Supplement to the "Queensland Agricultural Journal," March, 1952.

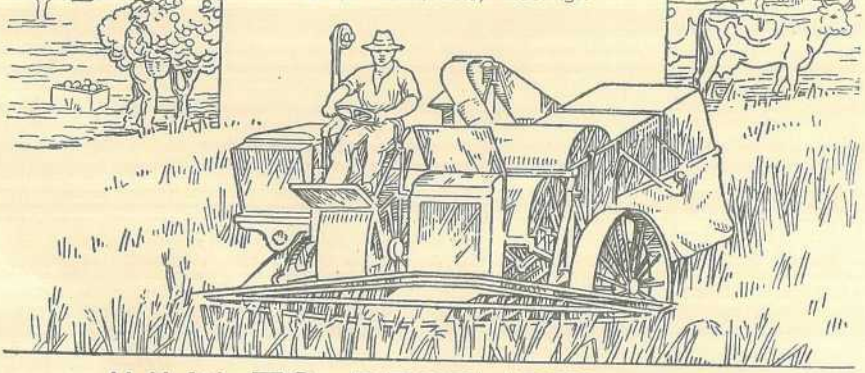
Volume 73

QUEENSLAND AGRICULTURAL JOURNAL

ISSUED BY DIRECTION OF

THE HONOURABLE
THE SECRETARY
FOR AGRICULTURE
AND STOCK

Edited by
C. W. WINDERS, B.Sc.Agr.



JULY TO DECEMBER, 1951.

Vol. 73 Parts 1 to 6

QUEENSLAND AGRICULTURAL JOURNAL

GENERAL INDEX.

INDEX TO ILLUSTRATIONS.

AUTHOR INDEX.

A. H. TUCKER, Government Printer, Brisbane.

VOL. 73. PART 1 JULY, 1951

DEPARTMENT OF AGRICULTURE

QUEENSLAND AGRICULTURAL JOURNAL

Flinders Grass—A Valuable Plant in Native Pastures.

LEADING FEATURES

Registered at the General Post Office, Brisbane, for transmission by Post as a Newspaper.

Volume 73 Part 1

QUEENSLAND AGRICULTURAL JOURNAL

Edited by
C. W. WINDERS, B.Sc.Agr.

JULY, 1951

Issued by Direction of
THE HONOURABLE H. H. COLLINS
MINISTER FOR AGRICULTURE AND STOCK

GOVERNMENT PRINTER, BRISBANE

Contents

Soil Conservation in Queensland.

8. Soil Conservation in Horticultural Areas.

J. E. LADEWIG, Senior Soil Conservationist, and A. F. SKINNER, Soil Conservationist.

ALTHOUGH the total area of land utilised for the production of horticultural crops in Queensland represents only a small percentage of the available arable land in the State, it nevertheless supports a high population density and is of considerable economic importance.

At present the chief centres of fruit and vegetable production in Queensland are located along the coastal fringe and in the Granite Belt. A large proportion of the land devoted to the production of these crops, particularly bananas, papaws and pineapples, is of very rugged topography, and this, when combined with high-intensity rainfall conditions, creates a serious erosion danger. As a result of the insidious process of sheet erosion, noticeable losses of topsoil have already occurred on large areas of this land, and on the steeper slopes of the coastal ranges there have been mass movements of land in the form of slips and creeps.

The present rate of decline in productivity of much of our horticultural land, due to erosion, is such that the adoption of measures for its prevention are an urgent necessity. Where it cannot be prevented entirely, steps should be taken to extend the life of the land to the maximum extent possible.

Many horticultural crops are perennials and therefore opportunities exist for the protection of the soil by such means as cover cropping and stubble mulching. Since the area devoted to horticultural crops on a farm is usually small, the planning and implementation of complete soil conservation programmes is accordingly much easier and cheaper than for larger agricultural holdings.

In the past, clean dust mulch cultivation was the rule rather than the exception and was based on the erroneous belief that the loss of soil moisture by evaporation was reduced by this type of cultivation. In actual fact the exposure of bare and finely tilled soil provided perfect conditions for erosion. Fortunately most orchardists now know that a protected soil will not erode, and cover cropping is being practised to a greater extent than formerly.

Plate 1.
A North Coast Banana Plantation Where Contour Planting, Cover Cropping and Mulching Procedures are Practised.

Plate 2.
Erosion in a Papaw Orchard Where Square Planting has been Practised.

Where there is a risk that cover crops will result in undue competition for soil moisture, stubble mulch procedures may be adopted either partly or wholly. Some orchardists have, with success, adopted the practice of growing Sudan grass or a similar crop in an area adjoining the orchard and, when mature, mowing the crop and transferring it to the orchard area to form a mulch up to six inches deep. This mulch is sufficient to suppress weed growth and reduce evaporation, and it certainly prevents erosion.

Where competition from cover crops is likely to affect a crop, it is sound practice to mow or lightly disc the cover crop and leave it on the ground surface as stubble mulch in order to reduce the erosion hazard.

SOIL CONSERVATION IN ORCHARDS AND VINEYARDS.

The prevention of erosion in new orchards or vineyards presents few problems if the landowner plants the trees on the contour and is prepared to adopt cover cropping and stubble mulching procedures designed to protect the soil and ensure maintenance of soil structure and fertility.

The orchardist accustomed to square planting systems may at first be confused by the apparent complication of contour layouts; the necessity of surveying of planting lines, provision of water disposal outlets and construction of contour banks may appear to be an unnecessary addition to the establishment programme. However, experience will show that this type of layout is easily applied, that cultural operations are simplified and that the benefits conferred through the conservation of soil and water far outweigh any apparent disadvantages.

Contouring.

The planting of orchards on contour lines is a most important requirement for the application of soil conservation practices to these lands. Contour planting means planting on a level or true contour line, or, as is more usual, planting along a line with a slight fall which is sufficient to enable surplus runoff to move across the field without scouring or carrying soil. This gradient normally should not exceed 6 inches per 100 feet but in special circumstances may be increased to 2 feet per 100 feet.

When contouring is practised, all cultivation operations are carried out on the contour or level. This ensures the pondage and absorption of a maximum amount of rainfall, and runoff and erosion are reduced to a minimum. This is in contrast to the square system of planting where up and down slope cultivation, on at least some sections of the area, is unavoidable; under these conditions runoff water finds a ready outlet, the velocity of the water increases rapidly because there is nothing to impede its downslope movement, and soil is carried away.

Where the land slope is comparatively gentle or the soils have a high absorptive capacity, and rainfall is not excessively heavy, erosion can be prevented by the adoption of contour planting and the associated contour cultivation, provided cover cropping and stubble mulching is practised to the maximum extent. However, in many of the horticultural areas of the State these conditions do not apply and it is necessary to provide additional protection by the construction of water diversion structures such as contour banks.

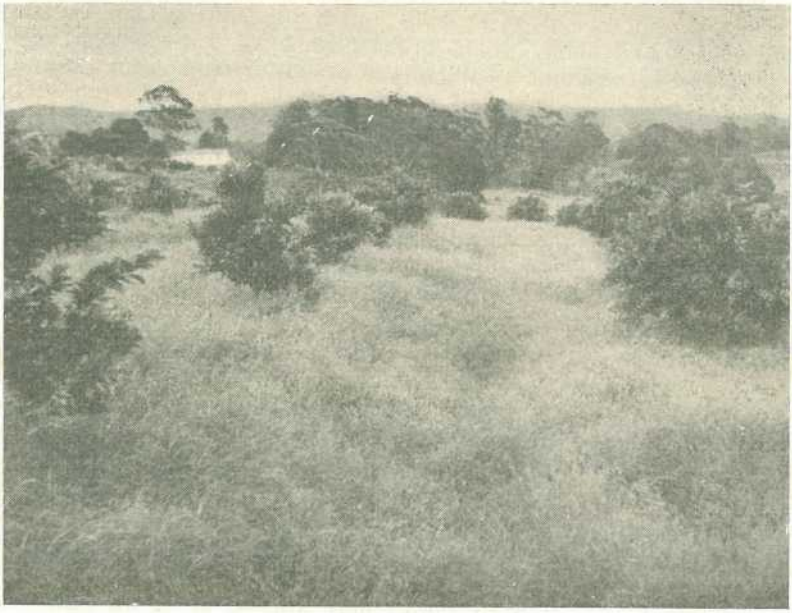


Plate 3.

A Citrus Orchard Planted on the Contour. The cover of vegetation protects the soil from the intense summer rains. Each row of trees is planted on a contour bank.

Since contour banks permit the diversion of runoff water to the disposal site, it is most important that prior provision be made for the safe disposal of water before the construction of banks is commenced. Where well grassed areas adjoin the orchard, the water from contour banks can be spread on grass, to the benefit of the pasture and without danger of causing erosion. In intensively settled areas, such disposal sites are not always available; in these cases the construction of a waterway and the establishment of vegetation thereon is a necessary pre-requisite to the construction of contour banks. Methods of constructing and vegetating these waterways were described in an earlier part of this series of articles.

Contouring the Orchard.

The method of contouring a new orchard will vary according to the topography of the land. In an area with regular slopes it is simply a matter of surveying, at the upper edge of the field, a contour line with the appropriate gradient to carry water to the outlet point. At intervals of 100 to 150 feet down the slope (depending on soil type and degree of slope) further bank lines are surveyed on the same gradient. Contour banks are constructed on these lines, which then serve as "key" lines, and tree rows are established in relation to them.

The bank spacing recommended above applies only to areas of moderate slopes; further, the success of banks spaced at this width is dependent upon a system of inter-row drainage, which can be assured by opening a substantial furrow between each contour row of trees.

On slopes exceeding 8 per cent. this protection is inadequate and it is then preferable to construct a series of banks corresponding to each tree row. Since they are closely spaced, these banks are usually smaller than for lesser slopes. Mechanical soil drift which is inevitable on steep slopes gradually builds up against these banks and eventually a bench terrace is formed.

Fields which can be designed as simply as described above are a rarity in the State, and where there is any marked variation in land conformation, irregularity will occur in width between banks; to achieve the best layout in cases such as this it is necessary to first prepare a contour map of the area. Variations in width of contours are clearly shown on such a plan, enabling the development of the most effective layout and the most efficient utilisation of the land prior to commencement of work in the field.

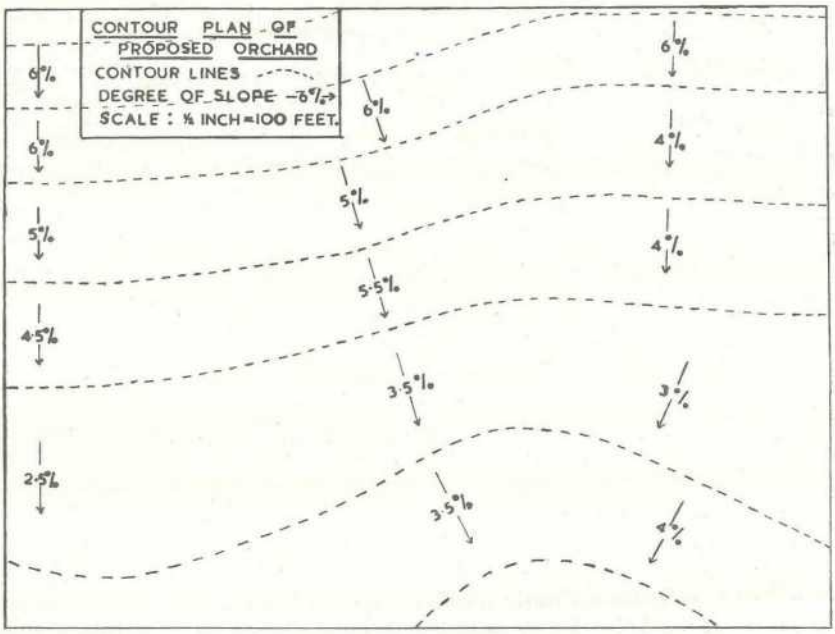


Plate 4.

Contour Plan of a Proposed Orchard.

Plate 4 shows a contour plan of a proposed orchard and Plate 5 illustrates the final layout.

The advance preparation of a contour plan is a good investment and can be done most easily by first pegging a 50-foot grid over the entire paddock. Levels are taken at each peg and a contour plan is prepared from this data. This plan is necessary for the careful and accurate designing of contouring systems, including the location of waterways, access tracks and fences. Contour bank lines and tree rows are plotted tentatively on the plan, various layouts being tried experimentally and finally the most satisfactory one chosen. This plan is taken into the field and appropriate distances (as determined from the plan) measured from the various grid pegs to establish the lines for

the contour banks and tree rows. Since minor errors may occur it is desirable to check the accuracy of bank lines to ensure that correct gradients are allowed within the tolerance of 2 inches per 100 ft. to 2 feet per 100 feet.

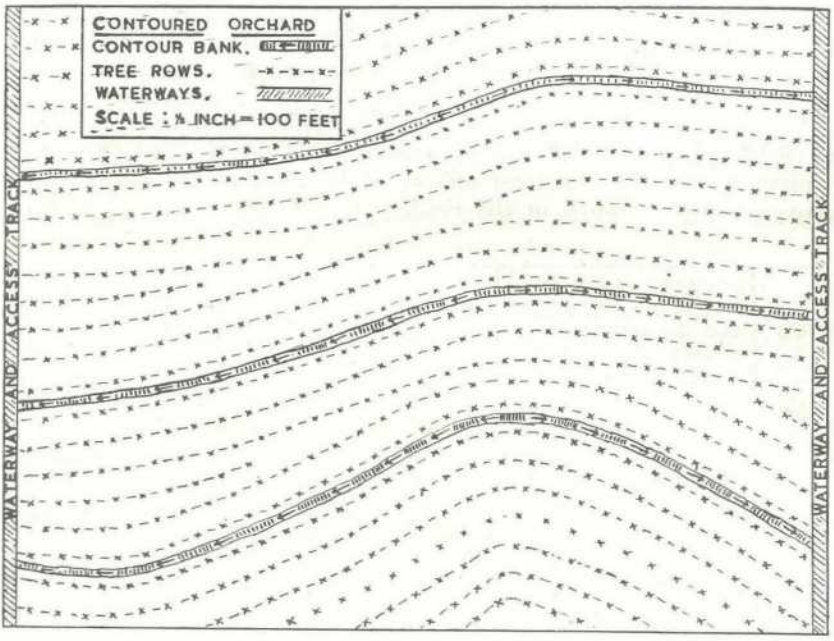


Plate 5.

Conservation Plan for the Orchard shown in Plate 4.

Where a surveying service is not available, it is practicable for a landowner to carry out a reasonably accurate grid survey utilising improvised equipment. One of the many types of improvised levels may be used; these include simple builders' levels, a spirit level attached to a tripod, a water tube level, or even a long length of hose filled with water.

Planting Trees on the Contour.

Having established "key" lines by the construction of contour banks, two alternatives are available for the planting of the trees in relation to the contour banks. A tree row may be established along the crest of the bank, or alternatively one row may be planted above and parallel to the channel and the other row immediately below the bank. The latter system was the one used most in early soil conservation work but there has been a trend in recent years towards the planting of a row along the crest of the bank. This provides a very satisfactory site for establishment purposes but bank maintenance is made more difficult in later years because of the tree canopy. The soil moved in bank maintenance may also result in the burial of the stock-scion union with possible detrimental effects in the case of citrus, custard apples and avocadoes.

Once the "key" planting lines are established the remainder of the orchard may be planted in one of two ways:—

(1) The second line is established at the appropriate spacing below the key line and parallel to it; each row is then spaced downslope from this until part or all of a row closes to within the determined spacing distance from the key planting line of the bank below. Where the interbank spacing is irregular in width it may be necessary to plant one or more short rows to fill in the widest part.

(2) The second row is established as above but the following row is run parallel to the key planting line of the bank below. Planting lines are then run parallel to both upper and lower lines until part or all of a row closes to within the predetermined row spacing distance. Short rows, if necessary, are then planted, but in this case they are located in a centre position between two banks whereas in the first method they are immediately above the lower bank.

Contouring an Established Orchard.

The contour planting of trees is obviously not applicable in established orchards, but it is still practicable to take steps to reduce the erosion incidence.

Waterways are planned, constructed and vegetated as in the case of new orchards and provision is made to intercept runoff by means of contour banks. The spacing, position and gradient of these banks is determined so that they will cause the minimum of dislocation. It is necessary to remove some trees, but this can be minimised by careful

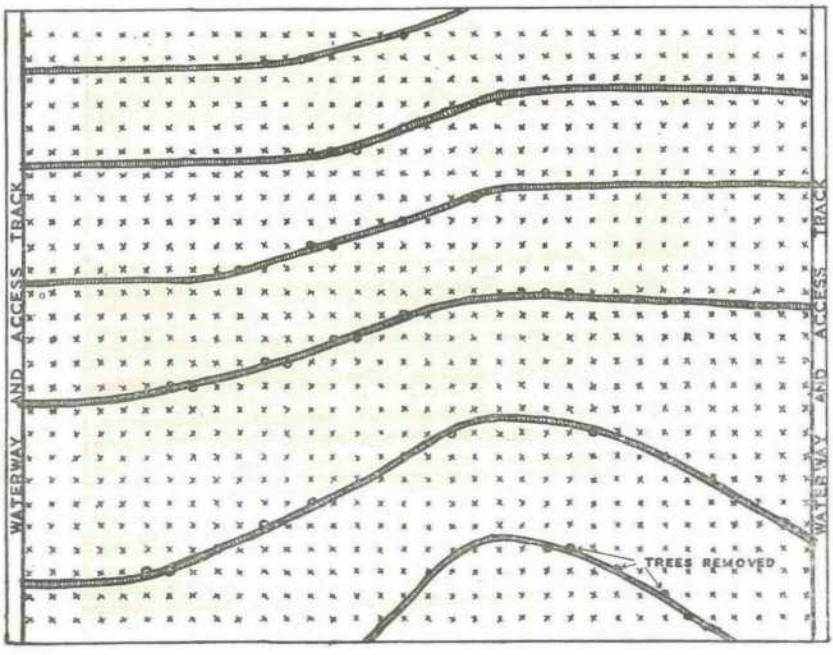


Plate 6.

Contour Plan for an Established Orchard.

selection of gradients and spacing of banks within the permitted tolerance. On average slopes the distance between banks may vary from 60 feet to 120 feet, and bank gradients within the tolerance of 2 inches per 100 feet to 2 feet per 100 feet.

