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QUEENSLAND AGRICULTURAL JOURNAL

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Event and Comment

Efficiency in Agriculture.

IN giving some impressions of his recent investigation of rural problems in South Africa and the two Americas in the course of a Press interview, the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, remarked that the agricultural race of to-day will be won by the most efficient countries. "If Australia is to maintain its position in the world's markets," he said, "it will have to plan for increased efficiency." He believes that many of the things he saw in other countries could be incorporated with necessary modifications, in practice in Queensland.

He had come back a better Australian, and convinced that Australia had many advantages over some other countries which he had visited, especially in relation to the colour problem. Australia accepted the White Australia policy as an every-day fact. Australians could not appreciate the colour problem of other lands until they had seen its difficulties, and many times he had felt intensely grateful for the wisdom which had inspired Australia's national policy.

Continuing, Mr. Bulcock said that he had been very deeply impressed with the time and consideration given by all the countries he visited to the economic organisation of agriculture. Bounties in some form were the order of the day. He wondered what would happen to agricultural countries which were without bounties when their goods met those of a bounty country in a common market.

Every country was seeking a solution of the problem of production. Some paid liberal bounties to provide an export market. In some quarters in the United States it was believed that funds devoted to agriculture should be derived from industry, and industry should subsidise agriculture.

Queensland had technicians equal to those he met overseas. It could work out its problems satisfactorily only on that keynote of efficiency.

Los Angeles was the home of agricultural co-operation. He had visited California to discuss its agricultural railway freights, refrigeration of perishable goods, water supply systems, and other matters.

Mr. Bulcock was particularly struck with the way the United States was facing up to its road transport problems. It was an art and a science in designing roads to prevent congestion and carry car traffic with speed and safety. The road programme was an amazing investment of national capital.

Canada was rapidly aligning its interests with those of the United States. A common policy embracing all the Americas was in course of evolution.

From Australian standards, the cost of living was very high in the United States, and in some capital cities in South America, but in the South American interior it was reasonably low. In his contacts throughout his tour he had discovered the international spirit of the agricultural worker.

In a close look at the operation of the New Deal in the United States he found it a broad social experiment to unite for a more equitable distribution of wealth. It aimed to find funds to give employment to what were called the under-privileged people.

At Honolulu he found the famous Waikiki Beach did not compare with those of the Queensland coast. That observation and sights of famous American scenic and tourist resorts en route led Mr. Bulcock to suggest that Australians should see their own country first, before touring abroad.

America, by skilled advertising, drew people from all over the world. If it had the Barrier Reef it would draw people from Mars. Australia had wonderful attractions. America popularised what it had by telling the world about it, but Australia had, apparently, not yet fully realised the potentialities.

Australians Well Off.

SUMMARISED observations of the Minister, based on his overseas tour, are:—

Australians do not realise how well off they are by comparison with the conditions of people in other countries.

This nation is building towards a destiny as one people—and that could not be said for some countries he visited.

Governments in Australia are closer to the people.

Mr. Bulcock expressed these opinions at a luncheon at which the Queensland Cabinet entertained him on his return to Brisbane.

The Premier (Hon. W. Forgan Smith) said that Mr. Bulcock had seen many things in his travels, and should have an interesting story

to tell when introducing his estimates in Parliament. He would benefit by being able to compare conditions in other countries with those in Queensland. Travel was, without doubt, the greatest of all educators. Much that goes on in life was the result of comparison—comparing conditions in one country with those of another. It was of great advantage to a man to have the opportunity of seeing other countries and acquiring the knowledge they could impart for the advancement of his own land. He had no doubt that Mr. Bulcock had discovered much from which Queensland would benefit.

Mr. Bulcock said that he had seen many things which could, with modifications, be incorporated into the agricultural life of this State. In the Argentine he paid particular attention to the cattle industry, and in Patagonia to sheep. While in the United States he saw many things of deep interest to Australians. The United States was doing a great job in technical research in agriculture, but there were paradoxes, such as huge expenditure to increase efficiency in production, and, within a fortnight, still greater expenditure to restrain production.

He had seen much of government. In Brazil he was invited to see anything he wanted to see. His general impression was that the gulf between governments and people was astoundingly wide; in Australia it was part of the people's life.

Restriction of Production—Will It Become Permanent?

"HAVING seen poverty and want and demonstrations of the problems of competition, I cannot believe that the restriction of production will become a permanent feature of agricultural life. I am inclined to believe that the position ultimately will be that markets shall be to the most efficient, and to those countries which can supply the consumers' needs at the cheapest rate. Therefore, the keynote of things is efficiency." With those observations, Mr. Bulcock concluded an intensely interesting address to the staff of his department at a welcome home gathering. The Minister added that the problems of the Queensland Department of Agriculture and Stock were of a minor nature in comparison with disease and other economic problems of other countries. In South Africa, for example, the stock disease position entailed continuous anxiety and constant vigilance. As a consequence, South Africa had developed a very high standard of veterinary service, and what was probably the greatest animal research station in the world had been established there. This was an institution to which, not only South Africa, but every other stock-raising country was deeply indebted.

In Monte Video, he had seen what is probably the world's best milk supply scheme in operation. In the Argentine the steer was king, and the impression he had gained there was that the steer could not be displaced from its pedestal in the scheme of production. In Brazil, in the course of a 2,000-mile journey, he had become greatly impressed with its agricultural possibilities. He found that a remarkably good job of work is being done there in soil research, and that that country is developing high agricultural standards.

Generally, Mr. Bulcock indicated that he had in the course of his mission abroad obtained at first-hand much information which would be of great advantage to his staff, and of immense benefit to the State.

A. F. SKINNER, Field Assistant.

IT is realised that unrestricted soil losses rapidly reduce crop yields to a point below which they are no longer profitable. In the past due consideration was not always given to the conservation of the soil, with the result that older cultivations bear witness to the fallacy of many traditional farming practices. It is in comparatively recent years only that recognition has been given to the full significance of this menace to the permanency of our soils. Older countries, however, have been compelled to plan and adopt efficient and permanent schemes for soil conservation.

Such schemes, as described in these notes, have been tested under a wide range of conditions and have proved so successful that large additional areas are being stabilised annually at the request of the owners.

Erosion can and must be controlled if the productivity of the soil is to be maintained. Soil erosion by water, as it is widely known, has been defined as "the accelerated transportation of soil particles from their source of origin to a lower and temporary position by the action of running water."

Associated with the occupation of territory by man is the inevitable destruction of much of the vegetative covering designed by nature for the protection of the surface of the earth against the elements. This mantle is fundamental to the preservation of the soil formed in the course of countless centuries. Time and experience have taught that its removal necessitates the substitution of other forms of soil protection.

That the soil is a country's greatest asset and the real basis of national prosperity is axiomatic. Its safeguarding must, therefore, be recognised in Australia, as elsewhere, as a subject of paramount national importance.

Attention is directed towards the extensive damage done to vast areas of farming land in many of the older countries of the world through the lack of realisation of the menace of soil erosion.

In the United States of America and the Union of South Africa particularly, enormous sums are spent annually in mitigating the damage, almost irreparable in some regions, that has already occurred, largely as a result of an unplanned exploitative farming policy. In these countries erosion has removed the surface soil from vast tracts of land which were once fertile and productive. All that now remains of these areas are seemingly illimitable expanses of scarred and barren waste. In many instances, the rate of destruction has gained such impetus that it has passed beyond the possibility of effective reclamation.

It is important that this warning should be heeded in Queensland and active intervention encouraged. In no case can the phrase "prevention is better than cure" be more aptly applied. The work of repair is very slow and, in badly eroded fields, very costly.

Queensland is fortunate in being a comparatively newly farmed country, and if this problem is attacked resolutely and at once serious loss will be averted.

Erosion has already made its mark in most farming districts, and loss of surface soil is continuing, although, in many localities, almost imperceptibly. Accumulations of silt against fences, logs, or on headlands, the filling-up of hollows, the formation of gullies, and muddy and silted watercourses are ample evidences of erosion.

Reduced crop yields are frequently a direct result of the loss of the top soil—loaded as it is with humus, and containing plant foods and beneficial soil bacteria—and not to impoverishment as a result of continuous cropping. Estimates have revealed that from the whole of the cultivated areas in the United States of America more than twenty-one times as much* plant food is removed from the soil by erosion as by crops.

The land is dependent on its top layer of soil for the ready absorption and retention of water—another important factor which obviously affects crop yields.

With the gradual exposure of the subsoil by erosion, effective tillage becomes increasingly difficult and greater resistance is offered to the penetration of roots and moisture. In brief, the top soil may be described as the living surface of the earth.

Erosion by water may be classified as either: (*a*) Sheet erosion; (*b*) gully erosion.

The first form is often a preliminary to gullying and causes heavy losses of top soil in thin layers with almost every heavy rain. In the absence of any protective system providing for the even distribution and drainage of water from the whole field, existing depressions provide the only channels of escape. On cultivated land these shallow channels may develop rapidly into gullies. Gullies may also develop in soft ground from slight mechanical depressions such as wheel tracks. With each successive rain, gullies deepen and gradually extend. Usually, lateral gullies develop at each entrance point of water. The resultant loss of soil and division of the fields are reflected in lower crop yields and reduction of tillage area. In extreme cases fields may become worthless for cultivation through the loss of surface soil in a comparatively few years.

* From "Farm Terracing," by C. E. Ramser, Bulletin No. 1669, U.S.A. Department of Agriculture.

CAUSES OF EROSION.

Running water is the most destructive servant of gravitation in its tendency to reduce the earth's surface to a level plane. Its eroding power is dependent on its volume and velocity. Common practices which assist erosion in its work of destruction are:—

1. Square farming.
2. Cultivating in the direction of the slope.
3. Failure to attend to small "washes" before they develop into large gullies.
4. Bare fallowing.
5. Indiscriminate clearing of timber and undergrowth on steep slopes, catchment areas, and on the banks of watercourses.
6. Failure to practise suitable crop rotations.
7. Insufficient pasture areas.
8. The bringing of fields with a slope greater than 15 per cent. into cultivation.

Most of these contributing factors are bracketed with improper utilisation of land. Careful consideration should, at all times, be given to the layout of fields and pastures, the clearing of new areas, and farming methods. An endeavour should always be made to fit the crop pattern to the natural contour of the land as closely as possible.

THE SOIL-SAVING PLAN.

In planning any complete soil conservation programme, there are problems peculiar to every farm which must be carefully considered by the owner. In no case should the urge for immediate gain to the detriment of the soil-saving plan influence the choice of a programme which may provide for more modest returns over a greater period of years.

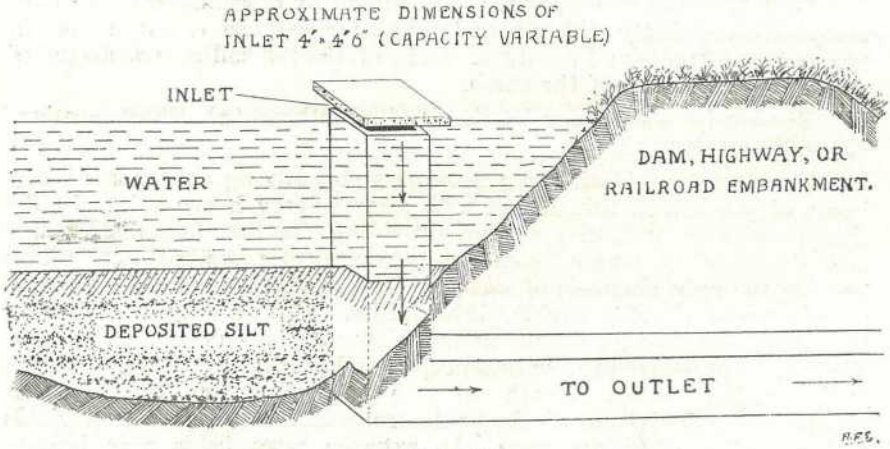


Plate 45.

CULVERTS AND DRAIN PIPES UNDER HIGHWAY AND RAILWAY EMBANKMENTS ARE FREQUENTLY THE CAUSE OF GULLYING OF LAND IMMEDIATELY BELOW THEIR OUTLETS. VERTICAL DROP INLETS PROVIDE FOR THE DEPOSITION OF SILT BY THE SLOW RELEASE OF WATER FROM THE SURFACE.

An effective scheme for an entire farm holding would probably necessitate a readjustment of the layout of cropping areas. Careful thought should be given to a planting programme which will not only allow for a reasonable margin of profit, but which also will assist in the conservation of the soil. This programme also will be influenced by such factors as land values, soil qualities, produce values, transport facilities, and labour costs.

A far-sighted policy is obviously necessary, and there is no reason to believe that any difficulties cannot be overcome in Queensland as they have been in many other countries.

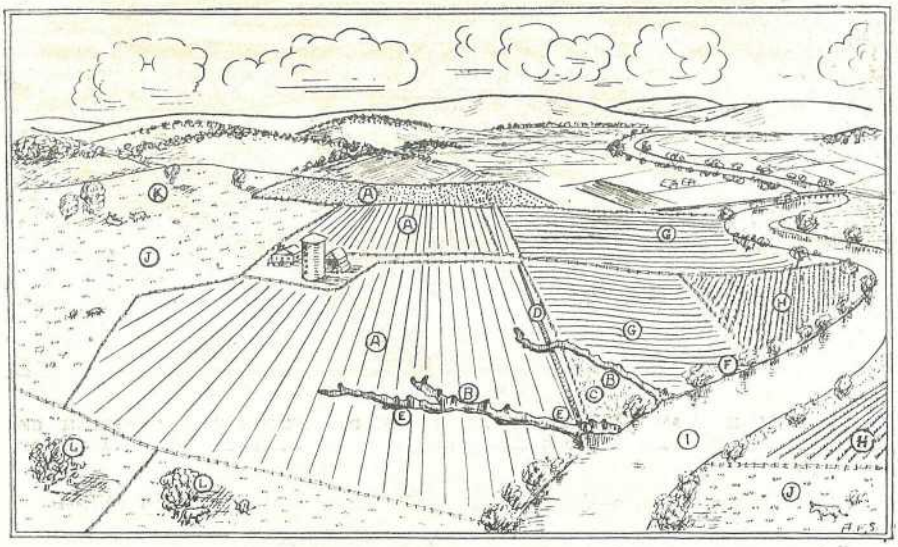


Plate 46.

This Illustration is Intended to Depict Some of the Common Practices and Effects of Present-day Farm Management which lead to the Loss of Soil and Ultimate Destruction of Fields by Erosion.

(A) Straight row cultivation and square fields.

(B) Gully development in natural depressions.

(C) Waste corners cut off by gully.

(D) Steep headland drain of unknown grade—a gully of the future.

(E) Neglect to check development of gullies by obstructing the flow of water.

(F) Destruction of timber on banks of watercourse.

(G) Ploughing and cultivating in direction of slope.

(H) River flats—row crop cultivation.

(I) Watercourse

(J) Non-subdivision of pasture areas.

(K) Destruction of timber on slopes greater than 15 per cent.

(L) Shade trees.

Control.

As the eroding power of moving water is governed by volume and velocity, the principles of prevention must be based on the control of these factors. In simple phrase, it is necessary to make "running water walk." This may be accomplished practically and methodically by diverting the flow of water from its most direct course to a line around the contours of the hills until a suitable outlet—such as a permanent pasture, timber belt, or vegetated waterway—is reached.

