant with a poorly developed root system cannot withstand drought; such a plant is more easily blown down by wind and there is also the possibility of the poor development being due to disease. The height of the ear on the plant (Plate 100) is another very important point to be considered. This should be borne at or slightly below the middle of the plant, particularly in the case of tall growing varieties. Where the ears are borne high up on the plant, harvesting is rendered more difficult and the plants will lodge much more readily during wind storms. Ears with shanks of medium length and thickness (Plate 101) and which turn down during ripening (Plate 102) should be chosen in preference to those with a short thick shank which remain in an upright position. An ear which turns down sheds water more readily and is also less liable to damage by birds and insects than an upright

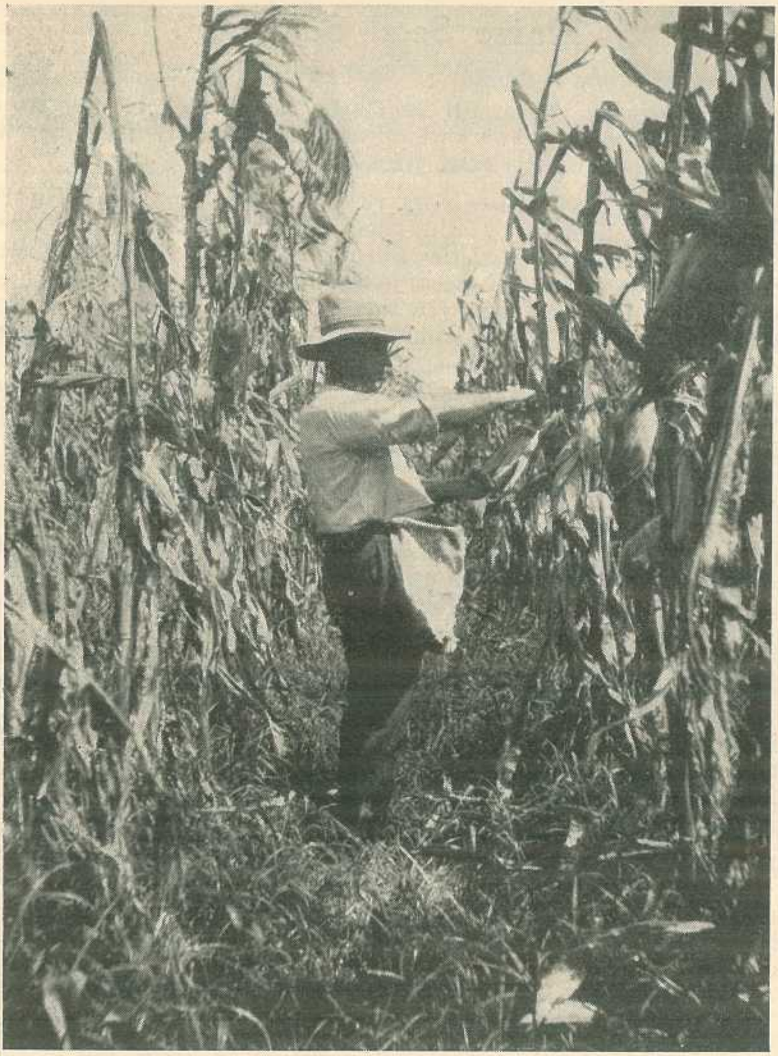

Plate 99.
SEED SELECTION.

ear, providing, of course, that the husk covering extends well over the tip of the ear. A good husk covering (Plate 103) is very necessary, particularly in coastal districts, for it will almost invariably be found that an ear which has the tip protruding is more or less damaged by water or by insect attack. It is advisable to select from plants which bear one good ear or at the most two ears, provided one at least of these is of standard size. Selection from plants which produce more than two ears is undesirable for the tendency then will be for the number of ears to increase and several small ears will be produced, with the result that the quality of the grain will be affected and the cost of harvesting increased.

Plate 100.

HEIGHT OF EAR.—*Left*: Ear too high. *Centre*: Ear correct height. *Right*: Ear too low.

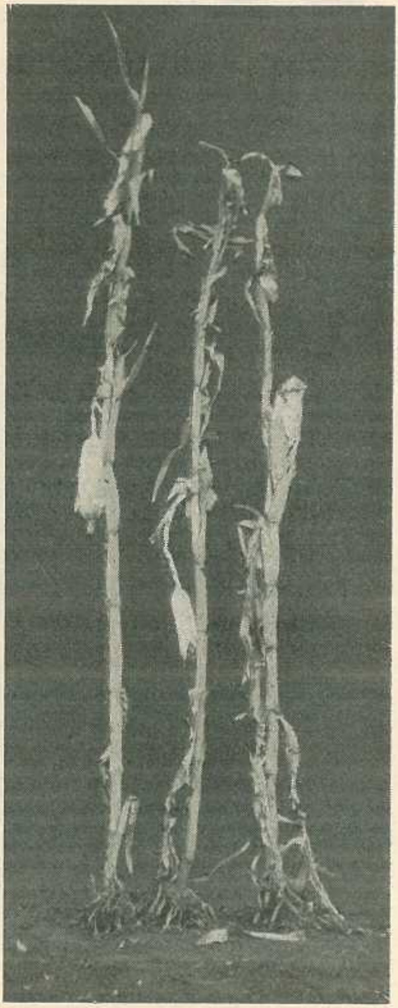

Plate 101.

SHANK LENGTH.—*Left*: Shank correct length. *Centre*: Shank extremely long. *Right*: Shank too short with stiff erect ear.

The type of dent varies appreciably, some maize varieties having a "smooth" or "dimple" dent, although the majority of the most popular varieties now grown in this State have a "crease" dent to a "medium rough" dent. Grain with a "pinch" dent should be avoided in seed selection for, although it is usually of good depth, it is almost invariably light and of a soft, starchy nature, and does not command the price obtainable for plump, well-filled grain.

Plate 102.

CROP OF FUNK'S 90-DAY MAIZE.—Showing well covered ears properly turned down.

The shape of the grain is also subject to considerable variation. Varieties which produce ears with less than fourteen rows have a slightly round-shouldered, broad grain, of medium depth. Those which produce

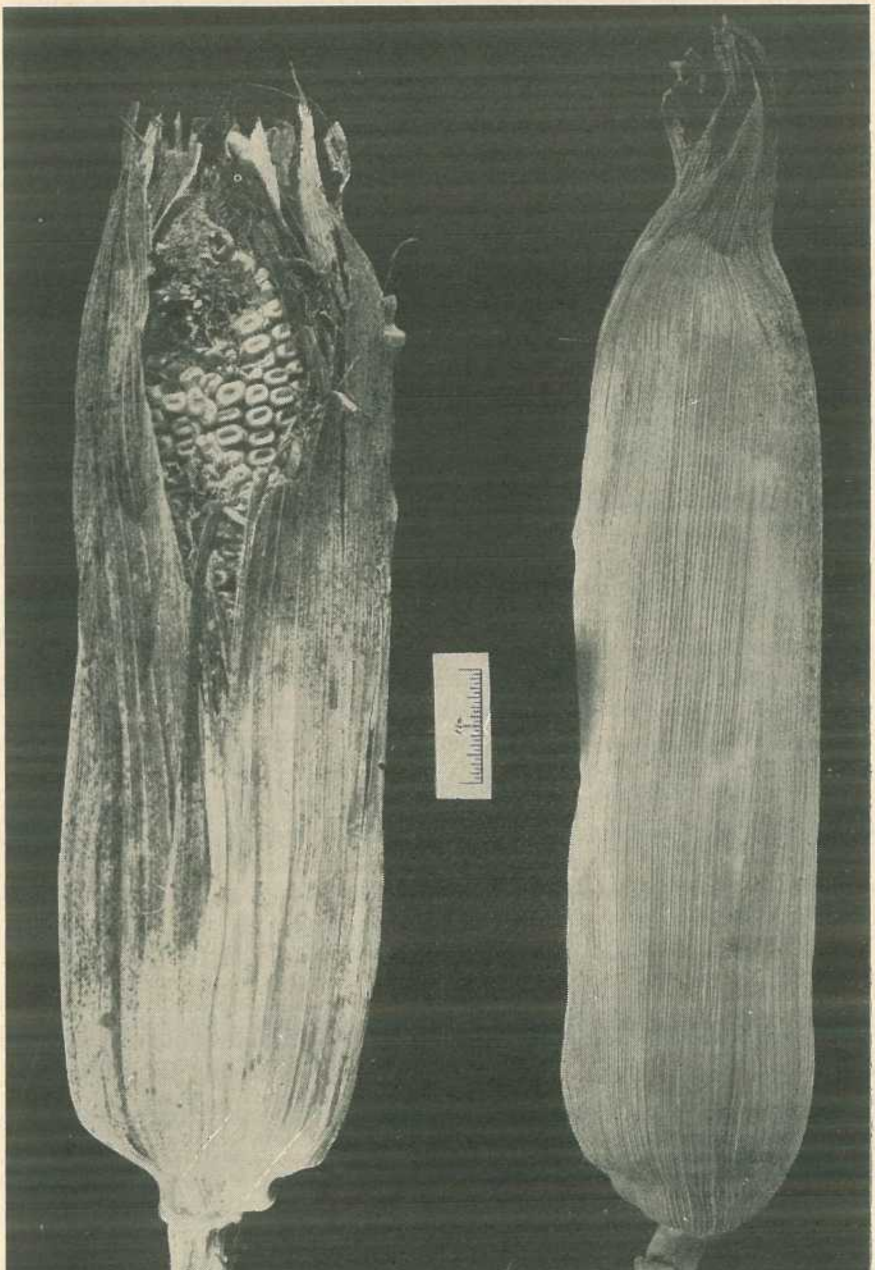

Plate 103.

EARS OF MAIZE.—*Left*: Poorly covered ear exposed to injury by birds, insects and weather. *Right*: Well covered ear more adequately protected against such injury.

ears with fourteen rows and upwards should be squarer in the shoulder, with a greater depth of grain, and should be tightly packed with very little space between the rows.

Uniformity in the breadth and the shape of the grain is a very important point and is one which should be strictly observed in seed selection, if the variety type is to be adhered to. The colour of the grain is a further varietal characteristic, but whatever colour is being selected uniformity should be obtained; e.g., on no account should an ear of a yellow variety be selected which shows reddish or white grains.

The grain should be firmly attached to the core and should show little or no movement when the ear is pressed with the points of the fingers. Ears with coarse, sappy cores should not be selected, as they dry out slowly and generally show a lower shelling percentage than those with a medium-sized core.

Straightness and evenness of the rows in the ears, while being desirable features, are of less importance than other characteristics to be sought for in maize seed selection. As long as the rows are reasonably straight and even, otherwise desirable ears need not be discarded.

Where field selection of seed is not practised and the selection work is left until the crop has been picked, it is impossible to tell under what conditions the ears were produced, and many which were produced under the most favourable conditions may be selected in preference to others which may not appear quite so attractive, but which were produced under average conditions. There is evidence that a well-developed ear produced by a plant grown under average conditions may be a better source of seed than a similar type of ear produced by a plant grown under exceptionally favourable conditions.

It is advisable to always select considerably more ears in the field than will be actually required for seed purposes, and a final choice should be made from these in the barn. The ears which are finally selected should be of good average size, without being coarse and should also be of uniform type, shape, and colour. They should be cylindrical in shape, except in the case of those varieties which produce a slightly tapered ear, and should be well filled up to the tip.

Topping and Tailing.

The ears should be topped and tailed before shelling, not that the round grains from the tips and butts would not germinate, but because with the average seed drill a more even sowing results when topped and tailed seed is used. The amount of seed required to plant an acre is very small, and where topping and tailing is carried out properly, little or no wastage of grain results, as the tips and butts can be used either for feeding stock on the farm or for sale in the usual way.

Every crop, unless grown under extremely favourable conditions, contains a large number of ears which would be ideal for seed purposes if topped and tailed, but which would otherwise be of no value for such a purpose by reason of the fact that many of the grains on the tips have been damaged by weevil, corn ear worm, or weather, and very frequently by birds also. Although well covered ears are less liable to attack by corn ear worm and birds than ears that are poorly covered, there are times when the grain, even on the best covered ears, is exposed to the adverse effects of the weather by insect and bird attack, but more frequently by the former. This applies particularly to the coastal districts, where the rainfall is heavier and insect attack much more prevalent than in certain of the drier inland districts. In such crops a considerable amount of extra time is involved in selecting only ears which are perfectly sound, and the time spent in doing so is much greater than that spent in topping and tailing. It also means that in an average crop a much smaller percentage of seed is available, and this is an important matter to growers who sell seed to merchants and farmers.

Topping and tailing, when carried out with a sharp cane knife or tomahawk, can be done so quickly and with so little damage to the grain, provided, of course, the ears are thoroughly dry, that it adds very little to the cost of the seed.

Sown under adverse conditions, it is considered that the middle grains stand a better chance of producing plants than the other grains, as they almost invariably possess a larger and stronger germ than the grains from the rest of the ears and more particularly than those from the tips. Furthermore, being of a starchier nature, they absorb moisture more readily than do the harder grains from the tips and butts and give a better germination in soil in which there is not a plentiful supply of moisture. It is also considered that the plants from the middle grains have a better chance of becoming established by reason of the fact that they have a greater supply of food to draw on while they are developing a root system.

Another point which can be advanced in favour of topping and tailing is that disease such as Diplodia ear rot usually spreads from the butt towards the tip.

Storing Seed Maize.

Before the seed is stored it should be thoroughly dry and quite free from living injurious insects; if living insects are present steps should be taken to kill them by appropriate fumigation. The quantity of seed required for the average farm is not large, and it is quite a simple matter to store the grain and keep it in good condition for the following season's planting. The thoroughly dry seed, free from living insects, should be placed in a tight-fitting container, such as a clean carbide drum, in which it should remain in good condition in so far as freedom from insect infestation is concerned, provided the drum is a really tight fitting one and provided the seed was free from insect infestation when placed therein. As an additional precaution, however, a small quantity of a mixture consisting of equal parts of paradichlorobenzene and flake naphthalene may be added to the stored maize. This mixture possesses some measure of toxic and repellent properties.

TANKING MAIZE.

Maize can be stored in good condition for very long periods providing ordinary precautionary measures are adopted prior to tanking the grain. Under no circumstances should grain containing excess moisture be stored in a tank or other similar receptacle. Excess moisture generates heat and moulds develop under such conditions and destroy the grain. Should it be impracticable to allow the ears to dry thoroughly in the field they should be stored in a well ventilated barn or crib and allowed to dry before being shelled. Grain containing not more than 14 per cent. of moisture can be stored with reasonable safety.

For storage on farms, ordinary 1,000 gallon tanks, which hold a little more than 3 tons of grain, are ideal. The only additional fittings required are, firstly, a specially large-sized manhole with a close-fitting weather-proof lid, and secondly, an outlet of approximately 8 inches in diameter with a projecting shoot at least 10 inches in length in place of the ordinary tap. A close-fitting cap is required for the end of the outlet shoot, the cap being fitted with a handle together with hasps and staples for fastening. All joints of the tank should be rivetted and soldered to make it as airtight and as insect proof as is practicable.

The tanks should be placed on a stand sufficiently high to permit of the grain being run off straight into bags when rebagging and, although this necessitates the use of an elevator when filling the tanks, the saving in handling costs when rebagging will more than compensate for the cost of an elevator. The tank should be filled during bright sunny weather, otherwise the grain may take up sufficient moisture to cause it to heat.

Sound, dry maize with a moisture content below 12 per cent. is not susceptible to weevil infestation. If, however, for any reason, weevil infestation is suspected in grain being placed in the tank as, for example, if the grain has been stored in an open barn or in bags for a period, or has been in contact with weevil infestation, then it should be fumigated immediately with carbon bisulphide. It is wise to examine the grain at intervals during storage and, in the event of reinfestation or continued infestation being noted, fumigation will again be necessary. Should it be intended to use the tanked grain solely for feed purposes, airing in order to remove the fumes of carbon bisulphide will not be required, but if any of the grain may be used later for seed purposes then the fumes should be withdrawn. Airing a tank after fumigating may be accomplished by opening the shoot and replacing the cap or slide quickly by a piece of fine wire gauze, wiring it into position. The heavy gases will escape when the lid is removed. After a few hours airing the lid and cap or slide should be replaced. While open, the manhole should be covered with fine wire gauze as a precautionary measure to exclude weevils.

—C.J.M.

Crop Rotations for Farms in Cotton Districts.

W. G. WELLS, Director of Cotton Culture.

[*Editorial Note*: The world food position is such that farmers must adopt every practicable measure for increasing the production of foodstuffs for both human and livestock consumption. The adverse seasonal conditions which have prevailed in the cotton-growing districts during the past year have affected the foodstuffs position in two ways. Firstly, the recuperative powers of many long-established pastures have undoubtedly been so severely affected by heavy grazing that it is advisable to plough out the pasture and cultivate the land with soil-improving crops before resowing. Secondly, the reduced cotton crop means a shortage of cottonseed meal, which will be reflected in milk production on coastal dairy farms during the winter season. Planning for a large cotton crop next season is therefore highly desirable in order to avoid a repetition of the cottonseed meal shortage in 1946. The following article is reprinted from the August, 1944, number of the Journal in order to bring again to the attention of farmers in the cotton-growing districts the important points concerning the relation of crop rotation to food production.]

THE bulk of the cotton crop grown in this State is planted in districts which receive an average annual rainfall of less than 30 inches. The more important of these districts are the Dee and the Don Valleys adjacent to Wowan, the Dawson Valley, the Callide Valley, the Upper Burnett, the western half of the Central and Southern Burnett, the Northern Darling Downs, and the Northern Maranoa.

The rainfall in these districts is variable but approximately 25 per cent. of the year's total occurs during August, September, and October, 50 per cent. during November, December, January, and February, and the remainder in the rest of the year. October is usually the wettest month of the first period, January or February of the second period, and March of the third period, although June is a fairly reliable month for soaking rains.

Owing to the general similarity of the climates and soils in these districts, the same crops can be grown in all of them. These include wheat for grain and grazing in the last two districts and for mostly grazing in the others, oats for grazing and some hay, grain and sweet sorghums, sudan grass, maize (except in the drier areas), cotton, and pumpkins. Large areas of both native and Rhodes grass pastures supply grazing for dairy cows and horses. Lucerne is grown under rainfall conditions on alluvial soils where the water table is sufficiently close to the surface to provide moisture during dry periods, and occasional areas of cowpeas are sown for grazing.

Cropping Programme.

With such a diversity of crops, a comprehensive rotational programme is required on each farm to ensure that the best use is made of the available land. Obviously it would be difficult to include in a short article specific recommendations for cropping programmes that would meet the requirements of every farm in districts where dairying and cotton-growing are conducted. Certain basic factors apply to all such farms, however, and these are briefly presented in order that every grower may carefully examine their applicability to his property.

Broadly speaking, good farming is only possible when the cropping capabilities of the different soils on the farm are understood and the property is subdivided so that each paddock contains only the one soil type. Thus on a farm with both alluvial flats and hilly slopes, a paddock should not include both, for they normally differ in their fertility and cropping possibilities. Likewise, if either the alluvial flats or the hillsides consist of more than one soil type, each should be farmed independently from the other if at all practicable. Thus, should an alluvial flat consist of an area of fertile heavy soil originally under red gums (often called blue gums) and an area of less fertile hard clay or clay loam originally under box trees, the two areas should not be enclosed in the one paddock, for they require different cultural and cropping practices.

It is also necessary to ensure that the farm programme will provide for the ploughing of pastures when their productivity falls to low levels, and that the cultivated ground be not cropped until the top soils fail to permit the easy penetration of storm rains.