Because of the necessity to avoid damage to trees, a narrow type of bank is constructed with a relatively deep narrow channel above.

Plate 6 illustrates the application of contouring principles to an established orchard. The topography of the land is the same as in Plates 4 and 5, but it will be noted that additional banks are required as illustrated in Plate 6 because contour cultivation cannot be practised to the same extent. The trees which have to be removed to accommodate the contour banks are indicated by a circle; in this particular case it is necessary to remove only 5 per cent. of the trees.

SOIL CONSERVATION IN BANANA PLANTATIONS.

Most of Queensland's banana land is located on the very steep slopes of the coastal ranges in the south-east.

The practice has been to clear the scrub of forest and, following the burn, to plant the bananas between the remaining stumps and logs. The slopes utilised are rarely less than 30 per cent. and frequently exceed 50 per cent. The areas are consequently completely unstable when the protective scrub cover has been removed. These areas are subject to sheet erosion rather than gullying but the most serious problem on the steeper slopes is that of landslides.

The utilisation of these steep slopes for what is virtually clean cultivation is completely contrary to principles of correct land utilisation; no conservation action, with the possible exception of bench terracing, can avert the eventual abandonment of these lands.

Plate 7.

A Banana Plantation Planted on the Contour, Showing a Contour Interception Drain.

Their life may be extended by the adoption of cover cropping to the maximum extent, utilising leguminous crops wherever possible. It is quite practicable to adopt a system of contour planting similar to that described for orchards; instead of contour banks, however, it is necessary on steep slopes to open a narrow deep contour drain in approximately every second row. The soil from the trench is disposed on the upper side and suitable grass filter strips established in the mound of soil. Soil moving down the slope is trapped against the mound and in the filter strip, eventually leading to the development of a modified type of bench terrace.

Logging of the slope on the contour, the disposal of discarded banana plants on the contour, and the maximum use of crop residues for the protection of the soil surface, all assist in reducing the incidence of sheet erosion.

Landslides or slip erosion will still occur despite the measures listed, and it is this type of erosion which ultimately has the most serious effect on the productivity of these banana lands.

There is no known control for this type of erosion, but these areas may be profitably utilised for forestry purposes because the deep penetration of tree roots tends to anchor the soil mass in place. Slips will still occur occasionally even under forest cover, but the incidence will be considerably reduced.

Plate 8.

Pineapples Planted on a Bench Terrace.

SOIL CONSERVATION IN PINEAPPLE AREAS.

The specialised requirements of this crop in respect of both soil moisture and temperature make it most difficult to design complete soil conservation measures.

Because of its sensitivity to low temperatures, this crop is normally grown on the sloping lands of the south-eastern coastal fringe; the slopes in use commonly exceed 20 per cent. and occasionally exceed 50 per cent. Slopes such as these are unstable under clean cultivation conditions and *permanent* conservation of soil cannot be effected without resort to practices such as bench terracing. Although these lands are normally cleared of stumps and timber, bench terracing is scarcely a practicable procedure at this stage because of the cultural disabilities involved.

The success of the bench terrace in countries such as China and the Philippines over a period of hundreds of years is evidence of the stability of this type of structure when supported by correct horticultural practices. Bench terracing is more suitable under conditions where labour is cheap and the major part of the cultural operations is executed manually. Since a major alteration of cultural methods is necessary to enable the utilisation of bench terracing for Queensland conditions, it is preferable at this stage to consider other less permanent methods of control which will result in a lesser dislocation of cultural practices.

Two main methods of control may be utilised:—

(1) Contouring.

(2) Cross-sectional drains.

Contouring.

This method of control is still in the developmental stages in this State, but where it has been applied it has effected a very satisfactory degree of control. On the shallow soils there is a possibility that the increased penetration of moisture resulting from contouring practices may produce conditions not entirely favourable for pineapple growth. However, unsatisfactory growth is usually associated with these soils even with up and down slope planting and it is probable that the utilisation of subsurface drainage systems will be necessary for satisfactory pineapple production on these soils.

Of the range of contouring practices which may be utilised, probably the most satisfactory for Queensland conditions involves the construction of a modified type of contour bank. Because of the steep slopes it is necessary to construct a comparatively narrow bank with a deeper and narrower channel than is normally used on the more gentle slopes.

On steep slopes erosion will occur from the downslope movement of water over comparatively short distances and consequently the construction of contour banks alone, even at the closest practicable spacing, will not prevent major soil movement. It is therefore necessary to intercept the runoff at each row and transfer it along the inter-row space to the outlet or waterway. Under these conditions the maximum downslope movement of water does not normally exceed six feet, and a comparatively small inter-row furrow is sufficient to ensure the safe flow of this quantity of runoff.

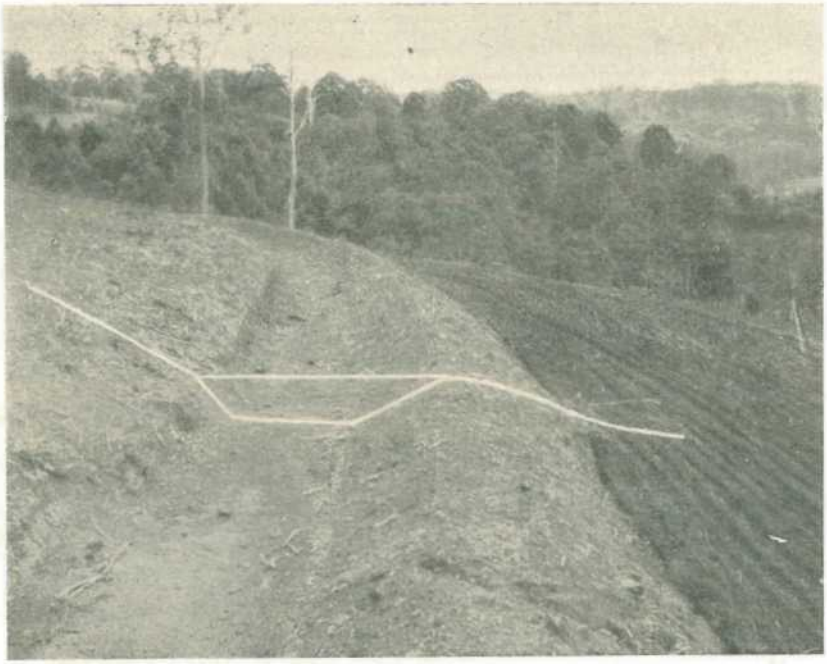


Plate 9.
Type of Contour Bank Suitable for Use on Steep Slopes.

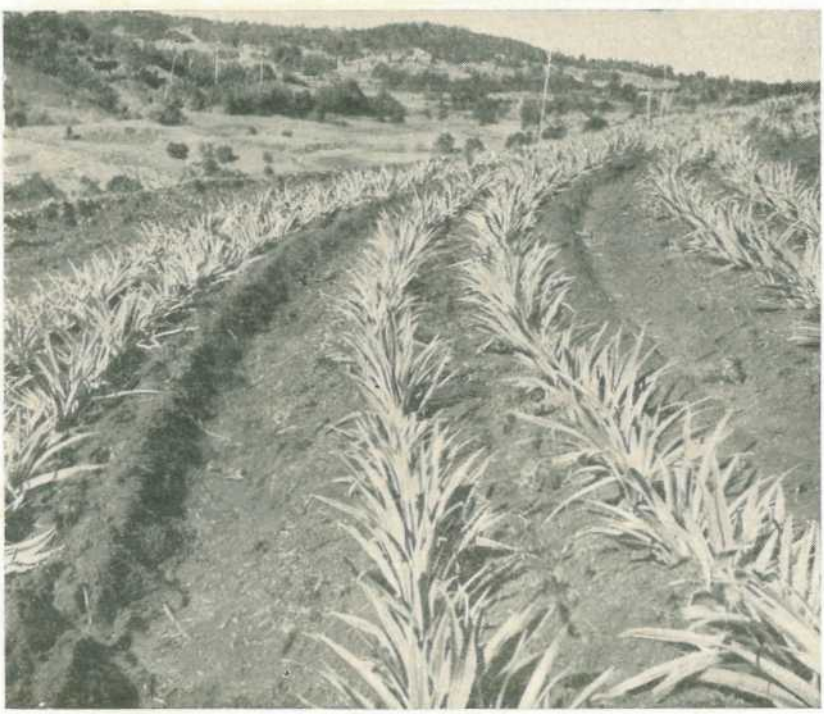


Plate 10.
Pineapples Planted on the Contour With Interception Furrows Between Each Double Row.

Since the runoff is intercepted in smaller quantities it is also practicable to increase the fall of gradient of the rows without causing scouring. This point is of considerable importance in designing structures necessary to reduce erosion to a minimum but at the same time prevent oversaturation of the soil.

Plate 11 illustrates a typical contour layout applied to a 25 per cent. slope.

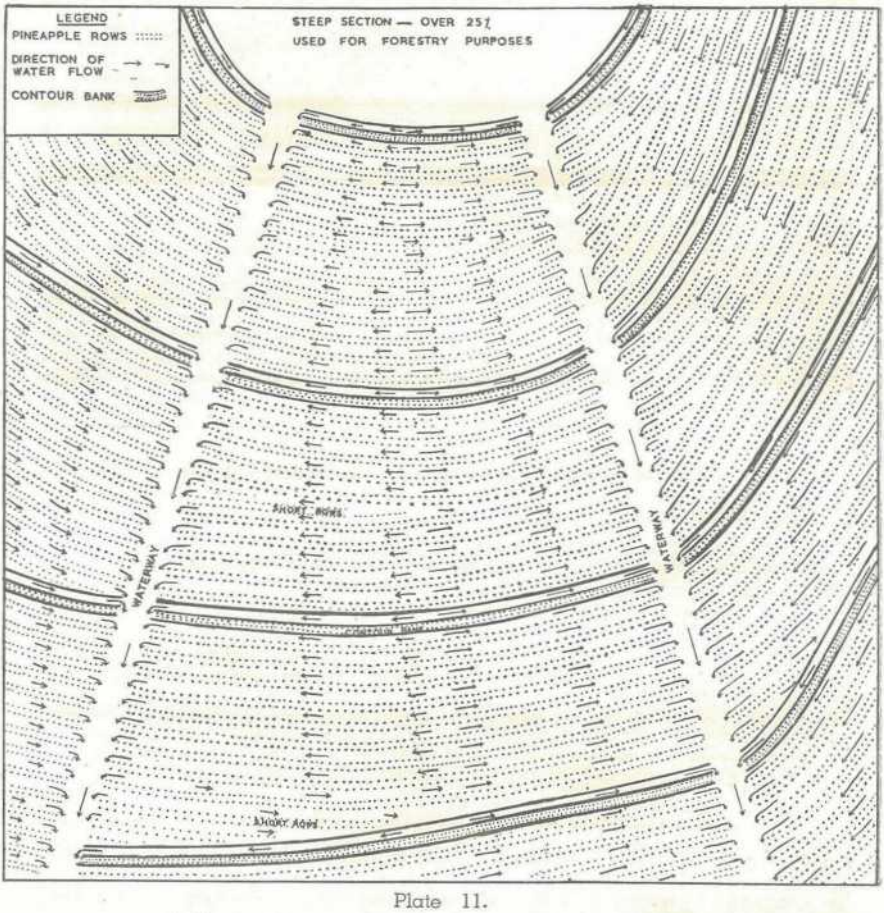


Plate 11.

A Contour Layout for Pineapples on a 25 per cent. Slope.

The method of bank construction will vary according to the type of equipment available for the work; where a suitable type of grader ditcher is available a comparatively large bank is constructed with a water carrying cross-section of approximately 4 square feet. In this case a bank spacing of approximately 70 feet may be adopted. Where grader equipment is not available a smaller bank may be constructed by the utilisation of a single furrow mouldboard plough for opening up and loosening the soil; excavation is done with a shovel and the soil deposited to form a bank below the furrow. The cross-sectional capacity of these banks rarely exceeds 2 square feet, and consequently a much closer spacing is required; the normal spacing in this case is approximately 35 feet.

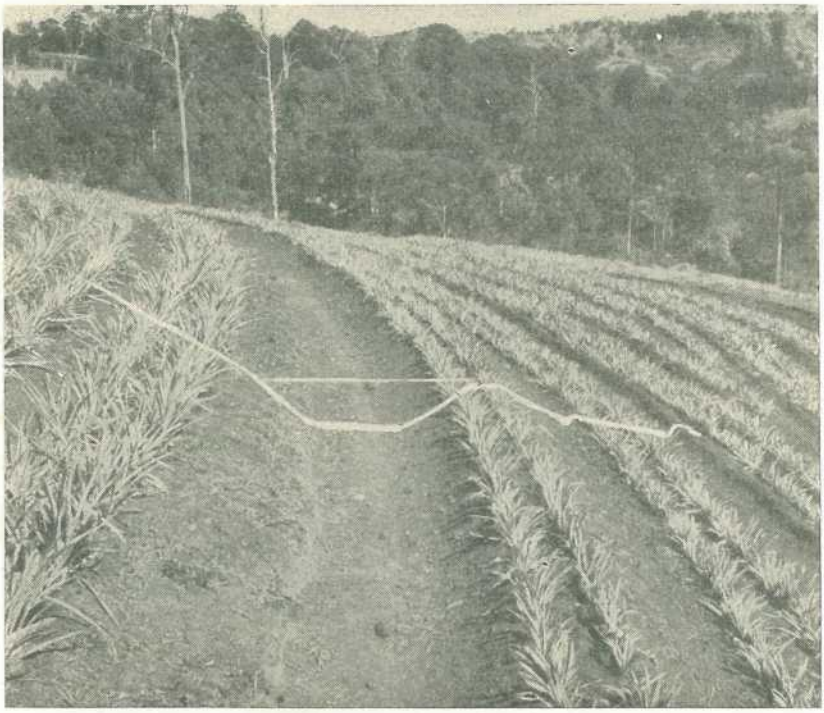


Plate 12.

The Section Shown in Plate 9 After the Pineapples Have Been Planted.

Application of Contouring Practices.

The provision of a stable water disposal system is a very necessary pre-requisite; in the interests of safety of control works and efficiency of harvesting it is desirable to limit the length of banks to a maximum of three to four chains and the position of waterways is determined in accordance with this factor. A combined waterway and access track spaced at this distance enables efficient water disposal at both ends of the bank and fruit has not to be carried more than 1½ to 2 chains to a roadway during harvesting.

Where waterways are also to be utilised as roadways, care in design and establishment is most necessary to prevent the development of gullies at a later stage. The waterways are constructed about 12 feet wide, with both edges level, but with a pronounced dish towards the centre; the bottom of the waterway should be at least 9 inches below the surrounding land to assist drainage from the contour rows. Kikuyu or buffalo grass sod is established over the entire waterway, and when the grass cover is complete, water from contour rows and banks may be carried without danger of scouring. Wheel vehicles are utilised for harvesting and transport and since the wheels straddle the main water-carrying section the danger of erosion along wheel tracks is minimised. This type of design is not suitable where slides are used for transport because of their destructive effect on vegetation, and in this case it is necessary to provide a roadway intermediate between two waterways, and bank gradients are designed to transfer all runoff from the roadway towards the waterways. In this case the waterway width may be reduced to eight feet for drainage areas not exceeding two acres.

Plate 13.

A Combined Waterway and Access Track.

Planting on the Contour.

Because of the curving rows involved in contour planting it is not practicable to use a planting line as for the normal square planting systems. However, since contour banks are constructed in advance of the planting programme they provide convenient base lines which will ensure the correct gradient of the pineapple rows.

The pineapple rows may be planted parallel to the bank above, and where there is a variation in the width of the bank interspace short rows will end at the contour channel. An alternative system is to plant parallel to the upper and lower banks, with short rows finishing in the centre of the bank interspace.

Cross-Sectional Drains.

This method of control was developed many years ago and where it has been applied carefully and systematically has resulted in a considerable reduction in the erosion incidence. A very serious disadvantage associated with this type of control is the continued loss of soil by sheet erosion because the pineapples are planted in straight rows which usually run up and down slope, though occasionally they are planted parallel to or at a slight angle to the drains.

The design is simple and involves the excavation of a number of shallow drains on a herringbone pattern; these drains are spaced approximately 40 feet apart and parallel to each other and drain towards a main disposal channel. The drains are often designed on an excessive gradient to prevent siltation and consequently result in greater soil losses than would normally occur under contoured systems of control.

Plate 14.

Showing the Location of Short Rows in a Centre Position Between Two Contour Banks.

Cross-sectional drains are suitable for use on shallow poorly drained soils, but it is essential to minimise soil loss by the systematic adoption of mulching procedures.

Mulching.

Earlier discussions have indicated the value of protecting the soil surface and in pineapples this can be achieved most effectively by utilising sawdust, crop residues or grass to provide a protective surface mulch. If this protection is systematically applied, the soil pounding and raindrop splash effects are eliminated and soil movement minimised. The increased infiltration rate ensures a maximum absorption of rainfall and water diversion structures such as contour banks and waterways are able to more effectively protect the land during periods of excessive rainfall.

The introduction of new weedicides in recent years has facilitated the control of many weeds, and the application of mulch may now be made without the former disadvantage of interference with chipping operations.

SOIL CONSERVATION IN VEGETABLE GROWING DISTRICTS.

The control and diversion of runoff presents only minor problems in vegetable growing districts because the area of the farms usually does not exceed a few acres. There are, however, many secondary problems involved in the design of measures which will prevent erosion and at the same time result in a minimum of dislocation of current horticultural practices.

The fixed spray-line irrigation system is the one most commonly used for vegetable production, but this system has only a limited degree of flexibility and the maximum irrigation range normally does not exceed a line 16 to 20 feet from and parallel to the position of the spray lines. Since the spray lines can be installed along a contour bank line, for convenience in cultivation, it is most important in soil conservation design to ensure that contour banks are installed parallel to each other where practicable and also that the distance between banks conforms with the width effectively watered from each spray line. Where the irrigation coverage is 40 feet, contour banks are designed on either a 40 feet or 80 feet spacing.

Since most contour lines curve in accordance with land conformation a soil conservation design invariably requires some curves in the spray lines. This is minimised where practicable by the adjustment of bank gradients within the limits of 2 inches per 100 feet to 2 feet per 100 feet. Where $\frac{3}{4}$-inch spray line is utilised the bends do not present serious difficulties, but where larger piping is used the fitting of a semi-flexible coupling at bends is a necessary requirement.