A contour is a line on the earth's surface joining all points of equal height. When constructing so-called contour terraces and drains, it is usual to allow a slight fall (termed "the grade") to carry the water slowly away.

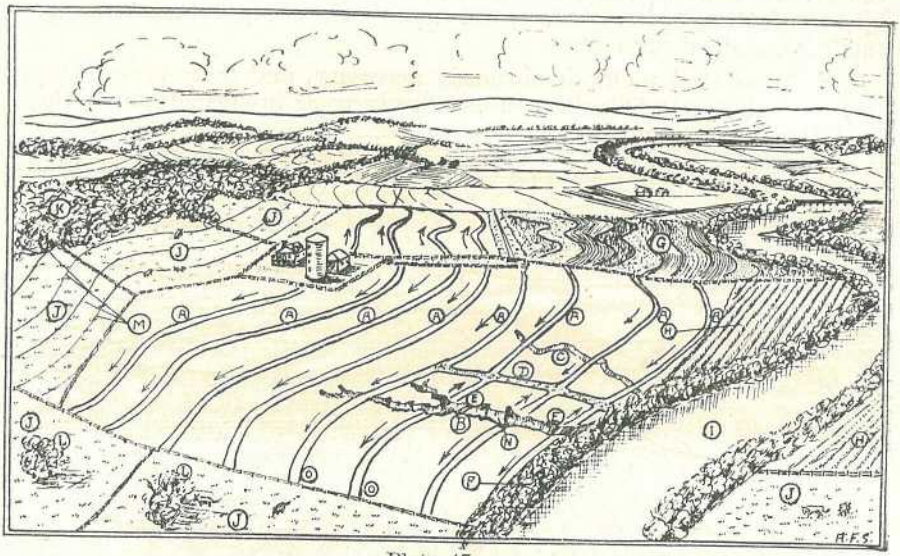


Plate 47.

THE SAME FARM (PLATE 46) AS IT WOULD APPEAR UNDER A SYSTEM OF MANAGEMENT PROVIDING FOR THE CONSERVATION OF SOIL AND THE RECLAMATION OF GULLIES.

(A) Contour channels—direction of grade ⟶.
(B) Gully too large to cross.
(C) Small gully crossed by contours.
(D) Vegetated waterway (channel outlets).
(E) Check dams in large gully (concrete, wire-netting and bramble, logs, straw, &c.)
(F) Timber protecting banks of watercourse.
(G) Strip-crop area—gentle slope not warranting contour drainage—cropping and cultivation on contour.
(H) River flat—row crop cultivation.
(I) Watercourse.
(J) Subdivided pasture areas for rotational grazing.
(K) Timber on slopes greater than 15 per cent.
(L) Shade trees.
(M) Contour furrows—pasture improvement.
(N) Hardy vegetation in large gully wherever possible—e.g., elephant grass or other suitable binding herbage.
(O) Channel outlets onto permanent pasture.

By preventing rapid run-off, more time is allowed for the penetration of water into the soil. In some cases, where the soil has a high infiltration value and where the rainfall is not excessive, run-off has been completely checked. The improved soil moisture content—the natural corollary—has the obvious result of stimulating the growth of both crops and pastures.

For the improvement of pastures, a common and simple practice is to open up single or double contour furrows at regular intervals along the slope. The work is best performed with a reversible mouldboard plough, as it is necessary to turn the furrows uphill.

For the prevention of erosion on cultivated areas, a carefully designed system of broad-based contour terraces, as described later, is recommended.

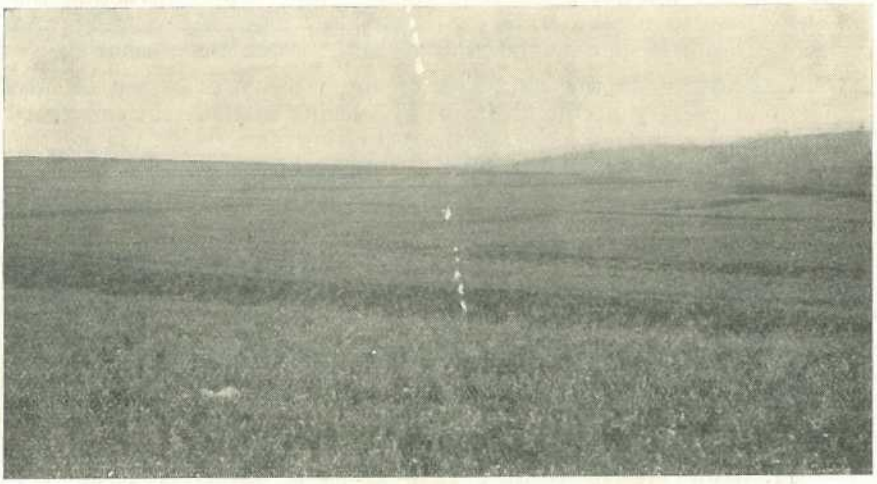


Plate 48.

Erosion has already made its Mark on many Farms on the Darling Downs. Such Terraces as these guard the Fields during Fallowing Periods.—This picture was taken at Willowburn, and represents portion of a demonstration area terraced in 1935.

There are, however, certain necessary preliminaries in the reduction of soil losses, which may be done on any farm at little or no cost.

The following suggestions are offered:—

1. Plough and cultivate across the slope, preferably on the contour.
2. Grow seasonal cover crops—such as cowpeas, field peas, vetches, clovers, oats, rye grass, and Sudan grass. They may be utilised either for grazing or green manuring.

   A common practice is to sow late summer and winter growing cover crops at the time of the last cultivation of seasonal row crops. Cover crops have been aptly described as "a rug for rain-worn soils."
3. Establish vegetated head drains to arrest any sudden rush of water from the catchment area above the cultivation.
4. Foster and protect the growth of vegetation in existing depressions to prevent them from extending. It is an obvious advantage to grow, wherever possible, something useful, such as suitable varieties of cow cane, sacchaline sorghums, or other strong-rooting crops. The growth of narrow strips of bamboos or banana plants on boundaries or headlands will serve, in fruit districts, as windbreaks, while the roots will help to bind the soil. Such trees as the kurrajong, bottle tree, carob bean, or Portuguese elm may be grown successfully on the Darling Downs.

5. Practise crop rotation, remembering that more soil is lost from row crops than from close covering crops—such as lucerne, cereals, or even pumpkins.

6. Check the development of existing gullies by obstructing the course of the water with rubbish, logs, wire-netting and bramble dams, or anything else to lessen the washaway.

7. Provide for the reduction of the velocity of water in any necessary headland drains by placing in them such obstructions as mentioned in the preceding paragraph. Make the grade of drains as gentle as practicable.

8. Obtain the correct tilth when ploughing or cultivating. A cloddy tilth arrests more free surface water than a fine tilth and is less likely to "wash." Do not break the surface down until the final working before sowing. Deep cultivation increases the absorption of water by the soil.

9. Retain belts of timber on the banks of watercourses and on the tops or slopes of hills where the grade exceeds 15 per cent.

10. When ploughing slopes, throw the soil uphill. A reversible hillside plough is suggested.

11. Grow erosion-resisting strip crops at intervals across the slopes—e.g., Rhodes grass, lucerne, or cane. For the protection of clean-tilled seasonal crops, strips of such annuals as small grains, winter legumes, and forage crops are suggested for the winter; and sorghum, Sudan grass, or cowpeas for the summer.

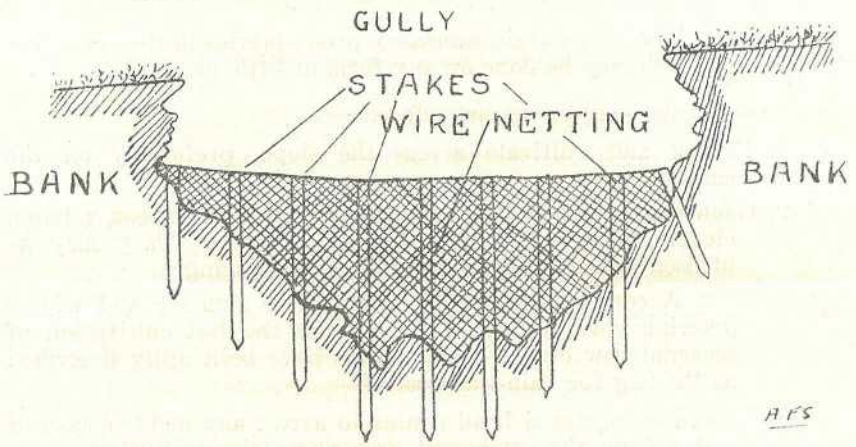


Plate 49.

WIRE-NETTING DAM WITH PACKED BRAMBLE, STRAW, OR OTHER MATERIALS.

On slight slopes in districts of low rainfall these precautions may, without doing anything else, be sufficient to reduce erosion losses to within reasonable limits. However, in steeply undulating country of high rainfall, like most of the coastal lands, they may be regarded as temporary checks only. Attention is directed, therefore, to the construction of broad-based contour terraces, which, in combination with strip crops, give the only guaranteed assurance of adequate protection against erosion. Their use may have slight disadvantages, but the fact

that thousands of farmers in countries practising the control of soil erosion continue to terrace additional fields annually is proof that the advantages of terracing must considerably outweigh the disadvantages.

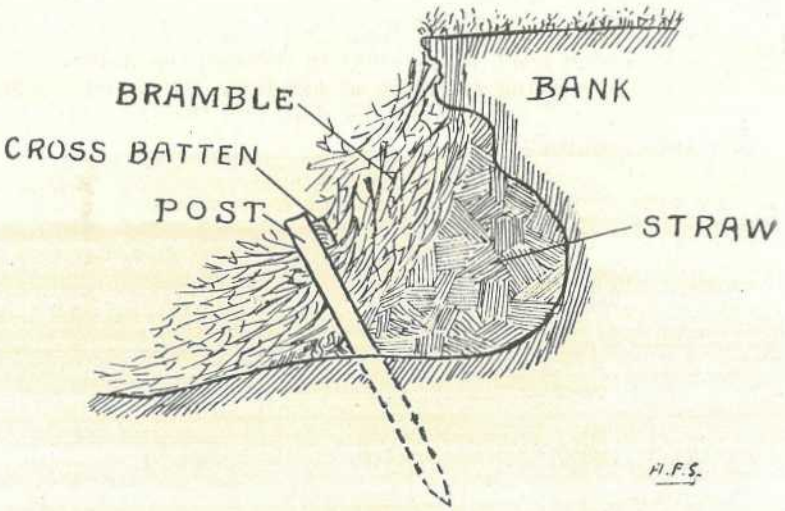


Plate 50.

Method of Controlling the Undermining Action of Erosion at the Head of a Gully.

The system has been very extensively tested in America particularly, where it has been found efficacious under actual and varied farm conditions.

Plate 51.

Properly Constructed Contour Terraces prevent "Washing" by making "Running Water Walk." (*Photo. taken at Willowburn, Darling Downs,* 1935.)

Construction of Terraces.

Care must be taken in the construction of these low, broad, undulating banks to ensure that they are capable in an emergency of arresting the maximum amount of rainwater likely to be precipitated in any one fall.

The use of some accurate levelling device, such as a dumpy level or home-made wooden level, is necessary in defining the proposed lines. Terraces form intercepting channels, at carefully calculated intervals, which arrest the flow of water down the slope and thereby provide low-velocity surface drainage.

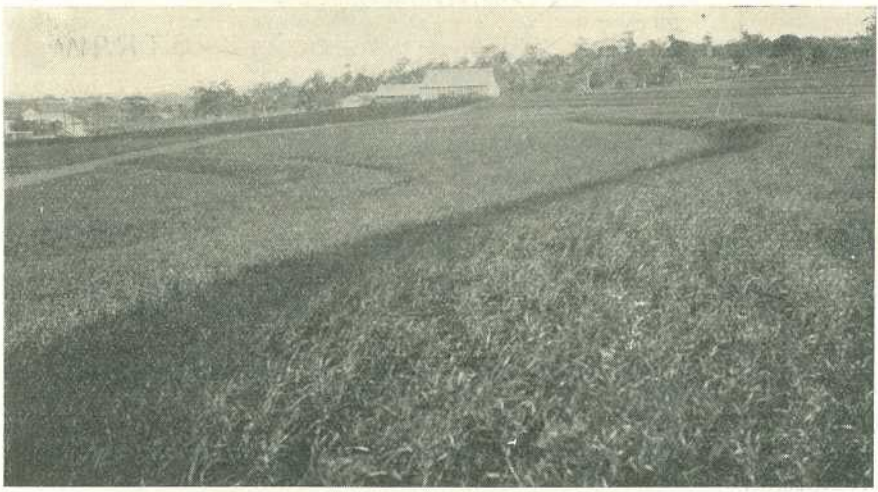


Plate 52.

LOW, BROAD TERRACES DO NOT HINDER THE NORMAL OPERATION OF CULTURAL IMPLEMENTS. (*Photo. taken at Willowburn, Darling Downs*, 1935.)

The three main requirements of a terrace cross-section are—

1. Ample channel capacity.
2. Channel and ridge slopes flat enough to permit the operation of implements along the terrace without unduly breaking down the terrace or hindering tillage operations.
3. Economical cost of construction.

In planning a system, it is of the utmost importance to locate the first terrace near enough to the drainage divide to intercept the run-off from the contributing area before it gains erosive velocity or a volume which will exceed the capacity of the first terrace channel. A point to be remembered is that the velocity increases not only with the degree of the slope, but also with the length of the slope.

In designing any contour drainage system, it is advisable to first prepare a plan of the area, marking suitable outlets for the disposal of the channel water, the slope of the fields, existing gullies and other obstructions, and the approximate length of the proposed terraces. This plan should serve in determining the distance between terraces, their grade (whether uniform or variable), and length of grade in any one direction.

A variable grade is necessary for terraces greater than 15 chains in length and having only one outlet. The grade becomes progressively greater as the terraces approach their outlets. For the first few chains, it is usual to allow only a very slight grade, if any.

Terraces longer than 15 chains, however, should have a double outlet wherever possible. This is accomplished by reversing the reading at a suitable point (preferably in the centre of a depression or on top of a ridge) when surveying and pegging out the proposed line.

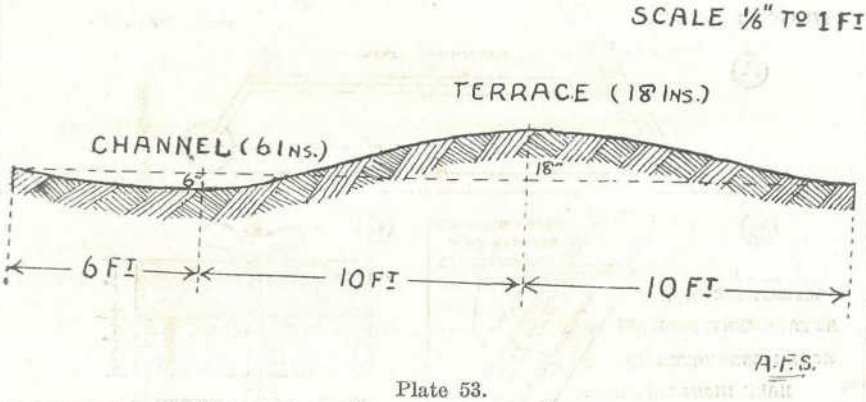


Plate 53.
Cross-section of Consolidated Terrace, showing Dimensions to be maintained.