A cropping programme which meets these requirements is essential on every dairy-cotton farm in this State. Many districts have been opened for closer settlement since 1920 and originally consisted of either open forest or scrub covered country. The forest country was mostly well covered with native grasses noted for their food value and palatability. Considerable areas of scrub country were rapidly brought under Rhodes grass by felling and burning the timber, planting cotton in the ashes, and then sowing the Rhodes grass towards the end of the cotton crop. The resultant pastures originally had a high carrying capacity and the yields obtained from dairying on them tended to divert attention from cultivated crops. The need for such crops is now apparent on many farms where, as a result of heavy stocking, the valuable native grasses have been replaced by more vigorous species of lesser food value and carrying capacity. Rhodes grass pastures similarly have lost much of their earlier productivity, and weeds have become troublesome. At the same time, deterioration in the older areas under permanent cultivation has occurred through either soil erosion or a change in soil structure which lessens its capacity to absorb and hold rain.

Investigations conducted at the Biloela Research Station and on farms in cotton-growing districts have shown that if worn out pastures are ploughed and planted with cotton for three successive seasons, a Rhodes grass pasture can be re-established and depended on for three seasons' good growth. It has also been ascertained that ploughed pasture land makes better use of rainfall than old cultivations on the same soil type and that storm rains occurring when crops are growing, penetrate deeper in the newer cultivations, particularly in row crops and on sloping country. These factors are of the utmost importance for much of the summer rainfall is of the thunderstorm type wherein two or more inches of rain fall in a few hours. In old cultivations on relatively level clay loam to clay alluvial soils, such rains may not penetrate more than 5 inches in mid-season if the tillage operations have ceased and the surface of the soil has caked. In the more permeable first or second year of cultivation following the ploughing of grassland, such rainfall penetrates to a much greater depth. This increased penetration of rainfall into the clay loam and clay soils which are the dominant types in these districts, is highly desirable and can be obtained by the inclusion of a Rhodes grass pasture for three years in the rotations practised on all cultivated areas. As periods of water stress of varying intensity are frequently experienced by most crops grown on old cultivations in these districts, the improvement of the permeability of the soils through including Rhodes grass pastures in the rotations, with the resultant increased penetration of rainfall, is obviously desirable.

When pastures are ploughed, the balance of plant foods in the soil is favourable to crops such as cotton which do not require large amounts of nitrogen. On the other hand, fodder crops may not grow well on soils of only medium fertility during the first year of cultivation after a long established Rhodes grass pasture, and it is advisable, therefore, to grow cotton at this stage in the rotation. The cultural operations required to grow this crop make available sufficient nitrogen for satisfactory growth in the following fodder crops. Conversely, if fodder crops are grown for a few years after the cotton crop, it may be necessary prior to re-establishing Rhodes grass, either to grow an early-planted crop of cowpeas for grazing off by mid-summer or to leave the land in a rough fallow during the spring and early summer. Either procedure will increase the nitrogen content of the soil sufficiently to promote a substantially better growth of Rhodes grass than would be the case if the grass was sown directly after a fodder crop such as sorghum, oats, or wheat.

Summary.

The decline in the productivity of both pastures and old cultivations on dairy-cotton farms in districts receiving an average annual rainfall of less than 30 inches, makes it highly desirable that farmers should consider suitable remedial measures. Generally speaking, failure to practise suitable rotations has been the cause of reduced yields from both pastures and cultivated crops. The productivity of pastures can be greatly improved by ploughing them out, growing cotton for one to three years according to the fertility of the soil, and then establishing Rhodes grass for at least three years.

Investigations have also demonstrated that cotton crops yield particularly well during the first three seasons following grassland. There is a better balance of plant foods required by the cotton crop and the surface soil is kept more permeable with such a rotation than is the case where the land is cropped for long periods. The improved permeability of the surface soils permits better rainfall penetration than occurs in old cultivations, particularly heavy clay loams and clays, thereby providing more subsoil moisture for the crops.

It is advisable too, to incorporate Rhodes grass in rotations including summer and winter growing fodder and grain crops. There may be insufficient nitrogen for these crops, however, in the first year after

Rhodes grass. Cotton should therefore be the first crop planted after the pasture is ploughed as the cultural operations in this crop stimulate the production of sufficient nitrogen for the following fodder crops.

Where Rhodes grass is to be established on land that has been cropped to cereals or sorghums for some years, an early planted cowpea crop for grazing or several months' cultivated fallow should precede the establishment of the Rhodes grass, to provide sufficient nitrogen to promote a satisfactory growth of the pasture.

A USEFUL TRAILER.

Each vehicle on the farm ought to serve as many purposes as possible. For instance, a root trailer, with its side-boards detached and raves or ladders fixed at its ends, can be used for haymaking and harvest. And the same trailer can be converted for servicing a tractor.

Two or three 40-gallon drums can be placed on the trailer platform horizontally. So that they shall not roll, they can rest on two wooden brackets, shaped as in the sketch, and can be secured by iron bands passing over the drums and bolted to the platform of the trailer.

A convenient way to fill the tractor tank from the fuel drums is to use a one-inch semi-rotary pump and a short length of paraffin-resisting flexible hose. The pump can be mounted on to an iron suction pipe long enough to reach nearly to the bottom of each drum.

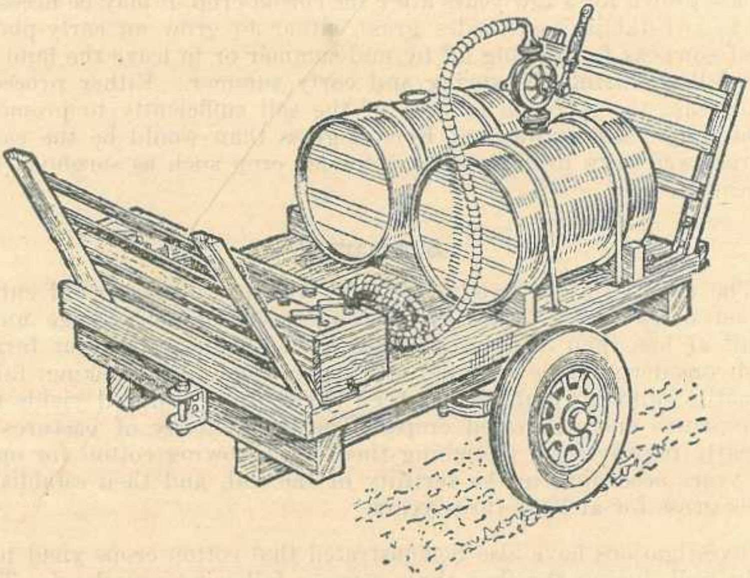

Plate 104.

A locker also should be mounted on to the trailer platform, large enough to hold plough shares and spares, tins of petrol and lubricating oil and water, and a chain. There will still be room to carry a bicycle or motor bicycle so that the tractor driver can get back from the field to his meals.

A drawbar should be made on the back of the trailer so that a plough or other implement can be hitched on and towed along the road.

With this outfit a tractor can tow to the field all the equipment it will need for a week's work. The frame for the drums, and the locker, can be made easily detachable so that the trailer can be converted quickly back to a flat platform type.

Tomato Seed-beds.

C. N. MORGAN, Fruit Branch.

ONE of the most important of the many cultural activities necessary for the production of a profitable tomato crop is the raising of healthy, vigorous seedlings. Unlike those of many of the tomato districts of the southern States of Australia, where the use of hot beds or cold frames is necessary for the raising of tomato seedlings, the climatic conditions in Queensland allow the use of the easiest and cheapest method of all—the open bed. Only in the early spring, when a late frost may cause damage, is it necessary to have some protection in such localities as Stanthorpe and portions of the metropolitan and adjacent districts.

The production of sturdy, vigorous seedlings is a matter to which the utmost importance is attached. It is impossible to over-emphasise the need to exercise the greatest care and attention in this operation in order to ensure the maximum results from a tomato crop. Authorities on tomato culture all over the world lay particular stress on the value of properly grown seedlings, which not only produce better yields but are better able to withstand adversity. In the preparation of a seed-bed, therefore, a grower cannot afford to be casual; yet, probably because of the comparative ease with which tomato seed germinates and the rapid growth which seedlings subsequently make, many are inclined to prepare their beds without consideration of the importance of the task. It is a fact that, in spite of all the subsequent treatment given to a growing crop of tomatoes, the use of carelessly grown plants creates a handicap that cannot be properly overcome. On the other hand, the grower who consistently produces the right kind of seedlings has few crop failures and, in addition, saves himself the tedious and unsatisfactory task of continual replacement after transplanting.

New soil is the ideal for seed-beds. If old tomato ground is used some soil-borne troubles which can be carried over from previous crops may affect the young plants. Failing new ground, a site may be used which has not previously grown tomatoes or other crops affected by tomato pests and diseases. In particular instances, it may be found that difficulty is experienced in raising plants because of the presence of diseases and pests transmitted by the soil, and in such instances soil sterilisation is recommended.

Preparation.

Most reasonably good soils can be brought into the right condition for seed sowing, provided they are given proper preparation. Beds should be well dug to spade depth and brought to a fine tilth. Raised beds approximately 4 to 6 inches high are generally recommended, as this ensures good drainage, which is most essential, and also gives an added depth of well-prepared soil, ensuring deep root development.

During the preparation of the bed, which should be carried out a few weeks prior to planting, a small quantity of fertilizer or well-rotted stable manure may be added to increase fertility. The latter is usually in sufficient supply on the farm for seed-beds. It is not advisable to fertilize heavily—a handful to a square yard should be sufficient. Blood and bone or any of the recognised tomato fertilizers are suitable. If the soil is made too rich the plants will be soft, with poor root system, and will tend to wilt when transplanted. The beds should be completed by levelling and raking, and given a good watering to well soak and consolidate the soil and also to germinate any weed seeds, which can then be destroyed prior to sowing the tomato seed.

Location.

It is desirable to grow the plants as quickly as possible, and the site chosen for the seed-bed should, therefore, be one which receives a maximum amount of morning sun and protection from heavy winds. In choosing the location many growers are tempted to use a position which is handy to available water but which is entirely unsuitable in other respects; but a site which has everything except handy water should not be discarded in favour of one with water but which lacks one or more of the other essentials, because it is usually not difficult to arrange to have a drum of water carted to the desirable site.

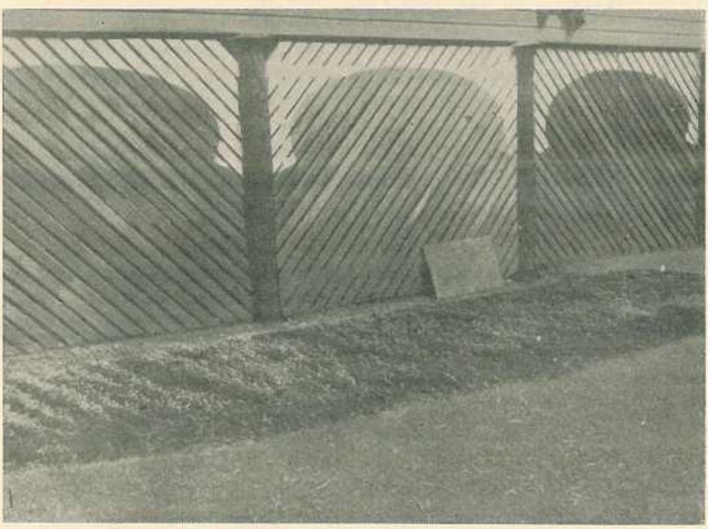

Plate 105.

YOUNG SEEDLINGS GROWING IN ROWS IN A RAISED BED IN A WELL-SHELTERED POSITION ALONGSIDE THE GROWER'S HOUSE.

The beds should be watered sufficiently a day or so before seed sowing, so that the top will have dried out enough for planting, whilst the rest of the bed will not require a heavy soaking immediately after the seeds are sown.

Planting the Seed.

Many growers broadcast the seed over the bed and lightly rake it in. A better method is to open shallow drills about 4 to 6 inches apart and about $\frac{1}{4}$ inch deep. The seed is sprinkled along these either by hand or shaken out of a small tin, in the bottom of which is a hole sufficiently large to allow the seed to run freely. After the seed is covered with soil by either of the above methods, it should be gently firmed with a flat board, and the bed lightly watered.

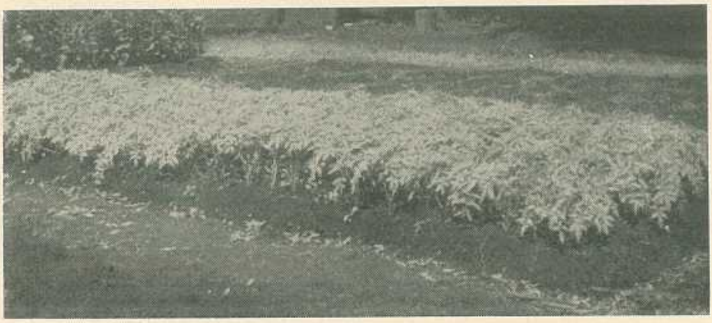

Plate 106.

STURDY SEEDLINGS GROWN ON A RAISED BED TO ENSURE GOOD DRAINAGE.—Each row can be easily lifted without causing excessive damage to the roots.

Mulching is recommended to save further watering until the seeds have germinated. Old bags are often used for this purpose, but it is essential that they be removed immediately the plants begin to show. Fertilizer bags should not be used. Old manure is good mulching material.

Regarding the two methods of sowing the seed, broadcasting, although quickly done, has little to commend it, as it is hard to get an even spreading of the seed, with the result that parts of the bed carry clumps of overcrowded plants whilst other portions are lightly seeded. Subsequent attention is difficult, especially disease and weed control, and the overcrowding results in weak, spindly plants which are not comparable with those which have ample room in which to develop.

The second and orderly method of planting in drills is therefore recommended. Seeds may be dropped evenly along the drills at the rate of four to six to the inch. As they are all covered by approximately the same depth of soil they germinate regularly. The free passage of air through the rows helps considerably in disease control, whilst light cultivation may be carried out between rows almost up to the transplanting stage. When the plants are ready for removal, the space between rows facilitates the work and permits their removal with a minimum of damage. It is again emphasised that overcrowding of a seed-bed should be avoided at all costs, as it encourages long, thin plants which do not transplant satisfactorily, and which wilt badly, especially in the warmer months. Desirable, sturdy, well-hardened seedlings are only possible where they have been grown with plenty of room and sunlight. Disease control is almost impossible in a disorderly bed, and the loss of plants means that the whole planting programme is upset, as most growers sow a variety with the object of planting at a specified time, almost to a day.

Watering.

Excessive watering of seed-beds should be avoided, as it encourages damping off disease; further, a waterlogged bed is not conducive to quick, sturdy growth. The raised, well-drained beds help considerably

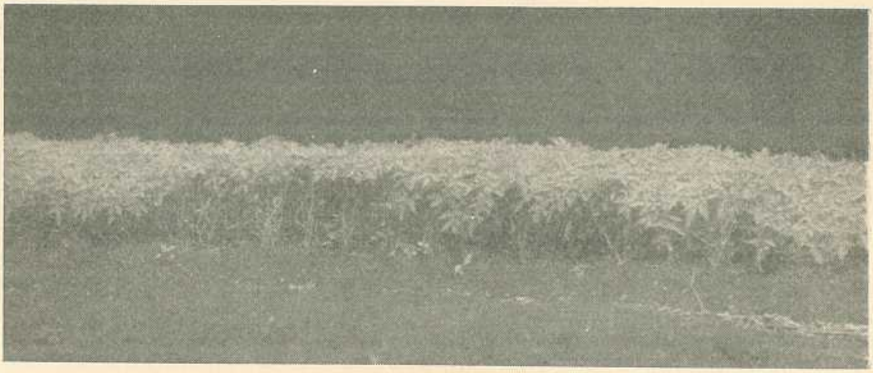

Plate 107.

A BED OF SEEDLINGS READY FOR TRANSPLANTING.—Note how the rows allow for the free passage of air between the plants.

in overcoming the danger. During the warmer weather, one watering a day, preferably in the morning, which allows the plants ample time to dry before night, is recommended. There is no hard-and-fast rule, however, regarding amount of water, as soils such as the red volcanic or sandy loams dry out much more quickly than the heavier black loams. In the colder weather, one or two waterings a week should suffice. Water should be applied lightly in the form of a fine spray or by means of a watering can.

After from four to six weeks in the beds, according to weather conditions, the young seedlings should be ready for transplanting. At this stage they should be approximately 6 inches high and showing eight to ten leaves, including the two seed leaves.

Early Stanthorpe seedlings, owing to the cool conditions, take considerably longer (up to ten weeks) to reach a satisfactory size for transplanting.

There are approximately 2,000 tomato seeds to an ounce, and good seed has a very high germination percentage. It is always advisable to have plenty of plants, however, and it is recommended that at least $1\frac{1}{2}$ oz. of seed be sown for each acre of field—i.e., approximately 2,000 plants.

PLANT PROTECTION

Diseases of the Tomato and Their Control.

J. E. C. ABERDEEN, Assistant Research Officer.

THE tomato plant is subject to attack by a large number of diseases, some of which may cause substantial losses to growers if adequate precautions are not taken to deal with them. Preventive measures should be adopted as far as possible, because they are generally cheaper and more satisfactory than control measures applied to infected crops. The programme of disease prevention and control should be planned well in advance of the planting of the crop, since it involves such matters as the purchase or selection of seed of varieties showing resistance to major diseases and collected from healthy crops, the establishment of seed-beds on suitable land, and the application of sprays or dusts regularly and thoroughly.

KEY TO AID THE IDENTIFICATION OF TOMATO DISEASES IN THE SEED-BED AND FIELD.

The following key should help in the identification of the major tomato diseases, apart from nutritional disorders. Any determination of a disease made by using this key, however, must be checked by referring to the detailed description of the symptoms given later under the heading of that disease. If the disease does not appear to correspond with any of those described, further advice should be obtained from the Department of Agriculture and Stock.

IN THE SEED-BED:

1. Seedling stem shrivels at ground level, and plant falls to the ground .. .. **Damping-off***
2. Stem shows a dark-brown to black spot near soil level; growing tip often purplish in colour .. .. **Target Spot**
3. Leaves show small, dark spots .. .. **Target Spot, Bacterial Spot,** or **Septoria Leaf Spot**
4. Leaves and stem show relatively large, dark, rotted areas **Irish Blight**
5. Entire seedling stunted and purplish; no disease apparent on leaves, stem, or roots .. .. **Faulty Nutrition** or **Virus Disease**

IN THE FIELD:

1. Entire plant wilted—
   (a) Wilting very rapid—sometimes in a few hours—suggesting plant severed from root system; no yellow leaves. Stem at soil level may or may not show a light-brown discolouration of woody tissues .. .. **Bacterial Wilt**

* Discussed in the February issue of this Journal.

(b) Wilting very slow—sometimes takes weeks; older leaves show distinct yellow colour; affected leaves break off easily from stem. Stem and leaf-stalks show light-brown to dark-brown streaks under bark in hard, woody tissue .. .. **Fusarium Wilt;** if summer. **Verticillium Wilt;** if winter.