Contouring.

Prior to the design of soil conservation measures it is necessary that a contour plan of the area be prepared. The base plan is prepared as described for orchards, and the position of waterways, access tracks, contour banks and spray lines is superimposed to form the complete conservation plan.

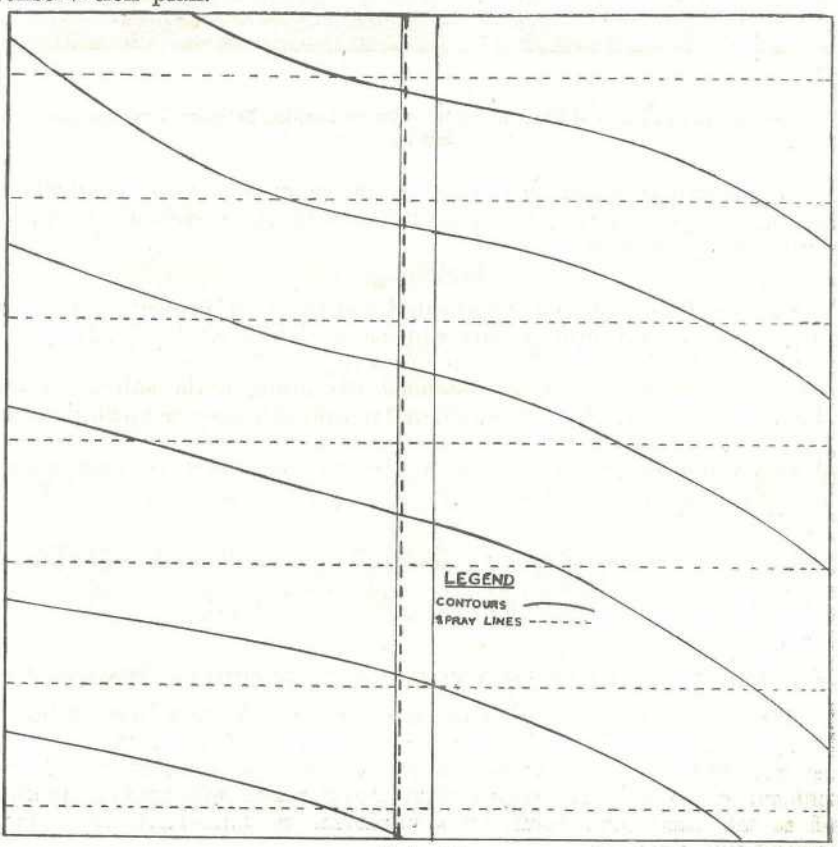


Plate 15.
Contour Plan of Vegetable Farm.

A number of trial designs are fitted to the contour plan until the most acceptable layout is determined.

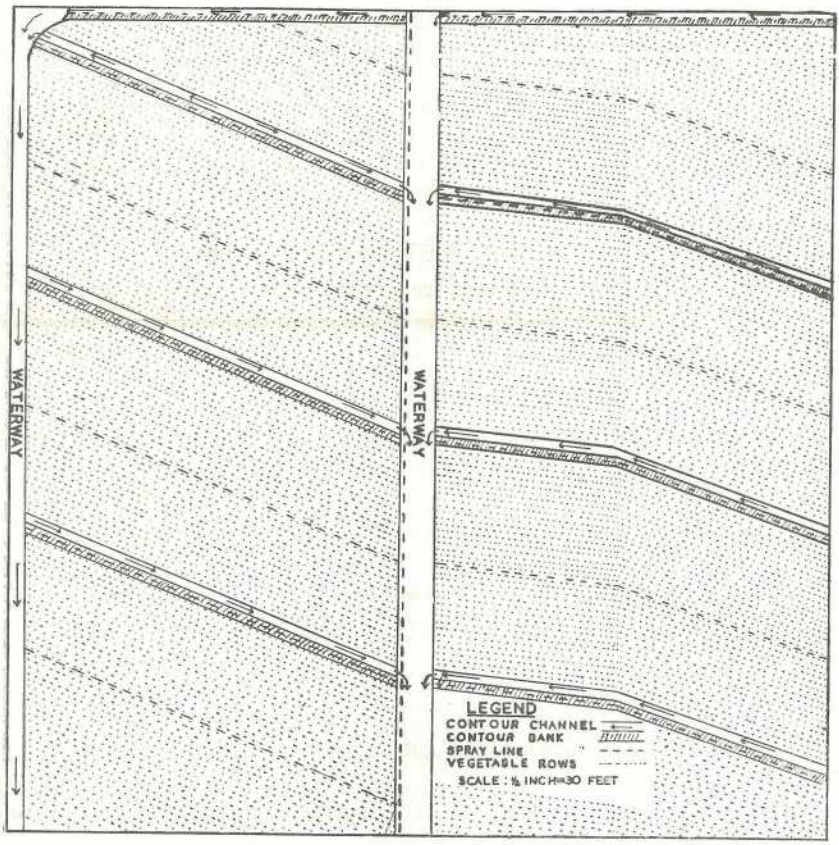


Plate 16.

A Contour Layout Applied to the Area Shown in Plate 15.

The provision of stable waterways is a necessary requirement; a concave waterway as described for pineapple areas is the most suitable and where practicable should be constructed so that the bottom of the waterway is nine inches below average ground level. Buffalo, couch and kikuyu grasses are the most suitable for these waterways but because of their vigorous growth habits they require careful management in small crop areas; for this reason Rhodes grass is preferred.

The type of contour bank constructed will depend on the bank spacing; where an 80 ft. spacing is used a broad-base bank is constructed with plough or small grader, but for a 40 ft. spacing a small, narrow bank is sufficient and is more suitable where the construction work is done mainly with the single-furrow plough and shovel.

The plant rows are established parallel to the contour banks and, where practicable, it is desirable that each row should carry a maximum amount of runoff towards the waterway. Bedding or hilling procedures will assist considerably in ponding the maximum amount of runoff between the rows and safely transferring the excess to the waterway.

Irrigation efficiency can be considerably improved on sloping lands where contouring is practised because of the better opportunity for infiltration.

Agronomic Practices.

The almost continuous clean cultivation involved in vegetable production, and the regular succession of crops on the one piece of land, tend to cause a rapid deterioration in soil structure. Since the infiltration rate also decreases under these conditions a most important requirement for the successful application of soil conservation measures is the adoption of practices which will lead to an improvement in soil structure and the capacity of the soil to absorb and retain moisture.

The primary requirements for these purposes are:—

(1) The retention of crop residues to the maximum extent.

(2) The adoption of regular cover-cropping and green manuring procedures in which leguminous crops and cereals are utilised.

(3) The adoption of crop rotations which will ensure that the land is "rested" under a cover of grass or a dense legume such as pigeon pea for a period of three years in ten.

HORTICULTURAL EXPERIMENT STATION WORK.

Fruit and vegetable growers are invited by the Horticulture Branch of the Department to visit the experiment stations at Ormiston and Nambour to examine investigational work in progress at those stations.

The official visiting days are Fridays at the Redlands station at Ormiston, and Tuesdays at the Maroochy station near Nambour. On these days officers are available to conduct parties around the properties and to explain the work in progress. Where practicable, the manager should be advised by telephone or letter of contemplated visits.

The Redlands station is concerned primarily with plant nutrition and soil problems affecting the fruit and vegetable industries in the Redlands district. The Maroochy station deals mainly with the problems of fruit production on the North Coast, with particular attention at present being given to pineapples, papaws and bananas.

The planting of horticultural crops on the contour is a feature of the Maroochy station, and growers who have their plantations on sloping ground will find much of interest in the contour-planted bananas and pineapples on the station.

Green Panic Grass.

S. MARRIOTT, Agrostologist, and W. J. WINCHESTER, Senior Adviser in Agriculture.

GREEN panic grass (*Panicum maximum* var. *trichoglume*), also known in Queensland as fine stemmed Guinea and slender Guinea, is a variety of the common Guinea grass. As the name suggests, these grasses are natives of Africa, but they are now common in many tropical countries.

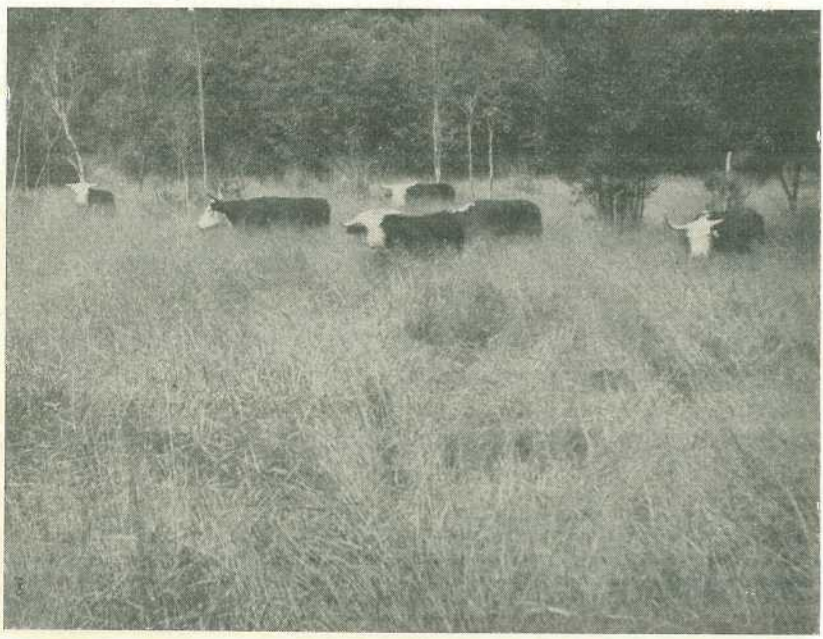


Plate 17.

Topping Off Herefords on Green Panic on "Madoora," Gayndah.—The paddock had been spelled for three months before grazing.

Green panic covers a considerable area in the Central Burnett, where its use on a commercial scale was pioneered by Mr. A. A. Petrie, of "Madoora," Gayndah, who over a period of some 15 years has established it on approximately 800 acres for grazing purposes. The

grass is also grown on the Atherton Tableland and adjacent country, while in trial plots which have been established in most of the State's dairying districts, it has in many cases shown distinct promise.

Description.

Like Guinea grass, green panic is a tall, tufted, summer-growing, perennial grass with an open type of seedhead, or panicle, which may be up to nine inches in length. Compared with common Guinea, green panic has a much finer stem and leaf, while its spikelets ("seeds") are covered with fine hairs, this latter character being used for botanical identification. When ungrazed it may reach a height of five feet or more under favourable conditions.

There appear to be several forms of the variety, and in observation plots variations in rates of growth, particularly following mowing or grazing, have been noted. Some seem markedly superior to the commercial standard variety in this respect but no seed of these new strains is yet available for general use.

Climatic Requirements.

Green panic makes its main growth during the summer. Severe frosts will check development and wither the upper foliage, but fresh growth will be made if warm periods occur during the winter months. Excellent growth is made under the high rainfall conditions of North Queensland, but the most extensive use of green panic so far has been made in the Central Burnett district, which is in the 28-30 inch rainfall zone.

Plate 18.

Green Panic in a Shaded Cattle Camp on "Madoora," Gayndah.

Its ability to withstand dry conditions was shown in the Central Burnett during the drought of 1946. Many Rhodes grass stands were completely killed, while on the other hand, neighbouring green panic stands under similar conditions survived until the drought broke, when normal regrowth appeared.

Green panic also exhibits some tolerance for shade and this characteristic may be exploited in several practical ways. For example, stands of this grass in the shelter of forest growth will be protected to some extent from frosts; thus the growing season is prolonged and the period of palatability of the grass lengthened into summer. Experience has shown also that it is capable of competing with lantana and under certain conditions may eventually suppress this pest.

Soils.

The grass has been grown on a number of soil types, ranging from deep, fertile volcanic softwood scrub soils to the soil types of low fertility levels represented by uncleared ironbark and spotted gum ridges and wattle slopes. As would be expected, best growth is made on the more fertile soils, but its ability to grow in competition with the worthless wire and spear grasses on the harsher country is a valuable asset.

Seed.

As with Guinea grass, the seed usually shatters from the head as it ripens. Since most commercial seed harvesting methods involve removing the whole seedhead, much of the material is always immature

Plate 19.
Green Panic on Poor Spotted Gum Country on "Madoora," Gayndah.

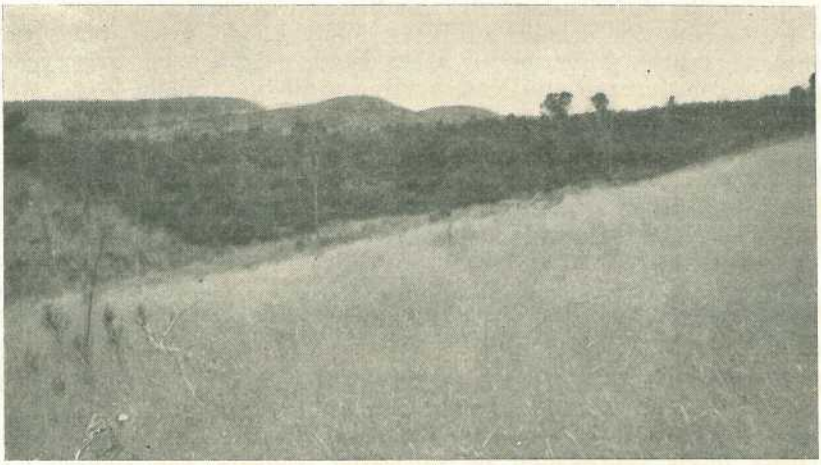


Plate 20.

Extensive Green Panic Pasture on Scrub Land near Gayndah.

and viability of most commercial seed is low. The heads may be cut, cured in small heaps and threshed by hand. In some areas a reaper and binder is used and the grass is cured in stooks before threshing. Higher quality seed is usually obtained when the heads are hand stripped in the field, and similar results have followed the use of properly adjusted wheat headers.

Good stands have been obtained using seed of only 5 per cent. germination at the rate of five pounds per acre. Tests being conducted by the Department of Agriculture and Stock indicate that seed showing 3 per cent. germination at harvest may after storage for 16 months give a germination percentage of 17 per cent. The minimum germination permitted for green panic seed under the Seeds Acts is 3 per cent.

Planting.

As is the case with most sown pasture plants, green panic does best if planted in disturbed soil or in the ashes of a scrub burn. When treated as a crop and sown on well prepared land with a firm seed-bed and covered to a depth of about half an inch, establishment is rapid. Should a sparse stand be obtained, the grass should be allowed to seed freely, when natural establishment will occur. Examples are known where green panic has slowly dominated Rhodes grass pasture in scrub burns.

A planting rate of four to five pounds per acre is recommended. This will entail the expenditure of £1 to 26s. per acre for seed (1950 costs), depending on seed prices. As the very young seedlings are sensitive to hot dry weather, it is advisable to plant during the summer wet season of January to March.

Satisfactory stands have also been obtained when the grass is sown with a cover or nurse crop. For summer plantings, Sudan grass has been successful and in autumn sowings, oats have been used. Planting in maize at the time of the last interrow cultivation is also practised with success on the Atherton Tableland.

Plate 21.

Three Months' Old Green Panic on Cultivation at Peachester.
The grass in the centre foreground is buffel grass.

On sloping grass lands, contour pasture furrows can be used to provide the seed-bed, and in this way a nucleus of the grass can be established through large paddocks.

In the tropics under high rainfall conditions, the tropical pasture legumes centro (*Centrosema pubescens*) and puero (*Pueraria phaseoloides*) are showing promise in trials in combination with green panic. No seed of either of these legumes is available commercially yet.

In the sub-tropical and temperate zones lucerne or phasemy bean (*Phaseolus lathyroides*), and in certain areas where frost is not serious, Townsville lucerne (*Stylosanthes sundaica*) could be considered. A satisfactory sowing rate for lucerne is 1 lb. per acre. Townsville lucerne should be oversown without covering the seed, using about 2 lb. per acre. Phasemy bean may be used at 2-3 lb. per acre; seed of this legume is not available commercially, but can be collected by hand from natural stands in many localities.

Management.

Newly established green panic pastures should not be grazed until the plants have made good growth and are firmly rooted. Where germination has been poor, the grass should be allowed to seed before feeding off.

Green panic grows at a rapid rate during the flush season, hence it is advisable to graze heavily for short periods with resting intervals to allow regrowth. This type of management with related grass

varieties has worked satisfactorily in North Queensland, where high carrying capacity over a long period has been maintained, and the same general practice of allowing resting intervals should be applied wherever green panic is grown. Continuous heavy grazing is detrimental to any good pasture. The Guinea grasses will succumb to this treatment, but green panic is thought to be more tolerant of heavy stocking than common Guinea grass. Alternatively, where pronounced understocking is commonly practised, it may happen that the stock will destroy the green panic through preferential grazing, leaving less palatable and less suitable grasses as dominants in the pasture.

While evidence is conflicting regarding the relative palatability of green panic and Rhodes grass when both are young, it is generally agreed that as the grasses mature, green panic is more attractive to stock. It is more palatable than the common native grasses and moreover has been found to retain its attractiveness into the autumn and early winter months for a longer period than most other summer growing species.

While actual feeding trials have not yet been conducted, the experience of farmers growing the grass indicates that cows produce satisfactorily when grazing on green panic, but as with all grasses, nutritive value drops as the plant matures. The variety's ability to make fresh regrowth during warm periods in the winter months enhances its food value, as the new growth will be more nutritious than the matured stems and leaves.

PLANT PROTECTION

The Sweet Potato Weevil.

J. A. WEDDELL, Assistant Senior Entomologist.

THE sweet potato weevil (*Cylas formicarius* Fabr.) occurs as a destructive pest of sweet potatoes almost wherever the crop is grown, and to this Queensland is no exception. The eggs of the insect are laid in the stems of the plant, in the tubers in the ground, or later in stored tubers. The white legless grubs that hatch grow to three-eighths of an inch in length. This is the destructive stage; the stems of the plant may be tunnelled and the tubers thoroughly riddled. The insects pupate in small oval cavities in the tubers and after a brief period the adult beetles emerge. These are slender weevils, about a quarter of an inch in length, and ant-like in general shape; the predominant body colour is metallic greenish blue, with an orange thorax.