The lines are best located by the use of a dumpy level; for small areas, a simple home-made level of wood can be used successfully. This level may be described as a light wooden frame with a span of 16 feet 8 inches at ground level; thus six spans will equal 100 feet. The frame itself consists of two sloping legs, each 8 feet long, a top cross-member also 8 feet long, and a central cross-member 12 feet 6 inches long. The lastmentioned crosspiece must be exactly parallel with the base line; the success of the level depends on this point. To obtain the required terrace grade, a proportionate length is cut off one leg; for example, to obtain a fall of 6 inches in 100 feet it would be necessary to cut 1 inch from leg, half an inch for a 3-inch fall, and so on. In pegging out a line, a carpenter's level is fixed to the central cross-member and the short leg is moved up or down the slope until a level reading is obtained. The long leg is always kept down the slope when commencing a terrace line from its outlet end. As the frame is moved forward, the rear leg is placed on the last position of the front leg. A peg is inserted at each point when located. A plumb-bob may be used instead of the level by attaching it to the exact centre of the top crosspiece and making a fine, distinct mark at the centre point of the centre cross-member.

If the level is to be used for different grades, an adjustable foot may be made on one leg.

When locating points with a dumpy level, the surveying staff is simply moved up or down the slope until the desired reading is obtained. A number of readings may be obtained in both directions from the one position of the tripod and level. It is usual to take readings at chain intervals on regular slopes. However, when crossing depressions or rounding ridges, readings at ½-chain intervals or less are necessary.

The correct allowance for grade is calculated in this way:—As all grades are given in a fall per 100 feet, this figure must be reduced proportionately to a fall in 66 feet. As the staff is graduated in feet

and decimals thereof, the determined number of inches must be reduced to a decimal point of a foot; for example, a fall of 4 inches in 100 feet equals 2·64 inches in 66 feet or ·22 feet in a chain. When commencing readings from the outlet end, this allowance is subtracted from the total reading at the end of each chain to obtain a fall, and *vice versa*.

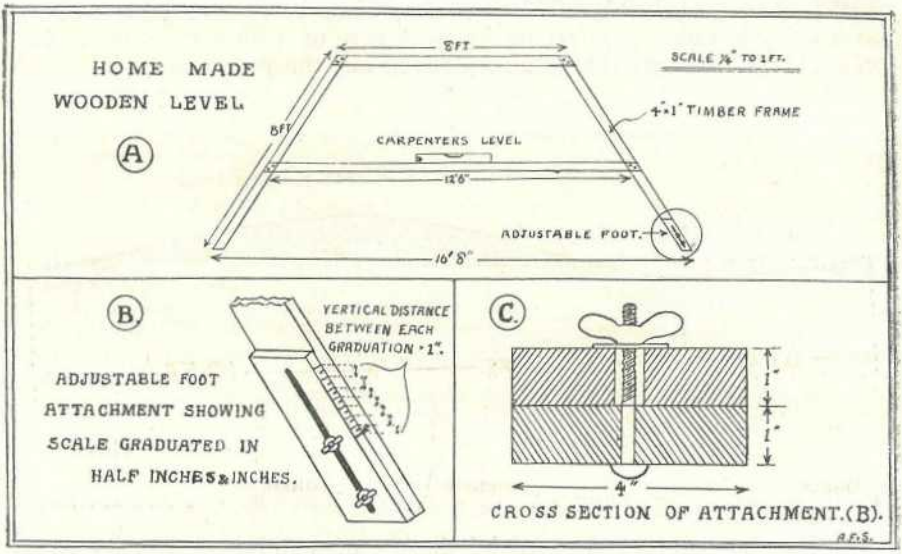


Plate 54.

THIS WOODEN LEVEL IS OF SIMPLE CONSTRUCTION AND MAY BE USED SUCCESSFULLY FOR PEGGING CONTOUR LINES ON SMALL AREAS.

It is usual to modify the acute curve when crossing gullies, and fill in the gully immediately above and below the terrace. At such points it is necessary to raise and strengthen the terrace banks.

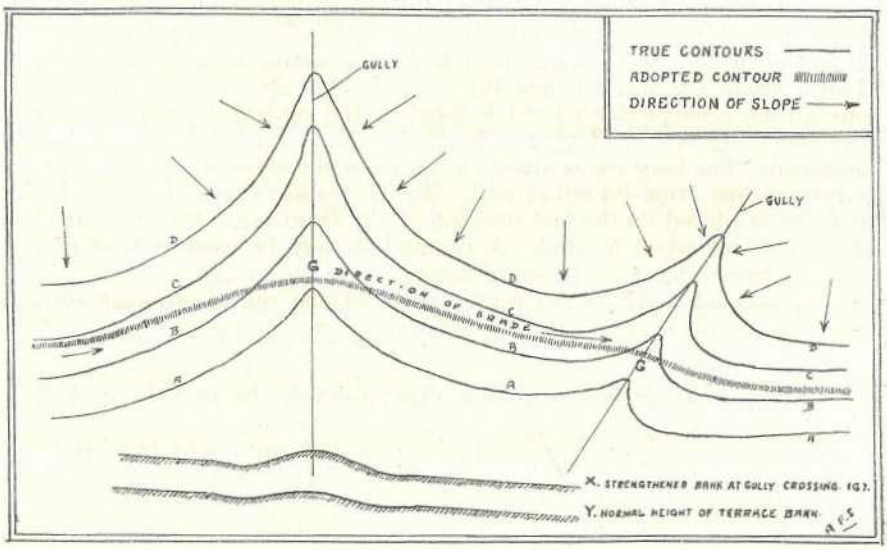


Plate 55.

WHERE CONTOUR TERRACES INTERSECT GULLIES, IT IS NECESSARY TO MODIFY THE ANGLE OF THE TRUE CONTOUR LINE AND RAISE AND STRENGTHEN BANKS AT SUCH POINTS.

Gullies too large to fill in in this way are best used as a dividing point in the length of the terrace. Suitable grades are allowed to carry the water away from, and not into, the gully. Additional measures for the reclamation of gullies, as previously described, should also be adopted.

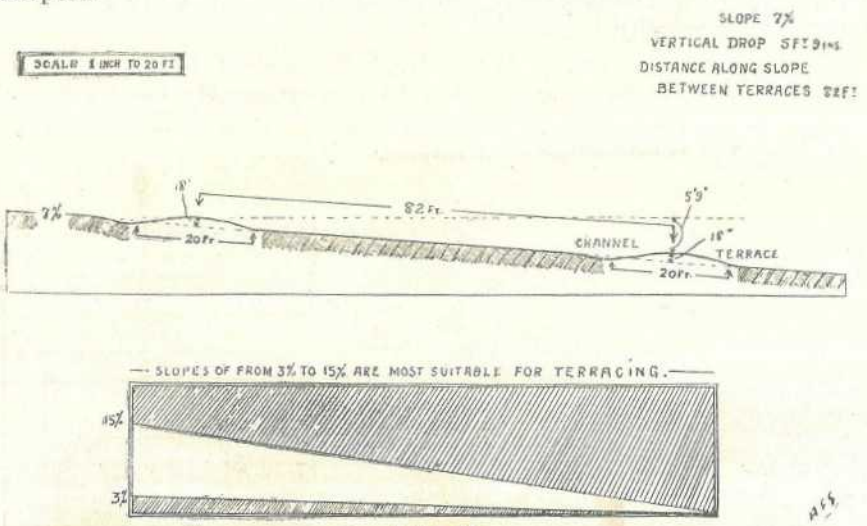


Plate 56.

The Distance along the Slope between Terraces is Governed by the Slope of the Land.—Such distances are calculated from the maximum permissible vertical drop as indicated in the accompanying table.

TABLE 1.

Inches of Fall in each 100 feet of Variable Graded Terraces.
(From Farmers' Bulletin 997, U.S. Department of Agriculture).

Section of Terrace.	Slope of Land.		
	5 feet in 100.	10 feet in 100.	15 feet in 100.
Feet.	Inches.	Inches.	Inches.
0 to 300	½	¾	1
300 to 600	1	1½	2
600 to 900	2	3	4
900 to 1,200	4	6	7*

* A terrace 1,100 feet long should have a fall of 6 inches in 100 feet at the lower end where the land has a fall of 15 feet in 100 feet.

TABLE 2.

Distance between Terraces on Different Slopes.

Slope in feet per 100 feet.	Vertical Drop between Terraces.	Distance between the Terraces along the Slope.
	Ft. in.	Ft.
1	1 9	150
2	2 6	125
3	3 0	100
4	3 6	87½
5	4 3	86
6	5 0	83
7	5 9	82
8	6 3	78
10	6 6	65
12	7 0	58

Terrace intervals are governed by the slope of the ground. They are spaced according to a calculated vertical drop between them, as shown in the accompanying table. In arriving at such calculations, the catchment area and slope are considered and the terraces are placed sufficiently close to one another to check the flow of water before it gains erosive velocity.

It is always necessary to construct the highest terrace first, as otherwise the catchment area would be proportionately too great for the channel capacity of terraces lower down the slope should heavy rain interrupt constructional operations.

Plate 57.

BROAD-BASED TERRACES MAY BE CROSSED WITH SEED DRILLS WITHOUT INJURY.—This field at Willowburn, Darling Downs, was sown with wheat during the settling of the newly-constructed terraces.

For the terracing of large areas, mechanical graders are the quickest and probably the most economical. Various types of home-made graders have also been used successfully. However, for a beginning, the banks may be simply and satisfactorily built with a multi-disc plough and harrows. Chain harrows are excellent, as they conform to the curves of the terrace. To commence the construction of a terrace bank, first plough along the lower side of the line of pegs, throwing the soil uphill. The return trip is made on the upper side of the centre line, and thus a crown is formed. Ploughing is continued until a strip of from 16 to 20 feet in width on average slopes has been completed. Usually it will be found that the wider the terrace the better. Again, commencing in the centre of the strip, the ploughed ground is further worked up into a crown, but this time the number of rounds of ploughing is reduced by one to give a gently rising shoulder to the finished bank. This procedure is continued until a broad-based mound is formed having a central height of at least 18 inches above the original ground level. An allowance of 3 or 4 inches should be made for settling. The bank may then be smoothed down by harrowing.

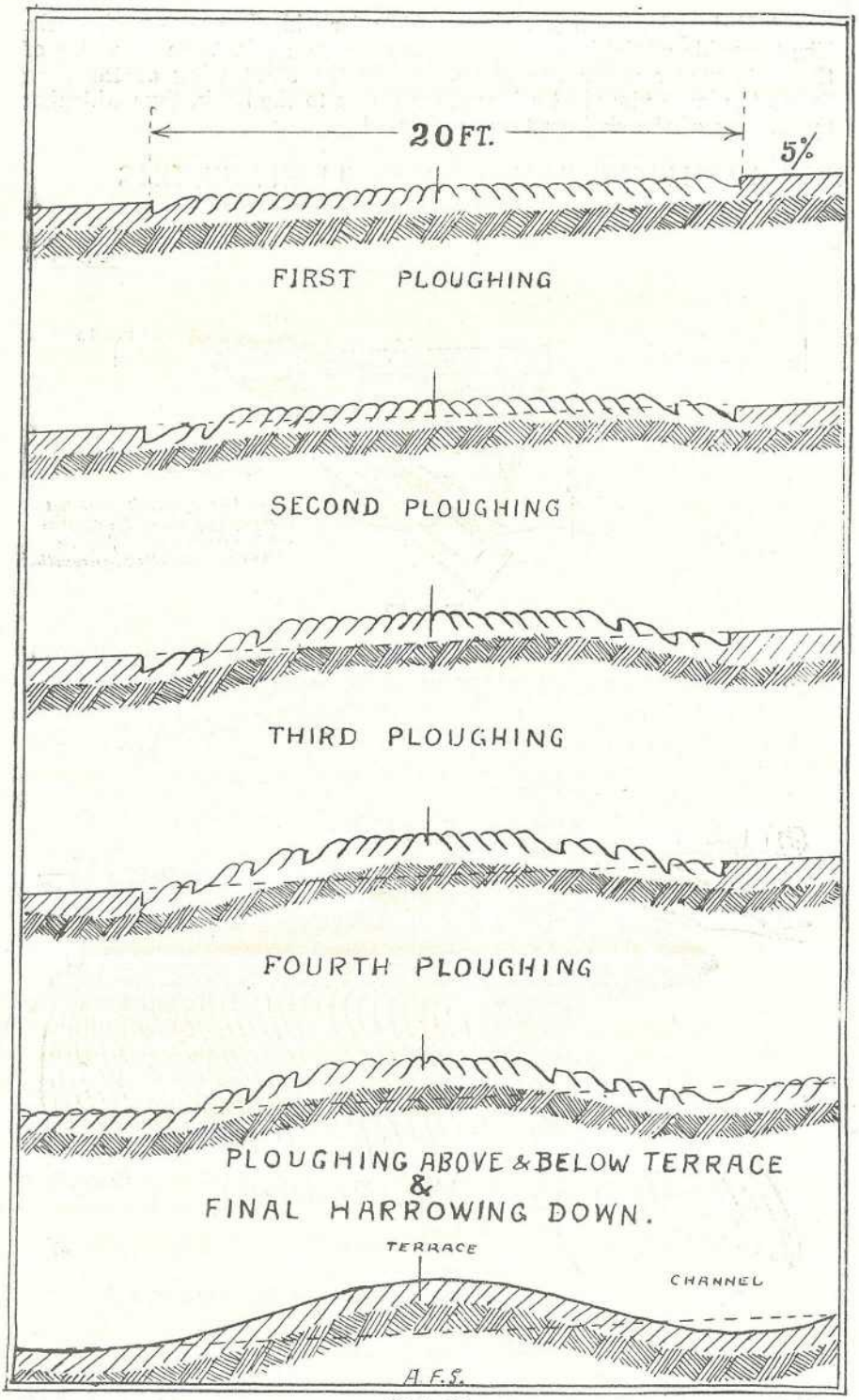


Plate 58.

METHOD OF CONSTRUCTING CONTOUR BANKS WITH A DISC PLOUGH AND CHAIN HARROWS. A V DRAG IS OF CONSIDERABLE ASSISTANCE.

A V drag has been used successfully for widening terrace channels. The long side of the implement exerts pressure against the land side of the last furrow above the terrace, while the short wing of the drag forces the loose ploughed soil further up on to the bank, thus widening the bottom of the shallow terrace channel.