(c) Some stems show splitting, and rotting of internal tissue with mealy appearance; affected leaves do not break away from stem readily .. .. **Bacterial Canker**

2. Entire plant stunted—

(a) Bronze markings on young leaves; these curved downwards more than normally .. .. **Spotted** or **Bronze Wilt**

(b) Young leaves show light and green markings and tendency to crinkle .. .. **Mosaic**

(c) Young shoots swollen and distorted, with last-formed flower buds standing erect; purplish colouration throughout tips .. **Big Bud**

(d) Young leaves malformed, with leaflets very spindly and fern-like .. .. **Fern Leaf**

(e) Irregular, greyish-black, slightly-sunken streaks on stem or leaves .. .. **Streak**

(f) Young shoots show intense purplish colouration **Faulty Nutrition, Excessively Cold Temperature, Virus Disease, Irish Blight,** or **Target Spot**— attacking stem—or **Nematodes**

3. Leaves and stems—

(a) Small spots about ⅛ inch in diameter, with grey centres and small, black, pin-point dots. Leaves at base usually affected first .. .. **Septoria Leaf Spot**

(b) Dark-brown spots, up to ½ inch in diameter—sometimes larger on stem—with sharp margins and often with concentric ringed appearance. Basal leaves usually affected first. By far the commonest leaf spot .. .. **Target Spot**

(c) Large, dark-brown lesions often involving entire leaflet. These have appearance of a wet rot in humid weather; are papery if atmosphere is dry. May show first on any part of plant .. .. **Irish Blight**

(d) Lesions uniformly small, rarely greater than ⅛ inch in diameter; dark-brown in colour .. .. **Bacterial Canker** or **Bacterial Spot**

(e) One leaf, or part thereof, shows decided wilt .. **Bacterial Canker**

4. Fruit—

(a) Dark, sunken spot present on flower end of fruit **Blossom-end Rot**

(b) Mottled, brown markings, covering large proportion of fruit surface; spread very rapidly .. .. **Irish Blight**

(c) Sunken, velvety, very dark spots—commonly up to ¾ inch in diameter—usually originating from stalk attachment; growth-crack or other injury .. .. **Target Spot** and other **Alternaria Rots**

(d) Small spots, 1/16-⅛ inch in diameter, often with halo around margin .. .. **Bacterial Canker**

(e) Small spots, 1/16-⅛ inch in diameter, often raised and scab-like; no halo .. .. **Bacterial Spot**

(f) Large, tough, white spot on side facing sun .. .. **Sunburn**
(g) Blotchy ripening .. **Virus Disease or Physiological Disorder**
(h) Fruits generally dwarfed, mis-shapen and hard .. .. **Virus**
(i) Fruit completely broken down by watery rot .. **Bacterial** or **Fungous Rot** following insect or other injury.

IRISH BLIGHT.

Where conditions favour its development, Irish blight is usually the most destructive and spectacular of the tomato diseases. It is very closely related to the Irish blight of the potato and, under certain conditions, the disease may readily pass from one crop to the other. In Queensland its importance varies in the several tomato-growing areas. Normally, tomato crops in the Stanthorpe district are not attacked by this disease until the end of the season, i.e., during March

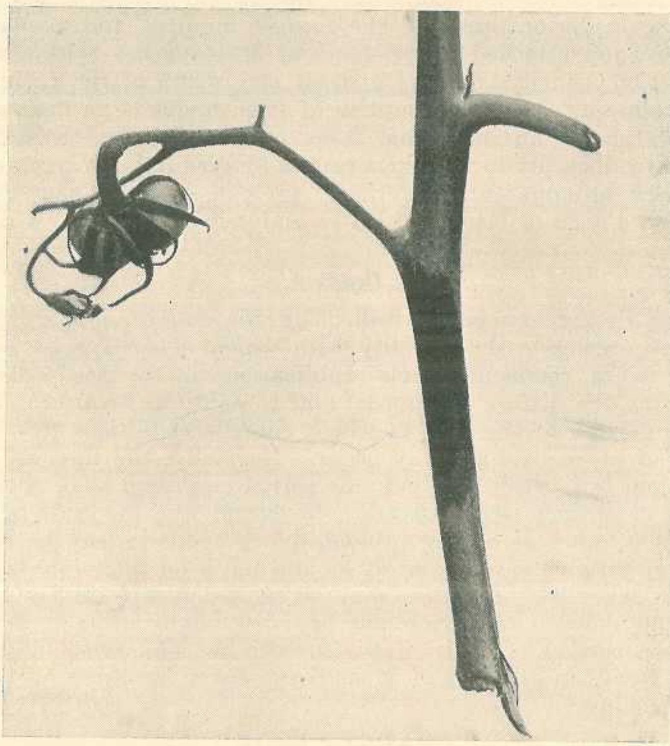

Plate 108.
Irish Blight Lesion on Stem.

and April; in the Brisbane-Redland Bay area it may attack plants at any time from April to October, depending on the local weather conditions; the disease is less common in the Yarwun-Rockhampton area, although it does occur there during the winter months; in the Bowen area it is of very rare occurrence. This association of latitude and severity of incidence is due probably to the lower winter rainfall and humidity and to the higher temperatures encountered in the more northern areas.

Irish blight is caused by a fungus* which grows very readily in cool, moist weather. In Queensland the disease appears only in the cooler months and may become epidemic when favoured by continued showery conditions and overcast skies; heavy dews also favour its spread. Extremely rapid development of the disease—which sometimes occur—is usually brought about, however, by a succession of sharp, cold snaps, as the causal fungus, under these conditions, can reproduce itself even more rapidly than when the weather is uniformly cool and moist. If the temperature rises appreciably, Irish blight will not develop in a crop and as the causal fungus is very susceptible to a dry atmosphere, and as Queensland winters are normally relatively dry, epidemics of Irish blight seldom occur in this State.

This disease produces extensive, dark-brown to black lesions on the stems (Plate 108) and leaves several days after infection occurs. In moist weather the leaf lesions have the appearance of a wet rot, but when dry conditions prevail, the lesions are dry and papery. The fruit is readily attacked in all stages of development, a large, mottled-brown lesion, usually covering at least one-fourth of the fruit surface, being produced. A minor symptom of Irish blight is an intense purple discolouration of an individual stem, apparently due to interference with the food supply to that stem caused by girdling. Where no control is exercised, an apparently vigorously growing crop of tomatoes may be reduced to a mass of blackened leaves and stems within a few days.

Control.

This disease can be controlled by the use of copper sprays or dusts and, owing to the rapidity with which it can spread, the usual practice is to commence their application in the seed-bed without waiting for the disease to appear, and to continue treatment throughout that portion of the year in which climatic conditions favourable to the spread of the disease may occur. Normally, the interval between applications is 7 to 10 days, but this period may need to be shortened if climatic conditions are unusually favourable to the development of Irish blight, whereas during prolonged dry spells it may be increased. Details of suitable sprays and dusts and notes on their application are given on page 296. Tomatoes may be packed in apparently good condition and develop the symptoms of Irish blight while in transit to, or on, the market. Hence, if the grower has had Irish blight in his crop, it is advisable for him to hold the fruit for three or four days before packing.

TARGET SPOT.

Target spot is present throughout all the tomato-growing areas of Queensland, and probably causes a greater aggregate loss than any other tomato disease. The disease is caused by a fungus† which may have associated with it several closely-related fungi responsible for fruit-rotting. All of these fungi are for more resistant to dry weather conditions than is the fungus causing Irish blight, and they appear to require very little moisture and wind movement for their development and spread. Autumn and spring are the seasons most likely to provide

* *Phytophthora infestans.*

† *Alternaria solani.*

conditions favourable to epidemics, but the disease may be present throughout the year. The available evidence suggests that the target spot fungus readily carries over in the soil from season to season.

The symptoms in seedlings are not always obvious if leaf lesions are absent. The seedling may be attacked only on the stem at ground level, and exhibit merely a hard, stunted appearance, although a period of warm, moist weather following infection may soon cause the death of infected plants. If the infection is unnoticed and the seedlings are planted out into the field, the stem lesion usually develops to a dry, shrunken area, causing retardation of the growth of the transplants or even girdling of the stem resulting in the death of the affected plants. A plant may sometimes recover, if it has been transplanted sufficiently deeply, by developing new roots above the target spot lesion.

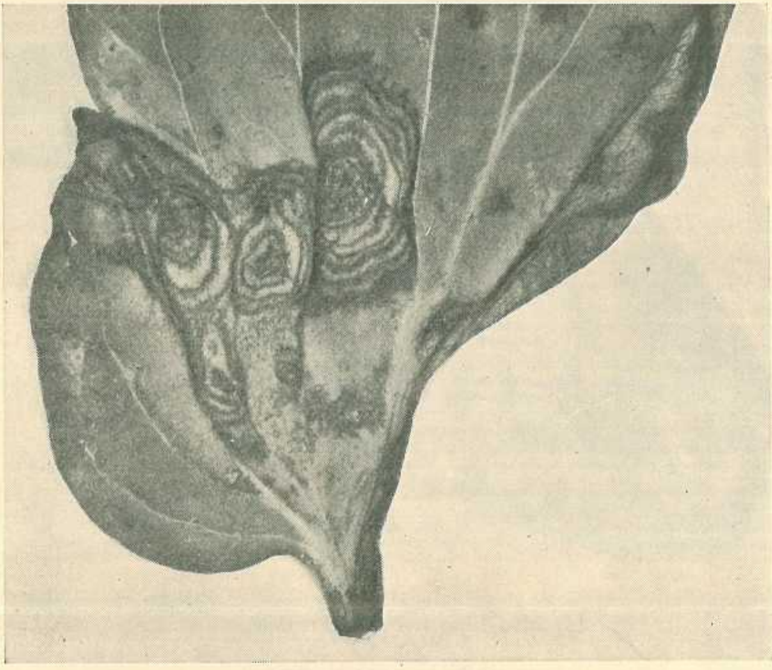

Plate 109.
TARGET SPOT ON FOLIAGE.

Leaves, stems, and fruit may be affected on plants in the field, dark-brown spots up to half-an-inch in diameter and with a definite margin being produced on the leaves and stems. These spots may be marked by the concentric rings (Plate 109) from which the common name of the disease is derived. The spots may also have a yellow margin. The fruit lesions are in the form of black to dark-brown, oval to round spots, which may occur immediately on the edge of the stem scar or scattered about the fruit. In the former case, they may often be associated with a growth-crack, while at other times the disease appears to have attacked the fruit stalk above and subsequently entered the fruit. The fungus does not grow readily in green fruit, so that mature green fruit which is infected, although not showing any spots when forwarded to the market, may develop the disease as it commences to colour.

Control.

Copper sprays and dusts, the former being preferred, are used as for Irish blight for the control of this disease. The degree of control obtained by the use of fungicides is not, however, always completely satisfactory. Hence, the destruction of the diseased crop by burning at the end of the season is more essential for the protection of the next crop than in the case of Irish blight, and the adoption of a three years' rotation is another worth-while precaution. Furthermore, great care should be exercised in the selection of the seed-bed site. There is some variation in the resistance of tomato varieties to target spot, but no variety is sufficiently outstanding to merit special mention.

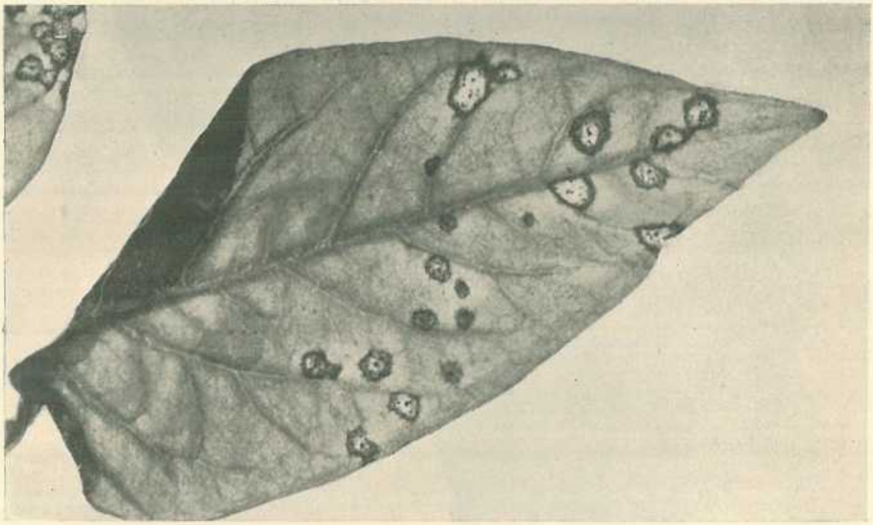

Plate 110.
SEPTORIA LEAF SPOT ON FOLIAGE.

SEPTORIA LEAF SPOT.

Septoria leaf spot occurs in all the State's tomato-growing areas, but it is not nearly as important as Irish blight or target spot. This disease is most serious in the warmer months of the year. The fungus* which causes the disease produces small, circular, brown spots about one-eighth of an inch in diameter, scattered over the lower leaves of the plant. While the margin of the spot remains brown, the centre develops a light-grey colour and is characteristically studded with a number of small, black, pin points (Plate 110), which are the tops of the minute, flask-shaped, spore receptacles belonging to the fungus. Yellowing of the leaf takes place around the spots, and gradually spreads until the leaf dries out and withers. The lower leaves are killed from the bottom up, and a scalding of the fruit thus exposed to the sun may result.

* *Septoria lycopersici.*

Control.

The plants in the seed-bed and the field should be sprayed or dusted with copper mixtures as recommended for Irish blight control, and all tomato refuse should be collected and burned as soon as the crop is off. This disease is seldom present unless in association with either Irish blight or target spot. As it seriously affects plants which are not growing vigorously—as a result of inadequate fertilizer application or of insufficient cultivation—attention to these aspects of the tomato crop's requirements helps to lessen the incidence of Septoria leaf spot.

BACTERIAL SPOT.

The fourth disease for consideration in these notes is bacterial spot,* which is suspected of being widspread throughout the older tomato-growing areas, although it seldom reaches epidemic proportions. It is

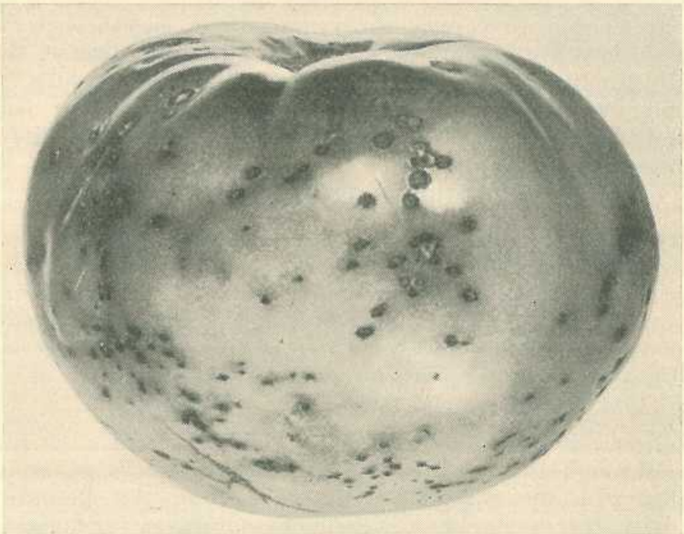

Plate 111.
BACTERIAL SPOT ON FRUIT.

usually active for but brief periods and affects only a small proportion of the crop. Autumn and winter appear to be the most favourable seasons for the development of this disease, and rain is the main factor in its spread.

The bacteria responsible for bacterial spot attack the leaves, stems, and fruit. On the leaves and stems the disease appears as small, brown spots similar in size to those of Septoria leaf spot but differing in that they do not develop the grey centres and pin-point fruiting bodies so characteristic of the latter disease. The leaf and stem spots are very similar to target spot lesions, but are generally smaller and do not develop concentric rings. On the fruit, bacterial spot appears as a small, black, raised, scab-like spot (Plate 111), which may increase in size to approximately one-eighth of an inch in diameter. The size of the spot depends on the amount of growth that the fruit makes after it is

* *Bacterium vesicatorium.*

infected, and does not increase after the fruit has matured. The fruit cannot be infected after a certain stage of maturity has been reached, which appears to correspond with the disappearance of the hairs from the fruit. This disease differs from bacterial canker in that the fruit spot has no light-coloured halo around it and it causes no wilting of the plant. It may, however, cause extensive defoliation. The fruit spot does not penetrate past the tissue immediately under the skin and if any extensive rotting occurs it is due to other organisms entering the bacterial spot injury. No new spots develop in storage or in transit.

Control.

The spread of bacterial spot by contact does not seem to be of any consequence and the main sources of infection in the case of this disease appear to lie in the seed and in the soil. Hence, the precautions to be observed in seed selection and treatment, as discussed in bacterial canker control on page 289, are of primary importance. There is evidence that the application of copper sprays sometimes checks bacterial spot but, if conditions are favourable to the spread of the disease, their use is generally productive of little in the way of beneficial results. On the other hand, crop rotation is of definite value in dealing with this disease and care exercised in the selection of the seed-bed site is also well worth-while.

FUSARIUM WILT.

Heavy losses are sustained in Queensland every year as a result of the incidence of Fusarium wilt, a disease which is present in practically every warm-temperate, sub-tropical, and tropical tomato-growing area in the world. In this State any soil which has grown tomatoes for more than two years may be assumed to be infected with the organism causing Fusarium wilt. A further point which is worthy of mention is the fact that acid soils tend to accentuate this trouble.

This disease is caused by a fungus* which penetrates the roots and grows up through the water-conducting vessels of the plant, causing interference with the passage of water through the plant. This, together with the action of a poisonous substance produced by the fungus, causes wilting. The fungus is usually introduced to a farm with the seed and carries over from season to season in the soil. The disease may be spread by soil washing across lower slopes, by ploughs or other implements, and by moving the residue of an infected crop on to an uninfected area for the purpose of destroying it. This disease requires warm temperatures for its development and consequently only affects plants growing during the spring and summer months. Plants that are only slightly affected at the beginning of winter may recover and produce a reasonable crop. The Fusarium wilt fungus occasionally grows from the stem into the developing fruit and infects the seed.

The first indication that a plant is infected with Fusarium wilt is given by a cessation of growth, but this symptom frequently passes unobserved. The next symptom is provided by the leaves, for those near the base of the plant commence to turn yellow and die and a week to a month later—according to whether temperatures are high or moderate—the entire plant has wilted. Sometimes the infected plant

* *Fusarium bulbigenum var. lycopersici.*

does not die but remains in a stunted state for several months. Further features of Fusarium wilt infection are that a diseased leaf readily breaks away from the stem and, if the bark is stripped off the plant just above ground level, light-brown to dark-brown streaks will be seen in the water-conducting tissue (Plate 112). In severe cases the dark streaks extend around the entire stem so that if the stem is cut across with a sharp knife a dark, narrow ring shows up just inside the bark.

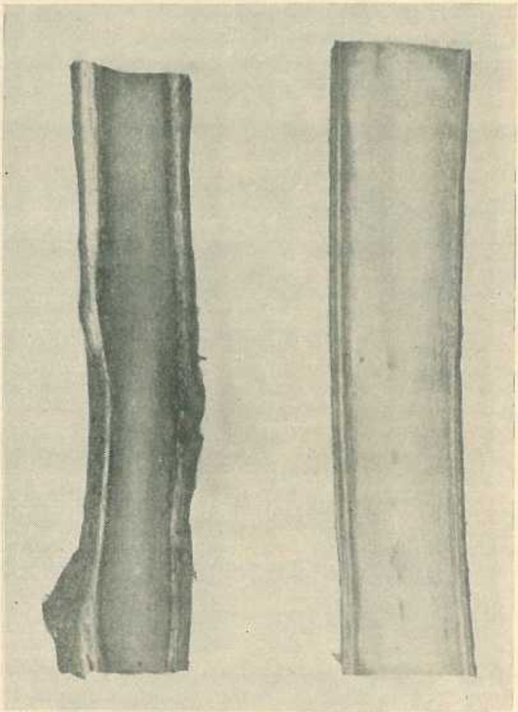

Plate 112.
FUSARIUM WILT.—Affected stem on left split lengthwise to show darkened water-conducting vessels; healthy stem on right.

Control.