In warm weather the insect can complete its life cycle in four weeks, but the adult weevils live for several months. Once infestation commences serious damage to tubers may quickly follow. The illustration in Plate 22 is of portion of a tuber freshly dug from an infested crop. Apart from the blemished appearance, infested tubers are inedible owing to an unpleasant bitter flavour.

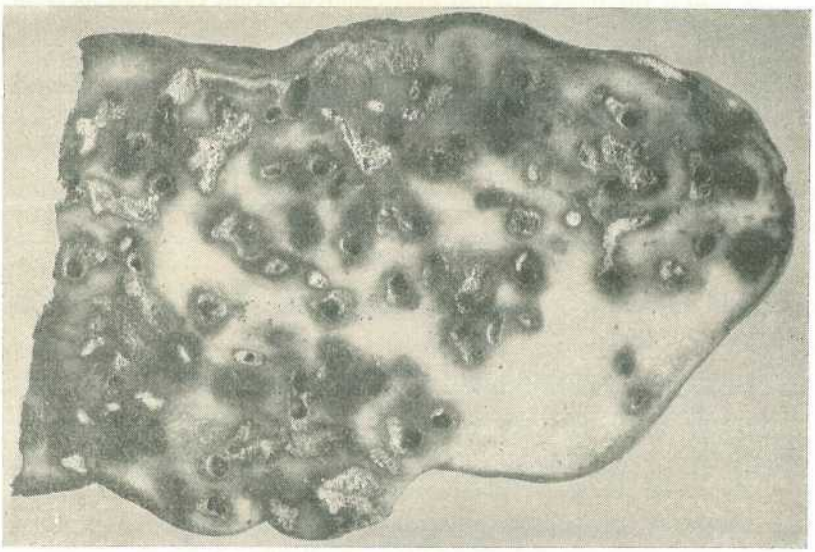


Plate 22.

Section of Newly-dug Sweet Potato Riddled by Grubs of the Sweet Potato Weevil.

As the insect is more or less established in areas where sweet potatoes are grown, there are several possible means of infestation in new plantings. An obvious source is of course the planting material, whether this consists of tubers or cuttings. Risk is incurred if the area selected for the next planting is on or adjacent to land carrying the remnants of an earlier crop. Further, weevils may migrate from old infested tubers that have been stored on the farm. Recognition of these facts suggests suitable measures to reduce risks of infestation. In addition, it has been found that under storage conditions the adult weevil is susceptible to the higher concentrations of DDT.

Control Measures.

Recommended measures to reduce losses from the sweet potato weevil are therefore as follows:—

(1) If sweet potatoes have been grown previously on the farm, the old area should be grazed or burnt off. Follow this by at least two ploughings to assist in destroying crop residues in the ground.

(2) Select the area for the new planting as far as possible from the previous crop. Do not follow sweet potatoes with sweet potatoes.

(3) Do not take planting material from the remnants of an old crop. Obtain tubers for planting from a weevil-free crop. As a further precaution, treat these tubers thoroughly with DDT at the rate of half a pound of DDT 10 per cent. dust to each bag of tubers.

(4) If a seed-bed is used, it should be established as far as possible from the main crop area, and destroyed as soon as the required cuttings have been obtained.

(5) When digging sweet potatoes, clean tubers should be bagged and the bags stitched and removed from the field as soon as possible.

(6) If the bags are to be stored temporarily on the farm, the shed should first be cleaned and then sprayed thoroughly with 1 per cent. DDT.

(7) Infested tubers may not be accepted raw by stock because of the bitter taste, but if only moderately infested they may be fed after boiling.

The Protection of Stored Seed with Dusts.

W. A. McDOUGALL, Senior Entomologist.

SEVERAL insects, chiefly the rice weevil (*Calandra oryzae* L.) and bruchids, attack seeds of various kinds and infestations often commence in the field, where control is not practicable. If these pests are left unchecked after harvesting, the stored seed material may become valueless for planting purposes.

Current rules for the certification of seeds under "*The Seeds Acts*, 1937-41," provide that before any of the undermentioned seeds will be certified they **must be treated with benzene hexachloride (BHC) dusts as follows:—**

Kind of Seed	Strength of BHC Dust (gamma isomer).	Rate of Dusting (per bushel).
	Per cent.	oz.
Hybrid Maize	1·0 ..	3
French Bean	1·0 ..	3
Grain Sorghum	0·5 ..	3

These rates should *not* be exceeded. Thorough mixing is essential to ensure a coating of dust on every grain.

Some growers harvest maize as early as practicable, husk and store the cobs until sufficiently dry to shell. To check weevil attack during this storage, the cobs may be dusted as above, and stored away from direct sunlight. After shelling it will be necessary to redust.

Seed dusted with BHC should not be fed to poultry.

Previously carbon bisulphide had been used for certified seed, and when treatments were carried out correctly it gave satisfactory results. At present, this fumigant is not readily available; however, a single dusting with BHC has been found a convenient substitute, and typical results are illustrated in Plates 23 and 24.

BHC dusts may be used successfully with most seeds, and germination will not be affected. The lighter strength of 0·5 per cent. gamma isomer should be used with the smaller seeds such as wheat, oats, barley and grain sorghum. Commercial BHC has a musty and distinctive odour, but deodorised BHC as a seed protectant on a large scale would be costly. If the ordinary BHC is found objectionable or is not readily available, a DDT dust of not less than 2 per cent. para para isomer will also give satisfactory results with non-certified seed. DDT is slower acting than BHC, and although the ultimate protection by either dust is good, a few weevils may survive in the seeds for some time after DDT dusting. The presence of these few living weevils would condemn seed submitted for certification.

The dusting rate of 3 oz. per bushel should not be exceeded. Excess dust is unnecessary for pest control, and it certainly detracts from the appearance of the seed (note the correctly dusted seed in Plates 23 and 24).

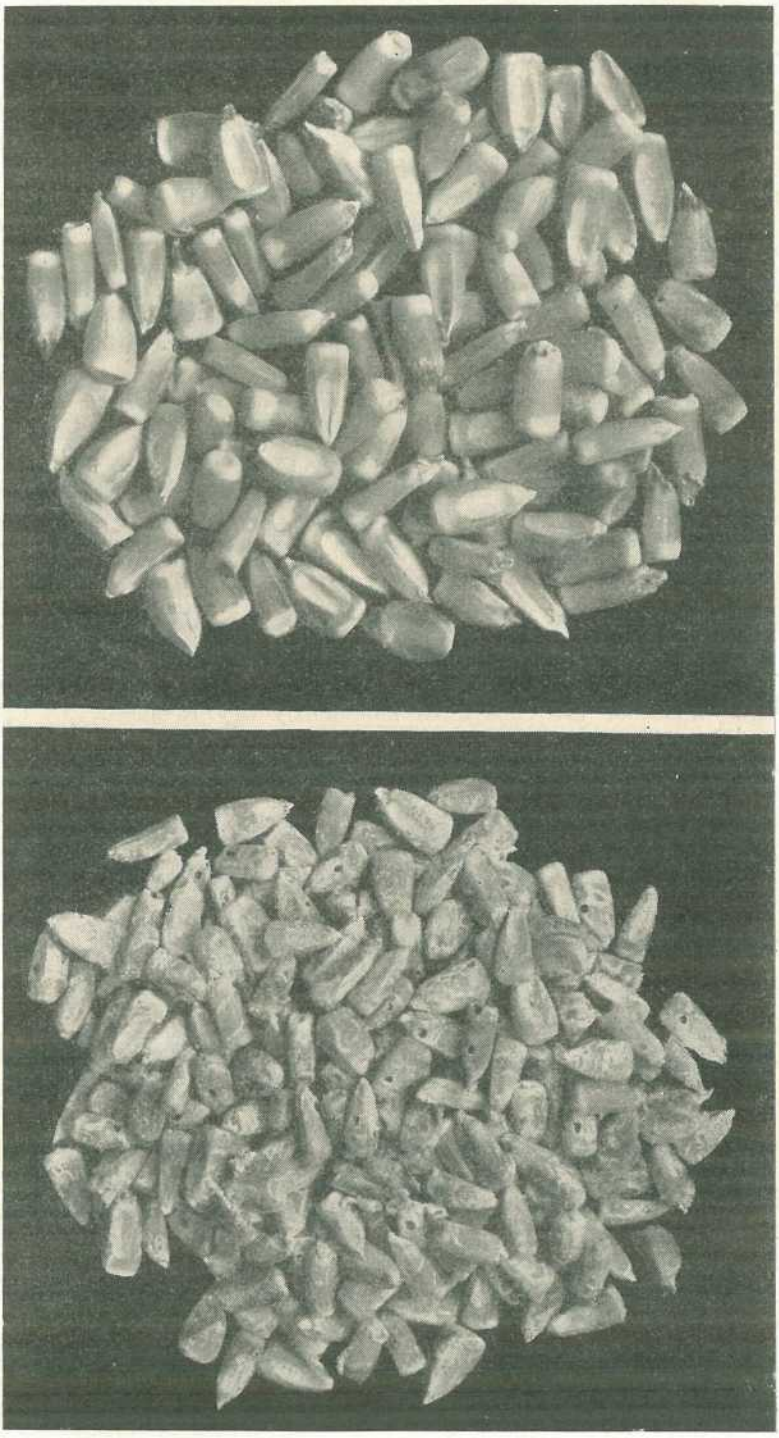


Plate 23.

BHC Dusting of Maize Seed.—Top, dusted maize after six months' storage; bottom, untreated seed from the same harvest after three months' storage.

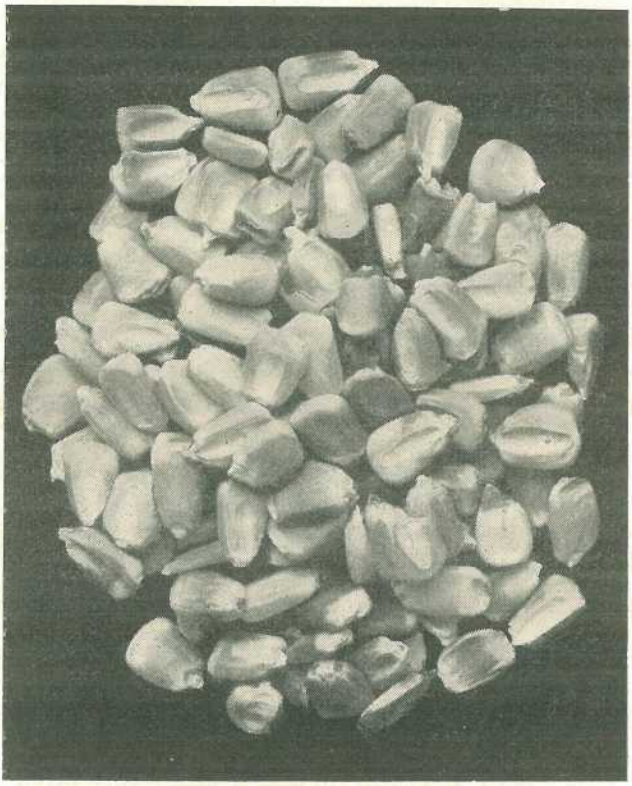


Plate 24.

BHC Dusted Maize After 16 Months' Storage.—Untreated maize put into storage at the same time was completely destroyed by weevils in four months.

DEVELOPING THE WALLUM.

The Minister for Agriculture and Stock (Hon. H. H. Collins) stated recently that, following new developments in research methods both in Australia and overseas, officers of his Department are now engaged in a close examination of the potential uses to which the many thousands of acres of "wallum" soils extending along the coast of Queensland might be put. To this end, by the use of aerial photography and ground examinations, various soil zones are being mapped and samples of the soil from various localities examined. In addition, the pastures and other plants growing on these soils are being analysed and these analyses correlated with animal health conditions of the various localities.

Some most useful data have been obtained and it is now known that phosphorous and copper are key elements in the development of much of the country. The deficiency of copper in these pastures has been shown to be correlated with a deficiency of this element in the stock, and the animals have in several cases been found to respond to administration of copper salts. Suitable methods of treating the pastures themselves are now being studied. Low phosphate concentration in the blood of stock results in unthriftiness, low production in dairy cows, infertility, and the habit of bone chewing.

This work will be continued, as it is felt that this class of country is destined to play a much more important part in food production than it does at present, or was envisaged a few years ago. The relatively good rainfall conditions of this coastal strip favour agriculture and the development of improved pastures.

Brucellosis Testing of Swine.

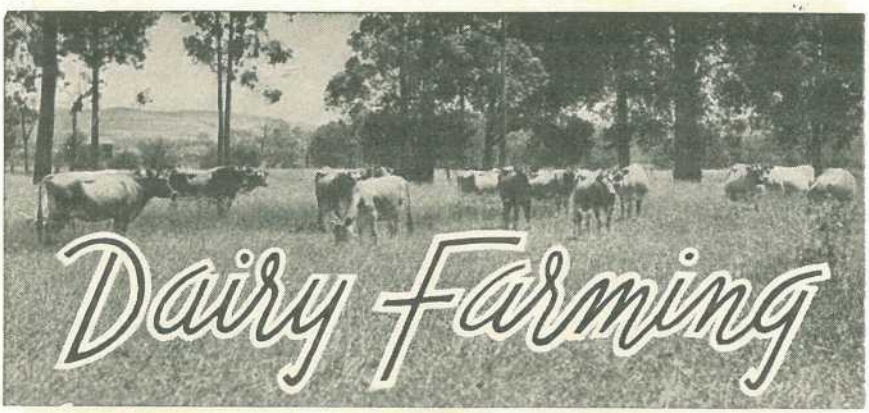
The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

TESTED HERDS. (As at 18th June, 1951.)

Breed.	Owner's Name and Address of Stud.
Berkshire	S. S. Ashton, " Scotia " Stud, Pittsworth
	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	H. V. Littleton, " Wongalea " Stud, Crow's Nest
	O'Brien and Hickey, " Kildurham " Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, " Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H. W. Wyatte, Rocky Creek, Yarraman
	H. M. State Farm, " Palen Creek," Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, " Rosevale " Stud, Beaudesert
Large White	H. J. Franke and Sons, " Delvue " Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	F. L. Hayward, " Curyo," Jandowae
	J. A. Heading, " Highfields," Murgon
	K. B. Jones, " Cefn " Stud, Pilton
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	R. Postle, " Yaralla " Stud, Pittsworth
	E. C. Smith, " Smithfield " Stud, Coomera
	E. J. Bell, " Dorne " Stud, Chinchilla
	A. G. Fry, " Birubi " Stud, Dalby
	M. E. Myers, Halpine Plantation, Kallangur
	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, *via* Rosewood
	J. H. G. Blakeney, " Talgai " Stud, Clifton
Tamworth	S. Kanowski, "Miecho " Stud, Pinelands
	N. R. Potter, " Actonvale " Stud, Wellcamp
	D. F. L. Skerman, " Waverley " Stud, Kaimkillenbun
	A. C. Fletcher, " Myola " Stud, Jimbour
	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, *via* Rosewood
	P. V. Campbell, Lawn Hill, Lamington
	Salvation Army Home for Boys, Riverview
	F. Thomas, " Rosevale " Stud, Beaudesert
Wessex Saddleback ..	W. S. Douglas, " Greylight " Stud, Goombungee
	D. Kay and P. Hunting, " Kazan " Stud, Goodna
	E. Sirrett, " Iona Vale " Stud, Kuraby
	C. R. Smith, " Belton Park " Stud, Nara
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	H. Thomas, " Eurara " Stud, Beaudesert



The Cleaning and Sterilizing of Dairy Utensils and Equipment.

W. F. SCHUBERT, L. E. NICHOLS, and E. B. RICE, Division of Dairying.

THE proper cleaning and sterilizing of utensils and equipment are essential for the production of high quality milk and cream. Where cleaning is skimped or omitted, milk films form on the surfaces of utensils, milkstone builds up in the milk lines of the milking machine, and yellow slime accumulates in the interior of the rubber connections. These films and residues form excellent breeding grounds for bacteria which affect the quality of dairy produce. As long as they are present, the work of sterilization is largely nullified.

DEFINITION OF TERMS.

There still seems to be a certain amount of confusion regarding the terms cleaning and sterilizing. They may be defined as follows:—

"*Cleaning*" is the removal of all milk and other residues.

"*Sterilizing*" is the destruction of bacteria by heat (steam or hot water) or by chemicals, such as chlorine and quaternary ammonium products.

Cleaning and sterilizing are separate and distinct operations. Cleaning is the more fundamental of the two processes and possibly the more important. However, both cleaning and sterilizing are essential for efficient results. In practice, the removal of films and residues also results in the removal of numbers of bacteria associated with them and most cleaners (detergents) have some power to kill or suspend the growth of bacteria. Sterilization without cleaning is a waste of effort and will eventually cause the down-grading of milk and cream. Sterilizing may be regarded as the finishing process. It is a "must" in the production of high quality dairy produce.

FACILITIES AND EQUIPMENT NECESSARY.

Cleaning and sterilizing cannot be effectively carried out unless there is an ample, and preferably a permanent, supply of good quality water available at the dairy (Plates 25 and 26). The source of supply may take the form of underground water storage tanks, streams, or

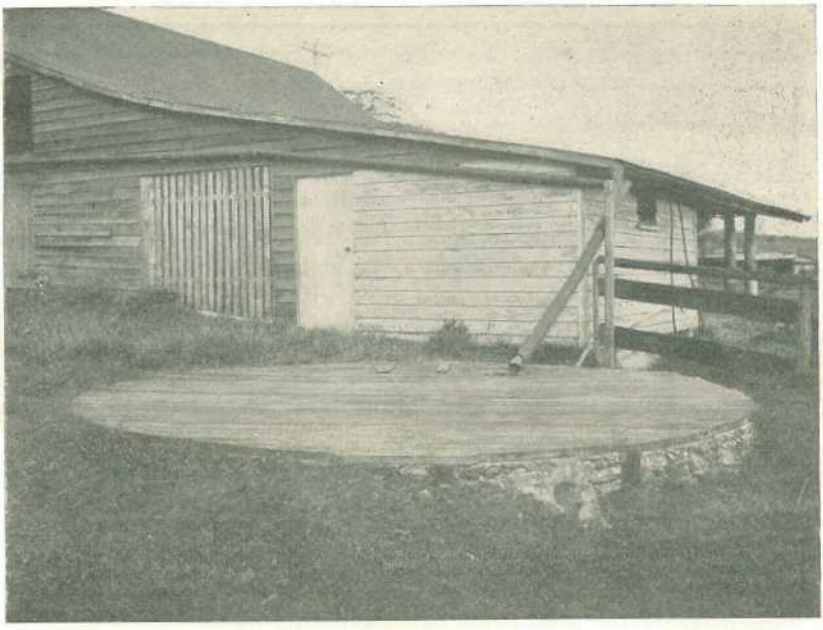


Plate 25.