HOMEMADE WOODEN V DRAG USED FOR BUILDING TERRACES

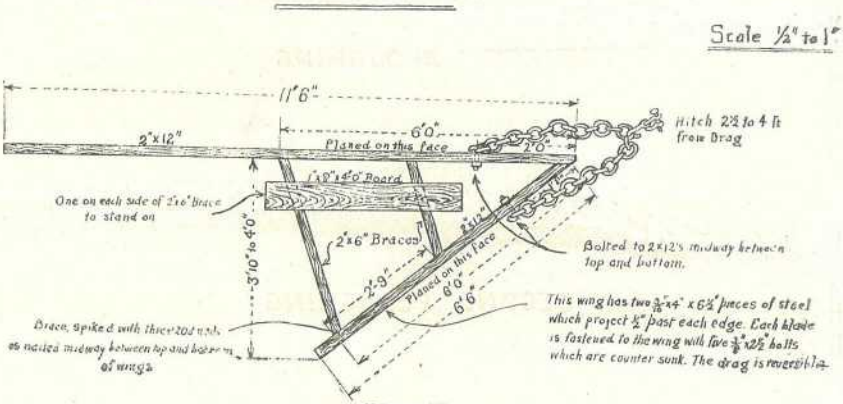


Plate 59

A terracing crop is of considerable value in preventing the soil ... and consolidating of the banks

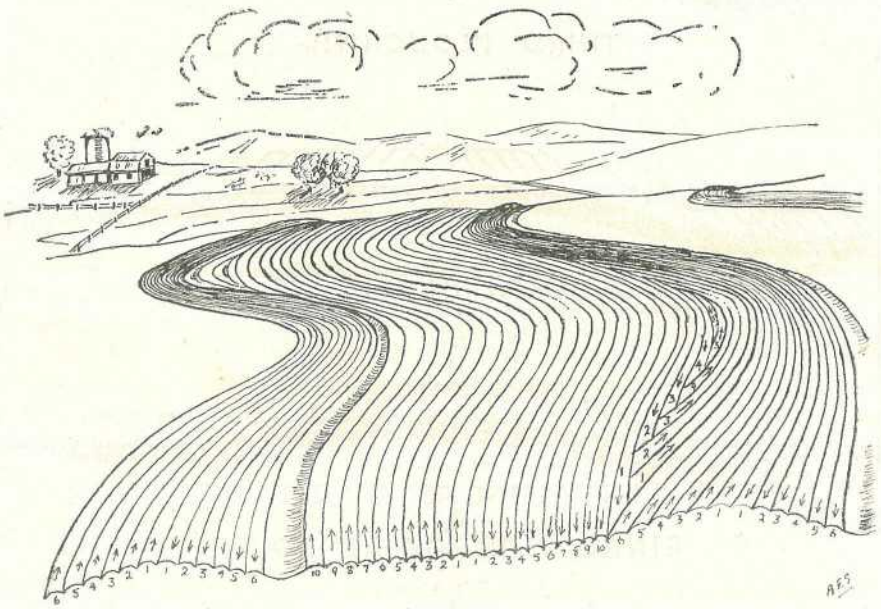


Plate 60.
METHOD OF PLOUGHING TERRACE INTERVALS OF IRREGULAR WIDTH.

Maintenance of Terraces.

Once established, the only maintenance necessary is a little extra time and trouble in ploughing and an occasional clean-out of the terrace channels. The frequency of this work will depend on the care taken

when ploughing, but it is important that it should not be neglected. It is always advisable to plough the terraces first. In so doing, a central crown or back furrow is made on top of the terraces and the furrows on both sides are turned towards the centre until the whole terrace has been ploughed. The terrace intervals are then ploughed separately, the number of lands depending on the width of the interval. It will often be found possible on grades of 10 per cent. or more to plough this strip out in a single land. In some places it may be found preferable to plough around the terraces, making the final dead furrow midway between terraces. Care should be taken, however, when turning furrows

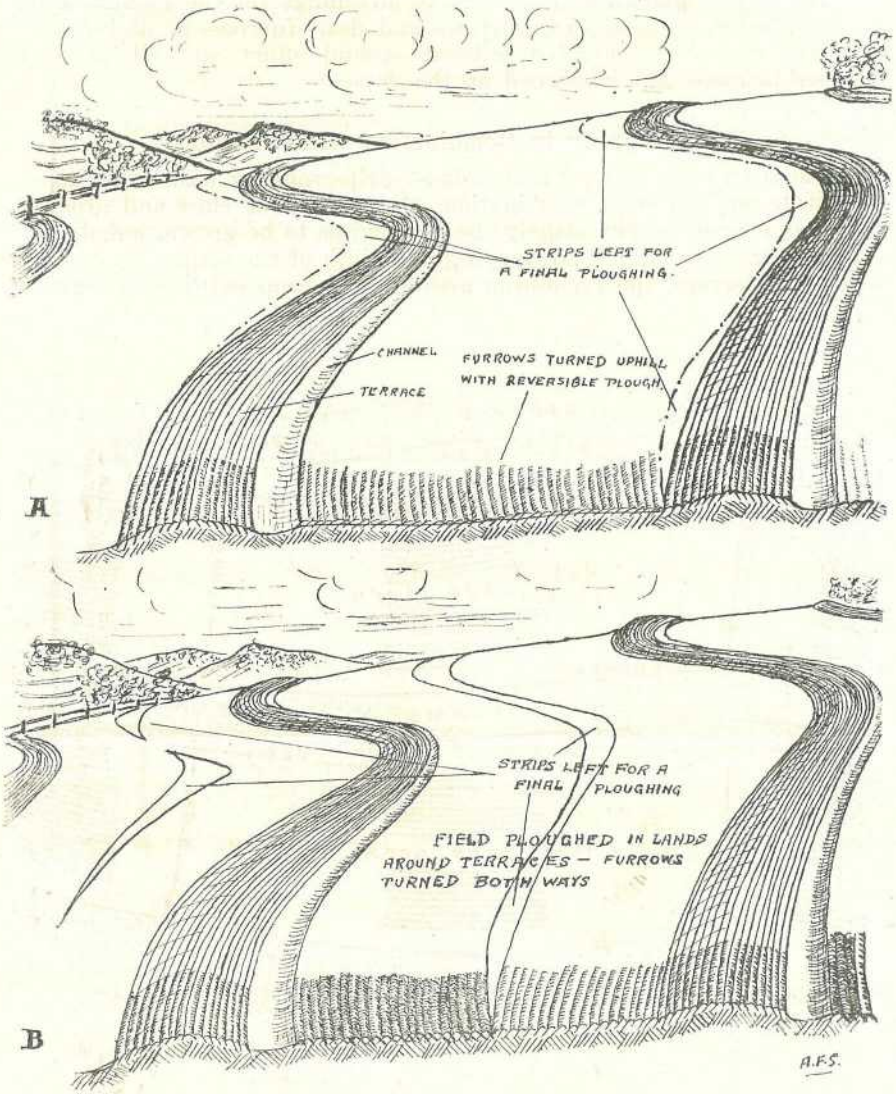


Plate 61.

The Position of the Irregular "Island" Strips of Land left for a Final Ploughing should be changed with each Successive Ploughing of the Field. This Illustration depicts One of Several Methods.

A. First ploughing. B. Second ploughing.

down the slope, not to fill in the terrace channel. As terraces are seldom, if ever, parallel, small "islands" will be left at the points of greatest width along the last furrow. It is obviously necessary to plough these individually.

For the second ploughing of the terrace intervals, a back furrow should be made on the site of the previous dead furrow. By alternating the ploughings in this way, the development of deep depressions will be avoided and the thorough working of the entire field will be accomplished.

A two-way plough may be used to advantage for the ploughing of terraced fields, as both back furrows and dead furrows in undesirable locations may be eliminated without special effort and all furrows between terraces may be turned up the slope.

Strip-cropping in Combination with Terracing.

These two systems of prevention—strip-cropping and terracing—constitute an invaluable combination. Naturally, the class and productivity of the soil govern largely the strip crops to be grown, but do not influence their location. By varying the width of the strip crop on and below the terrace, the remaining area for row-crop cultivation may be

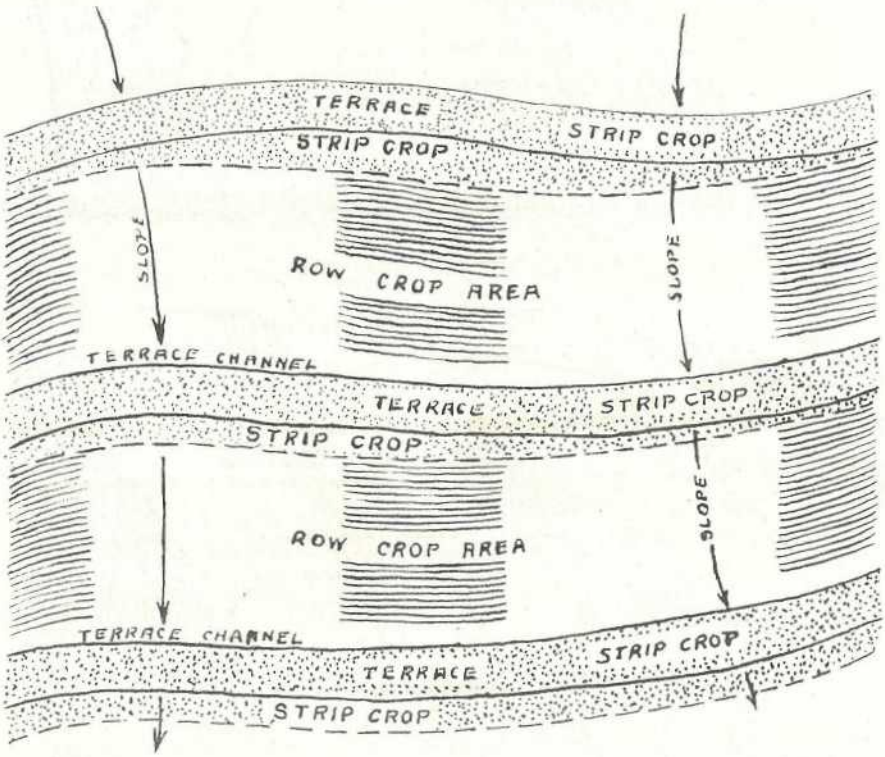


Plate 62.

METHOD OF STRIP-CROPPING EVERY TERRACE.—The width of the strip is varied to take up the short row area. This practice safeguards the terrace during its settling.

reduced to a parallel strip, thus overcoming the difficulty of short rows. When this system is adopted, it is usual to strip-crop every second terrace only, the alternate terraces being included in the row-crop area. All cultivation, of course, is on the contour.

In a rotation plan the location of strip crops may be altered to a position midway between terraces. The terraces may then be devoted to row crops.

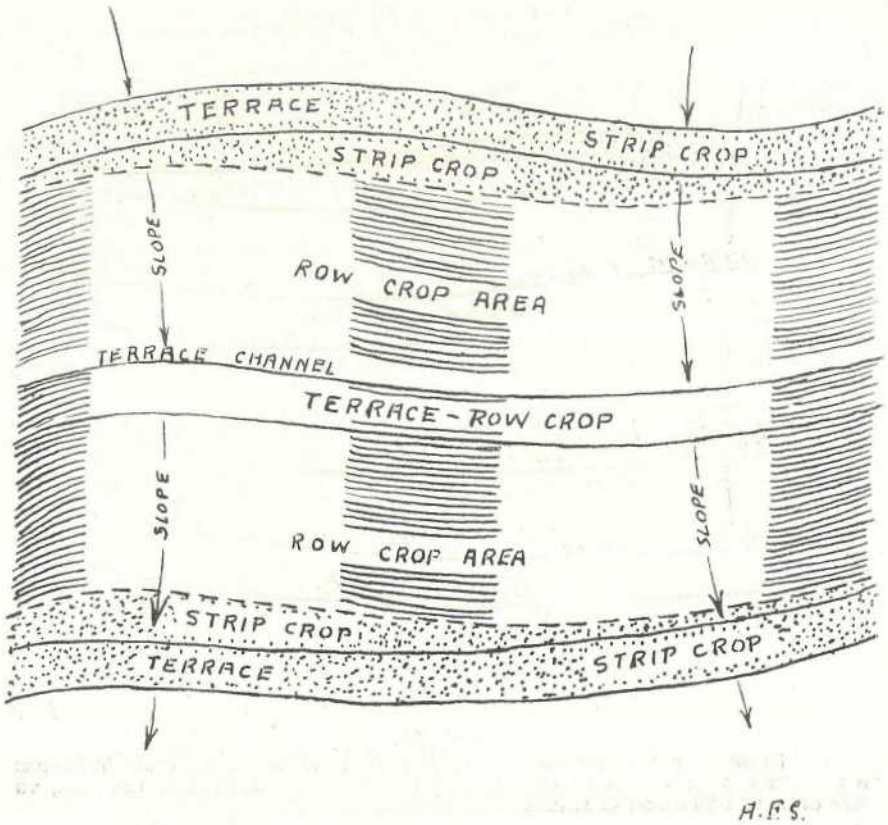


Plate 63.

Method of Varying the Width of Strip Crops on Alternate Terraces to take up the Short Row Area.

Again, the strip-crop area may be varied in width to fill up the short row area. The simplest method of achieving this is to plant the row crop first, leaving sufficient width for the strip crop. This may then be sown broadcast to fill up any irregularities in the width of the strip.

Conclusion.

To completely combat erosion in any country is far too great an undertaking to accomplish in a few years, but it is rather the cumulative effort of several generations.

Similarly, the subject has so many varied and complicated aspects that it has been possible only in these notes to deal briefly with the most important points in respect of erosion of farm lands. However, if this discussion helps to increase the interest of Queensland farmers in the growing menace, good results are certain to accrue.

Objections may be raised at first to the slightly increased difficulty of farming contoured fields, but once it is fully realised that any slight disadvantages are greatly exceeded by the advantages of a soil-saving plan of farm management, there is little doubt that the proposed schemes will meet with ready acceptance.

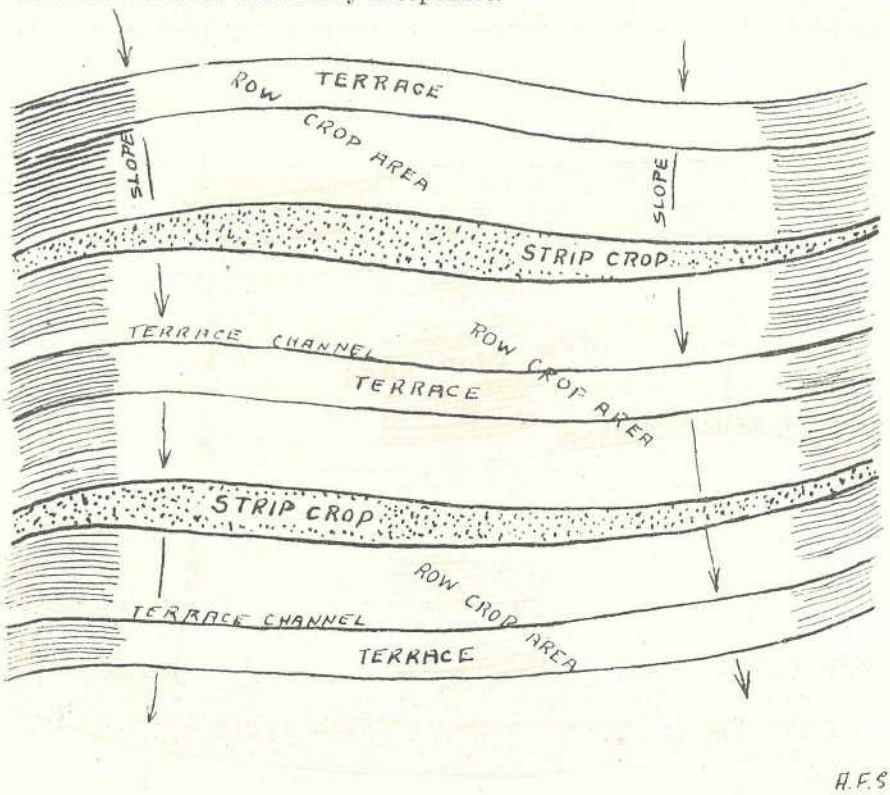


Plate 64.