The control of Fusarium wilt is best attempted by the use of resistant varieties. Sensation has shown itself to be the most resistant commercial variety, but it tends to produce a small type of fruit and has several other disadvantages. Other varieties possessing a considerable degree of resistance to this wilt are Break o' Day, Marglobe, Rutgers, Marvana—which unfortunately has a tendency to produce small fruit—Bowen Buckeye, Grothen's Globe, Red Marhio, Pritchard, and Barlow's Special. The Break o' Day variety is very widely grown, but it has shown considerable variability in its resistance to the disease. This may be due either to differences in the quality of the seed or to the occurrence of strains of the Fusarium fungus varying in virulence. Break o' Day also shows variation in other qualities, so care must be taken to obtain seed from a reliable source. Subsidiary control measures

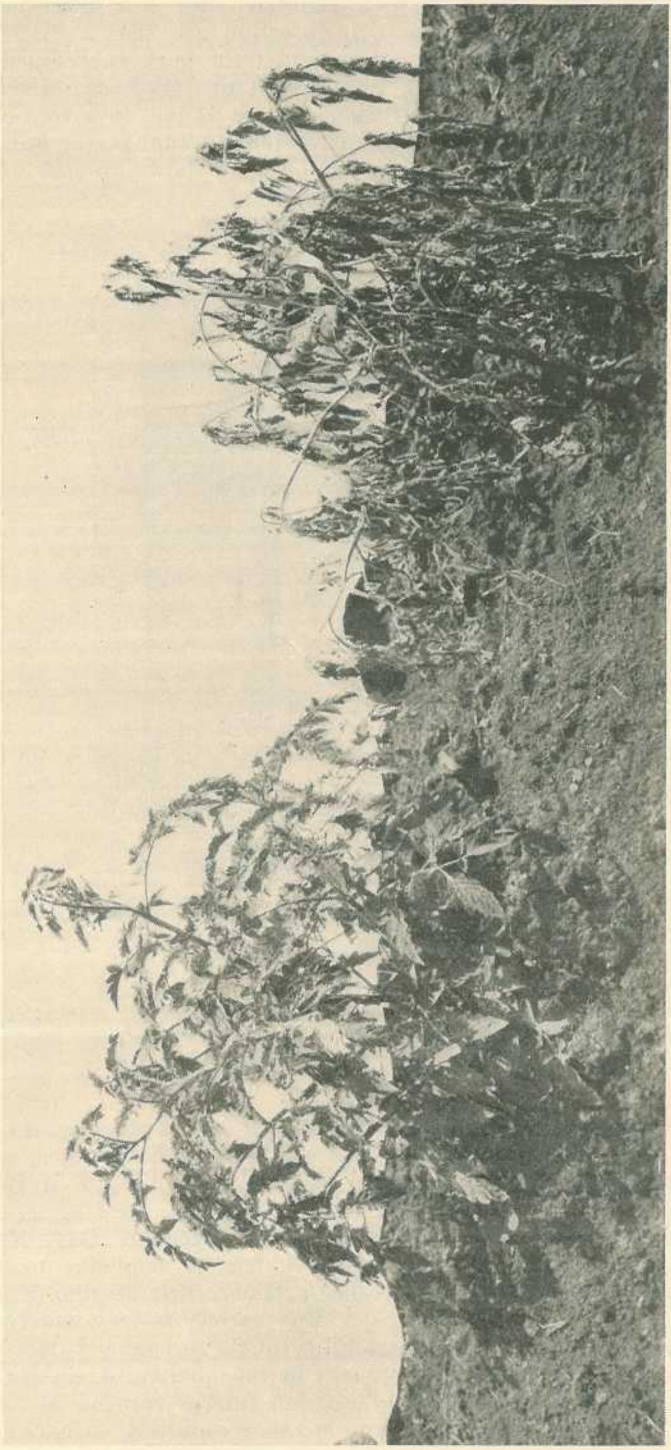

Plate 113.

BACTERIAL WILT.—Healthy plant on left; affected plant on right.

include the disinfection of seed, the careful selection of the seed-bed site, and the destruction of diseased plants by burning after the crop has been harvested.

VERTICILLIUM WILT.

The disease known as Verticillium wilt does occur in Queensland but it is of very little importance in this State. Its symptoms are very similar to those already discussed as being characteristic of Fusarium wilt, both in the manner of wilting of affected plants and in the discolouration of the water-conducting vessels. The fungus* causing Verticillium wilt, however, develops only during winter, whereas Fusarium wilt requires warm temperatures for its development. Salads Special is the tomato variety most frequently affected by this disease, probably because it is winter grown.

Control.

The only control measures which can be recommended for dealing with Verticillium wilt are crop rotation and the use of healthy seed. No varieties which are resistant to the disease can be recommended because, although at least one—Riverside—is resistant, it does not set fruit freely.

BACTERIAL WILT.

Bacterial wilt occurs in most tomato-growing countries, and has been recorded from the majority of the tomato-growing areas in Queensland. It appears, however, to be very localised in its occurrence; e.g., in one large district only portions of individual farms are affected. Unlike Fusarium wilt, bacterial wilt is favoured by alkaline soils. The soil may receive its primary contamination from infected seed, but it is possible that virgin soil may be infected. Like Fusarium wilt, this disease occurs only in warm weather, and is carried over from one season to another in the soil.

The first symptom of bacterial wilt infection is a slight stunting of the attacked plant, but the symptom which is generally noticed is the spectacular collapse (Plate 113) of what appears to be a vigorously-growing, healthy plant. This collapse may be complete within twenty-four hours and may show no preliminary symptoms on the lower leaves, and, in this respect, it differs from Fusarium wilt. The water-conducting vessels under the bark are often discoloured, as in Fusarium wilt infection, but when the stem of a bacterial wilt infected plant is cut across in an affected region a slimy ooze, which is never present in Fusarium wilt, may be seen. This disease is caused by a bacterium,† and in this respect it differs from the two previously discussed wilts, both of which are the result of fungous infection.

Control.

Soil treatment with sulphur has been successfully employed in the United States of America for dealing with this disease, but tests of this control measure have given only partial success in Queensland. Therefore it is not at present considered that the adoption of this treatment is warranted under Queensland conditions. So far as resistant varieties

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* *Verticillium alboatrum.*

† *Bacterium solanacearum.*

are concerned, the only commercial one that has shown any degree of resistance to bacterial wilt is Sensation; as mentioned in the discussion of Fusarium wilt, however, this variety possesses several disadvantages. Break o' Day, Marglobe, and similar varieties are extremely susceptible to the disease. It would appear, therefore, that losses due to bacterial wilt may best be minimised by the adoption of seed selection and disinfection and by refraining from growing crops of tomatoes on infected soil during the warmer months of the year.

BACTERIAL CANKER.

The only important tomato-growing area in Queensland from which bacterial canker has not been recorded is the Bowen district. This does not mean that it is not present there, however, because it could

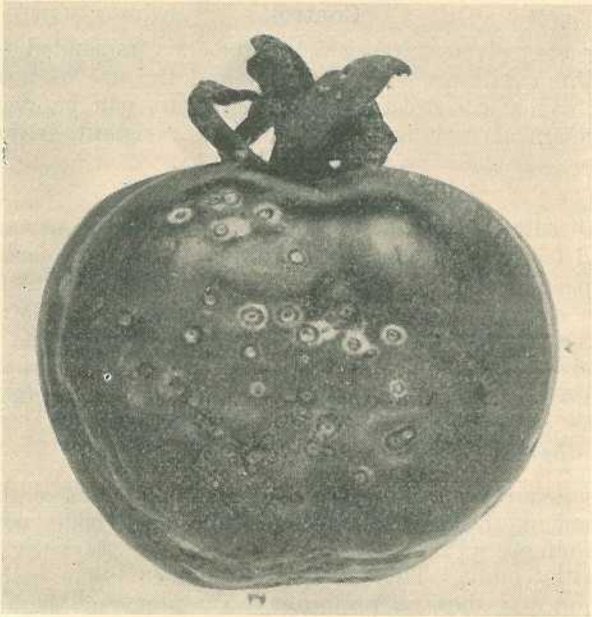


Plate 114.
BACTERIAL CANKER ON FRUIT.

remain undetected for a considerable time in crops growing unpruned on the ground. So long as care is exercised in seed selection aad treatment, it is unlikely that canker will affect a whole district to the extent that Irish blight may in a season which is favourable to its development. However, it can be disastrous for the individual grower, especially if he is trellising or staking the crop and has made several prunings before discovering the presence of the disease.

Bacterial canker, as the name implies, is caused by a species of bacterium*. The disease develops most rapidly in the early autumn and spring months, but crops affected in the early autumn will readily carry the disease into the winter. The rate at which bacterial canker may spread in an affected crop is accelerated by the onset of rain.

* *Aplanobacter michiganense.*

As bacterial canker is very easily spread from plant to plant by handling—especially in pruning a trellised or staked crop—it is important to be able to recognize the early symptoms of the disease. In a young, infected plant one leaf—or perhaps only the leaflets on one side of a leaf—droops and wilts, while the remainder of the plant looks quite normal and vigorous. Following this preliminary wilting, bacterial canker causes a die-back of the growing tip, and this is accompanied by a splitting of the stem.

The wilting of the leaflets on one side of the leaf, mentioned as occurring in the young plant, is characteristic of the disease in the mature plant. If an affected leaf on such a plant is broken or cut off, a brown discolouration of the tissues, just under the skin of the stem where the leaf was removed, can be observed and, on peeling away the surface layer of the stem just over this discoloured portion, the tissues are seen to have a mealy appearance. This discolouration continues into the inner portion of the stem as the disease progresses. In advanced stages of the disease the stems of an affected plant may split and produce the cankers from which its name is derived.

Several other tomato diseases display symptoms which are similar to those produced by bacterial canker, e.g., the one-sided wilt of the early stages of bacterial canker occurs at times in bacterial wilt and may also be caused by a stem-boring caterpillar. In addition to bacterial wilt, bacterial canker may be confused with Fusarium wilt. However, there is usually some distinguishing characteristic by which the diseases may be separated, e.g., the golden-yellow discolouration of the lower leaves, which is so characteristic of Fusarium wilt, is not found in bacterial canker, and these lower leaves do not break off so easily as is the case when Fusarium wilt is the cause of the trouble. Again, the mealy discolouration of the internal tissues of the stem which occurs in bacterial canker extends right into the pith, whereas in the case of Fusarium wilt and bacterial wilt it is confined to the water-conducting tissue and presents a woody appearance.

Although the disease originally enters the crop through the medium of infected seed, its subsequent spread takes place either by the handling of the plants in pruning or other operations, or—after the stems crack—by the splashing of the plants with bacteria in rain drops. Bacteria are present in large numbers in the stem cracks, and, if splashed on to the leaves and fruit by rain, extensive spotting will develop. The leaf spots are usually round and very small, and not particularly characteristic, but the fruit spots generally have a white margin (Plate 114) with a split in the centre and are therefore more characteristic and are suggestive of another name sometimes given to this trouble, i.e., bird's eye spot. The spots are rarely over one-eighth of an inch in diameter.

Control.

One of the most essential points in dealing with this disease is to obtain, if it is at all possible to do so, seed from a disease-free source in cases where a grower has to purchase seed. A grower who saves his own seed should take special precautions against bacterial canker infection, one of the most important of which is to allow the seed and pulp to ferment for three to six days without adding any water. The formation of acids in the fermenting pulp kills any bacterial canker organisms which may be present in the seed and in the pulp. However, as the type of fermentation may vary with different conditions, it is recommended that the seed be dried, after fermentation, and then treated in a corrosive sublimate solution according to the directions given on page 294. Seed from an unknown source should also receive this treatment.

Before the pruning of a tomato crop is commenced, an experienced person should check through the crop and mark all plants suspected of being infected with bacterial canker. If more than 5 per cent. of the plants are so affected it is advisable to leave the crop unpruned on the ground, thus reducing handling to a minimum. The hands should be washed very thoroughly in soap and water after working with any diseased plants, and any material which will be used again next season—e.g., stakes—should be sprayed with 5 per cent. formalin and immediately covered with bags for several hours.

VIRUS DISEASES.

At least five virus diseases of the tomato occur in Queensland, these being mosaic, spotted wilt, big bud, streak, and fern leaf. The main distinguishing features of these diseases are discussed in the following paragraphs.

Mosaic.

Mosaic of the tomato is identical with the disease of the same name which occurs on tobacco and potato, and is intertransmissible with these hosts. Affected plants in general are lighter green in colour than is normally the case in healthy tomatoes, and their foliage is slightly crinkled. A close examination of mosaic-infected plants also shows their leaves to be mottled with indefinite, light and dark-green areas. Fruiting on such plants may not be appreciably affected by the presence of the disease, but if the plant is infected early in life the fruit loss from mosaic, even if the disease is due to a form that is apparently mild in its effect on the vegetative growth, may be serious. Mosaic is extremely infectious and is readily spread by the hands, by pruning knives, and by aphids.

Spotted Wilt.

Spotted wilt is sometimes known as bronze wilt because of the fact that the young shoots of an infected plant develop a dark, reddish-brown or bronzed appearance. This is produced by a more or less close aggregation of circular, purplish-brown spots each measuring approximately one-eighth of an inch in diameter. Other symptoms include the stoppage of active growth, the bending back of the leaf stalk, and the incurving of the blades of the leaflets, thus giving a drooping appearance to the plant. Leaves which have developed the bronzed appearance wither and finally dry up. Bronze markings or a blotched, yellow and green appearance of the skin may develop occasionally on the fruit of affected plants. Spotted wilt is spread from plant to plant by two species of thrips, mechanical transmission of the virus not normally occurring in the case of this disease.

Big Bud.

The disease known as big bud, blue top, or bunchy top is common in some districts, but it cannot be regarded as a really serious tomato trouble. In affected plants there is a definite swelling of the leaf and flower stalks, an enlargement and abnormal development of the floral parts, a reduction in the size of the leaves and an increase in the number of leafy structures (Plate 115). A bunched and tufted type of growth, with a distinct purple colouration, is the final condition in big bud plants, which produce small, hard fruit with thickened and irregular septa. The disease can be transmitted by grafting an affected stem on to a healthy plant; in the field it is spread from plant to plant by the agency of a small, green leafhopper. Several species of garden plants are also susceptible to big bud and, in their case, it results in the production of green, malformed flowers.

Plate 115.
BIG BUD.

Streak.

The least common of the tomato virus diseases in Queensland is the one called streak, regarding which but little is known in this State. Elongated, slightly sunken, greyish-black streaks or spots on the stem are characteristic of this virus disease, which may also produce black lines on the leaf and brown, irregular markings on the surface of the fruit.

Fern Leaf.

A virus disease which is becoming very common in Queensland is that known as fern leaf. After a tomato plant has become infected, the first symptoms to appear are a thickening and a rolling of the leaf edges. At a later stage the terminal shoots become a mass of very narrow, distorted leaflets all with thickened and curled edges and, if any fruit is borne by such plants, it is malformed (Plate 116). The virus causing this disease can infect a very wide range of species, including many common garden and crop plants.

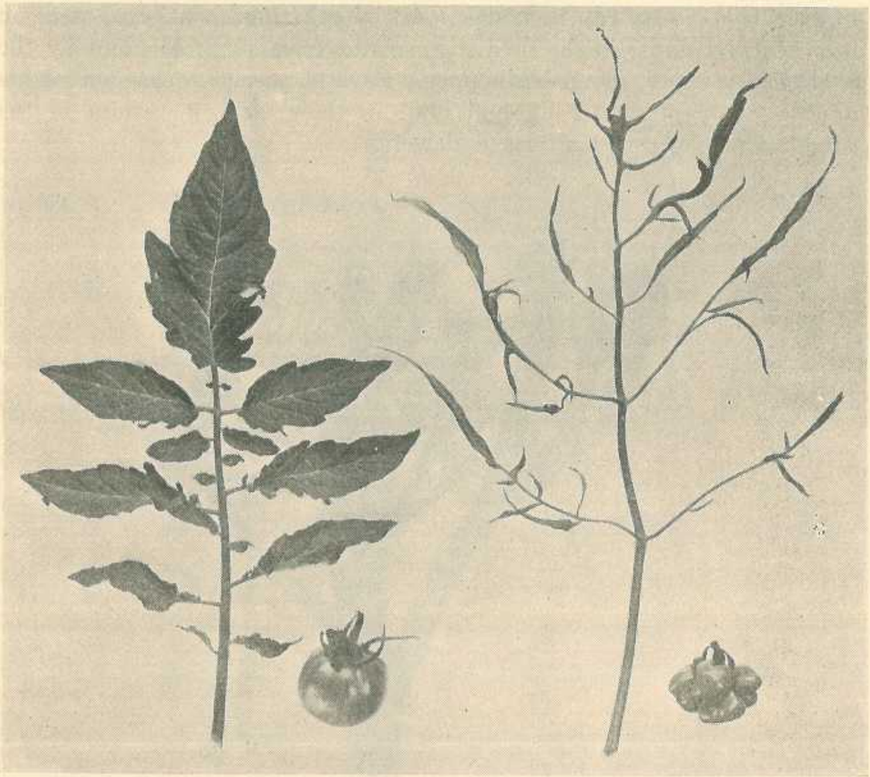


Plate 116.

FERN LEAF.—Healthy foliage and fruit on left; affected foliage and fruit on right.

Control of Virus Diseases.

The control of the tomato diseases just described may in large measure be achieved by strict attention to certain precautions. Firstly, the seed-bed should be establised on new land or on sterilized soil and all weed growth should be removed from its vicinity for some time prior to and during the propagation of the seedlings, because some hosts of the tomato viruses may be present among these weeds. Furthermore, the seed-bed should not be located close to flower gardens because many ornamental plants are known to be capable of harbouring viruses affecting tomatoes. Seed should be selected from healthy plants only, for it has been demonstrated that certain virus diseases of tomatoes can be carried in the seed. Frequent inspections of the crop are desirable while the plants are young and any abnormal plants observed during these inspections should be removed and burned in order to avoid having them act as a source from which the virus can be spread to other and, as yet, unaffected plants. The hands and pruning knives should be washed in soap and running water after touching diseased plants so as to minimise the possibility of transmitting disease to healthy plants. The remains of the crop should be cleaned up and burned as soon as it has ceased to be profitable, and volunteer tomato and potato plants, Solanaceous weeds and other host plants, which are likely to carry these diseases on until the following season, should be eradicated. The excessive use of nitrogenous manure should be avoided as these appear to render the tomato plant rather susceptible to some of the virus diseases.

BLOSSOM END ROT.

Blossom end rot is a disease of tomatoes which is usually prevalent during hot, dry periods in summer. It is characterised by the appearance of a light-brown to black, roughly-circular area at the blossom end of young, green fruit (Plate 117). The tissue of this discoloured region is firm and may be shrunken to form a slight depression or flattening of the apex. A soft rot may appear in it, but such a development is due to the invasion of secondary organisms. The early symptoms of the trouble take the form of small, light-brown lesions.

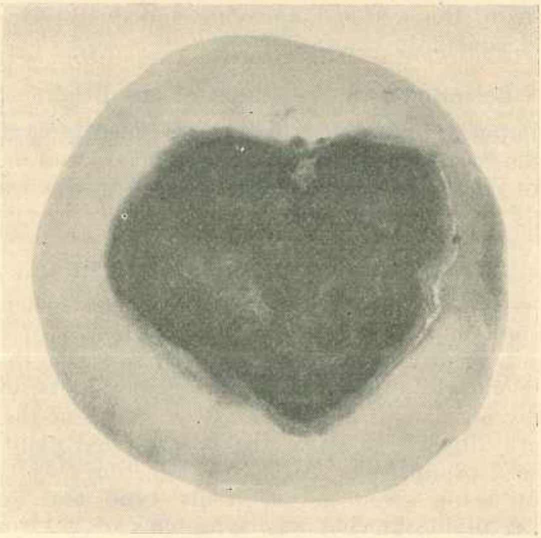


Plate 117.
BLOSSOM END ROT.

This trouble is a physiological one and is not due to the attack of any plant parasite, it being considered that blossom end rot incidence is associated with water uptake and transpiration. When the temperature is high and the amount of water vapour in the atmosphere is very low, the quantity of water transpired by the foliage of a plant may be so high that the uptake of water by the roots is unable to keep pace with the transpiration of water from the leaves. This disturbance of the water balance in the plant is felt severely by the fruit and the cells at the apex collapse, causing the typical firm lesion to develop. A dry soil, by limiting the uptake of water by the roots, is conducive to the development of the trouble, but, on the other hand, plants growing in a soil which has dried gradually do not develop blossom end rot as seriously as those which have experienced a period of heavy rain prior to the hot, dry weather. Infestation of the roots by nematodes, which reduce the efficiency of the roots as water absorbers, aggravates the trouble.