A 20,000 Gallon Underground Water Storage Tank From Which Water May be Pumped to an Overhead Tank for Dairy Purposes.

Plate 26.

An Overhead Tank From Which Water May Be Reticulated to Various Points.

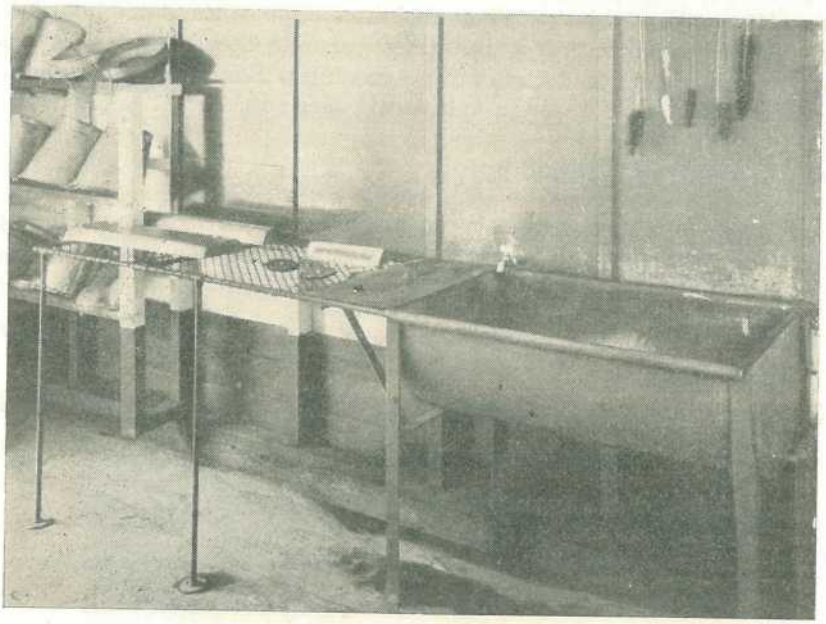


Plate 27.

A Wash-up Trough and Draining Rack.—Note brushes used in the cleaning of dairy utensils hung on the wall.

Plate 28.

A Solidly Constructed Angle Iron Storage Drying Rack.

more often, wells and bores. The wash-up section of the dairy buildings should be provided with a well-drained concrete floor. Certain equipment in the milking shed and dairy is absolutely essential. This should include a hot water supply, a sufficiently large wash-up trough (Plate 27), a metal, preferably a pipe, drying rack (Plate 28), and convenient sized brushes for all purposes.

Properly designed units for ensuring an *ample supply of boiling water* and the generation of steam are now available on the market as *electric hot water units* (Plate 29) and *steam sterilizers* (Plate 30).

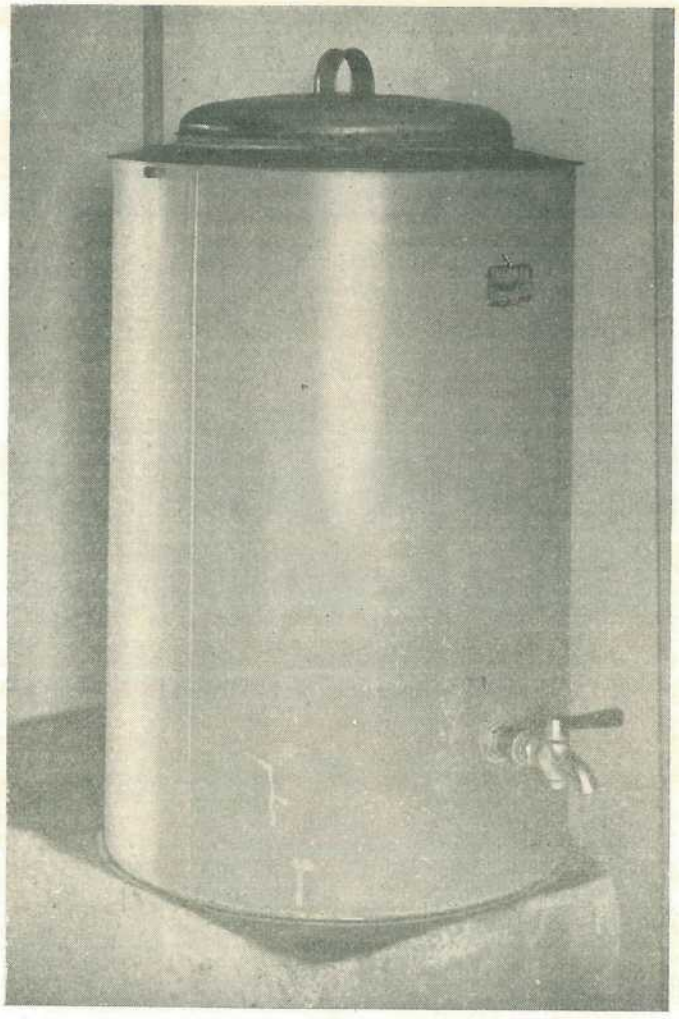


Plate 29.
An Electric Water Heater Suitable for the Dairy Farm.

The outlay involved in their purchase and installation should be regarded as an essential expenditure in the fitting up of dairy farm premises.

In the case of a small farm without a milking machine, boiling water can be supplied from a built-in copper of at least 12 gallons capacity (Plate 31).

On farms where electric power is available, the use of automatically controlled electric hot water storage systems is coming into favour. These units are thermostatically controlled and the use of a switch, which the farmer operates before milking begins, ensures that the water will be at boiling point by the time washing-up is commenced. Suitable units can be usually purchased through agents in local towns or direct from the manufacturers. A unit of at least 18 gallons capacity suffices for up to a 3-unit milking machine; a proportionately increased capacity is required for larger machines.

Cleaners and chemical sterilizers should be stored away from heat, light and moisture, in airtight containers placed on convenient shelves.

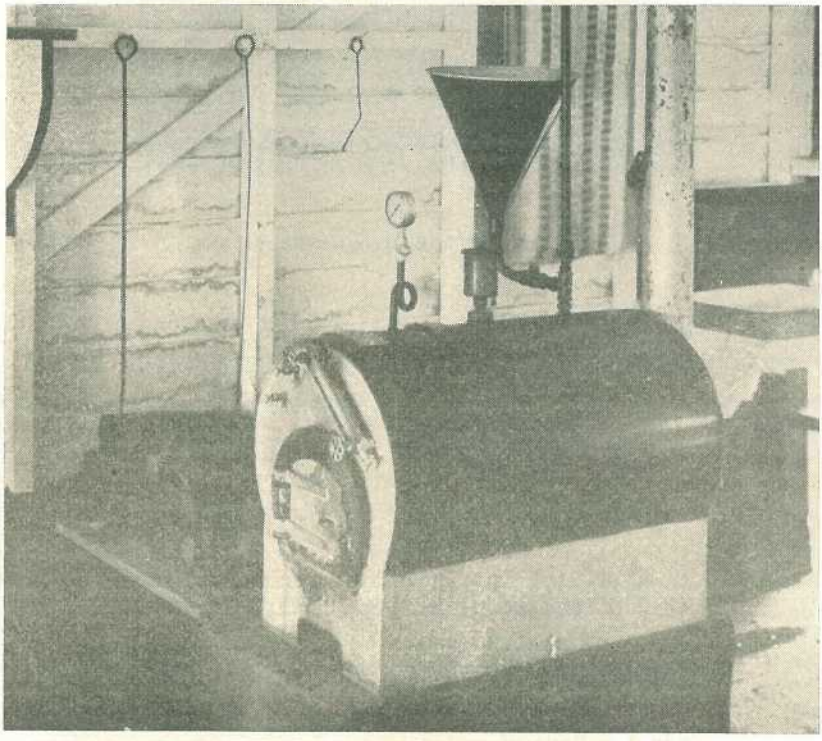


Plate 30.

A Steam Sterilizer for Dairy Farm Use.—Note also the hand wash basin and towel in the background.

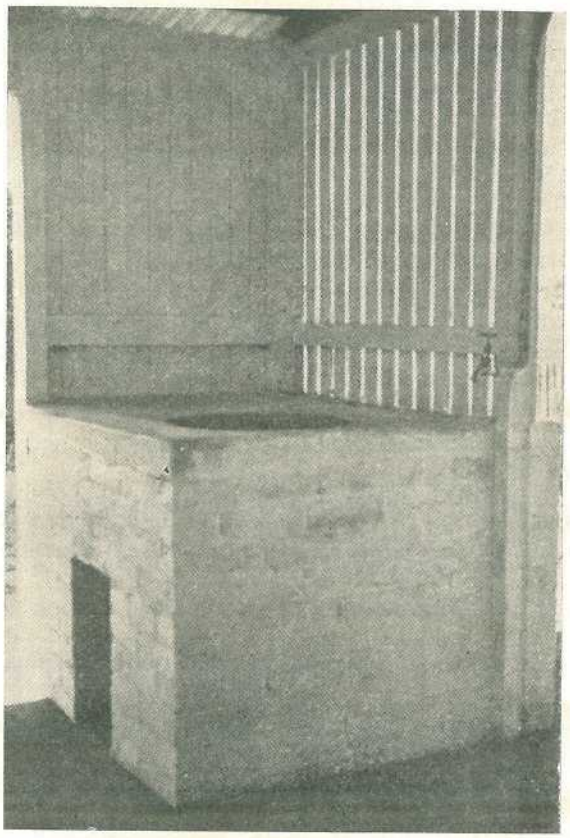


Plate 31.
A Convenient Built-in Boiler on a Dairy Farm.

RECOMMENDED CLEANERS FOR DAIRY FARM USE.

The following cleaners (detergents) have been found satisfactory.

(*a*) Caustic soda.—Strength, ½ oz. (one dessertspoonful) per 4 gallons of water. Caustic soda solution can be used for cleaning machines, but owing to its severity on the hands is unsuitable for utensils to be washed by hand.

(*b*) Sodium carbonate (washing soda).—Strength, 3-4 oz. (3 full tablespoonfuls) per 4 gallons of water.

(*c*) Soda ash.—Strength, 1-2 oz. (1 full tablespoonful) per 4 gallons of water.

(*d*) Trisodium phosphate.—Strength, 2 oz. (2 tablespoonfuls) per 4 gallons of water.

(*e*) Sodium silicate or sodium metasilicate.—Strength, 1-2 oz. (2 full tablespoonfuls) per 4 gallons of water.

There are also many satisfactory proprietary detergents which many farmers prefer to use. Farmers should bear in mind that a good cleaner should have a combination of desirable properties, which include—

(1) Wetting-power.

(2) Dissolving action on milk residues.

(3) Power of emulsifying fat.

(4) Ease of rinsing from the equipment.

(5) Water-softening action.

(6) Minimum corrosive action.

All these properties are seldom attained in a single chemical and therefore a good cleaning mixture should combine the good properties of two or more chemicals. For example, caustic soda has poor wetting-power, emulsification and rinsability and is strongly corrosive, but it will readily dissolve milk solids and is a good water softener. On the other hand, a cleaning mixture containing an alkali such as caustic soda, soda ash, trisodium phosphate, or a metasilicate, together with a wetting agent, approaches the ideal. A *wetting-agent* is a substance which when added to water gives it greater "wetting" power and thereby facilitates the removal of fat and milk solids. For certain hard waters, the inclusion of sodium hexa-metaphosphate (Calgon) is a distinct advantage.

TECHNIQUE AND PRINCIPLES.

The following technique should be applied to all dairy equipment, such as milking machine parts, separator, milk vat, cooler, milk and cream cans, buckets, strainer, strip cups, udder wash containers, &c., *after each milking.*

The cleaning of milking machines is described in a separate pamphlet obtainable on application to the Department or any local officer of the Division of Dairying.

Cleaning.

1. *Cold Rinse.*—Immediately after use, rinse all utensils and equipment with an ample supply of cold or lukewarm water.

Reason.—Once milk has been allowed to form a film on the surface of utensils, whether by drying in air, by coagulation, or by heat, removal becomes extremely difficult. Hence the importance of rinsing all utensils immediately after use with cold or luke-warm (not hot) water, and in good quantity. Hot water melts the fat and gives a greasy film. Very cold water hardens the fat. So probably the best temperature is one between 80°F. and 100°F. Hard water makes cleaning more difficult. Where such is evident a sample of the water may be forwarded to the Dairy Research Laboratory, Department of Agriculture and Stock, Brisbane, for analysis and advice on treatment to remove the hardness.

2. *Washing.*—Scrub the utensils in water which is not uncomfortably hot to the operator and contains an approved detergent (cleaner).

Reason.—The detergent solution acts in four ways:—

(*a*) by softening the water, making cleaning easier;

(*b*) by breaking down the fats and milk solids in the residual milk;

(*c*) by emulsifying and deflocculating the fat and milk solids remaining on the equipment: and

(*d*) by washing away the broken-down and loosened milk constituents.

Scrubbing with suitable brushes is necessary to provide mechanical force. (Under no circumstances should cloths be used in the cleaning operations). In addition, detergents, by facilitating the mechanical removal of films, also are of some importance in the removal of bacteria.

3. *Hot-water Rinse.*—Rinse utensils in boiling water.

Reason.—To remove detergent solution from surfaces of utensils and equipment and so prevent their possible corrosion from residual alkali.

Sterilization.

4. *Sterilizing after Cleaning.*—In dairy-shed practice sterility in the absolute bacteriological sense cannot be achieved, so it is necessary to be content with what is called "commercial" sterility or "near sterility."

Reason.—Sterilization at this stage is usually effected by heat—boiling water or steam—to destroy bacteria which have survived the cleaning.

Such a method of final heat treatment also ensures that the equipment after use is left thoroughly dry, thus preventing bacterial development between milking operations.

Boiling Water.—The practicability of using boiling water is determined by—

(*a*) the number of utensils to be sterilized; and

(*b*) the size of the farm copper.

For good results, the utensils must be completely immersed in water at a temperature of not less than 180°F. for 2 minutes or not less than 170°F. for 10 minutes. Periodically, temperatures should be checked with a thermometer.

In practice the use of "boiling" water for sterilizing is rarely thoroughly efficient, as often the water is not kept boiling and the quantity provided is inadequate.

Steam.—The use of steam offers several advantages—

(*a*) it is effective and convenient;

(*b*) there is a margin of safety so necessary in practice;

(*c*) it is less subject to failure due to the human element;

(*d*) as pure water is its only product there is no risk of contamination of the milk with objectionable substances;

(*e*) time and temperature are about the only variables involved.

Every dairyman interested in efficiency should install a steam sterilizer. It is, however, essential for effective results with cans, milking machines, &c., that they be steamed for at least two minutes.

In some countries certain chemicals, such as chlorine compounds and quaternary ammonium compounds, are used for sterilizing dairy utensils after cleaning. This practice is, however, not yet recommended in Queensland.

Storage of Utensils.

5. *Draining and Drying.*—After sterilization, all utensils should be allowed to drain and dry and be protected from contamination, by storing either on a metal draining rack in a dust-free area or in a metal cabinet, until required again.

Reason.—Any bacteria which survive efficient cleaning and sterilizing will be few and of inert types. In dry utensils they will be unable to increase in numbers, as moisture is essential for bacterial multiplication. However, the least trace of moisture in any utensil suffices to permit unrestrained multiplication of bacteria.

Treatment of Utensils before Re-use.

All utensils and milking equipment should be rinsed just before each milking begins in order to destroy bacteria which may have lodged and multiplied in them in the period between milkings. For this purpose a chemical sterilant is added to the rinse water. This pre-rinse with a chemical sterilant not only destroys bacteria which have multiplied in the equipment, but also eliminates the chance of contamination from untreated tank water adjacent to the dairy premises, aids in cooling the equipment and eliminates the possibility of corrosion which would normally occur if a chlorine sterilant were used after the normal cleaning operations.

Chlorine compounds dissolved in luke-warm water are mainly used for this purpose. They are effective, non-tainting and non-corrosive when used as instructed. It is important, however, to use them strictly in accordance with the instructions of the manufacturers and certainly not in excess of 50 to 100 parts per million of available chlorine in the rinse solution.

Quaternary ammonium products are also being used overseas as sterilants and are at present being tried out under Queensland conditions. Their use closely resembles that in vogue for chlorine compounds. They are non-corrosive.

Removal of Milkstone from Dairy Equipment.

If any milkstone is visible on utensils after the detergent treatment, this must be removed by weak acid, otherwise efficient sterilization will not be obtained. The weak acid solution should comprise three teaspoonfuls of phosphoric acid in 2 gallons of hot water. If milking machines are to be treated, run the weak acid solution into the affected pipelines, plug the ends and leave for at least half an hour. It may be necessary to use steel wool wrapped around a brush to assist the removal of the milkstone after the acid treatment. Immediately following such treatment, equipment should be washed in a soda solution containing 3 oz. washing soda (or 1 oz. soda ash) in 6 gallons of hot water, followed by a plain boiling water rinse.

Repeated treatment for a number of days may be necessary for satisfactory results. Cooler, cans, &c., may be similarly treated.

The supply of phosphoric acid should be kept in a glass bottle or stone jar, otherwise corrosion of metal containers can be expected. Phosphoric acid can be purchased from most chemists.

Scale Formation.

Where scale or fur results from the use of hard water, the water should be analysed to determine if it can be economically softened. In any case where a steam sterilizer is installed, analysis of the water is a wise precaution to ensure the life of the boiler. A representative sample of at least one gallon in a clean glass container can be forwarded to the Dairy Research Laboratory, Department of Agriculture and Stock, Brisbane, for analysis and advice on the economy or otherwise of treatment.

Combined Cleaning and Sterilizing.

To prevent the chance of chain-infection or carry-over of bacteria from utensil to utensil in the cleaning process, cleaners and sterilizers are being combined overseas in the washing up process. They also are being tried out under Queensland conditions and to date have given effective results, providing the directions are carefully followed.

However, even if combined cleansing and sterilizing is adopted, the methods outlined above are not appreciably altered.

SUMMARY.

The procedure for cleaning and sterilizing dairy utensils and equipment may be summarised as follows:—

(*a*) Immediately after use, rinse with cold or lukewarm water.