THE STRIP CROP MAY BE CHANGED TO ANY POSITION ON OR BETWEEN TERRACES TO PROVIDE FOR ROTATIONAL CROPPING. IT IS CONSIDERED ADVISABLE, HOWEVER, TO KEEP OPEN THE TERRACE CHANNEL.

With abundant and often tragic proof of the rapid deterioration of farm land, following on the pursuit of traditional farming practices, the United States of America has adopted a policy of active intervention by establishing a special soil-conservation service. As a result of extensive exploratory work, efficient and acceptable control measures have now been convincingly demonstrated, and a great wealth of information applicable to our own requirements may be gleaned therefrom. The basic principles of control must, obviously, remain unchanged, but it is anticipated that certain modifications and perhaps extensions of the American methods may be necessary.

In the light of available information, and with a practical knowledge of Queensland requirements, the recommendations contained in these notes are offered with confidence.

The Department of Agriculture and Stock is anxious to foster and assist practically in the promotion of soil-saving programmes, and will welcome, therefore, the inquiries of interested readers of this Journal.

Pineapples for Canning.

JAS. H. GREGORY, Instructor in Fruit Packing.

MUCH has been said and written in recent years about the respective responsibilities of growers and canners in the handling and processing of pineapples. With operations involving primary and secondary enterprise in a common output, the necessity of complete co-operation is apparent if economic efficiency is to be attained.

The pineapple industry is affected as much as any other Australian primary enterprise through the competition it has to meet on export markets.

This fact has been often obscured by argument between growers and canners as to the advantage, or otherwise, of sending fruit to the cannery with "tops on" or "tops off." The argument has now been settled, apparently, by a common agreement that "tops off" is, economically, the most satisfactory method of factory supply.

To the grower, however, removing the tops may seem to be the end of his responsibility in preparing fruit for the factory. When it is considered, however, that restriction of space and high rates and rents in city areas add to factory costs, some operations could be done more economically on the farm; and as all growers are shareholders in a cannery, the reduction of factory costs has become obviously a direct personal interest. Properly prepared fruit can be handled at the cannery without loss of time. Minor work—such as sizing, grading, trimming, and colour selection—if done properly in the packing shed, facilitates the work at the cannery.

Good packing, by getting full weight of fruit in the case, also is a factor in keeping down expenses, as it costs as much to handle partly filled as full cases. If the average weight of a case is increased by a few pounds, the daily gain to the industry will be considerable. Care in cutting down these costs should help to increase returns to growers when costs and prices are assessed.

Factory Operations.

A short explanation of the actual operations at the cannery when the fruit is received should assist growers in understanding the necessity for giving their wholehearted co-operation. To obtain even a better idea, growers are advised to visit a cannery when in full operation.

On arrival at the factory siding, cased fruit is removed from the truck and placed on a gravity roller conveyor leading into the factory. As the case passes along, it goes over a weighing machine. The name

of the grower and gross weight and tare of the case are taken and listed. The fruit is fed on to one of several Ginaca machines, each of which has a capacity for handling forty-five pineapples a minute. The machine peels and cuts the fruit to the diameter to fit the can, removes the ends, takes out the core, and delivers the fruit to the trimming table. The same machine also removes the surplus flesh from the skin and transports it to an inspection table. The skins, ends, and cores are treated for use as cattle food.

During all these operations a constant speed is maintained by the machine, its output being governed by the quantity of fruit placed to fill each section of the feeding elevator. Any hold-up of supplies through bad sizing and grading means waste time, which the machine cannot make up. Two men feed the elevator, and one inspects the fruit half-way along the elevator. These three men size and grade the fruit to prevent mechanical trouble developing during operations. The machine feeds to the trimming tables on conveyors, which ultimately carry the fruit to the slicing knives and canning section.

The staff required on the trimming section varies according to the quality and type of fruit. With first-quality fruit, seven trimmers can handle a machine at full capacity. Fair average fruit requires nine trimmers; with poor, ill-shaped fruit, it is necessary to have eleven trimmers to avoid having to stop the machine to clear the trimming section. It can readily be understood that fruit as illustrated in Plates Nos. 66, 67, 68, and 69 requires more trimming than the good type shown in Plate No. 65. The machine keeps up the same steady delivery of fruit to the trimmers, and if extra time is taken to trim ill-shapen fruit, causing congestion, the machine must cease to be fed for a period. This means loss of time and increased overhead costs.

As cannery output is governed by the quantity of fruit handled, the failure of machines to deliver their maximum output may be a big factor in increasing overhead costs. If one section of the cannery does not work to capacity, it prevents the other sections from doing likewise. The co-operation of the grower with factory staffs is necessary, therefore, to achieve the maximum results.

Type of Fruit Required.

To assist growers, a series of photographs have been taken of fruit extracted from actual consignments received at the factory. The explanation of these should show growers what not to do when packing. Also, a series of drawings is presented showing the actual recovery of fruit from good types of each size. A study of these drawings will enable growers to appreciate the necessity for careful sizing.

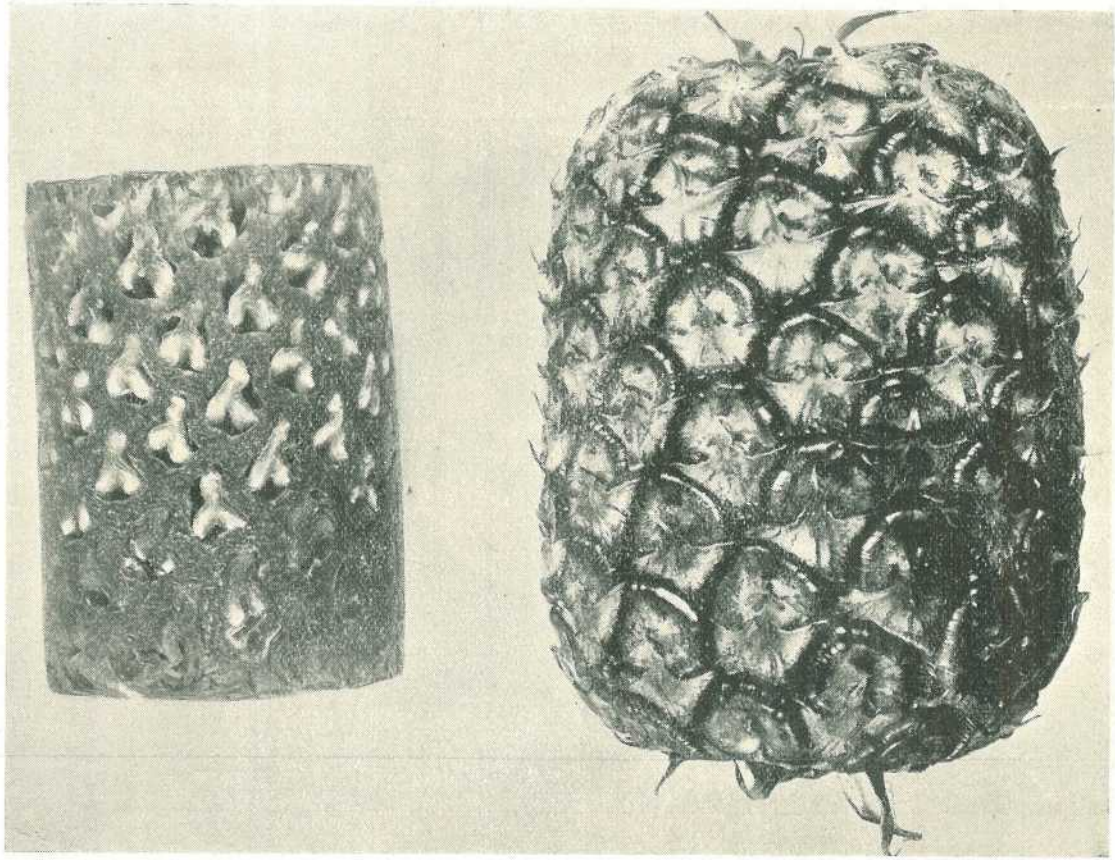


Plate 65.

PINEAPPLE SUITABLE FOR CANNING PURPOSES.—Showing square shoulders on fruit and minimum amount of trimming required after removal of the core and skin.

The type of pineapple shown in Plate 65 is that which is most suitable for canning purposes—being long, square-shouldered at top and base. Such fruit requires a minimum of trimming and time spent on it to place it as first quality for canning.

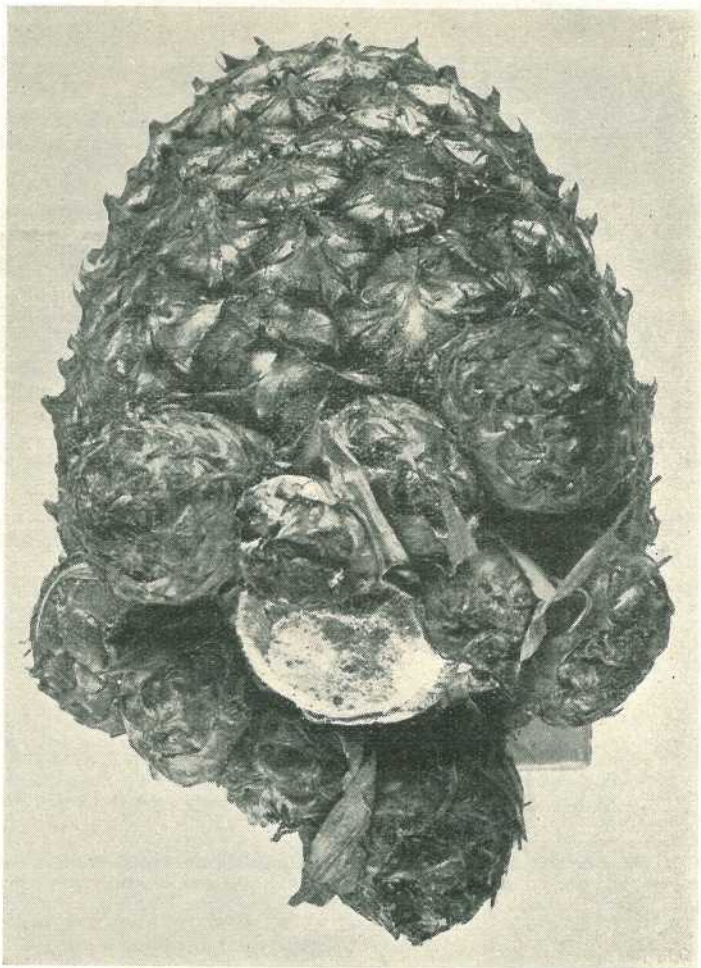


Plate 66.

TYPE COMMONLY PACKED FOR FACTORY.—Showing superfluous growth on base of fruit, which should be trimmed off.

The fruit illustrated in Plate 66 is a common type on plantations. The small adventitious pineknobs should be cut off before despatch to the factory. Feeding fruit of this type into the machine would bring about a variety of complications.

The type of fruit shown in Plate 67 is unsuitable because, its length being almost the same as its depth, it, more often than not, turns over when being fed into the peeling section of the Ginaca machine. This

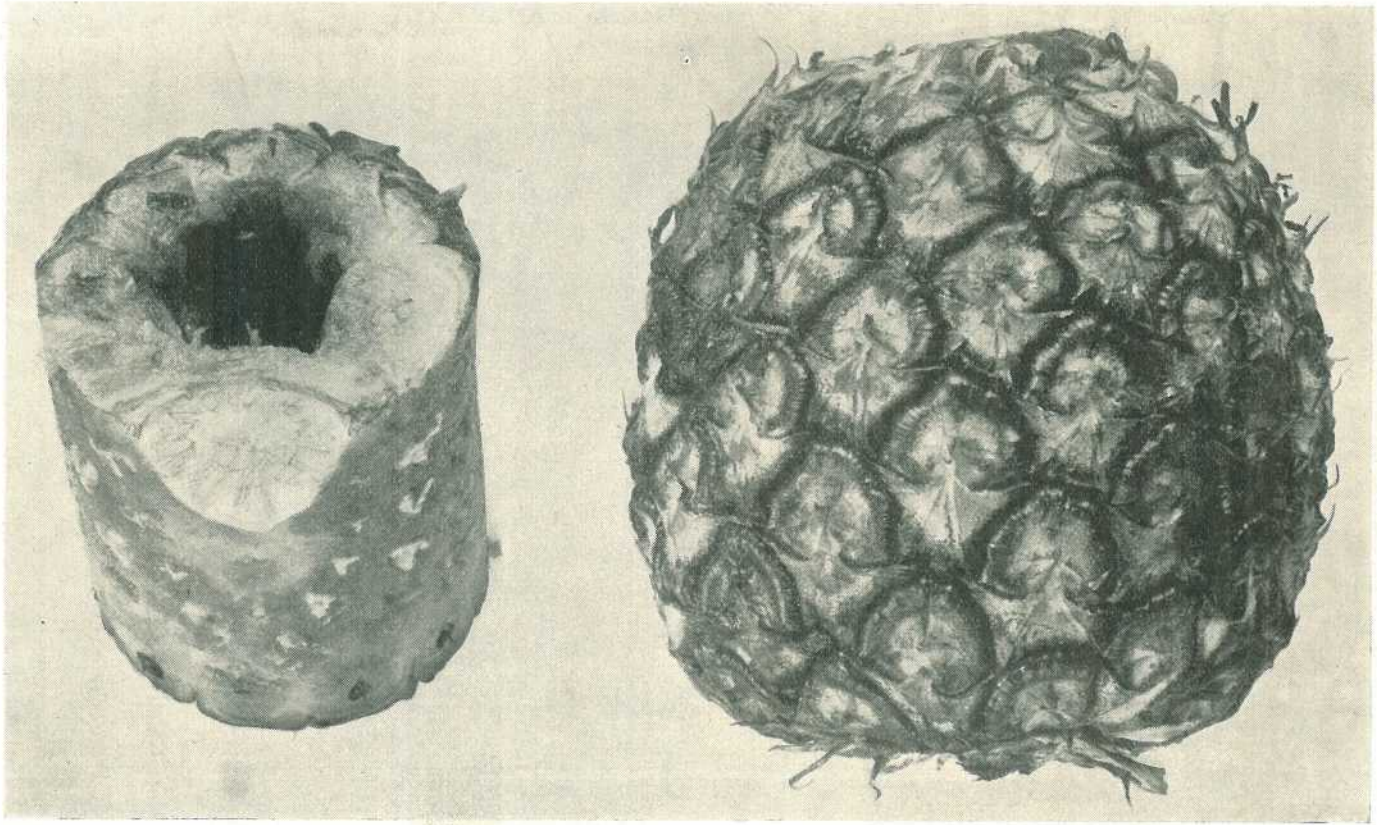


Plate 67.

SHORT OR ROUND TYPE FRUIT.—Unsuitable because of its tendency to turn over and so escape coring. Note how the core is left in the fruit, the fleshy part actually being removed instead.

causes the core-removing machine to punch a hole through the flesh, from side to side across the fruit, leaving practically all the core to be removed by hand. What is left of the fruit after the removal of the core residue is unfit for the slicing machine to turn into first or second quality canned fruit.