Control.

The control of this disease is, to some extent, beyond the power of the grower. However, he can help to provide an even supply of moisture throughout the growth of the crop by means of appropriate cultural practices and prudent irrigation. Heavy applications of fertilizers rich in nitrogen are undesirable, as these tend to produce abundant foliage, a condition which is conducive to the development of the trouble. When planting a crop it is well to remember that plants grown on the ground are less susceptible to the disease than are staked or trellised crops.

GENERAL NOTES ON CONTROL MEASURES.

Control measures in general are discussed in the following paragraphs under the headings, selection and treatment of the seed, selection and management of the seed-bed, spraying and dusting in the seed-bed and in the field, and crop sanitation.

Selection and Treatment of the Seed.

The most important diseases which are frequently carried on, or in, the seed are the virus troubles, bacterial canker, and bacterial spot. Other important diseases which are disseminated in this way, but which are not so likely to contaminate the seed, are Fusarium wilt, bacterial wilt, and target spot.

The selection of seed from disease-free plants is one of the means of combating virus diseases and is also the most efficient manner in which to eliminate the fungous and bacterial diseases of tomatoes. In view of this fact, growers are strongly urged to select their own seed. This should be done while the fruit is still on the plants, so as to ensure that only healthy plants will be chosen as the source of the seed supply. The fruit is naturally left to ripen on these selected plants before it is harvested for seed production. A further selection may then be made, special attention being given to the fruit type and to the health of the plant. A plant showing any symptoms of a virus disease—no matter how slight—should not be used for seed production, even although the fruit may appear unblemished. Should the grower purchase seed and there be any doubt as to the source of the seed, it should be disinfected with corrosive sublimate in the following manner:—The tomato seed is placed in a piece of mosquito netting and suspended for five minutes in a solution of corrosive sublimate, i.e., mercuric chloride, used at a strength of one part of the chemical in 3,000 parts of water. The seed mass is stirred occasionally with a wooden stick during the period of suspension in order to remove any air bubbles which may be present. After that it is thoroughly washed in four or five changes of water and dried, and should be sown immediately. Corrosive sublimate tablets, with directions for the preparation of the solution, are obtainable from chemists. Growers are reminded that this treatment does not protect the plant from any disease which may attack it after germination. A further precaution is to ensure that seed of disease-resistant varieties only are purchased if there is any possibility of Fusarium wilt being present, unless the crop is entirely a winter one.

Selection and Management of the Seed-bed.

The following diseases may occur in a tomato seed-bed sown with healthy seed:—Irish blight, target spot, Septoria leaf spot, bacterial wilt, Fusarium wilt, bacterial spot, damping-off, and possibly the virus troubles. Care in the management of the seed-bed is accordingly essential, for in the seed-bed the whole crop is concentrated into a small area and the rapid spread of disease is facilitated. Loss of seedlings through such disease incidence often results in a delay of several weeks in planting out, with a consequential failure to gain the advantages of an early market.

Tomato seedling disease control may be exercised at four stages in the production of the young plants. Firstly, the selected seed-bed site should be well away from ornamental gardens, as well as from tomato crops, and all weeds should be cleared from the site prior to sowing the seed. Secondly, the seed-bed should be sterilized and the seed disinfected. Thirdly, at the time of sowing, the seed should be sown in rows instead of being broadcasted; and, finally, after their emergence, the seedlings should be sprayed or dusted with a suitable fungicide.

The placing of the seed-bed on new land is usually sufficient protection against soil-borne troubles other than nematodes, but, if there is any doubt about this point, then the seed-bed should be sterilized by fire or by using formalin. If the heat method is employed, brushwood and branches should be laid evenly over the seed-bed and the surrounding margin, the quantity of wood required being the equivalent of a solid layer about 3 inches thick. The soil should be moist but not excessively wet when firing of the brushwood and branches takes place. Where wood is readily available, the heat treatment is the cheaper method of sterilizing the seed-bed soil. If the formalin method is employed, allowance should be made for the fact that the seed cannot be sown until some twelve to fourteen days after the formalin has been applied. The seed-bed in this case is prepared ready for sowing, and the soil should be moist, but not wet, when treated with the formalin. If the soil is dry, a 1 per cent. solution of formalin, i.e., 1 gallon of commercial formalin in 100 gallons of water, is used, and it is applied with a watering can at the rate of 10 gallons to the square yard; if the soil is moist, a 2 per cent. solution of formalin is watered on at the rate of not less than 5 gallons to the square yard. As soon as it is treated, the seed-bed is covered with sacking for two or three days in order to keep the fumes in. It is then aired for a further ten days or until the odour of formalin can no longer be detected, after which it is ready for use.

Growing conditions in the seed-bed include many factors, the more obvious of which—such as soil tilth and sufficiency of plant foods—

are well known to growers. One point which is worthy of consideration here, however, is whether the seed should be broadcasted or sown in rows; the verdict in this case is that the latter method is preferable in so far as disease control is concerned. A distance of about 6 inches between the rows allows of easy penetration of the spray or dust to the stems and also prevents the formation of a still, humid atmosphere beneath the leaf canopy, such as is found when the seed is broadcasted.

Regular spraying or dusting with a copper compound is necessary in the seed-bed and, if spraying is preferred, Bordeaux mixture at the 2-3-40 strength or home-made cuprous oxide at the 1 to 20 strength may be used. Care should be taken not to spray the seedlings too heavily, as an accumulation of spray liquid in the centre of the plants may result in burning the young foliage. Should the grower's preference be for dusts, then any one of the proprietary copper dusts may be used. Heavy applications of these dusts should not be made on seedlings if much free moisture is present on the young plants, especially if warm weather is likely to follow dusting. Under such conditions, burning may result with either copper carbonate or copper sulphate dusts.

Spraying and Dusting in the Seed-bed and in the Field.

In the recommendations for the control of certain of the tomato diseases, copper sprays and dusts have been mentioned but no details have been given with respect to their use and comparative efficiency. These details are now supplied in the following paragraphs.

Both sprays and dusts give effective control of Irish blight under normal circumstances, the advantage being with the sprays under epidemic conditions. Furthermore, the sprays are more effective than the dusts in controlling target spot. They also have a definite advantage in that the copper residue in a spray adheres to the leaves much better than it does in a dust, and their application is not interfered with by moderate winds. Dusting, however, has the advantages of being much quicker of application in an emergency and of entailing less trouble in cleaning the fruit after harvesting. The higher price for dusts as compared with spray materials is offset by the smaller amount of labour involved in their application.

Among the sprays are two home-made mixtures—Bordeaux and cuprous oxide—and several commercial products, containing basic copper sulphate and copper oxychloride, manufactured specially for spraying purposes. All these mixtures are equally efficient as fungicides, but the Bordeaux is definitely inferior to the rest as a spray in that it reduces the yield of fruit to a greater extent than does any one of the others. The home-made cuprous oxide suffers from a slight disadvantage in that it is difficult to check up on the thoroughness with which the spray is being applied, although this is largely overcome if arsenate of lead is included in the mixture. The preparation of cuprous oxide mixture also requires the exercise of a special amount of care.

Two types of copper dusts are available, one of which is copper carbonate with a kaolin filler and the other, dehydrated copper sulphate with hydrated lime as a filler. They appear equally efficient in controlling Irish blight, but the copper sulphate dust is slightly superior to the other in controlling target spot. Copper carbonate, however, has a less detrimental effect on the total yield of fruit, which more than compensates for a slight reduction in efficiency in target spot control.

The following figures should be of some assistance to new growers in determining the quantities of sprays or dusts required to treat a crop. Where the plants are two to three feet across, 20 lb. of dust or 120 gallons of spray per acre should be sufficient for each application. As the plants increase in size, the figures will rise to about 60 lb. of dust and about 200 gallons of spray per acre. However, there is a considerable degree of variation in the quantities used by individual growers.

Sometimes a grower desires to compare the strength of a home-made spray with that of a commercial spray or to compare the fungicide content of a spray with that of a dust. The essential point in such a case is to compare the amount of copper which is being applied. This varies with the different mixtures used, e.g., the fungicidal materials in various proprietary brands—basic copper sulphate, copper carbonate, and copper oxychloride—contain approximately 50 per cent. copper by weight, dehydrated copper sulphate contains 35 per cent., and copper sulphate crystals 25 per cent. For ease of comparison the above proportions may be remembered as one-half, one-third, and one-quarter, and, on this basis, the following figures give a standard to work from. Bordeaux mixture of the 4-4-40 strength, home-made cuprous oxide mixture at a strength of 4 gallons of stock solution in 36 gallons of water, basic copper sulphate at a strength of 2 lb. to 40 gallons, and copper oxychloride at 2 lb. to 40 gallons all contain 1 lb. of copper per 40 gallons of spray. A dust made up of 2 lb. of copper carbonate and 12½ lb. of kaolin is of the same strength as one containing 3 lb. of dehydrated copper sulphate and 11½ lb. of hydrated lime, which means that each contains 1 lb. of copper in 14½ lb. of dust and that the dust contains approximately 7 per cent. copper. Thus, in comparing dusts and sprays, 40 gallons of the above copper mixtures equal 14½ lb. of a 7 per cent. copper dust in so far as the amount of copper applied is concerned. As general practices stand at present, less copper is applied per acre per application when a crop is dusted than when it is sprayed, but, in the majority of cases, the available evidence indicates that this reduced quantity is still sufficient to control the Irish blight fungus, although special care must be exercised at critical periods. One important point in this connection, of course, is the fact that dusts are usually applied more frequently than sprays and the total amount of copper applied during the growth of the crop may be approximately the same for the two methods of application.

Crop Sanitation.

The destruction of the residue of a tomato crop when harvesting has been completed is a disease control precaution which is all too frequently ignored. This is unfortunate because the prompt destruction of the crop residue is a valuable control measure in the case of all diseases and is particularly important for the control of Fusarium wilt, Verticillium wilt, bacterial wilt, bacterial spot, and target spot.

Spraying and Dusting Programme for Disease and Pest Control.

With every tomato crop grown there is usually an infestation of various insect pests, the control of which generally entails the use of certain dusts and sprays, and for economy of labour and materials these may be combined with fungicides in the one application, both in the seed-bed and in the field. The remaining paragraphs in this article, which are quoted from an earlier departmental publication, discuss suitable combinations of fungicides and insecticides.

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 by weight will ensure seedling growth free from most pests and diseases. A proprietary dust of this kind would carry the following analysis:—7·75 per cent. arsenic pentoxide (As_2O_5) as arsenate of lead, 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 the 2-3-40 strength of Bordeaux mixture (or 1 in 20 home-made cuprous oxide mixture) with colloidal sulphur (1 lb. to 50 gallons) and arsenate of lead (1 lb. to 50 gallons) will achieve the same purpose. If aphids appear, they should be treated with a 3 per cent. nicotine dust or a nicotine sulphate spray (½ pint nicotine sulphate, 2 lb. soap, and 50 gallons water).

In the field, an all-purpose dust mixture should contain arsenate of lead 10 parts, sulphur 6 parts, and copper carbonate 4 parts. Such a proprietary dust would carry the following analysis:—15·5 per cent. arsenate 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 the 4-4-40 strength of Bordeaux mixture (or 1 in 10 home-made cuprous oxide mixture), to which 1½-3 lb. of arsenate of lead and 1 lb. of colloidal sulphur are added to each 50 gallons of the spray may be used. A nicotine dust or a nicotine sulphate spray similar to that used in the seed-bed should be applied if aphids become numerous. Treatment in the field should commence when flowering begins and continue at approximately seven to ten day intervals at least until picking tallies are at their maximum. Such a schedule, in addition to dealing with other pests and diseases, should give a reasonable measure of control of the corn ear worm. However, should this pest be unusually troublesome, it may be necessary to make a special application of arsenate of lead alone, between routine applications of the combination dust or spray.

Mixed dusts containing insecticides and fungicides in similar proportions to those stated in the recommended formulae 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.

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 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 is therefore sometimes adopted. 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 far apart to allow rapid penetration of the solution and quick draining—and are immersed in the acid dip for one and a-half minutes, the case being moved up and down in order to wet all the fruit. The case is withdrawn at the end of the acid dipping period, it is allowed to drain on the draining boards for a few minutes, and is then 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.

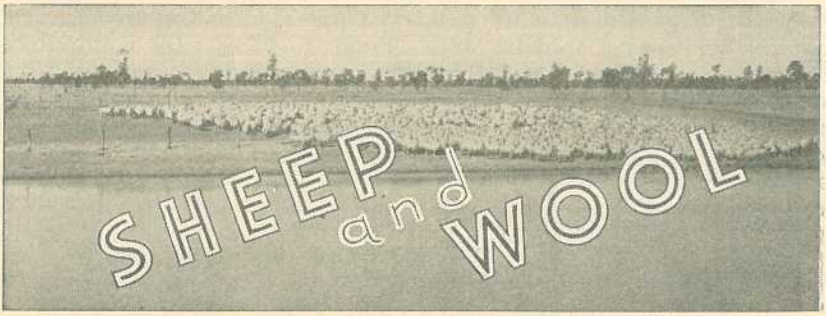
Eight gallons of the acid dip is a sufficient quantity to treat at least 12 bushels of tomatoes carrying heavy spray residues. Sound and scarred tomatoes, whether coloured or green, are not injured by this treatment, nor is cracked fruit affected, provided it is dried quickly after the dipping process.

THE ACETYLENE TREATMENT OF PINEAPPLES.

The acetylene treatment of pineapples consists in introducing a small quantity (approximately 2 fluid oz.) of a saturated solution of the gas into the heart of each plant or ratoon, where it is retained in contact with the growing point by means of the leaves cupped around it. Provided no rain falls within 24 hours and temperature conditions are favourable, only a single application of the solution is necessary to induce the formation of a flower bud, which appears 6-8 weeks later. Several methods of preparing a saturated solution of acetylene in water have been worked out. The simplest of these consists in dropping a medium-sized handful (3-4 oz.) of ordinary commercial carbide into a kerosene bucketful of water and then stirring gently until evolution of gas from the carbide has ceased. The solution so prepared may be applied to the plants by any convenient means; a knapsack sprayer fitted with a trigger release and with the nozzle removed has been found very satisfactory for this purpose.

For advancing the peak of the winter crop from August to May, the best month for treating the plants is October—that is, 3-4 months before flower buds would normally appear in them. The fruit harvested in May from acetylene-treated plants may be slightly smaller than that which would have been obtained from the same plants in July or August, had they been allowed to flower normally, but this difference in size is more than offset by reduced wastage from diseases and the better quality of the fruit due to its improved flesh colour and its higher sugar and acid content. In this connection, it should be noted that the size of the fruit which will develop from an acetylene-treated plant is largely determined by the size and vigour of the plant at the time of treatment. Obviously, partially developed or under-sized plants should not be forced into flower by this means. The acetylene treatment may also be used during late February and early March to force a crop for December and January.

—H.K.L.



The Corriedale.

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

THE growing tendency to make more use of the Corriedale in Queensland is to be commended. There is a definite place for this comparatively new breed, especially in farmers' flocks.

It is pleasing to report the gradual improvement in the breed, and present growers are to be congratulated on the steps they have taken, by the importation of high class stock both male and female, to step up the type. In the early days of the introduction of the breed to Queensland, growers generally had not the right conception of the type wanted. To most breeders a Corriedale was just a Corriedale. The main mistake was observed in the breeding of too fine an animal. This more or less defeated the idea for which the Corriedale was evolved. A general utility sheep was aimed at, and with the passage of time this was achieved as far as the true-to-type animal was concerned. The Corriedale as a breed dates back about 70 years only. In the world of breeding this is a comparatively short period.

The breed was evolved by the crossing of pure-bred Lincolns with pure Merinos, and the selection and interbreeding of animals, true to type, within the breed. The result of those, true to type, was a very large sheep of great individual weight, with a covering of valuable wool averaging about 56 counts. He is a sheep of good constitution, and early-maturing carcase. The breed is prolific, and very satisfactory lambing percentages may be looked for in a well cared for flock. The pure bred Corriedale is an impressive looking sheep with a fine bold outlook, massive frame, well sprung ribs, broad back, and well filled hindquarters. The breed, although nothing like immune, is not as prone to the ravages of blowfly attack as is the Merino.

The covering of the Corriedale is most important. Wool of the breed true to type is of high commercial value. If it appears that the writer stresses the "true to type" when referring to this breed, no apology is made, as it is probably the most important single quality in a sheep of such comparatively recent origin. The fleece is bold and dense, with a very well defined crimp, denoting plenty of quality and character. The staple is long, as it must be with wool of such strength. This means that a wool of such counts (56s) must carry length. A short wool of the same counts would incline to commonness. The financial return from quality Corriedale wool is most satisfactory. As a matter of fact some crack Corriedale wools in Victoria run Merinos very close for top price. The weight cut per head is higher than that of the average Merino.

Breeders of this general utility sheep should always have in mind the maintenance of strength without harshness. This is no easy task. It is the easiest thing imaginable to "run out" with this type of wool. By this is meant the gradual fineing of the clip until, in some cases, Merino counts are touched. This, of course, defeats the object for which the Corriedale was evolved. With the fineing of the covering goes loss in size and constitution, and also a considerable loss in weight of fleece.

The careful, systematic culling of a Corriedale flock is of the greatest importance. This stands to reason when it is recollected that the breed is of comparatively recent origin. Generally speaking, the younger the breed the greater necessity for heavy culling in the endeavour, by selection, to retain only those sheep as breeders which are true to type.

Culling of a Corriedale flock, apart from size and constitution, malformation, or any other obvious reason, consists of the elimination of those sheep leaning too much to the Lincoln on the one hand, and with too much resemblance to the Merino on the other hand. Length of fleece, of the right counts, is a necessity. Really short wools, even of the right counts, cannot be tolerated if the most is to be made from this breed.

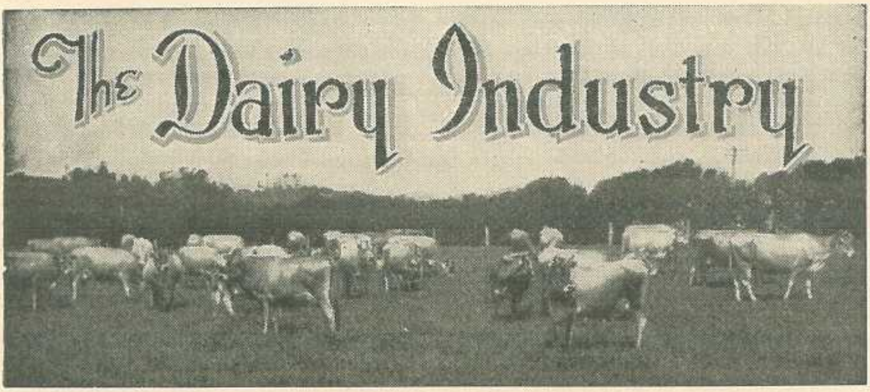
The Corriedale, being half English bred, is splendidly adapted for farmers' flocks. The breed is extremely docile, and the ewes have proved prolific milkers, a most important point in the production of early maturing and robust lambs. They lend themselves, too, to successful confinement in small paddocks, a quality in which the Merino more or less fails, as the latter do much better when confinement is at a mimimum and there are large areas on which to graze. The Corriedale is at home on cultivation. It is especially important to provide winter feed for these flocks. Our grass lands, dependent on the season, are quite all right for grazing during the summer months, but some winter provision is a necessity.

Our improved brigalow and belah lands are very suitable for the successful running of the Corriedale. The breed, to the extent of its half-English parentage, appreciates rich lands and grazing.