(*b*) Wash thoroughly with warm water in which is dissolved a detergent (cleaner).

(*c*) Rinse off residual detergent solution with hot water.

(*d*) Near-sterilize by immersing in boiling water or by steam.

(*e*) Allow the utensils to drain and dry in an inverted position on a metal draining rack situated in a dust-free atmosphere. Do not use cloths to dry dairy utensils.

(*f*) Just prior to milking rinse all equipment with luke-warm water containing a chemical sterilant.

(*g*) If milkstone is present on utensils, remove it by the special method referred to. If hard water only is available at the dairy shed, arrange for it to be analysed in the Dairy Research Laboratory and treat it in accordance with the recommendation of the Laboratory.

The proper application of the procedures outlined will do much to ensure the production of milk and cream of the highest quality, as—

(i.) efficient cleaning of utensils will remove most of the bacteria and all food for bacterial subsistence;

(ii.) sterilizing will destroy all but a few of the most inert types which are of little importance in affecting the quality of dairy produce;

(iii.) storage in a dry condition will prevent any increase in numbers of the few residual inert bacteria;

(iv.) the pre-rinse with a chemical sterilant just before re-use will destroy any bacteria which may enter and multiply in equipment during storage between milkings.

Investigation of Plant and Animal Nutrition Problems on Springbrook Plateau.

Compiled by C. R. von STIEGLITZ, Chemical Laboratory.

LATE in 1946 a dairy farmer at Springbrook brought to the notice of the Agricultural Chemist that dairy cattle on the plateau were suffering from "depraved appetite" and infertility. He further stated that difficulty was being experienced in the growing of satisfactory fodder crops and that milk production had declined.

A preliminary examination of (*a*) the general topography, geology, and major soil types of the district, (*b*) the quality of the pastures, and (*c*) the general health of dairy cattle, was subsequently made and the following information obtained.

DESCRIPTION OF THE DISTRICT.

Topography.

Most of the country used for dairying at Springbrook is mountainous and confined to the 1,500-2,500 ft. levels. The maximum height of the plateau is 3,400 ft. Any flat areas are relatively small and enclosed by steep slopes. The area is well watered by small, swiftly running streams. Plates 32 and 33 show typical country used for dairying.

Climate and Vegetation.

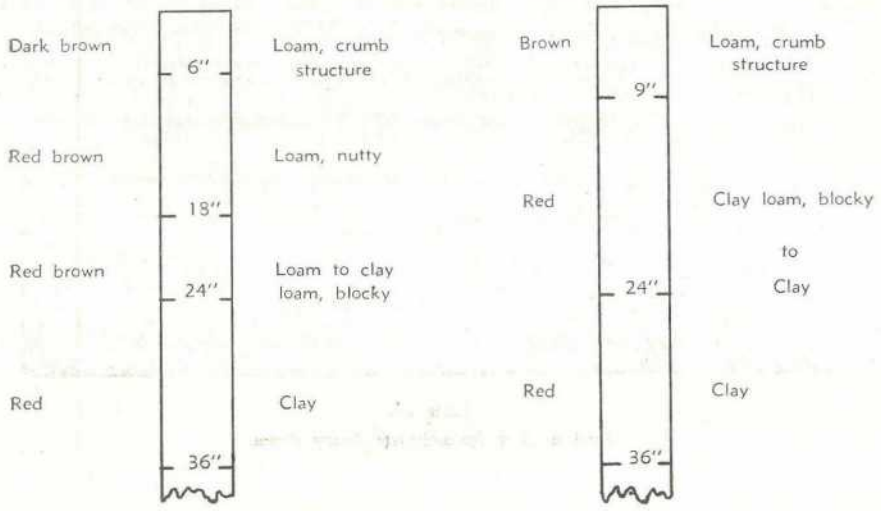
The average annual rainfall is 160 inches, most of which falls in the summer months; the late winter and early spring seasons are relatively dry.

The cleared land, originally covered with rain forest, is now devoted to sown pastures of paspalum and/or kikuyu grass. These pastures have, in recent years, been infested by the white grass-eating grub (a Melonthid), and bracken fern (*Pteridium aquilinum*) invasion has, in parts, become serious.

Soils.

Two main types of soils occur. They are (i.) a dark brown loam and (ii.) a brown loam, the former being associated with rhyolite and the latter with basalt.

Typical profiles to 3 feet are:—



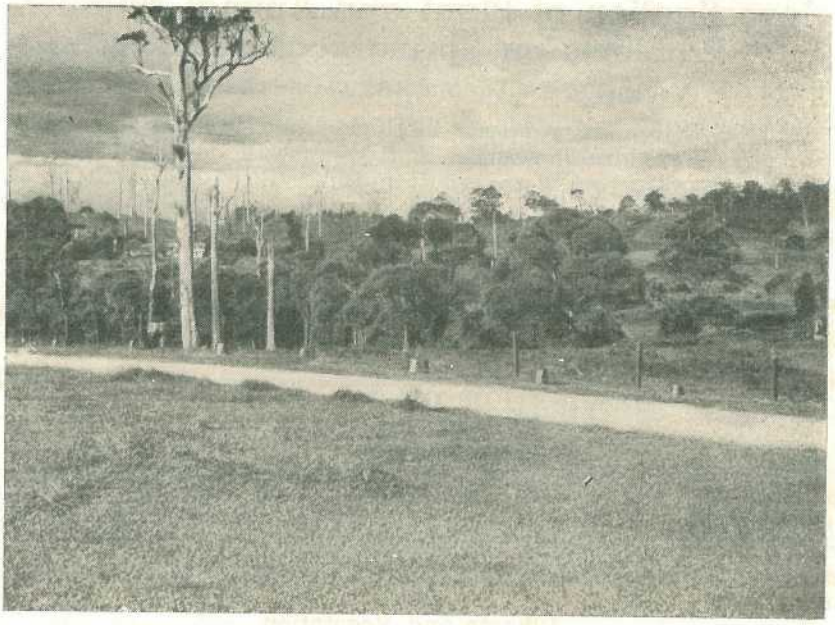


Plate 32.
Typical Springbrook Dairying Country.

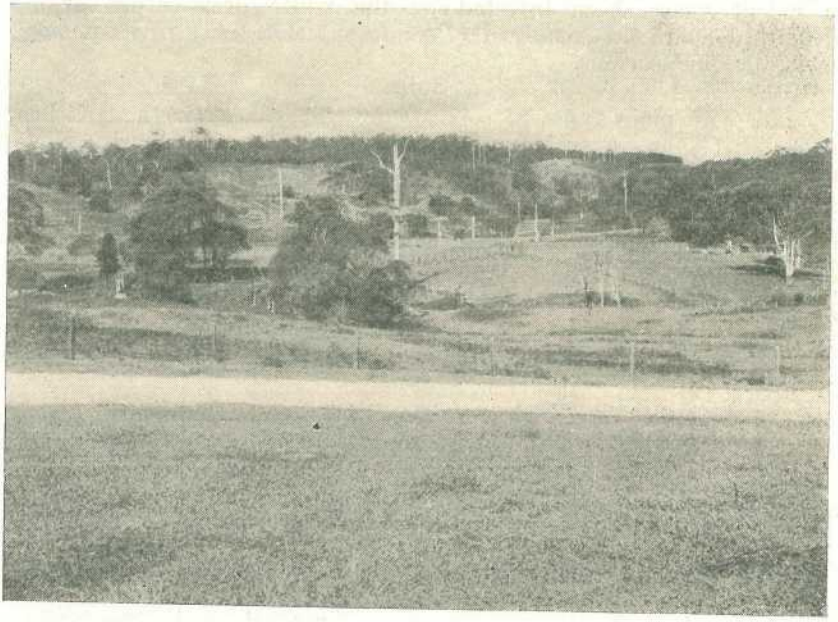


Plate 33.
Portion of a Springbrook Dairy Farm.

Both soil types are easily worked in the field, although, owing to their porous nature, they dry out very quickly after rain and good conditions for cultivation are of short duration. Organic matter plays an important part in maintaining suitable moisture conditions in such soils, and once the original supply (which is normally high) becomes depleted through cultivation, the amount of water available to plants which may be stored becomes very small.

The red colour of these soils is due to high percentages of iron oxides under free drainage conditions.

Plates 34 and 35 show typical sections (or profiles, as they are called) of the soils derived from rhyolite and basalt respectively.

Plate 34.

A Profile of a Soil Derived from Rhyolite.

Plate 35.

A Profile of a Soil Derived from Basalt.

Pastures and Fodder Crops.

The pastures consist of paspalum or mixed paspalum-kikuyu grasses; in some places clovers are present.

Some farmers have attempted to improve their pastures by applying dolomite and superphosphate, and claim beneficial results; all those interviewed were of the opinion that dolomite gave better results than did pulverised limestone. On one property dolomite had been applied annually at the rate of one ton per acre and superphosphate at the rate of 2 cwt. per acre for 6-7 years; another had made similar applications for four successive years. The owner of the second property had been able to establish, successfully, under cultivated conditions, pasture consisting of lucerne, red and white clovers, and prairie grass.

Fodder crops are not normally grown and the complete failure of a crop of oats was noticed on one property. Failure was apparently due to insufficient nutrients during growth, caused largely by the effects of erosion. From field observations it seemed evident that deterioration of the pastures had been caused by (*a*) overstocking, and (*b*) the low plant food status of the soils.

Health of Stock.

At the time of the inspection, which was immediately following a particularly dry winter, dairy cattle were low in condition and were showing obvious signs of "depraved appetite." Milk production had reached a low level and the infertility index was high.

Samples of blood were drawn from four milking cows on one property and six on another, to check the levels of phosphorus and calcium. The analyses were made on the farm.

The results showed that the animals were suffering from gross phosphorus deficiency, particularly those in the second group, which was composed of high milk-producing Jerseys. The immediate use of bone meal, fed in the bails and bound with molasses, was recommended. This was to be replaced, later, with a bone-salt "lick."

The possibility of associated copper and/or cobalt deficiencies in the pasture was also considered and pastures were sampled for analysis. In addition, a sample of liver from a slaughtered beast was taken to be analysed for its copper content.

Results of Laboratory Tests.

Analyses of the soils showed that all samples were strongly acid in reaction, low in available calcium and magnesium and very low in available phosphorus; total nitrogen was high and available potash generally fair but in a few cases low. The analyses of pasture and liver for copper indicated that a deficiency of this element did not appear to be of major importance. However, in order to obviate any possibility of copper and cobalt being limiting factors, a copper-cobalt mixture was made up for one of the farmers who consented to administer it to his herd in the form of a drench. It seemed fairly obvious from the results of the soil tests that the low plant food status of the soils, particularly in relation to available phosphates, was the chief factor affecting the quality and vigour of the pastures, and that the poor quality of the pastures, in turn, caused the gross phosphorus deficiency in the animals.

INVESTIGATIONAL WORK.

Health of Stock.

In April, 1947, an inspection of stock which had been receiving the bone-salt lick since the previous visit was made and blood drawn from the six cows previously tested. A marked improvement was noticed in the condition and general appearance of the cattle. This was attributable partly to the season but largely to the effects of the bone-salt supplement. The inorganic phosphate and serum calcium figures for the blood of six animals are recorded below, in comparison with the results obtained previously.

	Blood phosphate. mg. % P.		Serum calcium. mg. % Ca.	
	December, 1946.	April, 1946.	December, 1947.	April, 1947.
Cow No. 1	2·5	4·0	8·8	11·8
Cow No. 2	3·0	5·2	7·8	10·0
Cow No. 3	3·4	5·6	8·8	11·2
Cow No. 4	4·2	3·1	8·9	10·7
Cow No. 5	2·5	5·4	8·1	10·1
Cow No. 6	2·0	7·5	9·8	10·6

It will be seen from these results that appreciable improvement had been made in the blood phosphate content of all but one cow, and an increase in the serum calcium in all cases.

The owner of the dairy herd in which "depraved appetite" was prevalent at the time of the initial visit reported that the condition had ceased, and that milk production had increased appreciably. Infertility had largely disappeared.

It therefore seems evident that a mineral supplement of calcium and phosphate is essential for animals on paspalum and kikuyu grass pasture in this area.

A certain amount of difficulty was experienced in supplying the lick to dry stock, as, owing to the heavy rainfall in the district, appreciable loss of the lick occurs even in covered troughs. It was found practicable, however, to feed the milking cows, and also some of the dry stock, in the bails at milking time.

Soil Investigation.

As mentioned previously, soil analysis showed that both soil types contained high amounts of total nitrogen, very low percentages of available phosphates and, in most cases, fair quantities of potash. Both types were strongly acid and, in consequence, low in available calcium and magnesium.

The graph in Plate 36 shows the change in reaction of the soil brought about by the addition of various quantities of lime.

A quantity of soil of the type derived from rhyolite was taken to Brisbane for use in pot experiments, with a view to testing the locally held opinion that dolomite (which contains both lime and magnesium as carbonates) gave better results than pulverized limestone when each was used in conjunction with superphosphate.

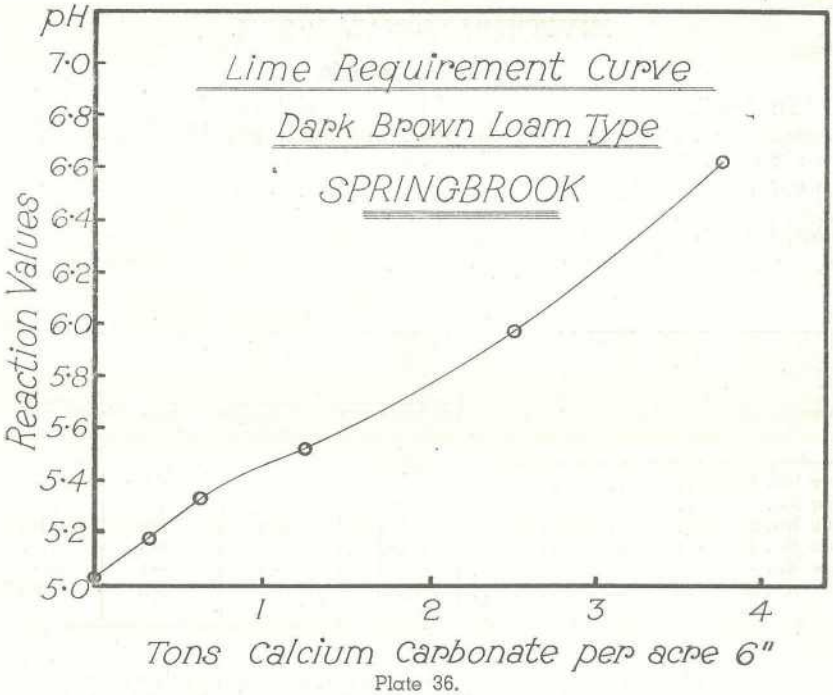


Plate 36.

Graph Showing Effect of Lime Applications on Acidity of the Soil.

The soil in all pots received superphosphate as a basal dressing and the experiment was arranged to test responses to calcium, magnesium, potassium and nitrogen. Maize was used as the indicator crop. Highly significant responses to calcium and magnesium, a significant response to nitrogen, and a response approaching significance to potash were recorded.

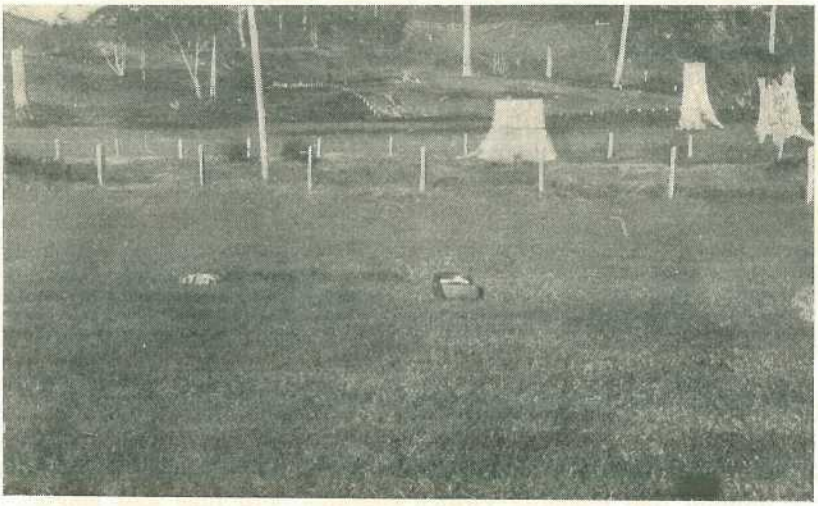


Plate 37.

Portion of Paspalum Paddock Selected for Experimental Purposes.

Prior to the carrying out of the pot experiments, arrangements were made for setting out an observational field trial on a portion of the pasture. The area selected (Plate 37), which was fenced off so that it could be protected from grazing as required, was a gently sloping portion of a field carrying principally paspalum.

The area was first renovated with cutaway disc harrows by discing in two directions at right angles, and then divided into 18 plots to which the following treatments were given in duplcate:—

(1) No fertilizer.
(2) Dolomite
(3) Dolomite + rock phosphate.
(4) Dolomite + superphosphate.
(5) Lime.
(6) Lime + rock phosphate.
(7) Lime + superphosphate.
(8) Rock phosphate.
(9) Superphosphate.

The lime and dolomite were applied in October, 1947, and the phosphates four weeks later.

It was hoped that natural regeneration of red and white clovers, which had been present in the pasture originally, would take place in the plots to which lime or dolomite, plus phosphate, had been applied.

A general marked improvement in the growth of the pasture in all plots resulted from the renovation alone, and some clover did become re-established, but only in those plots which had received either lime or dolomite plus phosphate, the best treatment appearing to be dolomite plus superphosphate. The area was grazed from time to time and mowed

Plate 38.
Close-up of Unfertilized Plot.

Plate 39.

Close-up of a Plot Treated with Dolomite and Superphosphate.

occasionally to prevent the grass from growing rank. In order to further test the efficacy of the treatments, a strip running at right angles to the plots, and therefore covering all treatments, was again renovated in the autumn of 1948, and sown to mixed clovers.

Patches of both red and white clovers appeared throughout, but, as previously, they were confined almost entirely to the plots which had received lime or dolomite plus superphosphate.

Plates 38 and 39 show comparisons of the pasture on an untreated plot and on one which had been treated with dolomite and superphosphate. The patch of red clover on the latter plot will be noticed.