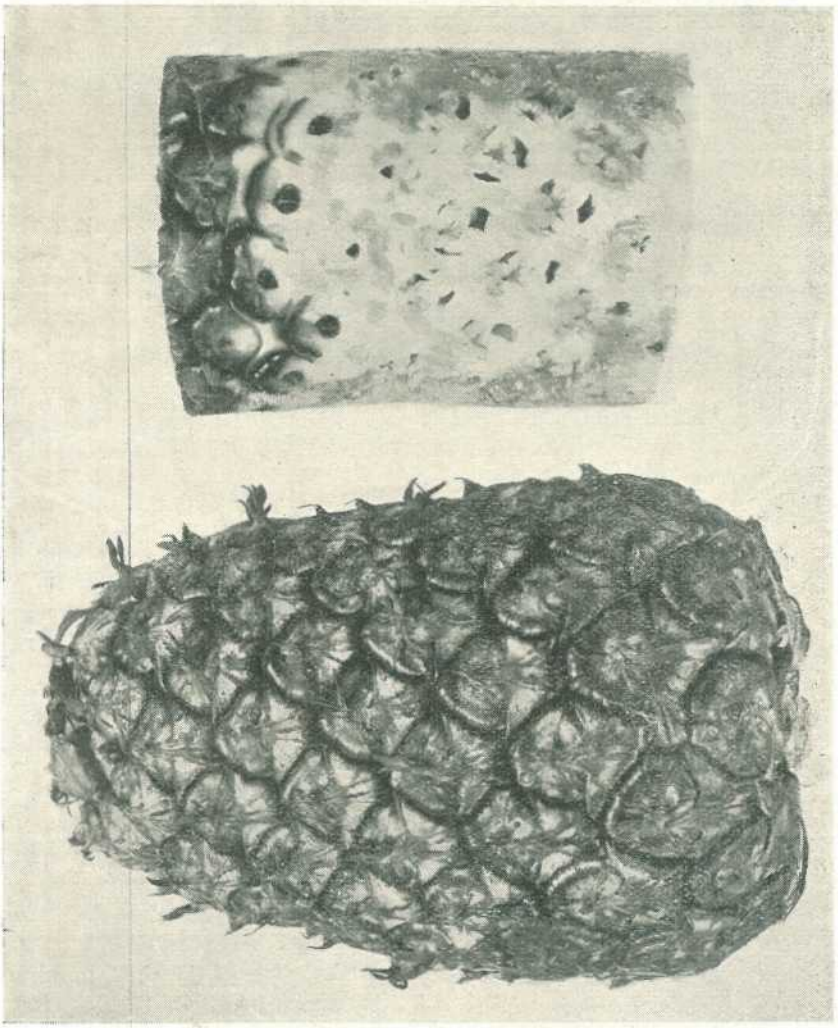


Plate 68.
A Tapered Type of Pineapple.—At least half of this type of fruit has to be trimmed off to remove the "eyes."

Plate 68 shows a tapered type of pine and the centre obtained after it has been through the machine. It will be noted that it is necessary to trim from the pineapple nearly half its length to remove the eyes missed by the machine at the tapered end. This leaves little of the fruit for first-grade canning. Growers, when packing, should place this type of fruit in the next smallest size, as advised in the notes on sizing. It can be readily understood that extra treatment is required and the time expended in handling is increased, but the value of the fruit

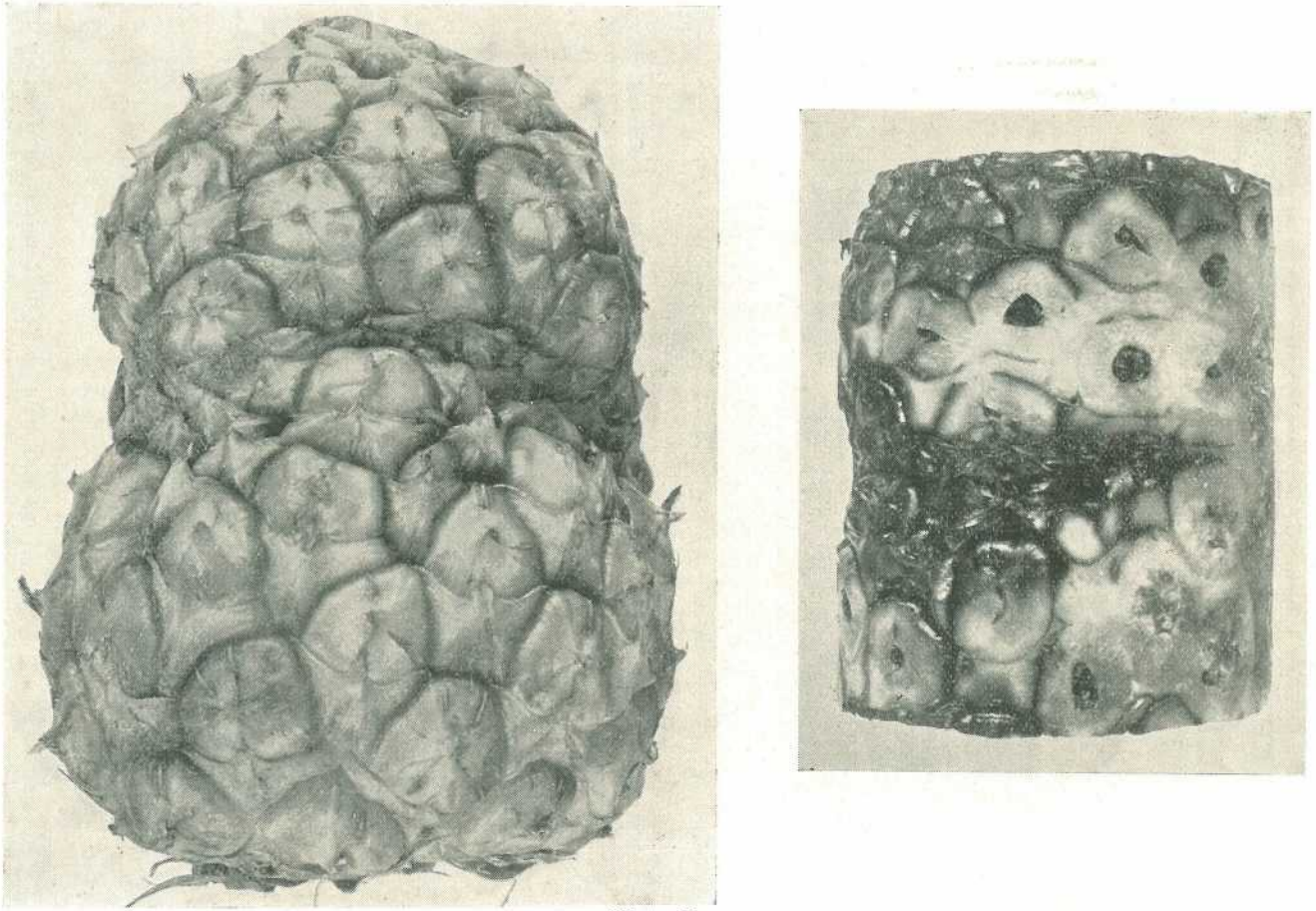
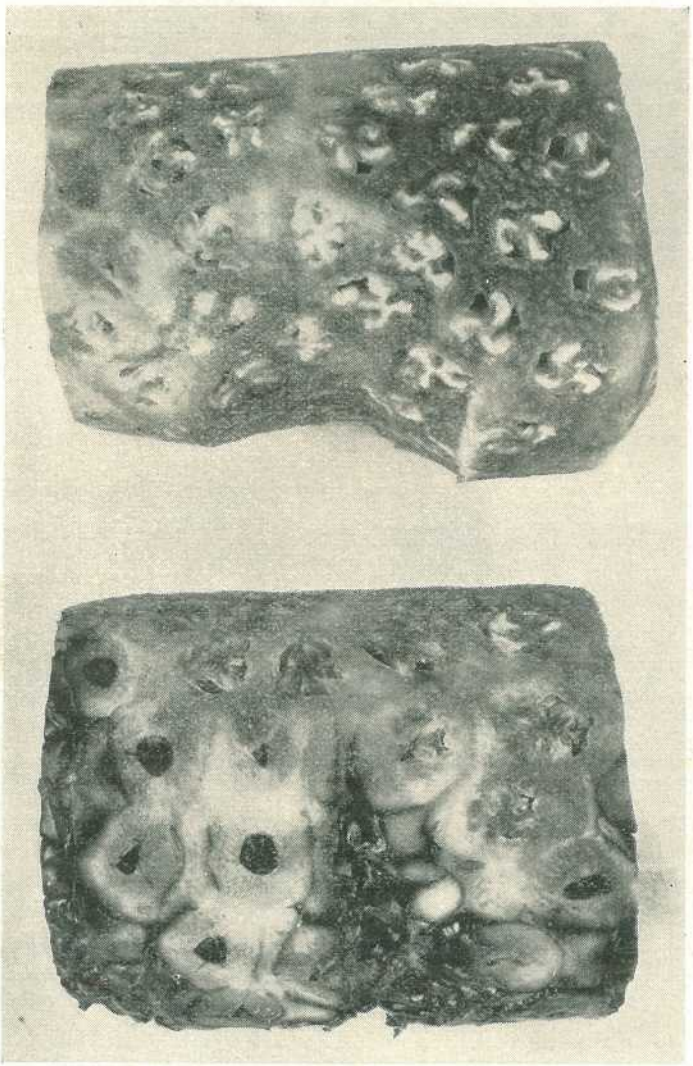


Plate 69.

Badly Shaped, Crippled Pineapple Before and After Peeling Process.

recovered is not as great as that received for the type of fruit illustrated in Plate 65. The trimmed centre before feeding to the slicing machine appears to be very similar to that illustrated in Plate 70.

This type of fruit (Plate 69) is exceptionally hard to handle, and is undesirable for factory use. Growers, if they feel that they must send fruit of this type, are advised to pack it apart from good-shaped fruit. The factory has to definitely rule poor-type fruit out; so growers send it at their own risk.



A. B.

Plate 70.

Centres Cut from Fruit Illustrated in Plate 69.—Showing (A) before trimming, and (B) after trimming. How many first-grade slices could be obtained from fruit of this type?

As can be seen, after peeling and trimming, nothing fit for feeding to the slicing machines is left, and all the labour, time, and other expense involved means practically nothing over for the grower. Remember, more time and handling is involved with badly shaped than with correctly shaped fruit!

The difficulties of processing fruit like this are apparent, for only about half of the recovery is suitable for canning. The overhead expense involved is the same as that for fruit of good type. The cost of handling is increased 100 per cent., while the return of fruit is only 50 per cent.

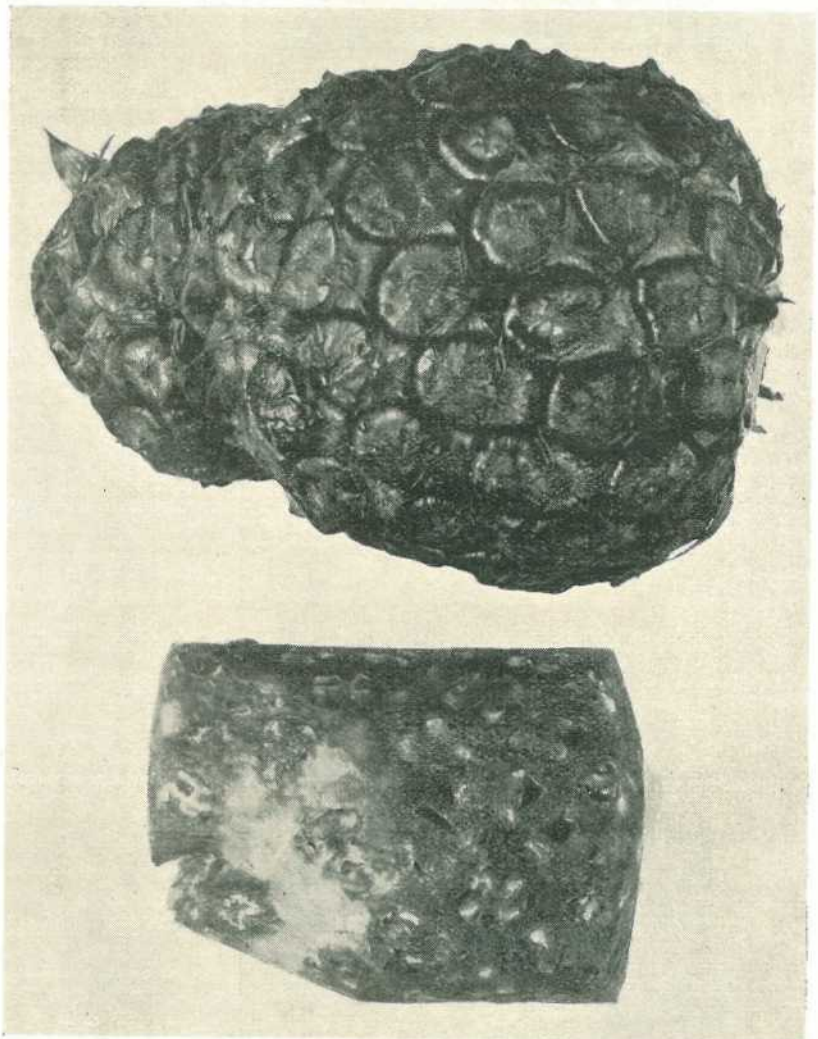
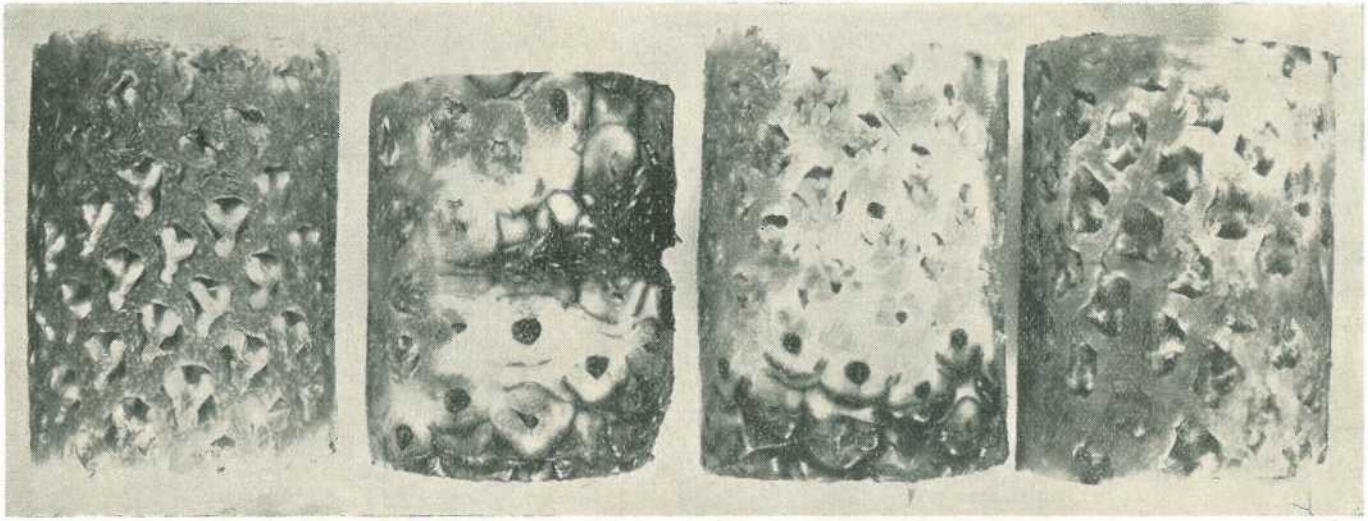


Plate 71.