As far as likely returns are concerned, the breed under review has everything to recommend it. It is admitted that, compared with flock Merinos, the initial cost is high. However, the farmers would be well advised to make the purchase. The ewe lambs should be rigidly retained, apart from culls, as an increase to the flock.

Those graziers on larger areas wishing to establish the blood are advised to use first-class Corriedale rams on their Merino ewes. On the ewe progeny, continue with rams of the same breed. This followed through gives a grade animal of value in a comparatively short period. The breed is of value in the fat lamb industry. Joined with rams of the Downs breeds, excellent early maturing lambs are the result. The ewes, being so domesticated and such good milkers, give their lambs a great start, always provided the feed is satisfactory. The Corriedale has come to stay in Queensland. There are definite indications of an increase in numbers, and a fast growing popularity for the breed.

Those with studs in the State would be well advised to use only the best of sires, and to rigidly cull their breeders. They will thus be in a position to profit in the demand for rams so evident in the coming years.



Charcoal Coolers on Dairy Farms.

F. G. FEW, Dairy Branch.

ONE of the most important problems of dairy farmers in this State is the satisfactory holding of cans of cream awaiting transport to the factory. Although the primary objective of the farmer should be to produce nothing other than a cream which will grade choice on arrival at the factory, his toil and care are largely without avail if the product is allowed to deteriorate in quality while being held on the farm. Peak production is usual during the summer months, and the proportion of choice butter manufactured annually thus depends very materially on the percentage of choice cream supplied under summer conditions. Any effective method of maintaining the quality of a choice cream during the period from separation on the farm to manufacture at the factory is thus an item of considerable economic importance to the dairying industry of the State.

Theory.

While lower temperatures may be advantageous, a cream temperature of 70 deg. F. is considered satisfactory for farm holding purposes, as in cleanly produced cream it favours the growth of lactic acid bacteria which produce flavours in cream desirable for butter making. With shade maximum temperatures generally between 90 deg. F. and 100 deg. F. under summer conditions it is thus necessary to maintain a temperature 20 deg. F. to 30 deg. F. below the daily maximum for satisfactory cream storage on the farm. Such a temperature can be readily produced and maintained by the use of refrigeration, but for the average farmer the cost has so far, unfortunately, been almost prohibitive. For the storage of milk, where much lower temperature are required, refrigeration is a prime necessity, but cooling cream to 70 deg. F. is quite practicable in many parts of the State if use is made of the principles of natural evaporation. On this principle of evaporative cooling very many industrial practices depend, the cooling of water at butter factories for one purpose or another by tower or spray pond recirculation being an example that will be familiar to most dairy farmers. The degree of cooling possible by this means depends on the prevailing atmospheric conditions, the shade temperature and the relative humidity (the dryness or dampness of the air as popularly understood) being the governing factors. From these two values the so-called wet-bulb temperature is determined, and this is the lowest temperature that can be realised by the natural evaporation of water under atmospheric conditions. Cooling to 70 deg. F. by natural means is thus quite practicable in any part of the State where the wet-bulb temperature is not greater than 70 deg. F. during the summer months and this condition exists in many parts other than those usually described as the coastal areas.

Charcoal Coolers.

Charcoal coolers, utilising the principle of natural evaporative cooling, have been in use in the Wowan district, south-west of Rockhampton, for some considerable time. Peculiarly enough their use seems to be confined almost exclusively to this district, and to those immediately adjoining areas. Briefly, these coolers consist of an inner cabinet of sufficient size to hold the necessary cream-cans surrounded with loosely packed charcoal from 9 to 12 inches in thickness. Both the sides of the inner cabinet and those of the cooler itself are made of chain wire or wire netting, thus allowing a degree of air circulation between the inner chamber and the outside atmosphere. The charcoal sides are thoroughly wetted, thus setting up evaporative cooling which reduces the temperature within the cabinet to an extent depending on the prevailing atmospheric conditions. The cabinets are usually fitted with a cold-storage type door, and a flue of indefinite length supposedly intended to draw air through the sides of the cooler and into the inner chamber. A more detailed consideration of the coolers will be given under their design of construction later in this article.

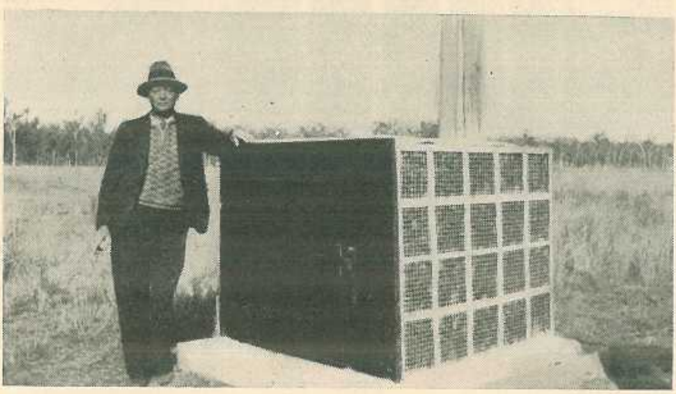


Plate 118.
Front and Side View of 4-gallon-can size Charcoal Cooler.

Description of Tests.

An investigation of the charcoal coolers was completed last February, the immediate purposes of which were to determine the practicability of an extension in the areas where they might be profitably used, the technique required for maximum efficiency, details of design, construction, &c. With the assistance of Mr. S. E. Pegg, Dairy Inspector, Rockhampton, together with the co-operation of many farmers in the Wowan district, it was possible to conduct all experimental work necessary for the investigation. The bulk of the work, however, was carried out on the farm of Mr. E. Harris, at Wowan, this location being convenient for easy transport from the township, while the charcoal cooler in use may be described as of good standard design.

The principal experiment consisted of placing a can of cream in the cabinet of the cooler immediately following separation after milking the herd in the morning. A can of similar size was placed in a position in the dairy building where such would be normally kept if no charcoal cooler were in use. Commencing at 9 a.m., temperature and humidity readings were taken over a period of 24 hours, values being obtained for the more important period (during the day) at half-hourly intervals. Further tests were carried out on other days, the object being to investigate other features usually incorporated in the construction of charcoal coolers. Finally, various types of coolers situated on different farms in the district were tested to ensure that the conclusions reached were applicable in general, and were not influenced by any peculiarly local considerations.

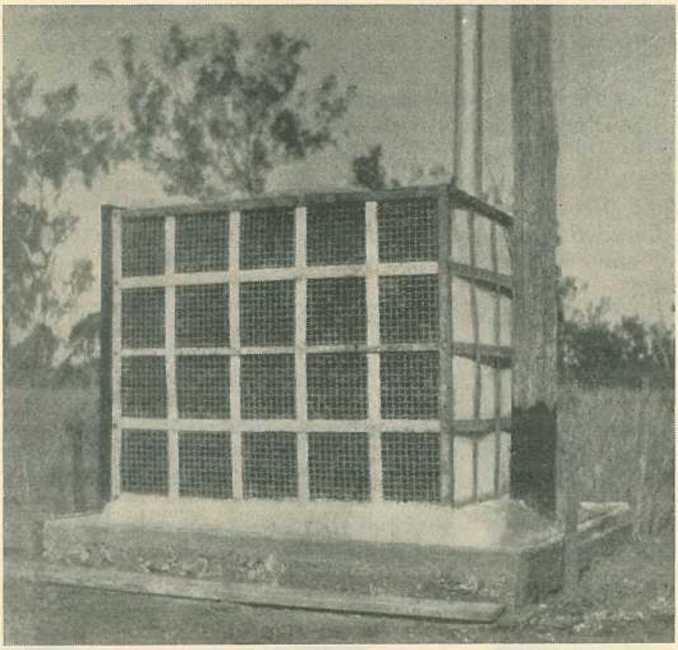


Plate 119.

SIDE AND BACK VIEW OF 4-GALLON-CAN SIZE CHARCOAL COOLER.

Results.

The deductions applicable to the practical operation of charcoal coolers are listed as follows:—

(1) The most important fact arising from the investigations is that wet-bulb temperatures are obtained in all reasonable designs of charcoal coolers, this temperature being realised, in fact, in 15 minutes, after thoroughly wetting the charcoal sides, in the case of one unit previously out of use for some considerable time. Charcoal coolers would thus prove quite satisfactory in any area of the State where wet-bulb temperatures are around 70 deg. F. or less for the greater part of the day under normal summer conditions. Information is being obtained at present to definitely determine such suitable areas, but, in the meantime, it is safe to say that such conditions would exist in most

dairying areas apart from those on the immediate coastal strip. Suitable areas would include the Darling Downs, the North and South Burnett areas, and other inland dairying districts.

(2) The sides of the cooler, packed with charcoal, are responsible for the evaporative cooling effect produced, and this effect is independent of the placing of the unit to suit any prevailing winds, and also the location of the unit in an outside exposed position or otherwise. During the greater part of the day the charcoal sides have a definite insulating effect which prevents the cabinet following any possible fluctuations in the wet-bulb readings. As a result of this, and considering the fact that watering the charcoal tends to annul this insulating effect, it is not desirable to water the charcoal during the hotter part of the day unless absolutely necessary. The best time is during the night or early in the morning, and the latter time can be considered as most practicable on the average farm. The charcoal sides should just be thoroughly wetted as early as possible in the morning.

(3) It is, in general, inadvisable to open up the cabinet or remove the cans from the cooler overnight. For the most part, the atmospheric temperature will fall below that of the cabinet during the night, but the time lag in cooling the cans of cream removed from the cooler is so great that any value of so doing is more apparent than real.

(4) The fitting of a flue to charcoal coolers is totally unnecessary so far as efficient cooling is concerned. Retention of a vent for hygienic

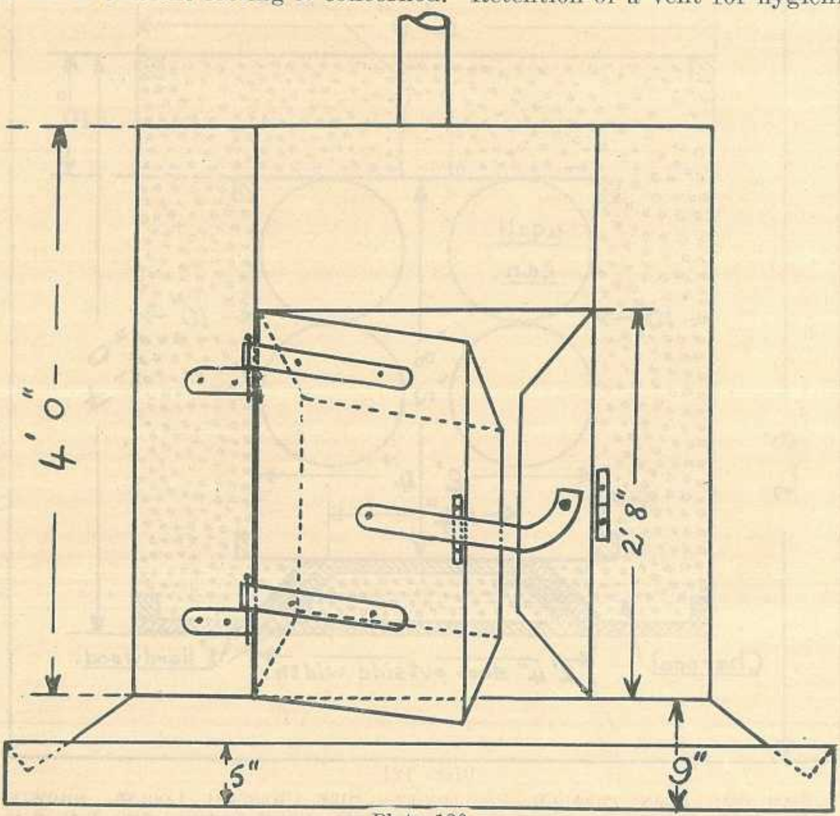


Plate 120.

FRONT ELEVATION OF 4-GALLON-CAN SIZE CHARCOAL COOLER.—Bevelled door 2 ft. 8 in. high by 2 ft. 4 in. wide outside.

reasons and to avoid any impairment of the insulating effect of the charcoal by supersaturation of the atmosphere within the cabinet is desirable, however, and in practice the fitting of one 2 or 3 feet length of piping of 4 inches diameter is recommended.

(5) *The use of charcoal coolers does not eliminate the problem of cream cooling after separation from the milk.* The time lag in the cooling of a can of uncooled cream when placed in the cabinet results in the cream being kept at too high a temperature for a lengthy period. This is likely to have a deleterious effect on cream quality, although after the first 12 hours of storage the quality then existent should be maintained.

In the case of the charcoal cooler used for the main experiments the cabinet temperature remained closely to 70 deg. F. throughout the 24 hours, wet-bulb readings varying about 8 deg. F. from 68 deg. F. to 76 deg. F. The cabinet temperature only varied from 70 deg. F. to 73 deg. F., thus showing the insulating effect of the charcoal packing, and the resulting stability of the inner chamber temperature. The maximum cooling effect was obtained at 2 p.m., the difference between the atmospheric shade temperature and the cabinet temperature being then 20.5 deg. F. (92.5 deg. F. and 72 deg. F. respectively).

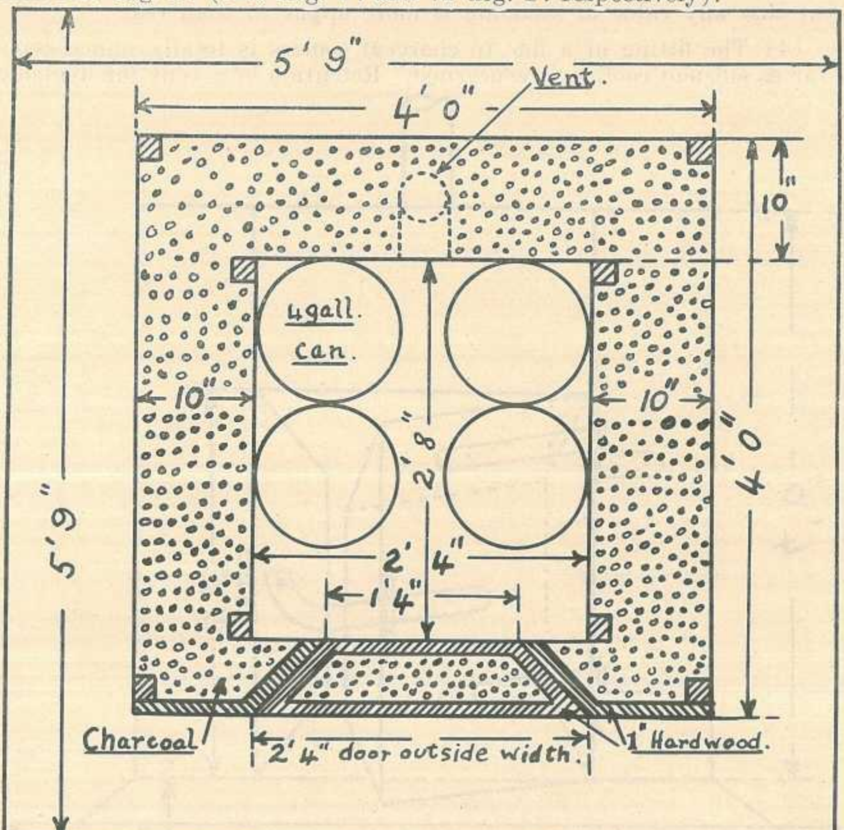


Plate 121.

SECTIONAL PLAN THROUGH 4-GALLON-CAN SIZE CHARCOAL COOLER, SHOWING ALSO CONCRETE BASE.—Door 6 in. thick horizontally, 9-inch bevelled face 1 ft. 6 in. wide, 1 ft. 6 in. high inside.

The can of cream was placed in the cooler at 9 a.m., the cream temperature being then 85 deg. F. Its temperature fell steadily but very slowly, and at 5.30 p.m. was still 75 deg. F., although the cabinet temperature was only 71 deg. F. Even after 24 hours the cream temperature was 74 deg. F., illustrating the extreme slowness of cooling when the cream temperature is within 5 deg. F. of the cabinet temperature. Initial cream cooling after separation is thus very desirable. The slowness of cooling of the can of cream is, similarly, the reason why removal of the cans from the cabinet overnight cannot be justified. During the experiments the cans simply stored in the dairy building showed a temperature of 82 deg. F. at 8 p.m.; while at 7 o'clock the following morning it had fallen only to 72.5 deg. F., despite the fact that the atmospheric temperature fell to 60 deg. F. during the night. It is true that at this latter time it was 1.5 deg. F. below the temperature of the can in the cooler cabinet, but by 9 a.m. it had risen to 74 deg. F.—the temperature of the can in the charcoal cooler. Similarly it was found that the can of cream, removed from the cooler at 10 a.m. and at a temperature of 74 deg. F., had risen to only 75 deg. F. when graded exactly one hour later at the factory, despite the fact that the atmospheric temperature was then 88 deg. F. For reasonable transport to a factory the lag in heating-up is thus a definite safeguard against any deterioration in quality. If the cream had been initially cooled or held on the farm for a second day its temperature would have approximated to that of the cabinet (70 deg. F.) and it would have been graded at substantially the same temperature one hour later at the factory.

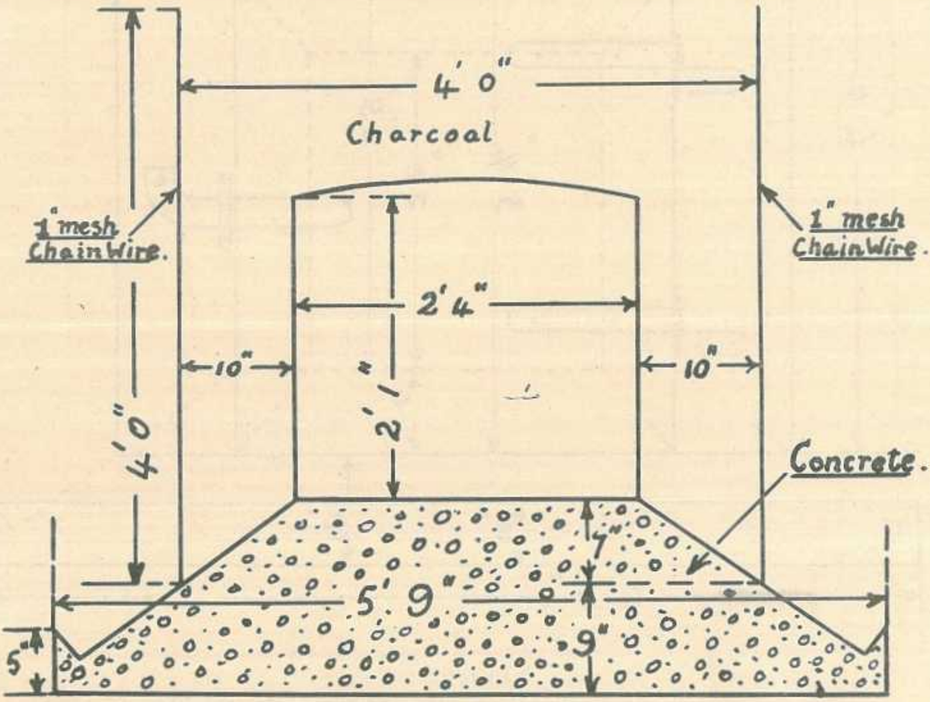


Plate 122.

SECTIONAL ELEVATION THROUGH 4-GALLON-CAN SIZE CHARCOAL COOLER, SHOWING OPEN TOP AND CONCRETE BASE.

Design and Construction.

The practical construction of charcoal coolers is obviously an item of the greatest importance from the farmer's viewpoint. For this reason considerable attention was given to existing types of coolers in the Wowan district with a view to standardising a design incorporating all desirable features. Quite a reasonable degree of flexibility does exist, however, especially in regard to the choice of suitable building materials, and this may considerably simplify the actual construction on the farm. The drawings included in this article (Plates 120 to 124) have been made to facilitate the construction of a cooler unit, and they include features considered necessary as a result of the investigational work. Brief specifications of possible materials of construction are also included, all of which are equally suitable for the specific purpose mentioned.