In 1950, four years later, it was reported by the owner that some clover has become established in the rock phosphate plots. This suggests that success might well be obtained by treating the pasture, after renovation, with either basic superphosphate or rock phosphate, but that interaction with the latter would seem to depend on the state of fineness of the particles. If rock phosphate alone could be used successfully it would, of course, be the most economical fertilizer to apply.

At the same time as the experiments on the pasture were being conducted, the farmer was encouraged in his work of cultivating small areas on the contour. These were first planted to cash crops, such as peas and turnips, which had been limed and fertilized according to Departmental recommendations and were then sown to mixed pasture grasses and clover. This system was found to be sound economically and the cash crops not only gave satisfactory returns but also paid handsomely for the heavy fertilization which later, as residual material, supplied the plantfood needs of the sown pasture.

Further pot experiments were also carried out with red clover with a view to comparing its composition when grown in differently fertilized soil.

The results, whilst chiefly of academic interest, do show that more magnesium has been absorbed by the plant from those pots receiving superphosphate plus dolomite than from those treated with superphosphate alone or superphosphate plus lime. This again supplies further evidence of a magnesium deficiency in these soils.

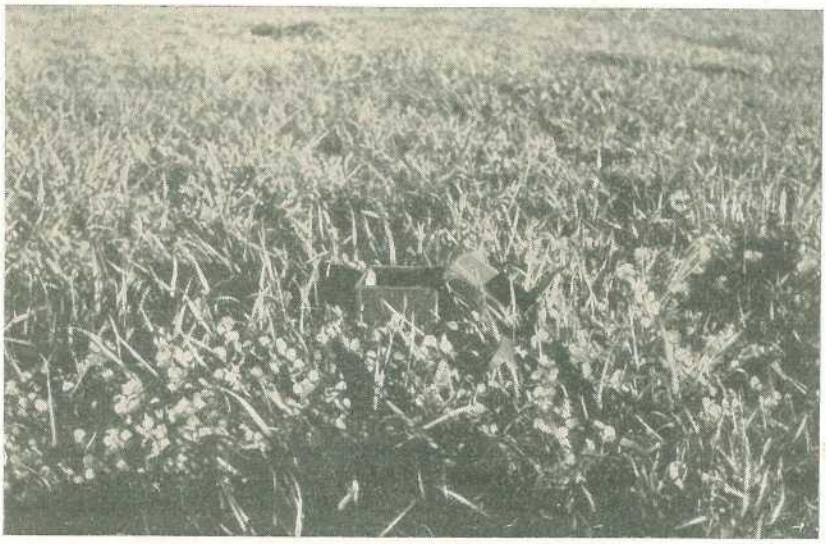


Plate 40.

Close-up of Ryegrass and Clover Pasture Grown on Cultivated Land.

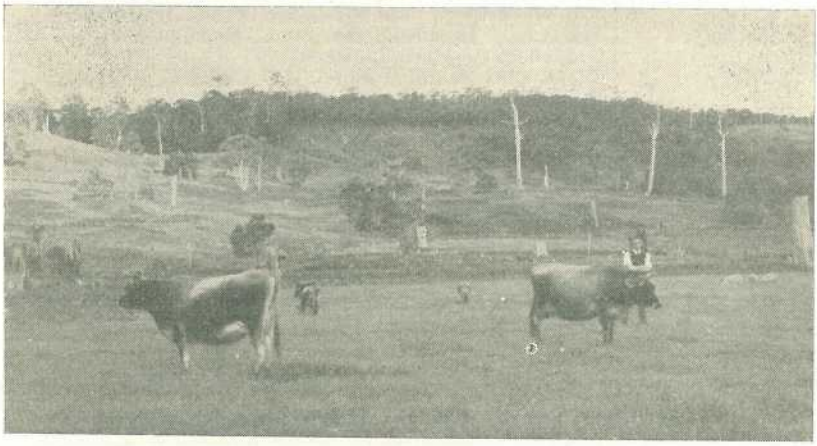


Plate 41.

View of Portion of a Dairy Herd, Showing The Good Condition of the Stock After Pasture Improvement and Supplementary Feeding Had Been Practised

An inspection of the farm made in May, 1950, showed that the health of the dairy herd was good and that marked success had been obtained with cultivated and sown pastures.

Plates 40 and 41 illustrate the excellent pasture that was being grown under cultivated conditions at the time of the visit, and the sleek condition of the stock.

TUBERCULOSIS-FREE CATTLE HERDS.

(AS AT 18th JUNE, 1951.)

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas F. H. Hutton, " Bingegang," Dingo
A.I.S...	F. B. Sullivan, " Fermanagh," Pittsworth D. Sullivan, " Bantry " Stud, Rossvale, *via* Pittsworth W. Henschell, " Yarranvale," Yarranlea Con O'Sullivan, " Navillus Stud," Greenmount H. V. Littleton, " Wongalea Stud," Hillview, Crow's Nest J. Phillips and Sons, " Sunny View," Kingaroy Sullivan Bros. " Valera " Stud, Pittsworth Reushle Bros., " Reubydale " Stud, Ravensbourne H. F. Marquardt, " Chelmer," Wondai W. G. Marquardt, " Springlands," Wondai A. C. and C. R. Marquardt, " Cedar Valley," Wondai
Ayrshire	L. Holmes, " Benbecula," Yarranlea J. N. Scott, " Auchen Eden," Camp Mountain
Friesian	C. H. Naumann, " Yarrabine Stud," Yarraman J. F. Dudley, " Pasadena," Maleny
Jersey	W. E. O. Meier, " Kingsford Stud," Rosevale, *via* Rosewood J. S. McCarthy, " Glen Erin Jersey Stud," Greenmount J. F. Lau, " Rosallen Jersey Stud," Goombungee G. Harley, Hopewell, Childers Toowoomba Mental Hospital, Willowburn Farm Home for Boys, Westbrook F. J. Cox and Sons, " Rosel " Stud, Crawford, Kingaroy Line R. J. Browne, Hill 60, Yangan P. J. L. Bygrave, " The Craigan Farm," Aspley A. Verrall and Sons, " Coleburn Stud," Walloon R. J. Crawford, " Inverlaw Jersey Stud," Inverlaw, Kingaroy P. H. F. Gregory, " Carlton," Rosevale, *via* Rosewood E. A. Matthews, " Yarradale," Yarraman

PLEURO-PNEUMONIA INVESTIGATION.

The Division of Animal Industry of the Department has undertaken an investigation to ascertain if the present methods of control of pleuro-pneumonia can be improved and the disease eventually stamped out.

A veterinary officer now stationed at Cloncurry will work over a large territory extending into the Gulf region and down the western stock routes. He will collect information on all aspects of pleuro-pneumonia infection of paddock and travelling stock and the efficacy of quarantine and vaccination in controlling the disease.

Outbreaks of pleuro-pneumonia are the cause of considerable stock losses and dislocation of stock movements.

The Sheep Blowfly Problem in Queensland.

5. Modern Methods of Blowfly Control.

S. J. MILLER, Sheep Husbandry Officer.

AT least some of the methods which can be used to control blowfly strike are fairly well known. Woolgrowers who utilise them all to advantage realise the importance of working to a programme which anticipates the fly waves, and of taking reasonable precautionary measures to prevent strike.

Clear cut programmes for blowfly control measures must be worked out for application under various conditions—for example, spring or autumn lambing, summer or winter rainfall, &c. Many factors have to be considered. The known lines of attack, pointing out advantages and disadvantages of various methods used, the time to apply them, and when they can be best used in a co-ordinated programme, are discussed in this section.

Blowfly control measures start when the lambs are marked and these continue throughout the life of the sheep. No one method of attack is sufficient. Most graziers realise this but there are many who do not or will not realise that when more than one line of attack is used the aim is to keep ahead of the fly and anticipate a wave.

Preventive methods may be grouped under three headings:—

(*a*) Measures to reduce inherent predisposition.

(*b*) Measures to reduce immediate susceptibility.

(*c*) Treatment of strike.

I. MEASURES TO REDUCE INHERENT PREDISPOSITION.

The following methods tend to reduce conformation defects which make sheep attractive to attack by blowflies. Their effects last throughout the life of the sheep and the cost when distributed over the productive life is small in comparison with the protection afforded.

1. Docking.

Correct docking should be the first step taken by graziers to protect their sheep against fly strike. The effects of this simple operation are often marred by trying to work too quickly or by carelessness. The length at which the tail is docked affects both the occurrence of tail strike in the wound immediately after docking and the incidence of crutch and tail strike in the later life of the animal.

It has been shown in field experiments that the shorter the tail the greater the incidence of crutch strike. The most suitable length at which to cut lambs' tails appears to be about level with the tip of the vulva. Tails cut at this length grow proportionately with the rest of the body and give the greatest protection against crutch strike, as the following figures given by C.S.I.R.O. indicate:—

	Grouping According to Tail Lengths.		
	Vulva Covered.	Medium.	Short.
Number of sheep	74	69	81
Number of breech strikes ..	9	15	20
Number of breech and tail strikes	–	5	8
Number of tail strikes	1	2	7

The younger the lamb when docked and the longer the stump the more quickly the wound heals. Further, healing is hastened if the skin is pushed forward with the knife before cutting so that the severed skin slightly overlaps the bone. The quicker this wound heals the less chance there is of tail strike in recently marked lambs. The turning back of this severed skin over the end of the stump does away with the woolly tipped tail and so removes the chance of this area becoming soiled with faeces and urine and thus becoming attractive to flies.

2. The Mules Operation.

Many woolgrowers do not seem to realise that the main and most important effect of the Mules operation is to stretch the bare area under the tail. In correctly treated sheep the bare area usually measures about four inches across as against 1½ inches in untreated animals; consequently, repeated soiling of the wool-growing skin by urine is prevented and the area will not become attractive to flies. The Mules operation can give added protection from crutch strike even to plain breeched sheep, and this, of course, results entirely from the stretching of the bare area.

The technique has been described in several publications but it is one that can best be learned by demonstration, for which purpose the district Sheep and Wool Adviser of the Department should be contacted. Despite the fact that the Mules operation has given excellent results under field conditions, many woolgrowers are antagonistic to its use. These are usually men who have never tried it!

Sheep can be treated with the Mules operation at any age, but the most suitable time is after their first shearing. Should this be undesirable due to prevalence of the small black bush fly which prevents the wound from healing, it would pay to have a special crutching at a later date and apply the Mules operation immediately afterwards. Several graziers to-day are performing the operation at marking time because of labour shortages. When applied at this age the operation should be more radical, which may result in unmothering of lambs. However, the earlier protection against blowfly strike may compensate for this.

There are several indirect advantages to be derived from applying the Mules operation. These may be stated as follows:—

(1) *Easier Crutching.*—It is far easier to crutch sheep which have been treated by the Mules operation. This is an important factor both to the man who does his own crutching and to the owner who has this work done by contractors. It means better work and greater contentment amongst the shearers and there are less stained pieces.

(2) *Better Jetting and Spretting.*—While it is not usually necessary in Queensland to jet or spret sheep which have been treated by the Mules operation and which are crutched once a year, it may have to be done if it is difficult to arrange for crutchers. Should this occur, it will be found that it is a good deal easier to get even penetration of the wool by the jetting fluid. This of course means better jetting or spretting and better protection.

(3) *Reduction of Breeding Grounds.*—It has been shown conclusively that the primary fly, that is, the one which initiates the majority of strikes, breeds mainly in strike on living sheep. The Mules operation virtually robs the fly of its breeding ground and in this way it is an important direct attack on the fly population itself.

(4) *Relief from Worry.*—One of the most important indirect advantages of the Mules operation is the mental relief it affords owners and managers, who in the days before the Mules operation could never feel quite certain that there was not a bad smash just around the corner as the result of a fly wave suddenly developing. If the sheep have been subjected to the Mules operation, even the worst fly wave is unlikely to be responsible, either directly or indirectly, for heavy losses.

(5) *Improved Property Management.*—The Mules operation has an immense effect on property management. It reduces blowfly control measures to a minimum and what used to be a continuous and onerous task is now a simple job, which can be expeditiously performed. This means that more time is available for constructive work such as the erection and maintenance of improvements. This was well borne out during the war when station labour was difficult to obtain. Properties which practised the Mules operation on each year's "drop" of ewe weaners soon had complete flocks which had been treated. Relieved of the work usually associated with fly control, the available labour could be devoted to constructive work.

3. The Tail Strip Operation.

The Mules operation will not prevent strike originating on the tail. Docking to the recommended tail length will greatly reduce the number of tail strikes, but it will not eliminate them completely. The longer tail advocated has met with the following objections from graziers:—

(1) It is more difficult to shear or crutch cleanly.

(2) There is more risk of injury to the vulva at shearing.

(3) It increases the tendency to dagginess when the sheep scour.

(4) The presence of wool-bearing skin on the tip and underside of the tail results in soiling and strike in some sheep.

The tail strip operation has been shown to be a valuable adjunct to correct docking. It consists of removing a strip of wool-bearing skin from the upper surface of the tail so that the wound, on healing, draws

up the bare skin from the under surface of the tail to cover the sides and tip. The cut commences about two inches above the butt of the tail. This operation is preferably done on its own at marking time but may be performed in conjunction with the Mules operation at marking or weaning.

II. MEASURES TO REDUCE IMMEDIATE SUSCEPTIBILITY.

Important measures can be adopted to provide temporary protection against strike. Their adoption is governed to a large extent by local conditions, available labour and plant, husbandry methods practised and a knowledge of when the main fly waves are likely to occur. They are used, too, in anticipation of fly waves.

It is unsound practice to depend entirely on the measures described in this section for the control of fly strike in a flock. In nearly all cases they are to be regarded as supplementary to the measures outlined in the preceding section in order to keep ahead of the seasonal fly waves.

1. Shearing.

Shearing is probably the most efficient method yet known of reducing susceptibility to fly strike. Two main waves of blowfly activity can be expected, one in autumn (April-May) and the other in spring (September-October-November). Shearing just prior to, or at the beginning of, what is normally the worst fly season of the year will usually give a good deal of protection, and may even completely tide the sheep over that particular fly wave. If fly strike commences earlier than expected and shearing is in progress during a wave, there may be trouble from strike in cuts. Sheep that have been previously subjected to the Mules operation are less likely to be injured. It is not possible for all wool growers to shear just prior to the worst fly period, as factors such as availability of shearers, lambing dates, grass seed occurrence, and seasonal conditions have to be considered. However, shearing dates should be selected to meet each combination of circumstances. If shearing can be done prior to one fly wave, the mid-season crutching will precede the next and mating, lambing and marking can be arranged.

2. Crutching.

Crutching is the measure most commonly adopted for the prevention of breech strike. One crutching at or near mid-season is valuable not only by conferring protection but also by preventing the occurrence of excessively dirty wool. The protection given against breech strike usually lasts for about six weeks. Sheep which have been treated with Mules operation are easier to crutch and the finished job is more satisfactory.

It is frequently necessary to shear the wool away from the prepuce of rams and wethers to prevent soiling and consequently fly strike. This is known as ringing and is done while crutching.

In normal years, correct docking, the application of the Mules operation, and shearing and crutching at the right times will reduce losses due to fly strike to a minimum. The important things are:—

(*a*) *to do these things;*

(*b*) *to do them efficiently;*

(*c*) *to do them at the right times.*

Anticipate fly trouble—don't wait for it.

3. Jetting.

Jetting is used as a preventive against fly strike. It consists essentially of forcing a jet of water containing a maggot poison in suspension or in solution into the fleece so as to saturate areas susceptible to fly strike. The success of the method depends on attention to essential details and especially to the early treatment of flocks when fly activity begins. Its main use should be in an emergency, such as when local conditions prevent shearing or the mid-season crutching and a wave is expected or has actually started. Another time when it will be necessary to jet will occur if the expected fly wave commences later than anticipated, and the advantages sought by shearing or crutching are no longer effective. Thus, as a control measure against breech strike, it is an emergency weapon and a good one. Jetting can be done at short notice using labour and materials already on the place.

Jetting is most commonly used for protection against crutch and tail strike in ewes, but it can also be applied to the breech and head of rams, and the breech and belly of wethers. With the advent of the newer insecticides, it has also given promise against body strike.

The fluid used contains either a maggot poison such as arsenic or BHC, or a substance such as DDT, which prevents flies from laying eggs on the treated wool. Of the older jetting fluids, calcium arsenite is the most protective and also one of the cheapest of the materials available. It has been recommended for general use, because it is considered that the extra period of practical protection which it affords against strike (4-5 weeks as compared with about three weeks from sodium arsenite) more than compensates for some difficulty in its preparation and management. (Calcium arsenite drops out of suspension unless the jetter tank has an agitator working in it.)

Sodium arsenite provides a cheap mixture which is relatively simple to prepare and which does not require the fitting of an agitator to the machine. It may be used for all jetting on small properties where an extra treatment during a fly wave is unimportant because of easy mustering.

There are a number of points about jetting which call for comment.

(1) *Multijet Nozzles.*—The number and size of jets that may be used depend on the capacity of the plant available. Fluctuations in pressure as the cut-off is opened should not exceed about 15 lb. up or down when jetting at 80 lb. per square inch. Jetting should be done at the lowest pressure at which the fleece can be quickly wet to the skin. Crutch wool is especially difficult to jet as the sheep may crouch and then the staple is nearly vertical. Because of this it is necessary to jet upwards onto the crutch and downwards over the tail. It is often wise to mix a colour (1 lb. red oxide to 100 gallons) with the mixture to see if complete penetration is attained.

Many people jet safely at 120-150 lb. pressure, but it is advisable to use a small nozzle (3/64 inch), and hold it about 12 inches from the fleece. Larger plants are capable of working a 5-jet nozzle, each having a bore of 1/16 inch or 5/64 inch. This delivers nearly four gallons of liquid per minute at 80 lb. per square inch, necessitating the re-use of fluid which runs off. With the smallest power jetting plants, one 3-jet nozzle (1/16 inch bore) may be used.

To prevent blockages, a sieve fine enough to protect the nozzle and fitted at the outlet from the jetter tank is essential. A sieve of 24 mesh to the inch at the outlet will prevent nearly all blockages in 1/16 inch nozzles but it is hardly fine enough for 3/64 inch nozzles.

(2) *Re-using Jetting Fluids.*—If the largest nozzles are fitted, arrangements should be made to return to the jetter tank the liquid that splashes from the sheep, in order to avoid waste of mixture, excessive requirement of water, and the accumulation of poison in the vicinity of the yards. If calcium arsenite is being re-used, new full strength mixture must be continually added to maintain the strength and to avoid progressive lowering of the arsenic content of the fluid as the result of the deposition of arsenic in the wool. About 100 gallons of the new mixture is added after the treatment of each 400-600 sheep.