Another Type of Crippled Pineapple with a Definite Second-growth Development.—Approximately only half is suitable for using as sliced pineapple.



A B C D

Plate 72.

CENTRES FROM VARIOUS TYPES OF FRUIT.—(A) Centre from good-type factory pineapple; (B) taken from pineapple with double growth; (C) bottle-shaped pineapple centre; (D) centre showing the effects of marbling—this cannot be canned under any circumstances.

Sizing the Fruit for Packing Factory Grades.

A study of the processable fruit obtained might give the impression that a larger centre could be taken from each fruit, but when the depth of the eyes is considered the actual difference between the outside ring measurement of diameter and the diameter of the flesh removed by the cutting knives is soon realised. The necessity for keeping the sizes above their minimum if the machines are to give a maximum recovery is plain.

Factory fruit is graded into four sizes—"Ones," "Twos," "Threes," and "Fours"—as follows:—

"Ones":—Fruit 4 inches in diameter and under $4\frac{1}{2}$ inches.

"Twos":—Fruit $4\frac{1}{2}$ inches to $4\frac{3}{4}$ inches in diameter.

"Threes":—Fruit over $4\frac{3}{4}$ inches in diameter but under $5\frac{1}{8}$ inches.

"Fours":—Fruit $5\frac{1}{8}$ inches and over in diameter.

No fruit less than $4\frac{1}{2}$ inches in length from base of fruit to bottom of shoulder should be included. (*See* Plate 72 showing "Ones.")

Sizing rings suitable for measuring the pineapples are obtainable from the Committee of Direction of Fruit Marketing. The correct way of using the rings is shown in Plate 73.

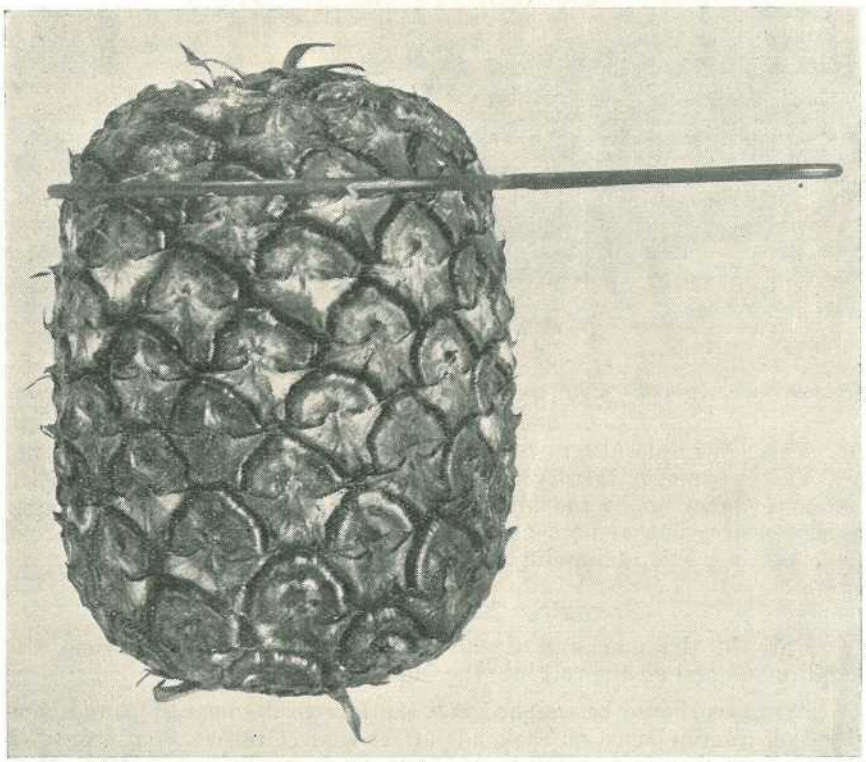


Plate 73.

A Well-shaped Factory Pineapple.—Showing the method of using the sizing ring.

When measuring the fruit, the ring is placed over the top end. If the ring fits over more than quarter of the length of the pineapple (approximately $1\frac{1}{2}$ inches), the fruit should be placed in the next smallest grade (i.e., a fruit large enough to be a "Four" at the bottom would be classed as a "Three"). Plate 74 illustrates this point.

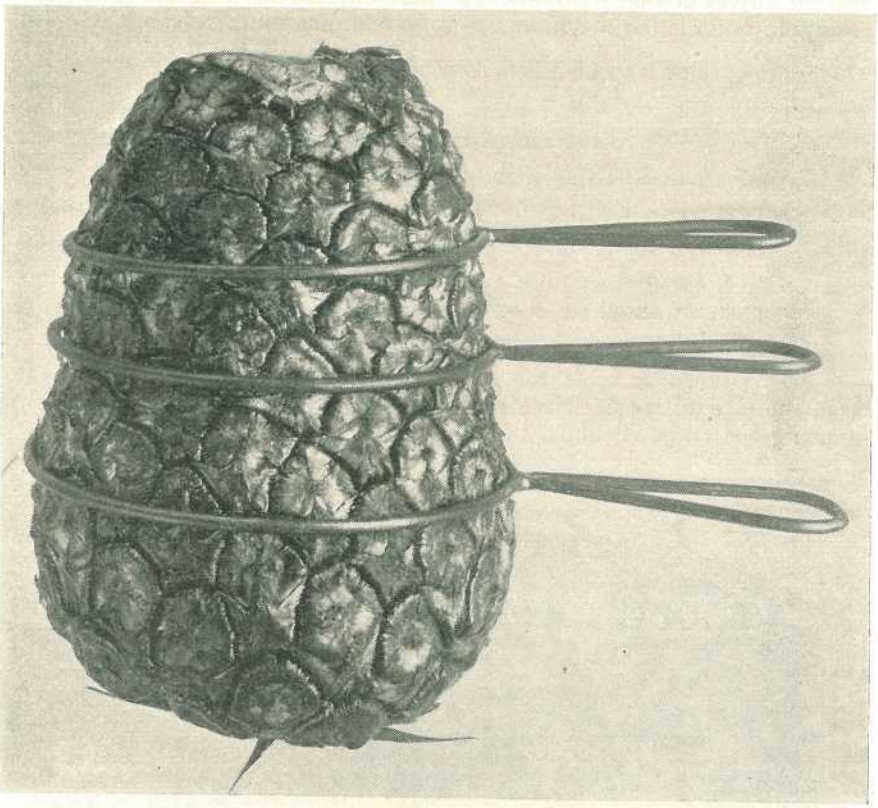


Plate 74.
SHOWING TAPERED PINEAPPLE WITH RINGS 2, 3, AND 4 GRADE PLACED ON THE FRUIT.

This pineapple (Plate 74) would be classed as a "Two," but is not a desirable type for factory use, for when marked down to a "Two" it has a tendency to be too big at the base for the "Two" machine to handle easily; but, if used as a "Three," it would have too many eyes left, entailing extra trimming.

Preparing the Case for Despatch.

Care in the marking of the cases correctly will save time and handling on and off the rail into the factory.

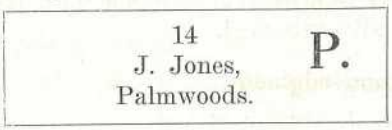
All cases should be weighed and the tare to the nearest pound stencilled on the top board on each side of the case. Growers should reweigh the cases regularly, for often cases are of green wood when first used, and gradually become lighter as they dry out. Neglect to do this results in loss to the grower, for the higher green timber weight would be deducted when assessing the weight of the fruit. Stencils for marking weights on

the cases are obtainable free of charge from the Committee of Direction of Fruit Marketing. Cases not branded for weight are usually tared at 15 lb.

The grower's name and district index mark should be branded on each side underneath the tare in letters at least 1 inch in height. The district marks are as follows:—

A Amamoor.
B Beerburrum.
C Cleveland.
D Dagun.
E Elimbah.
F Wamuran.
G Glasshouse Mountains.
H Manly.
J Nikenbah.
K Kandanga.
L Lagoon Pocket.
M Imbil.
N Nambour.
O Caboolture.
P Palmwoods.
S Gilldora.
U Eudlo.
W Woombye.
X Beerwah.
Y Gympie.

All size grades should be marked plainly on both ends of the case.



Sides of case.

Ends of case.

After cases are returned from the factory, all markings should be erased where necessary, and the case repaired where damaged.

Packing.

Unfortunately, because of the variety of shapes and sizes of pine-apples sent to the factory, standard packing systems, as used for most other fruits, cannot be conveniently applied. The aim of the grower, without sacrificing the grade, should be to place as high a weight of fruit in the case as possible. Most summer fruit handled in the tropical fruit case—24¾ x 12 x 12—during packing experiments may be packed, using the following packing table:—

PACKS FOR FACTORY PINEAPPLES.
(Tropical fruit case 24¾ x 12 x 12.)

—	Pack.	Count.	Layers.	Total.	—
"Ones" ..	2 — 1	6 × 5	2	34	Fruit placed directly one upon the other.
	2 — 1	5 × 5	2	30	Fruit placed in pockets. Large "ones" or small "twos."
"Twos" ..	2 — 1	5 × 4	2	27	Fruit placed in pockets. See note on 30 count.
"Threes" ..	2 — 1	4 × 4	2	24	Fruit placed in pockets. Large "twos."
	2 — 1	4 × 3	2	21	Fruit placed in pockets. Large "twos."
	2 — 1	3 × 3	2	18	Large "threes" or small "fours."
"Fours" ..	2 — 1	3 × 2	2	15	Fruit inclined.

Notes.—Place shortest fruit in bottom layer.
Any long pineapples may be packed at the ends.
As far as possible, keep the top of the top layer level.
Crippled fruit should be excluded from all packs of good-type pineapples.

The method of placing the fruit is with the base of the fruit down in the bottom layer and reversed with the base of the fruit up in the top layer.

On some plantations, long fruit, more of the type as produced in the winter crop, are found. With large fruit of this type it was found best to pack the bottom layer base down as in the packs already mentioned, while the top layer was placed on this with the fruit resting on its side. When finished, all cases should have the fruit placed so that it comes level with the top and does not project above. This is necessary if fruit is to be canned without being damaged by the cases stacked upon it during transit.

No definite maturity standards are given, as this problem is still in process of investigation to enable a suitable guide to maturity to be fixed.

In conclusion, it is hoped that the information given in these notes will enable the grower to better understand some of the difficulties to be overcome in cannery operations. An understanding of these difficulties should help to foster closer co-operation between both sections of the industry, to the benefit of all concerned.

Acknowledgment.

Thanks are due to Messrs. J. Duthie and J. Howe, of the State Cannery, for much helpful comment and assistance, and to the growers who kindly assisted by supplying fruit for experimental purposes.

PINEAPPLE IN MEDICINE.

The following paragraph was sent by a teacher to the Editor of the *Queensland Education Office Gazette*, following upon an article in a previous issue of that journal:—

Some years ago, Senor Marcano, a leading medical authority of South America, discovered that the juice of the pineapple materially aids in the digesting of the proteids of both animal and vegetable foodstuffs. More recently, Dr. R. Chittenden, of the Connecticut Academy of Sciences, asserted that the fresh pineapple juice is a constant and powerful digestant of albuminous matters, acting in both alkaline and acid media, but more energetically in neutral than in either of the others. Chemists have now separated the active digestant principle and put it in the materia medica. This substance, closely analogous to pepsin, is known as bromelin. Pineapple juice has been found to be most efficacious in throat troubles and diphtheria, as the juice dissolves the fleshy tissue, such as is found in these ailments. A cure of diphtheria in a most marked and, in fact, abandoned case is reported in an American medical journal, as follows:—"For three or four years I have been hearing of the use of pineapple juice for the cure of diphtheria, but thought little of it. Recently, however, it has taken better shape in the report of a case where the child was given up by the doctor, and a friend, coming in, remarked that he had known children relieved by pineapple juice. The physician in attendance said, 'Get it and try it; it can do no harm.' A ripe pineapple was obtained and the juice expressed and given in teaspoonful doses slowly. It seemed to clear the throat, swallowing was much easier, and in a few hours the child was sleeping. Complete recovery ensued. A number of cases in the same neighbourhood were subsequently treated, with the same successful outcome." In bronchitis, also, pineapple juice has been found to be excellent, by Dr. Flasher of America, in softening the mucus. The pineapple is also a mild laxative. From the fruit itself, pharmaceutical chemists have separated a crystalline substance which they call mannitol, which is in active use in compounding prescribed medicines for throat and lung troubles.

The Queensland Nut.

J. M. WILLS, Fruit Branch.

THE Queensland Nut (*Macadamia ternifolia*), one of the best of the edible nuts, is indigenous to the coastal rain forests of Southern Queensland and Northern New South Wales.

Hitherto, the excessive hardness of shell of some of the more widely distributed types precluded their common use. Recently, however, trees have been located which bear nuts with shells thin enough to be cracked with an ordinary nut cracker, and the cultivation of this type is extending in Australia, particularly in the coastal districts of Southern Queensland, where conditions are naturally suitable for commercial production.

This native nut is highly nutritious and is one of the richest oil-yielding nuts known, producing about 76 per cent. oil equal in quality to that of the best olive oil. An undoubted market exists for it, and success for its cultivation is assured, provided quality, uniformity, and continuity of supply are maintained.

The regional limit of successful cultivation of the nut is given as the tract of coastal country between Camden Haven, New South Wales, in the south, and Maryborough, Queensland, in the north; but a few trees are under observation as far south as Sydney. The most widely known species is *M. ternifolia,* named commonly as "Australian nut," "Queensland nut," "bush nut," "Bopple nut," or "macadamia nut."

When growing naturally in rain forests, the nut tree attains a height of from 50 to 60 feet, and branches out when above the surrounding jungle. Under cultivation or when growing out in the open, the tree is a robust, handsome evergreen with rounded top and branches clothed closely with glossy light green to dark olive green foliage. The young leaves, which are greenish yellow, yellow, pink, or red in colour according to type, are produced from terminal buds at the base of the leaf axils.

The tree is not deciduous, but a definite resting period during the colder months is observed, the time varying according to climatic conditions. Flowering may commence when the tree is from five to six years old, when an odd nut or two may set. The crop increases each year until, from ten years and upwards, good type trees produce regularly commercial quantities of nuts. The first flowers appear in early September, and flowering may continue through to October, according to weather conditions and individual peculiarities of the trees. The ever-bearing variety, *M. integrifolia* (see page 177), produces a quantity of blooms and nuts throughout most of the year. The blooms are abundant and very attractive to bees and other useful insects; consequently, pollination is largely unrestricted. Large quantities of nuts do not always mature, however, and it appears to be quite characteristic of some trees to consistently bear nuts in long clusters, while others just as consistently bear only three or four and some only one on each rachis.

The kernels are encased in a brown shell, varying from the common thick hard type to one thin enough to be cracked easily with an ordinary nutcracker. Some of the thin-shelled types, however, crack open

prematurely on the trees and the planting of these should be avoided. The nut kernel is creamy white in colour, rich in flavour and oils, and possesses excellent keeping qualities.