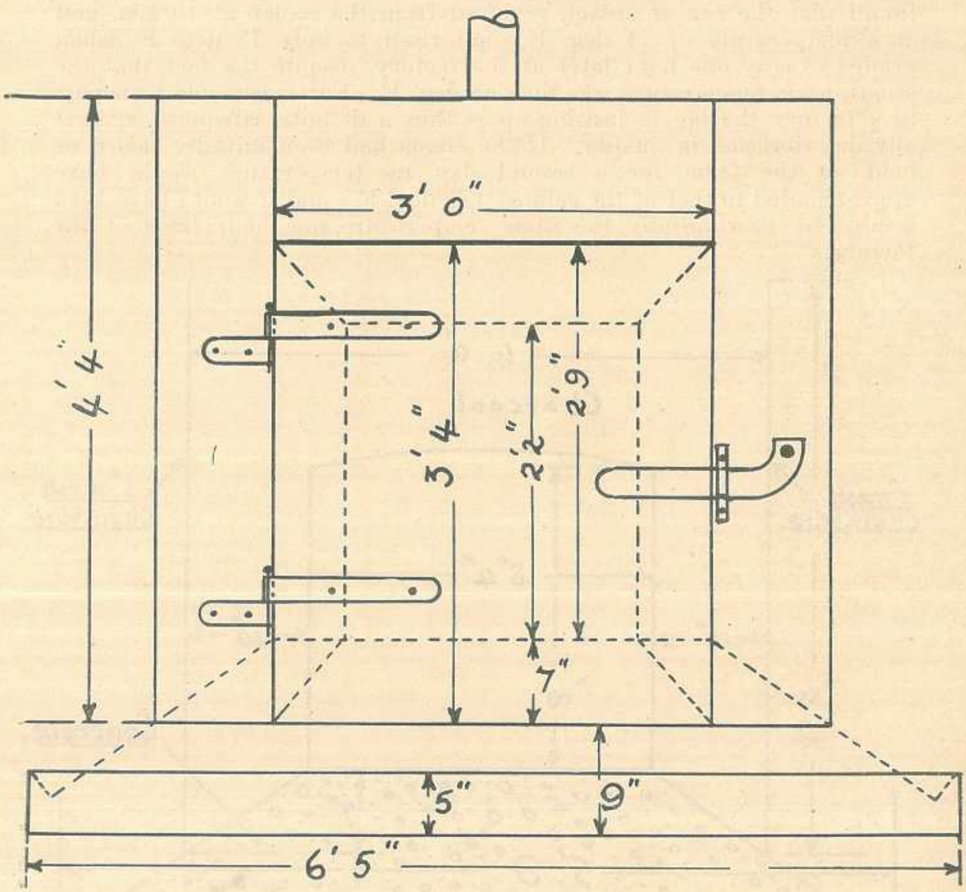


Plate 123.

FRONT ELEVATION OF 8-GALLON-CAN SIZE CHARCOAL COOLER.—Cabinet height 2 ft. 9 in.; door inside 2 ft. 2 in. high, 2 ft. wide; door outside 3 ft. 4 in. high, 3 ft. wide.

Essential features in the construction are the inclusion of charcoal-packed sides, with additional charcoal insulation on the top and at the back of the inner chamber. A thickness of 10 inches is ample for maximum efficiency, although the thickness on top can be greater, especially if the top of the unit is left open, and the unit is in an outside exposed condition. This outside location is quite allowable and permits construction at a place often more convenient for one reason or another than in the dairy building. The open top of the unit is shown in the sectional elevation (Plate 122) which is not shaded to allow inclusion of as many dimensions as possible. The charcoal itself is easily prepared from any suitable timber on the farm and should be reasonably small in size, well-packed, but definitely not powdered to any appreciable extent. The charcoal at the sides of the unit both inside and outside is kept in place solely with chain wire (1 inch mesh), or, alternatively, half-inch wire netting additionally supported with metal or wooden slats. With the exception of the sides and the short vent pipe, the inner cabinet is practically airtight, the vent being placed either at the top of the back wall or at the rear of the cabinet ceiling itself. A proper cold-storage type door is advisable to ensure air-tightness and effective insulation, the hollow interior of the door being most conveniently packed with charcoal. The inner cabinet can be constructed of a reasonably rust-proof material such as galvanised iron, although lightly reinforced concrete is also suitable. The roof is preferably arched to ensure the draining off of any water added to the

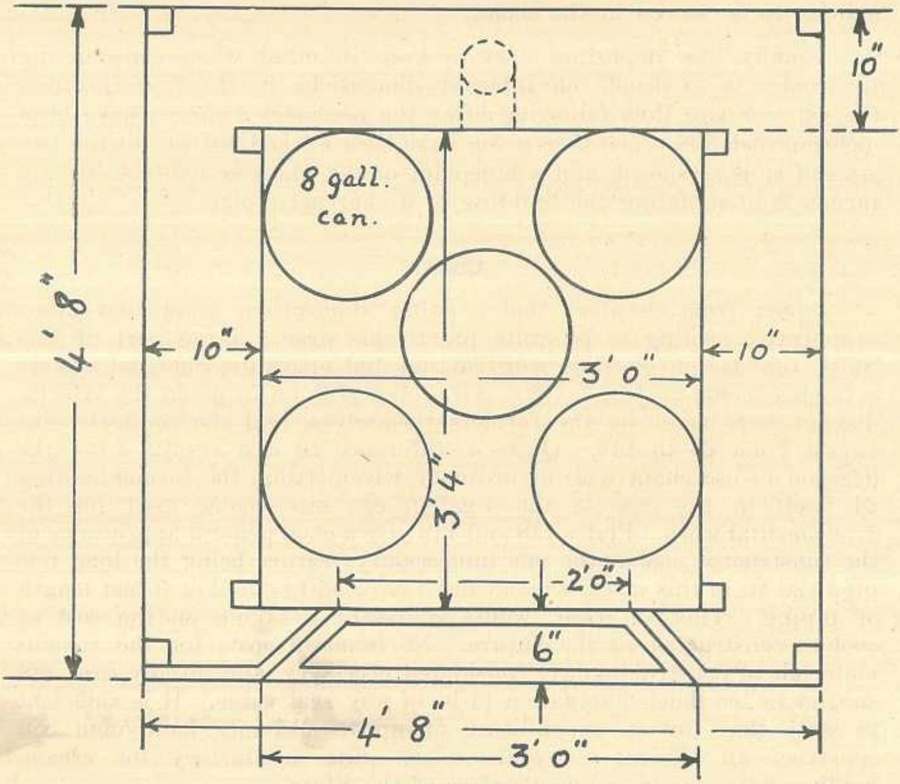


Plate 124.
Sectional Plan of 8-gallon-can size Charcoal Cooler.

top of the cooler, while the floor should be raised as shown to prevent water accumulating in the cabinet after watering the sides or top. All around the inner cabinet charcoal is met of a thickness suitable for insulating purposes, in addition to allowing evaporative cooling in the case of the sides of the unit. It is also quite practicable to use a layer of charcoal beneath the concrete floor and foundation for insulation purposes, any thickness of 6 to 12 inches being ample in this respect. The concrete foundation includes a shallow trough which, when filled with water, effectively prevents ants from gaining access to the cooler chamber. Likewise, the vent pipe should be covered with coarse-mesh gauze at the end of the uptake to avoid the entry of frogs, snakes, &c., while, in addition, a cowling can be fitted to prevent entry of water during periods of heavy rain.

The dimensions given are suitable for coolers of two sizes depending on the capacity of the cans to be stored. Two sizes, one suitable for 4-gallon cans and one for 8-gallon cans, are shown in the designs, and either should meet all requirements for any average farm. Four of the smaller sized cans can be stored in the smaller cooler, while the larger unit is capable of holding five 8-gallon cans. It will be noted that the height of the inner cabinet in the case of the larger cooler has been made sufficient to allow inclusion of a shelf, the height of an 8-gallon can being only approximately 21½ inches. Quite a useful storage for certain household food articles can thus be provided, and there is no objection to this practice if proper care is taken with regard to the articles to be stored in the cooler.

Finally, the important fact to keep in mind when constructing the cooler is to decide on internal dimensions in the first instance, the exterior size thus following after the necessary features have been incorporated. The dimensions given have been worked out to suit the two sizes of cans as shown, and a blueprint of the plans is available to any farmer contemplating the building of a charcoal cooler.

Costs.

Apart from the fact that existing atmospheric conditions allow evaporative cooling to be quite practicable over a large part of this State, the cost involved in constructing and operating charcoal coolers is the big factor in their favour. All coolers seen on farms in the Wowan district were made by the farmers themselves, and the complete cost varied from £8 to £15. Quite a difference in cost results from the decision to use chain wire or ordinary wire-netting, the former costing £4 itself in the case of the 4-gallon can size cooler used for the experimental work. Plates 118 and 119 give a good general appearance of the constructed cooler, the one unnecessary feature being the long flue pipe (20 ft. in this case), which can be reduced to one 2 or 3 feet length of piping. This, in itself, would represent a saving on the cost of coolers constructed in the future. No itemised costs for the various materials of construction are considered necessary, and, in any case, are subject to too much fluctuation to be of any real value. It is sufficient to state that for an expenditure of up to £15 any handyman can construct an efficient charcoal cooler, quite satisfactory for cream-holding purposes in many districts of the State.

PRODUCTION RECORDING.

List of cows and heifers, officially tested by Officers of the Department of Agriculture and Stock, which qualified for entry into the Advanced Registers of the Herd Books of the A.I.S. and Jersey Societies, production records for which have been compiled during the month of March, 1945 (273 days production unless otherwise stated.)

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORN.			
	MATURE COW (STANDARD 350 LB.).			
Rosenthal Lilac 4th	S. J. Mitchell, Warwick	12,215·75	523·805	Rosenthal Vain Prince
Melmerle Pet	K. Roche, Warwick	9,736·78	435·416	Wilga Vale Lavina Broxburn
Trevlac Wallflower	W. A. Freeman, Rosewood	9,267·75	388·712	Trevlac Prince
Fairlie Fairy 14th	S. Mitchell and Mulcahy, Warwick	9,842·25	352·755	Rosenthal Credence
Ardilea Broady	H. W. Hinrichsen, Clifton	7,875·0	350·987	Midget Sheik of Westbrook
	JUNIOR, 4 YEARS (STANDARD 310 LB.).			
Rosenthal Choice 17th	S. J. Mitchell, Warwick	10,337·25	398·06	Rosenthal Perfection
Rosenthal Dove 24th	S. J. Mitchell, Warwick	9,304·0	373·835	Rosenthal Perfection
	JUNIOR, 3 YEARS (STANDARD 270 LB.).			
Trevlac Fay	W. A. Freeman, Rosewood	12,362·5	472·173	Trevlac Supreme
Mountain Camp Rose	W. Caldwell, Bell	7,564·69	344·824	Trevor Hill Reflection
Mountain Camp Brier Sweet	W. Caldwell, Bell	7,374·82	306·222	Trevor Hill Reflection
	SENIOR, 2 YEARS (STANDARD 250 LB.).			
Mount Camp Scarlet's Gift	W. Caldwell, Bell	7,985·5	341·058	Trevor Hill Reflection
Penrhos Charlotte 5th	A. Webster, Helidon	8,655·15	322·826	Penrhos Pansy's Prince
Penrhos Sheila 13th	A. Webster, Helidon	8,760·55	315·385	Penrhos Pansy's Prince
Penrhos Merle 4th	A. Webster, Helidon	8,540·0	307·359	Penrhos Pansy's Prince
Bunya View Fuchsia	W. Caldwell, Bell	6,845·79	288·178	Trevor Hill Reflection
Yarranvale Iris (258 days)	W. Henschell, Yarranlea	6,605·51	272·104	Trevor Hill Bosca
	JUNIOR, 2 YEARS (STANDARD 230 LB.).			
Penrhos Lucy 8th	A. Webster, Helidon	8,397·4	304·802	Penrhos Pansy's Prince
Yarranvale Favourite	W. Henschell, Yarranlea	7,429·37	282·264	Sunnyview Royal National
	JERSEY.			
	MATURE COW (STANDARD 350 LB.).			
Hocknell Golden Girl	N. C. Webb, Beaudesert	9,760·95	525·927	Bremerside Zillah's Boy
Glenmore Diana	S. H. Caldwell, Bell	8,105·16	462·797	Wheatlands Jester
Pineview Aster 2nd	W. Muller, Marburg	7,277·5	399·122	Pineview Rivoli
	JUNIOR, 2 YEARS (STANDARD 230 LB.).			
Kinross Dollena	H. Randall, Biggenden	5,161·55	266·464	Glenview Royal Diamond
Woodview Hopeful	P. H. Schull, Oakey	4,019·55	250·02	Trecarne Royal Officer
Lermont Gentle	J. Schull, Oakey	4,796·8	245·748	Woodside Golden Volunteer

ANIMAL HEALTH

Performing the Mules Operation.

G. R. MOULE, Government Veterinary Surgeon.

THERE are many sheep-raisers who still think the Mules Operation aims at removing the wrinkles from the sheep's breech, and if they set out to "Mules" their flocks they would snip off just enough of the wrinkles to make the sheep "plain" or "A class." The radical Mules Operation, which has been developed by the C.S.I.R. and which is giving such excellent results under field conditions in Central Western Queensland at the present time, does more than "dewrinkle" the breech—it also stretches the "bare area" around the vulva and anus. To do this it is necessary to follow a definite "pattern" in performing the operation, irrespective of the degree of development of the animals being treated.

The Standard "Pattern."

The ideal is to cut a crescent shaped piece of skin, which should be removed in one piece, from each side of the sheep's breech. The commencement and end of the cuts should be pointed and the widest part of the cut should be opposite the level of the tip of the vulva.

An easy way to attain this effect is to follow the pattern suggested by the guide lines shown in Plates 125 and 126. The first cuts are made in the direction of the line A B D: i.e., from a point about 1 inch to 2 inches above the level of the base of the tail and along the line joining the diagonal hock D to the edge of the "bare area" B. At B the cut is turned to run up the *inside* of the crutch along the line B C. The end result is shown in Plate 127.

Hold Shears Correctly.

Particular note should be taken of the way the shears are held in the illustrations in Plates 125 and 126. The back of the hand is to the sheep (and not the palm, as in shearing) and the thumb is held on the top blade to make sure that the cutting edges of the shears are kept in apposition.

Making the Cut.

In commencing the cut at A it is advisable to pick the skin up with the shears before it is touched with the left hand. This ensures a sharp point at A (in Plate 125), whereas if the skin is picked up with the left

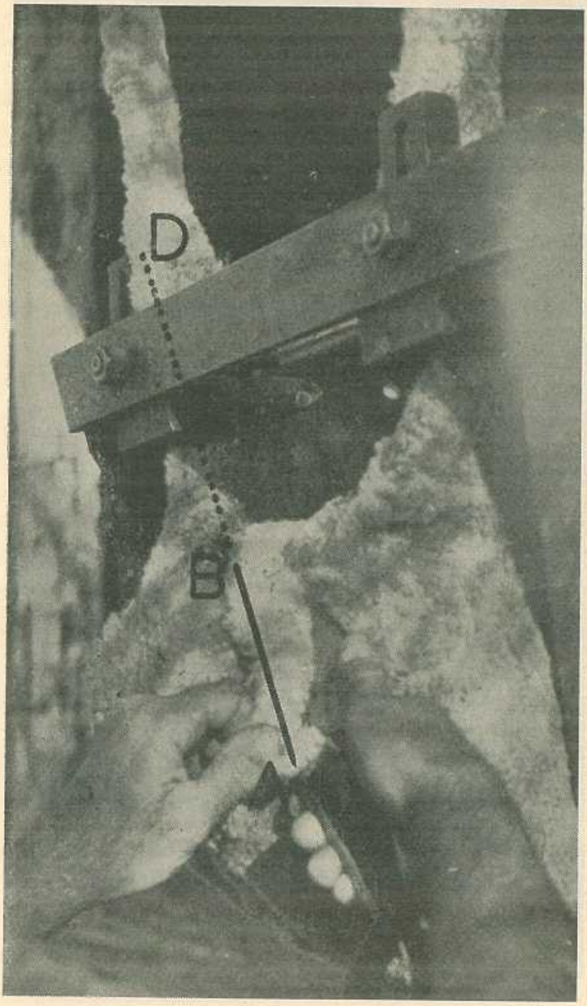


Plate 125.
SHOWING THE FIRST CUT IN THE STANDARD "PATTERN" FOR THE MULES OPERATION.

hand and drawn into the shears before the cut is commenced a "square end" results at A and this may heal or form a fold or pocket capable of holding moisture and thus inducing flies to strike.

The shears should be held firmly down on the sheep and the whole of the blade's length and not just the point should be used for cutting. It is important to take a new "bite" with the shears just opposite the "bare area." This ensures a good wide cut at that level.

In practice it is found that the shears are "rolled over" the pin-bone and then the new "bite" is taken and the turn up the *inside* of the crutch is made after the "bare area" is passed. Thus the inside edges of

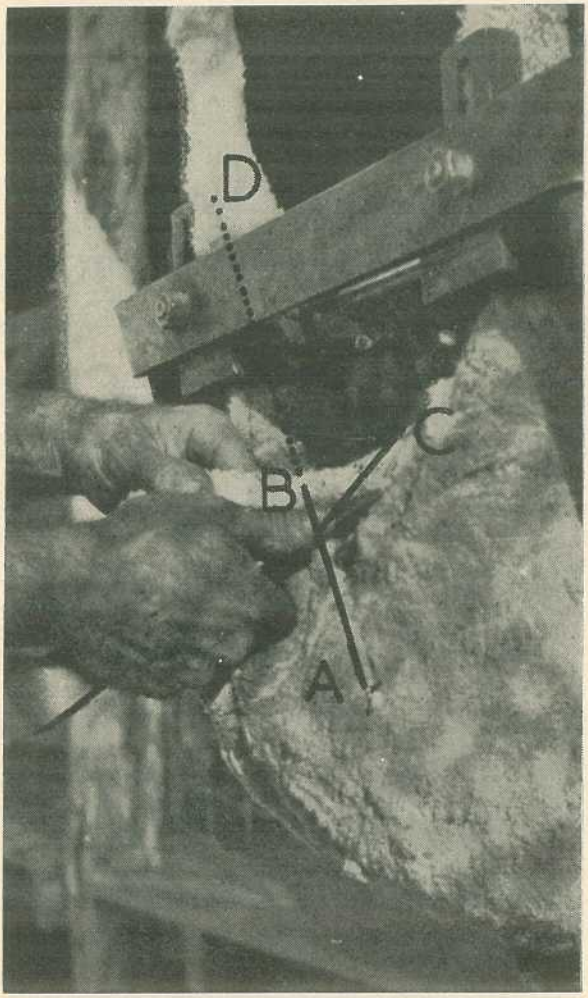


Plate 126.

SHOWING THE SECOND PART OF THE STANDARD "PATTERN" FOR THE MULES OPERATION.

the cuts are between 1 inch and 2 inches apart and about 1 inch to 2 inches below the tip of the vulva. Care should always be taken to see that the cuts run up the inside of the sheep's crutch—this removes any fold or wrinkle that may happen to be present in that part.

Shape of the Removed Skin.

The piece of skin that is removed in performing the operation is more or less kite shaped—pointed at each end and wide in the middle—and the more development the animal is carrying the wider this piece of skin should be.