(3) *Jetting Injuries.*—Jetting injuries can cause serious loss. They usually result from forcing the fluid through the sheep's skin. Accurate control over the operation is obtained by holding the nozzle 2-3 inches from the wool, reducing the pressure to the lowest at which the fleece can be wetted to the skin, and compensating for lost speed of delivery by using larger or multijet nozzles. The policy of economical blowfly control by jetting involves the jetting of many small strikes. To jet seriously struck sheep with arsenic is dangerous. However, BHC can be used. If arsenic is being used it is advisable to refrain from jetting and to substitute dressing for strikes which are more than three inches across. The smallest strikes can be jetted as if they did not exist, and strikes of intermediate or doubtful size can be treated at reduced pressure, by drawing back the nozzle while jetting the surrounding fleece at normal pressure.

(4) *Special Considerations.*—There are a number of difficulties to be overcome or objections to be met if a jetting programme is to be used. Under Queensland conditions jetting to prevent crutch strike should be used as an emergency in conjunction with the methods already discussed.

(*a*) *Lambing.*—The normal lambing period occupies about six weeks. Jetting applied a week before lambing begins will not protect the most susceptible ewes from crutch strike until lambmarking.

(*b*) *Mating.*—The fear is sometimes expressed that a thorough jetting programme may interfere with mating. Experiments, however, failed to show that any disadvantage resulted from jetting ewes prior to mating.

(*c*) *Small strikes.*—No jetting methods have succeeded in preventing all strikes for more than two weeks. For a further 2-3 weeks the increase in size in individual strikes is greatly delayed. Nevertheless the small strikes, up to two inches in diameter, may be numerous in a jetted flock, and their presence causes many graziers to condemn jetting or to expend unnecessary effort in dressing the few sheep that are struck.

(5) *Jetting with DDT and BHC.*—Recently, work has been done to determine the value of DDT and BHC for control of crutch strike. BHC is a maggot poison but will not last long in the fleece. DDT has a greater residual effect and prevents flies depositing eggs.

The advantages of these materials over arsenic may be stated as follows:—

(1) DDT and BHC both kill flies and hence reduce the fly population.

(2) DDT and BHC are much easier to handle.

(3) Jetting injuries are less likely to occur.

(4) BHC can be used on struck sheep without fear of harmful effects.

On the other hand, DDT is not a good maggot poison and is very costly when used to jet struck sheep.

Consequently, BHC is better to use once a fly wave has commenced. In a well organised control programme, where the aim is to keep ahead of the fly, arsenic is equally effective except for the fact that DDT and BHC help to reduce fly numbers and are not harmful to struck sheep.

4. Protection of Rams' Heads.

Head strike in rams is due to the rapid multiplication of bacteria in the excretions in the skin creases about the poll and base of the horns. It may also follow infection of wounds from fighting. The methods used to control head strike are as follows:—

(1) *Shearing.*—Shearing rams twice yearly will prove beneficial, especially if it can be done in spring and autumn before the fly waves.

(2) *Swabbing.*—The maggot poison or fly repellant can be worked well in around the base of the horns. Arsenic, BHC or DDT could be used in this way, but the method is very time-consuming.

(3) *Dry Dressings.*—For this purpose dry boracic acid powder worked in thoroughly at the base of the horns is of value.

(4) *Jetting.*—This is probably the best method to use provided it is applied at the correct time. Arsenic has been used successfully, though there is some danger of rendering the rams infertile. Jetting must be done carefully to avoid splashing and a pressure of 30-50 lb. is sufficient.

Preliminary trials indicate that jetting the poll and adjacent parts with DDT or BHC preparations may give protection for up to six weeks. About one-third to one-half gallon should be used so that the wool is thoroughly saturated. Preparations containing 1 per cent. BHC or 2 per cent. DDT have proved successful and are to be preferred to arsenic if the rams are being treated prior to joining.

5. Protection from Body Strike.

Flies are attracted to areas where bacteria are active in the fleece. This condition is usually referred to as fleece rot. It is most prevalent in wet seasons and young sheep are much more likely to be affected. The obvious first line of attack is to shear the sheep if possible. However, this is not always practicable and other methods must be employed. Treatment of sheep with DDT or BHC preparations offers some promise for the control of body strike. Application may be by either spraying or dipping.

A light spray of DDT can be applied from the top spray of a shower dip. Alternatively, a jetting plant, to which is attached a special spraying device, can be used. The rose of a garden hose, or a series of fish tail, "Rega" cyclone, or Roseberry patent nozzles fitted to a curved spray boom, which is bent to fit over the back and shoulder of an average sheep, facilitate the work. The jetting plant is run at a pressure of about 150 lb. per square inch.

BHC can be applied from the top of a shower dip or from a jetting plant with the usual or specially adapted nozzles.

A 1 per cent. solution of DDT or 0·05 to 0·075 per cent. solution of BHC is used. Amounts used vary from a quarter to half a gallon per sheep, depending on wool length.

The materials have been applied to an area extending from behind the neck, in front of the shoulders, to the tip of the tail, and well down both sides and flanks of the sheep. In practice the DDT solution is applied till run-off just commences. The re-use of any DDT collected on the floor is not recommended. The re-use of BHC is only recommended where large quantities (up to two gallons) are used for jetting struck sheep through wide bore (up to 5/64th inch) nozzles.

If plunge dipping is undertaken the sheep should be passed through a swim dip containing DDT or BHC at not less than four times dipping strength recommended to control body lice. This method is usually practised if spraying fails during a severe fly wave. It is very costly, especially if the sheep are full woolled.

Spraying or dipping with DDT or BHC will prevent body strike or reduce it to a very low level for a few weeks. Spraying in advance is particularly useful when heavy rains are expected and in areas where it is difficult to muster and treat sheep. For this purpose DDT is preferable. Waves of body strike usually last for 2–4 weeks and spraying with DDT should protect sheep for that period. DDT is ineffective against blowfly maggots and if sheep are not sprayed until body strike is detected, treatment with BHC is preferred. It will not confer such a long period of protection against adult flies as DDT, but it rapidly destroys all maggots.

Tentative recommendations for using these newer insecticides are therefore:—

(1) Use 1 per cent. DDT when spraying sheep in anticipation of a wave of body strike.

(2) Use ·05 per cent. BHC generously when treating sheep after a wave has developed. This can be used as a jetting fluid to treat struck sheep, without shearing the wool away to expose maggots.

A recent report by the Joint Blowfly Committee stated:—

> "When tested under rigorous artificial conditions 'fogging' with 10 per cent. DDT or 2 per cent. BHC gave no protection against body strike on the nineteenth day. No earlier tests were made. In a controlled field trial 'fogged' sheep were struck within three (3) days and there was no significant difference in the number of strikes on treated and untreated sheep during the three weeks following exposure."

III. TREATMENT OF STRIKE.

Blowfly strike may be defined as the condition produced by the development of blowfly maggots on the living sheep. In treating the condition it is necessary:—

(1) to remove the maggots with as little damage as possible to the sheep's tissues;

(2) to encourage healing;

(3) to kill maggots;

(4) to protect against restrike.

Some strikes will occur in spite of preventive measures. Therefore when flies are active, frequent, careful inspection of the flock is necessary for two reasons:—(1) the sooner strikes are detected the less harm they do and the more easily and quickly they heal; (2) early detection and treatment of strikes retards the rate at which fly populations increase. Because of the latter, the maggots in the wool should be destroyed after having been clipped from the struck area if possible. No known dressing will protect a sheep which constantly soils its crutch or breech with urine. The obvious course is not to seek some "super dressing" but to apply the Mules operation. Treatment of struck sheep, after all, is the last line of defence.

In crutch strike of plain breeched sheep or of sheep on which the Mules operation has been performed, and in pizzle strike and body strike, the removal of the wool and the destruction of the maggots enable the struck area to dry out and very little more is required for satisfactory healing. The simplest dressings are sufficient under these conditions, as, for example, carbolic dip or 5 per cent. bluestone ($\frac{1}{2}$ lb. per gallon).

In more deeply seated strikes and in horn strikes where the struck area cannot be fully exposed by shearing, a liquid dressing with good penetrating qualities is required. During the last decade C.S.I.R.O. has released formulae for three dressings, all of which are effective. They are known as CBE, BTB, and BKB.

The incorporation of DDT, and to a lesser extent BHC, in blowfly dressings has the advantage that flies alighting on the dressed areas are likely to be killed and hence each treated sheep becomes, in a sense, a poison bait.

If (through the severity of the fly wave, or failure to adopt preventive measures) strikes are too numerous for available labour to deal with each of them properly, jet the struck area and two inches around it with ·05–0·1 per cent. BHC. This is a powerful maggot killer and treatment will hold the position temporarily. Mark these sheep and go over them again as soon as possible; shear off the struck areas and apply fresh dressings to any which have not dried out.

In instances where hundreds of sheep were affected with body strike, the struck animals were shower dipped with 0·05–0·1 per cent. BHC, $\frac{1}{2}$–1 gallon per head being used. This cleaned up the majority of the strikes completely.

One cannot overstress the fact that a "super dressing" is not the answer to the blowfly problem. The aim is to apply other known and proved methods of control efficiently so as to obviate as much as possible the use of dressings.

CONCLUSIONS.

The blowfly is such a major cause of decreased production in the sheep industry that husbandry methods need to be arranged to allow an efficient control programme to be put into action without interfering with other aspects such as mating, lambing, &c. Because of this no general calendar programme can be given to cover the State or even a district.

The best control programme commences early in the sheep's life by carrying out procedures which will reduce the animal's susceptibility to strike throughout its life. These are—

(1) correct docking;

(2) Mules operation;

(3) tail strip operation.

After having made the sheep less attractive to the fly, certain procedures must be carried out to keep ahead of the seasonal fly waves. It is known that these occur in the autumn and the late spring. In any programme of work designed to prevent fly strike, shearing and crutching play an essential part. If possible, these should be arranged so as to precede the fly waves. If the fly wave is earlier or later than expected, or shearing cannot be arranged for various reasons, such as the occurrence of grass seed, shortage of labour, &c., jetting is necessary.

However, correct docking, Mules operation, shearing and a mid-season crutching will keep the fly under reasonable control in most years. Jetting is an added weapon to meet unusual circumstances.

Modern insecticides such as DDT and BHC each play an important part in the control of head strike and body strike. BHC can also be used to advantage to check heavy strike conditions if the numbers affected become too great to dress.

Some strike will occur regardless of preventive measures, but the aim should always be to act before the fly and so keep strike numbers to a minimum.

ASTRONOMICAL DATA FOR QUEENSLAND.

AUGUST.

Supplied by W. J. Newell, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6·30	5·18	Cairns	17	41	Longreach	29	40
6	6·27	5·21	Charleville ..	26	28	Quilpie	36	34
11	6·23	5·23	Cloncurry	41	58	Rockhampton ..	4	16
16	6·19	5·26	Cunnamulla ..	30	28	Roma	16	18
21	6·14	5·28	Dirranbandi ..	21	17	Townsville ..	15	35
26	6·10	5·31	Emerald	14	24	Winton	33	47
31	6·04	5·33	Hughenden ..	26	44	Warwick	5	3

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Day.	Rise.	Set.
	a.m.	p.m.
1	5·19	3·38
2	6·01	4·35
3	6·39	5·32
4	7·13	6·28
5	7·44	7·24
6	8·13	8·20
7	8·42	9·16
8	9·12	10·14
9	9·45	11·16
10	10·21	..
		a.m.
11	11·04	12·21
12	11·55	1·28
	p.m.	
13	12·55	2·36
14	2·02	3·41
15	3·14	4·40
16	4·25	5·31
17	5·34	6·14
18	6·40	6·52
19	7·42	7·26
20	8·43	7·58
21	9·42	8·30
22	10·40	9·02
23	11·38	9·37
24	..	10·14
	a.m.	
25	12·37	10·57
26	1·33	11·43
		p.m.
27	2·26	12·35
28	3·15	1·30
29	3·58	2·26
30	4·38	3·24
31	5·14	4·21

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

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

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	9	30	25	44	0	20	26	53
6	17	19	33	36	8	10	37	41
11	29	12	44	26	19	1	52	29
16	27	12	43	26	18	1	50	29
21	13	23	28	39	2	14	31	44
26	9	30	25	45	0	21	26	54
31	13	25	28	41	3	16	31	48

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	3	53	34	66	18	51	4	44
3	10	46	37	61	22	47	9	38
5	20	36	43	55	28	40	17	31
7	30	24	51	46	35	32	25	21
9	42	13	58	39	43	24	35	13
11	52	8	66	36	50	21	43	8
13	56	2	68	32	52	17	46	3
15	53	4	67	33	50	19	44	5
17	42	13	58	39	43	24	35	13
19	29	32	50	53	35	38	25	28
21	18	37	42	56	27	41	16	32
23	8	47	36	62	21	47	8	39
25	5	55	35	67	19	52	5	45
27	2	56	33	67	17	53	3	46
29	5	51	35	64	19	50	5	43
31	13	43	39	59	24	45	12	36

Phases of the Moon.—New Moon, 3rd August, 8.39 a.m.; First Quarter, 10th August, 10.22 p.m.; Full Moon, 17th August, 12.59 p.m.; Last Quarter, 24th August, 8.20 p.m.

On 15th August the sun will rise about 15 degrees north of true east and set the same amount north of true west, and on the 7th and 19th the moon will rise and set very close to true east and true west respectively.

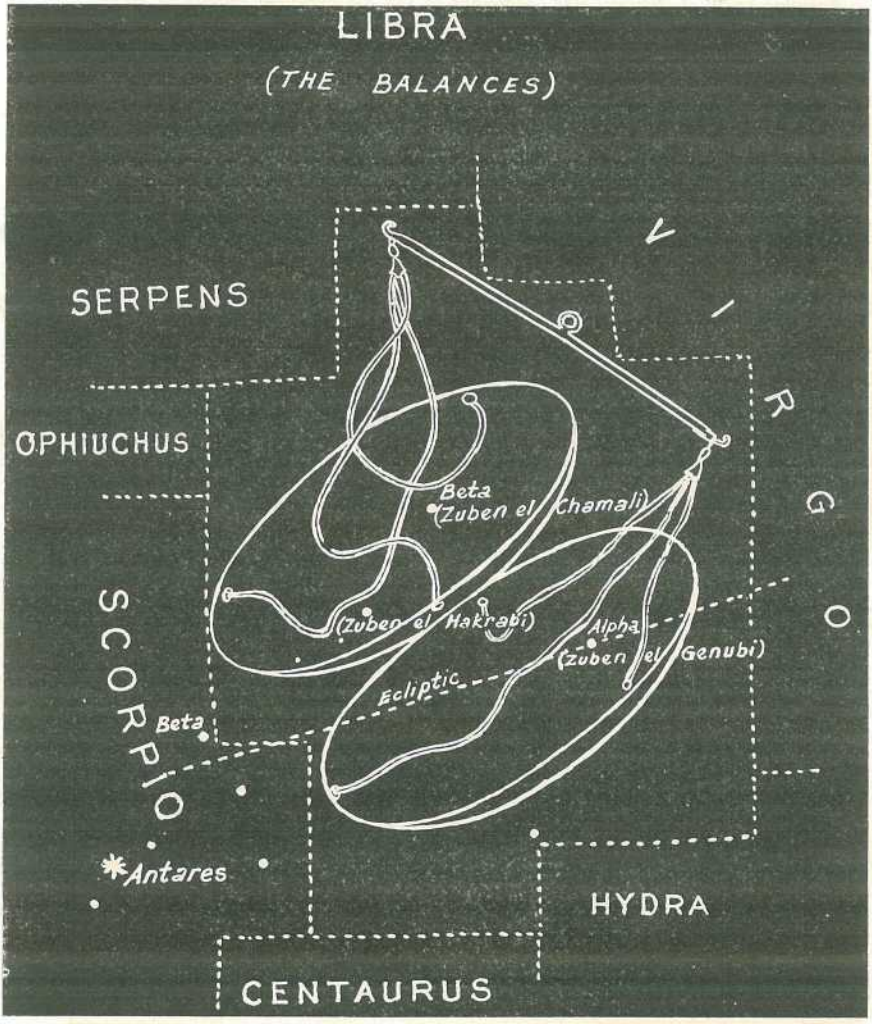
Mercury.—An evening object all this month, not far from Venus but much fainter and near to the sun. At the beginning of the month, in the constellation of Leo, will set over 2 hours after the sun and will reach greatest angle from the sun on the 3rd. By the end of the month it will be in line with the sun.

Venus.—Now passing out of the evening sky. On the 1st it will set about 3 hours after the sun and by the 31st will set only ½ hour after sunset.

Mars.—In the constellation of Gemini, should now be easily seen low in the eastern morning sky, when it will rise about 1 hour before the sun at the beginning of August and about 1½ hours before the sun at the end of the month.

Jupiter.—Now a brilliant object in the eastern sky during the early part of the night; rising between 10 p.m. and 11.15 p.m. at the beginning of the month and between 8 p.m. and 9.15 p.m. at the end of the month.

Saturn.—In the constellation of Virgo, will set between 9 p.m. and 10.15 p.m. at the beginning of August and at the end of the month only 2 hours after sunset. It is higher in the sky than Mercury and Venus but fainter.



THE CONSTELLATIONS.

LIBRA AND SEXTANS.

Between the constellations of Virgo (described in the May Journal) and Scorpio (described in the July Journal last year) lies the constellation of Libra; represented by the scales or balances. It is not a particularly bright group, having only one star of 2nd magnitude and two of 3rd magnitude among the number of fainter stars. It is well known as one of the "Signs of the Zodiac," the sun passing through it from 1st to 25th of November. Alpha, which is a double star, lies almost on the ecliptic and a line from Antares (Alpha Scorpii) points to Beta Librae, which is a 3rd magnitude green star and an exception to the rule that green stars are faint and generally small companions of binaries (binaries are groups of two or more stars moving about a common centre of gravity). In this constellation is another example of Beta. this being brighter than Alpha.

Serpens (The Serpent).—This is also a group of rather inconspicuous stars, the brightest being of 2nd magnitude. However, it contains several interesting telescopic objects, including M5, a fine globular cluster, and many doubles and variables.