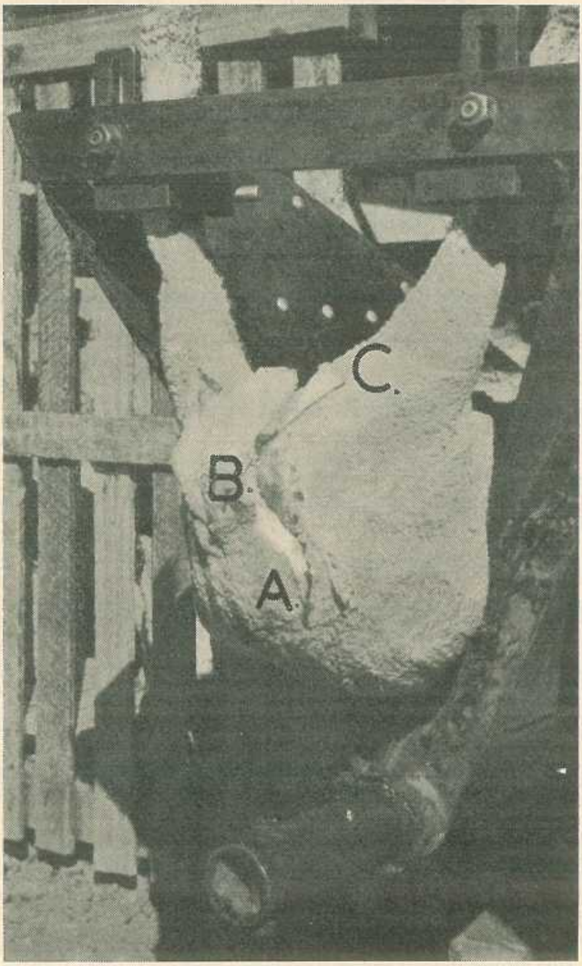
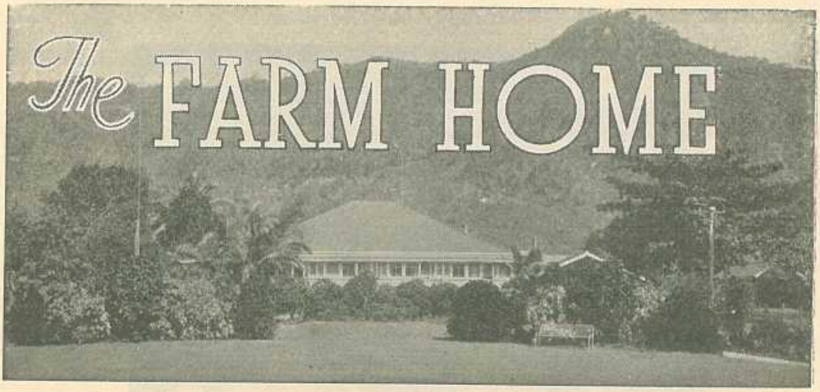


Plate 127.
SHOWING SHEEP AFTER THE RADICAL MULES OPERATION.

The beginner would be well advised to spend some time with an experienced operator before attempting to treat animals himself, but if this is not possible he should follow the pattern that is illustrated in the accompanying photographs.

As experience and confidence are gained it will be found that the shears can be run in much the same way as a tailor "runs" his scissors through cloth. This ensures faster work and neater cuts with clean edges, and it is less tiring to the operator.



Mother and Child.

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

MOTHER, MAKE BABYHOOD SAFER FOR YOUR BABY.

WITH every year that passes, motherhood is being made easier and safer. At the Clinics for expectant mothers established by the Government or Hospital Authorities or through the attention given in the consulting rooms of their own doctors, mothers may obtain advice calculated to ensure an uncomplicated pregnancy and the safe delivery of a healthy baby.

In addition, new discoveries in medicine have considerably reduced the risk of complications. It is now the responsibility of the mothers to make babyhood safer, and the first and most important step towards that end is for every mother to feed her baby herself.

The fact that early infancy is much safer for the baby who is fed by his own mother has been taught for many years and accepted by every person experienced in the care of babies either sick or well. It is an established fact that thousands of baby lives are lost every year directly or indirectly because these babies did not have the protection of their own mother's milk. Many of these babies were weaned unnecessarily because of the doubts of the mother who, often wrongly advised, was afraid that her breast milk was insufficient for the baby or did not agree with him.

Parents should understand that each mother's milk is created for her own baby. It is clean, free from germs, and is always at the right temperature. It passes directly from the mother to her baby, and so the risk of infection from bottles and teats is eliminated.

The death rate of breast fed babies is much lower than it is for those artificially fed. There is a greater protection from illness and a much better chance of a quick and complete recovery from illness should it occur.

The risk of digestive disorders is very small and the nutrition of the whole body is better. The mouth and jaws develop more satisfactorily, thus ensuring good dentition.

Surely in the heart of every woman with the right attitude towards motherhood there lies the belief that feeding her baby is but the natural completion of her work of bearing him, and a gift which it is her privilege to bestow and his right to receive. Pregnancy, birth and lactation form a complete cycle, which is broken abruptly if the mother fails to suckle her infant, to the detriment of the baby's health and frequently that of the mother also.

In time of war the preservation of infant life is a paramount duty and the mothers are in the forefront of the fight for its preservation. We ask the mothers to realise this responsibility and to allow no-one to minimise the importance of their task.

Given the proper care and instruction, every mother should be able to feed her baby and should take pride in the fact that not only is she capable of bringing a healthy baby into the world, but is equally capable of being a complete mother to him by giving him the food nature intended him to have.

Breast feeding is not necessarily as simple as it looks—it requires knowledge and a correct technique, together with an understanding that difficulties may arise. Should they do so, mothers are not asked to shoulder them alone. The Sisters of the Maternal and Child Welfare Service have been specially trained to assist mothers with this important work and those who are not within reach of a centre are invited to write to the Sister in charge of the Ante-natal Section of the Maternal and Child Welfare Service, 184 St. Paul's Terrace, Brisbane. These letters may be addressed "Baby Clinic, Brisbane," and need not be stamped.

IN THE FARM KITCHEN.

Some Tasty Dishes.

Meaty Circles.

Make a pastry with 1 cup self-raising flour and 1½ tablespoons dripping mixed to a dry dough with a little water; roll out very thinly. Skin two or three sausages and mix the meat with one teaspoon butter and enough warm water to make it soft. Spread pastry with mixture, sprinkle with pepper and salt, form into roll and cut into ¼-in. slices. Put circles flat on greased baking dish and cook a nice brown.

Spinach Soup.

Heat ½ oz. of butter and brown a finely chopped onion in it. Add 4 cups vegetable water, salt to taste, and cook a bundle of spinach in this till tender. Put through a sieve. Heat ½ oz. butter and stir in 1 oz. flour, adding gradually ½ pint milk and bring to the boil. Add sieved vegetable liquid, simmer for five minutes. Before serving, sprinkle with a little nutmeg.

Cheese Soup.

Grate an onion and cook with a knob of butter in a quart of milk and water (equal parts) for a quarter of an hour. Mix two tablespoons of flour with a little milk and add gradually, stirring all the while till the soup thickens, then season with salt and pepper and add grated cheese (4 oz.) and continue stirring till the cheese is melted (do not boil). Sprinkle with chopped parsley before serving.

Tripe Oysters.

1 pound fresh tripe	Pepper
Salt	1 beaten egg
Fine bread or cracker crumbs	2 tablespoons cold water

Clean honey comb tripe carefully and simmer it for one hour in water to cover. Drain and chill, then sprinkle with salt and pepper, and cut in oblongs the size of an oyster. Dip in fine crumbs, then in beaten egg to which the water has been added, then in crumbs again. Fry in deep fat until brown. Serve with a border of cold slaw, or slices or points of lemon with finely chopped parsley sprinkled over them.

Oxtail Soup.

2 or 3 oxtails	1 quart diced vegetables
Fat	Salt and pepper to taste
Bay leaf	

Wash the tails and cut into short lengths. Brown the pieces in fat, put them into a large kettle, cover with water, add a bay leaf, and simmer until the meat is tender enough to fall off the bones. Strain off the broth, and to it add diced vegetables, such as mixture of onions, carrots, turnips, and potatoes, and cook slowly until the vegetables are tender but not broken. Chop up the meat and serve in the soup. Season to taste and sprinkle with chopped parsley.

ASTRONOMICAL DATA FOR QUEENSLAND.

JUNE.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Date.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.30	5.00	Cairns	7	50	Longreach	26	43
6	6.32	5.00	Charleville	25	29	Quilpie	37	33
11	6.34	4.59	Cloncurry	36	63	Rockhampton ..	1	19
16	6.36	5.00	Cunnamulla ..	31	28	Roma	15	19
21	6.38	5.00	Dirranbandi ..	22	16	Townsville	8	42
26	6.39	5.02	Emerald	11	28	Winton	29	52
30	6.39	5.03	Hughenden ..	21	49	Warwick	4	4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Date.	Rise.	Set.
	p.m.	a.m.
1	9.39	10.41
2	10.41	11.27
		p.m.
3	11.43	12.09
4	..	12.49
	a.m.	
5	12.45	1.27
6	1.49	2.06
7	2.53	2.46
8	3.59	3.29
9	5.06	4.15
10	6.13	5.06
11	7.18	6.02
12	8.19	7.01
13	9.14	8.00
14	10.03	8.59
15	10.45	9.57
16	11.23	10.52
17	11.57	11.45
	p.m.	
18	12.29	..
		a.m.
19	1.00	12.37
20	1.30	1.28
21	2.02	2.19
22	2.37	3.12
23	3.14	4.06
24	3.56	5.01
25	4.43	5.58
26	5.35	6.54
27	6.32	7.48
28	7.32	8.39
29	8.34	9.26
30	9.36	10.10

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Date.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	26	12	43	27	18	2	50	30
6	19	20	35	36	10	11	40	42
11	12	28	27	43	1	19	29	52
16	14	23	30	39	5	14	34	45
21	23	16	39	31	14	7	45	36
26	28	11	44	26	19	1	52	29
30	24	14	40	29	15	4	46	33

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Date.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	47	8	62	36	47	22	38	9
3	39	16	56	42	41	27	33	16
5	34	26	54	47	38	33	29	22
7	23	37	46	56	31	41	21	32
9	13	46	39	61	24	47	13	38
11	8	50	37	63	21	49	8	42
13	8	48	37	62	21	48	8	40
15	13	42	39	59	24	44	13	36
17	20	34	44	54	29	39	18	29
19	29	31	51	51	35	36	25	26
21	38	21	56	45	41	30	32	19
23	46	13	61	40	46	25	37	14
25	50	7	64	36	48	21	41	8
27	50	6	64	35	48	21	41	8
30	41	14	57	41	42	26	34	14

PHASES OF THE MOON.

Last Quarter, 3rd June, 11.15 p.m.; New Moon, 10th June, 2.26 p.m.; First Quarter, 18th June, 12.5 a.m; Full Moon, 26th June, 1.08 a.m.

DISCUSSION.

On 23rd June the Sun will rise about 25 degrees north of true east and set about 25 degrees north of true west. This is the date of our winter solstice, when the Sun has a maximum declination north (23½ degrees). From now on, the direction of rising and setting will gradually become south until in September the Sun will rise true east and set true west. On 19th June the Moon will rise and set almost at true east and true west, respectively.

Venus.—In the constellation of Aries, Venus at the beginning of the month rises between 3 and 3.30 a.m., about 10 degrees north of true east. At the end of the month, still in the constellation of Aries, it will rise between 3 and 3.30 a.m. about 16 degrees north of true east.

Mars.—At the beginning of the month, in the constellation of Pisces, Mars will rise between 2.45 and 3.15 a.m., about 8 degrees north of true east. By the end of the month, in the constellation of Aries, it will rise between 2.30 and 3.00 a.m., about 16 degrees north of true east.

Jupiter.—This planet, at the beginning of the month in the constellation of Leo, will rise about midday and will be well up in the sky by nightfall. It will set about midnight. By the end of the month Jupiter will set between 10.30 p.m. and 11 p.m., about 5 degrees north of true west.

Saturn.—Early in the month Saturn will be visible low in the west during evening twilight, setting between 7 and 7.30 a.m. By the end of the month it will be too close in line with the Sun for observation.

AN ECLIPSE OF THE MOON.

An eclipse of the Moon differs from an eclipse of the Sun in that the Sun is a self luminous body, and during a solar eclipse the light from the Sun is cut off from us by the interposition of the Moon, the shadow of the Moon being thrown on to the Earth; whereas the Moon is not a luminous body, and during a lunar eclipse the shadow of the Earth is thrown upon the Moon, the Sun's light which causes the Moon to shine being cut off by the Earth. Again, solar and lunar eclipses differ in respect to the area from which they are visible and also the times of eclipse. The cone of shadow from the Moon is comparatively narrow and covers only a small area of the Earth's hemesphere over which it falls. Only from places within the shadow cone is eclipse visible and as the Moon and Earth continue on their journeys the shadow moves across the surface of the Earth. Thus, during a solar eclipse the Sun's rays are cut off from a limited area only and the time of eclipse and phase vary from place to place. At a lunar eclipse, however, we are watching a shadow cast on to the Moon, and, from wherever the Moon is above the horizon, all the phases are visible at the same absolute instant.

During almost all the night hours of 25th-26th June, the Moon will be eclipsed. She will enter the penumbra at 10.26 p.m. on 25th and first contact with the umbra will be made at 11.37 p.m.; after which there will be a marked darkening of part of the Moon's face. The area of darkening will grow bigger and bigger until at the middle of the eclipse, at 14 minutes past one on the 26th, about 9/10 of the Moon's disc will be darkened. The Moon will leave the umbra at 2.51 a.m. on the 26th and the penumbra at 2 minutes past 4 on the 26th.

QUEENSLAND WEATHER IN APRIL.

In the Peninsula South, Central Coast West, Darling Downs and Maranoa Divisions the district aggregate rainfalls were above average and in the South Coast and Warrego areas slightly below normal. Except for isolated North Coast stations all other sections of the State were well below normal with little or no rain in Western Divisions. Rainfall, where distributed, was patchy because of thunderstorms of variable amounts, but in the Maranoa, Downs and southern half of the Central Highlands the spread of beneficial totals of approximately two to three inches was fairly general. Useful falls were lacking along the dry southern inland border and soaking rain with mild temperatures would be welcome in those districts and other pastoral sections of the South-West, Central and Upper West and Central Interior where many stations show aggregate totals for the first four months of this year of only three to five inches, in some cases under two inches. In the south-east quarter agricultural districts seasonal conditions and prospects, to date, should be fair to good. Apart from drier patches about the Central Coast and adjacent inland localities rains of February and April were very favourable across the Downs. Some North Coast stations show aggregate rain totals for the first four months considerably in excess of the yearly average (Cairns 10,568 points (8,875), Babinda 18,393 points (16,617), Millaa Millaa 11,490 points (10,448), and Innisfail 15,281 points (14,378)).

Temperatures.—Maximum temperatures ranged from about normal to approximately 1.9 deg. above at Thargomindah and 1.1 deg. at Longreach. Minimum temperatures mostly slightly below, to .8 deg. above at Thargomindah and over 3 deg. at Longreach. Moderately sharp night temperatures early in the month were followed by milder conditions. First light frost Stanthorpe 5th, temperatures 35 deg.-29 deg. Cold nights 8th-10th. Bybera 45 deg.-36 deg. (9th), Tambo 39 deg.-34 deg., Herberton 48 deg.-41 deg.

The rain position is summarised below:—

Division.	Normal Mean.	Mean April 1945.	Departure from Normal.
	Points.	Points.	Per cent.
Peninsula North	659	456	31 below
Peninsula South	164	283	73 above
Lower Carpentaria	101	17	83 below
Upper Carpentaria	115	72	37 ,,
North Coast, Barron	788	439	44 ,,
North Coast, Herbert	822	537	35 ,,
Central Coast, East	288	97	66 ,,
Central Coast, West	145	186	28 above
Central Highlands	150	101	33 below
Central Lowlands	121	25	79 ,,
Upper Western	57	7	88 ,,
Lower Western	80	19	76 ,,
South Coast, Port Curtis	249	97	61 ,,
South Coast, Moreton	416	362	13 ,,
Darling Downs East	161	207	28 above
Darling Downs West	119	189	59 ,,
Maranoa	129	220	71 ,,
Warrego	110	99	10 below
Far South-West	86	5	94 ,,

Commonwealth Meteorological Bureau, Brisbane.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

MARCH RAINFALL.

(Compiled from Telegraphic Reports).

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	March.	No. of years' records.	March. 1944.	March. 1945.		March.	No. of years' records.	March. 1944.	March. 1945.
	In.		In.	In.		In.		In.	In.
North Coast.					*South Coast—contd.*				
Atherton	9·08	42	7·23	23·32	Gatton College ..	3·33	44	0·24	0·46
Cairns	18·16	61	11·42	48·13	Gayndah	3·10	72	0·12	0·78
Cardwell	15·77	71	12·66	41·96	Gympie	6·13	73	2·12	2·29
Cooktown	15·28	67	5·00	28·96	Kilkivan	3·90	62	0·16	1·92
Herberton	7·93	57	3·94	16·33	Maryborough ..	5·90	72	2·73	3·41
Ingham	15·99	51	10·07	39·85	Nambour	9·41	47	5·37	5·18
Innisfail	26·81	62	24·61	66·06	Nanango	3·42	61	0·48	0·41
Mossman	18·75	19	11·05	54·17	Rockhampton ..	4·48	72	3·01	1·28
Townsville	7·11	72	15·04	15·84	Woodford	7·90	55	1·08	2·80
Central Coast.					*Central Highlands.*				
Ayr	6·37	56	10·46	15·60	Clermont	3·16	72	1·22	0·50
Bowen	5·74	72	13·96	14·98	Springsure	2·97	74	0·62	0·45
Charters Towers ..	3·71	61	9·08	7·56					
Mackay	12·09	72	19·36	13·32	*Darling Downs.*				
Proserpine	12·17	40	23·84	20·78	Dalby..	2·74	73	0·07	0·54
St. Lawrence ..	5·41	72	5·24	2·55	Emu Vale	2·47	47	0·50	0·20
					Jimbour	2·43	64	0·30	1·05
South Coast.					Miles	2·74	58	0·33	0·34
Biggenden	3·98	44	0·79	1·01	Stanthorpe	2·59	70	0·41	0·27
Bundaberg	5·35	60	3·86	0·78	Toowoomba	3·78	71	0·65	0.65
Brisbane Bureau ..	5·67	93	1·36	1·29	Warwick	2·60	78	1·36	0·46
Caboolture	7·83	67	1·43	3·93					
Childers	4·84	48	1·26	1·10	*Maranoa.*				
Crohamhurst.. ..	11·12	50	3·06	4·27	Roma	2·72	69	0·09	0·11
Esk	4·72	56	0·20	0·91	St. George	2·15	62	0·26	0·03

CLIMATOLOGICAL TABLE FOR MARCH.

(Compiled from Telegraphic Reports.)

Divisions and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature.		Extremes of Shade Temperature.				Rainfall.	
		Mean Max.	Mean Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cairns	..	85	73	93	6	66	18	4,813	23
Herberton	..	76	64	87	8	53	25	1,633	24
Townsville	..	85	72	90	9, 10	61	15	1,584	13
Brisbane	29·97	83	67	91	6	62	14	129	9
Darling Downs.									
Dalby	..	86	60	94	9	53	14	54	1
Stanthorpe	..	79	55	86	9, 24,	43	14	27	3
Toowoomba	..	80	60	92	25, 26 9	51	29	65	5
Mid-Interior.									
Georgetown	29·80	89	72	96	27	63	26	738	11
Longreach	29·88	97	72	105	8, 9	61	23	3	1
Mitchell	29·93	90	62	102	9	53	23	..	..
Western.									
Burketown	..	92	74	97	6, 7	70	16	299	7
Boulia	29·79	98	70	105	8	62	7	..	..
Thargomindah	29·90	95	66	100	3, 4	58	13	38	3

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Commonwealth of Australia,
Meteorological Bureau, Brisbane.