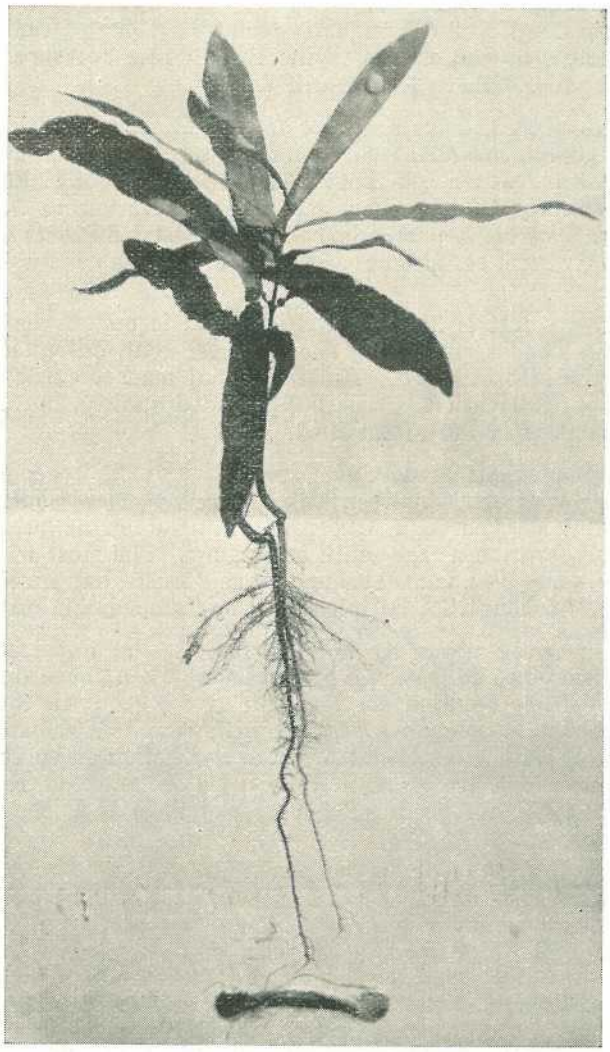


Plate 75.

A SEEDLING NUT TREE.—Note the length of tap root.

The whole nut, which is enclosed in a green, rounded pericarp or husk, matures in about six months after setting. A sure sign of maturity is the opening of the husk, which allows the nut to fall to the ground. Sometimes the partially opened husk, with the nut still enclosed, will fall to the ground, but this is not indicative of false maturity, and these nuts may be safely included with others which have fallen clear of the husk.

Root production in *M. ternifolia* is vigorous, the primary root at an early age being almost twice the length of the seedling's aerial growth. Secondary roots are rapidly developed, being well spaced and travelling well down into the soil, anchoring the tree firmly in its position, with a wide spread of feeding rootlets.

In the variety *M. integrifolia,* there is always a tendency for the secondary roots to be rather shallow, travelling for great distances just a few inches beneath the soil surface; consequently, great care should be taken during cultivation, otherwise many roots will be cut and so weaken the hold of the tree in the ground to the extent that it may be blown down by a strong wind.

Plate 76.
Macadamia Nut Seedlings in the Nursery Bed on the Property of Mr. D. Tulloch, Mudgeeraba.

A remarkable thing about the Queensland nut tree is that although it is found growing naturally where there is a good average rainfall, when grown under cultivation it is fairly drought-resistant after it has become firmly established.

When grown under suitable conditions, the trees may be expected to bear commercial crops for at least fifty years, and examples of trees forty-five to sixty years old which are still bearing large crops of nuts can be cited. It is quite probable that the life of individual trees may extend to upwards of 100 years. The Macadamia has been grown in Hawaii in small groves since its introduction from Australia in 1892. At present plantings aggregate about 800 acres, containing approximately 60,000 trees, most of which are less than fifteen years old. The plantings consist entirely of seedling trees, the seed having been selected from old trees noted for high yields of nuts of good quality. Both types—*ternifolia* and var. *integrifolia*—are grown, and their marked differences in vegetative and nut characteristics have been noted.

In Queensland there is undoubtedly scope for improvement in some of the types at present in cultivation, and all seedlings should be care-

fully watched so that any outstanding desirable characteristics may be observed, with the hope that better nuts may be evolved.

Plate 77.

MACADAMIA NUT TREE IN BEARING.—A close examination will show the clusters of nuts.

Location and Soil.

Although thriving in competition with all types of trees which make up coastal rain-forest country, the Queensland nut tree is very adaptable, and readily establishes itself under cultivation in a very wide variety of soils, ranging from open eucalypt forest to richly fertile alluvial flats. A marked antipathy to poor coastal sands has, however, been noted. Seedlings planted in these poor sands appear to stand still, or else develop into a scantily foliaged, stunted imitation of their

vigorous-growing progenitors. Under natural conditions, the tree is found growing well along watercourses in association with hoop pine, and where clay is but a few inches beneath the surface. It compares favourably in vigour also with other scrub trees, including cedar, carrabin, and similar soft woods, which are indicative of the richness of the loams supporting the heavy rain forests wherein they are found. Mild frosts do little harm, except to young growth.

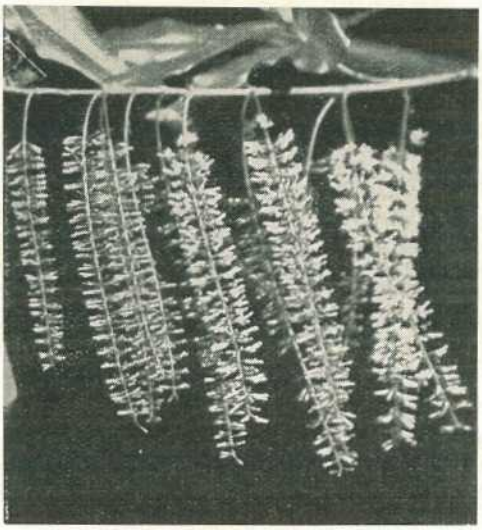


Plate 78.
THE MACADAMIA BLOSSOMS ON LONG PENDANT RACEMES.

The general recommendations in selecting an orchard site apply to a nut plantation, except, perhaps, that soil requirements need not be so exacting if the trees are to be planted with the idea of growing small crops between the rows. Furthermore, because of the length of time which must elapse before the nut trees become profitable, consideration may be given to interplanting with some kind of fruit, the economic life of which coincides with the time taken by the nut trees to attain full development. For example, nut trees may be planted between rows of bananas, papaws, and passion fruit. By the time plantations of those fruits have become commercially unprofitable, the nut trees will have become firmly established without affecting to any noticeable extent the productivity of fruit trees or vines with which they have been interplanted.

Situations exposed to high cold winds should be avoided, as ample shelter is necessary for the protection of young nuts. They are easily broken off by impact with limbs, rough edges of leaves, or just by the force of strong winds. Cold also delays the ripening of pollen, and adversely affects fertilization of the flowers, which may result in irregular setting and scanty filling of the nut clusters. Good drainage is essential for the satisfactory development of an adequate root system, and where it is lacking it should be provided. Waterlogged situations are quite unsuitable, for, even if they do not perish, the trees will not thrive.

From observation in districts which are regarded as the natural habitat of the *Macadamia,* altitudes above 1,500 feet are unsuitable for its vigorous development, and few trees are found in higher rain-forest country.

Attempts to establish Queensland nut groves at altitudes of 2,000 feet and over on rich soil have been mostly disappointing. The young trees definitely lack natural vigour in comparison with trees of similar age planted at lower altitudes. In brief, the Queensland nut thrives best under conditions commonly required for growing bananas and papaws.

For some reason, certain sections of "scrub," in districts where the trees grow naturally, do not carry macadamias. For instance, through the lower Little Nerang Valley, from Talai Mountain, in the north-east, to Wunburra, south-east, they are not to be found. Searches made through "scrubs" from the junction of the Little Nerang with the Big Nerang at Gilston up to Wunburra Mountain at the north-east of Springbrook have been made without finding a single macadamia growing. On the western side of the range in the Nerang Valley, the eastern side in the Mudgeeraba Valley, and below the junction of the two creeks at Gilston, the trees grow and flourish naturally. Grevillias and *Stenocarpus* are indigenous to the Little Nerang rain forests, but there is apparently some unsuitable condition preventing the natural distribution of the macadamias in the other regions mentioned.

Two small groves planted on the western side of Talai Mountain are producing nuts of moderate quality. But the trees have developed a spindly growth under cultivation, in contrast with the sturdy, stocky growth common in more favourable situations in other parts of the district.

Propagation.

Propagation at present in confined chiefly to the raising of seedlings. Grafting young seedlings with scions from trees possessing desirable characteristics is engaging the attention of experimentalists, who are hopeful of overcoming a natural difficulty which is in the way of complete success of this work.

Until they reach bearing stage, trees raised from seed must be regarded as an unknown quantity, because of the effect of cross pollination. No information is yet available as to the percentage of seedlings which will bear true to type and possess the characteristics so much admired in the parent tree. As a general recommendation, seed should be obtained from trees which have been selected for their vigour, productivity, habit, freedom from disease, and earliness in reaching commercial bearing, and, in regard to the nuts, the shape, thinness of shell, size of kernel, flavour, and oil content.

Most satisfactory germination is obtained by planting the nuts immediately after they fall from the tree, when at least 70 per cent. strike may be expected. Although the nut keeps well, good results have not been attained by the planting of old and indifferent quality nuts. The nuts should be removed from the husk (but not from the shell) and planted about their own depth beneath the surface in a well-prepared seed-bed, or, preferably, in boxes filled with good river bed sand or sandy loam. Seed boxes should be placed in a sheltered, warm, handy position where they can be watered regularly to keep the sand moist. Without frequent watering the young seedlings quickly die. The germination period varies considerably, even with nuts from the same tree. Thin-shell nuts

germinate much more quickly than the medium and thick-shell types; some thin-shell seedlings have been known to appear within two weeks from planting. Normally, the young seedlings should appear above ground at from thirty to ninety days, but instances of up to 150 days are known. When the young growth has hardened off, the seedlings should be lifted and planted about 1 foot apart in nursery beds and well watered. If seedlings are left too long in shallow germination boxes, the primary root reaches the bottom rapidly, becomes malformed, and the growth and development of the young plant are retarded.

Another successful method of raising seedlings is to inspect the nuts in the sand boxes at intervals of a few days after the first two or three weeks of sowing, and to remove any which are showing signs of cracking and plant them at intervals of 12 inches in a nursery bed, or in 12-inch pots, where they should remain until the young seedlings have developed sufficiently for planting in their permanent positions in the field. They must, however, be handled carefully so as not to damage the young root tip. It will be found, irrespective of the germination method adopted, that the young plants will grow better if transplanted into nursery rows from the seed bed or seed box. Root development is then more vigorous and the young trees have more room to grow. By the following spring, or when the seedlings are about six months old, they should be from 6 to 9 inches high, and, provided weather conditions are suitable, will be far enough advanced for transplanting permanently. If the weather is dry they may be left until autumn.

The germination of indvidual nuts is so uncertain that it is inadvisable to plant them direct into the field. Warmth and moisture and attention are essential for rapid germination, and these are best provided by following the procedure outlined.

Planting.

In digging the trees from the nursery rows, they should be removed as carefully as possible to avoid excessive injury to the roots. If the tap root is broken during digging, the injured portion should be cleanly cut off above the point of mutilation. The tap root normally is long, and may be pruned back in young seedlings to about 12 inches. It is advisable to soak the bed thoroughly a few hours before lifting the young trees. They will then be easier to extract from the ground without injury to the roots. The digging of a trench 15 to 18 inches deep alongside the rows and about 8 or 9 inches from the plants will simplify digging; or, alternatively, by pushing a spade down alongside the young seedlings about 8 or 9 inches from them a week or so before lifting, long secondary roots are cut back and lifting is facilitated.

The last growth should be allowed to harden off before the young trees are transplanted, otherwise many failures will result. Seedlings planted out during the rainy season—February to April—quickly establish themselves, and fewer losses will follow transplanting. There is then plenty of moisture in the soil, while frequent showers and high humidity assist the young trees to rapidly recover from the shock of disturbance.

Where different varieties are to be grown in the same grove, they should be kept separate, each variety being planted in a block or row by itself. By so doing, the nuts from each variety can be kept separate during harvesting, and this is most important, because thin-shelled nuts should be marketed separately. Furthermore, if everbearing trees are

mixed with other varieties, nuts in different stages of maturity will often be included in the same parcel, causing dissatisfaction to buyers and disappointing returns to the grower.

If the seedlings are planted with other fruits, planting distances will be more or less governed by the fruit tree rows, but experience has shown that a minimum of 20 feet and a maximum of 30 feet between nut trees will give satisfactory results. The square system of planting is most popular because of the ease with which cultivation can be carried on. In the hexagonal system, the tree rows are staggered, and permit of 15 per cent. more trees being planted to the acre. Another method of planting, which has much to commend it, is to plant 15 feet apart on the square and, after the trees are ten years old—or sooner, if the branches become interlocked—to cut out every second tree, leaving a final spacing of 30 feet by 30 feet. This method is very successful where a grove is planted with the idea of dispensing with interplanting of small crops after the third year. Under the lastmentioned method a much larger acreage return is naturally obtained during the first years of bearing, helping to offset the cost of maintaining the grove from time of planting to time of coming into profit; furthermore, the close planting for that period does not appear to affect adversely the growth or bearing capacity of the trees, while it has been suggested that pollination is improved.

To calculate the number of trees to the acre when planted on the square, multiply the distances apart in feet and divide the result into 43,560, the number of square feet in 1 acre. The following table gives the approximate number of trees to the acre when planted at the distance shown:—

Distance Apart.	Number of Trees per Acre.	
	Square.	Hexagonal.
15 feet	190	220
20 feet	109	125
25 feet	70	80
26 feet	64	73
27 feet	60	69
28 feet	55	63
29 feet	51	58
30 feet	48	53

One of the first essentials in successfully establishing a grove is to thoroughly prepare the land before planting, by ploughing and harrowing until the soil has been worked to a satisfactory tilth. Where it is impracticable to plough the land, then the work must be done by hand, a forked hoe being the most suitable implement for the purpose.

Having decided the distances apart the trees are to be planted, the next thing to do is to measure the land and peg the positions the trees are to occupy.

When digging the holes, the surface soil should be taken out first and placed on one side. The subsoil should then be well broken up deep enough to allow the tree to be planted to a similar depth to that occupied in the nursery bed. The holes need only be wide enough to allow the roots to be properly spaced without cramping. A small mound of top soil should be placed in the bottom of the hole and the roots evenly

spaced outward and downwards at an angle of about 45 degrees, the spaces between the roots being filled in with fine soil and pressed firmly. Before the hole is completely refilled, water should be applied and allowed to soak well in.

Should the weather be hot or the position be exposed to high winds, shade and supports should be provided. For shade, a piece of hessian or brush placed over stakes supporting the young trees is sufficient. A satisfactory way of providing supports is to drive three or four stakes well into the ground around each tree, and to these it is held firmly by tying with strips of hessian or galvanised iron wire slipped through pieces of rubber hosing or similar material to prevent the trunk from being injured at point of contact. The stakes also help to protect the young trees during cultivation and also from grazing cattle and other animals during the trees' early growth, when they are planted in open grazing paddocks. Apart from cattle eating the young shoots, the continued breaking of tender growth results in the development of stunted and malformed trees.

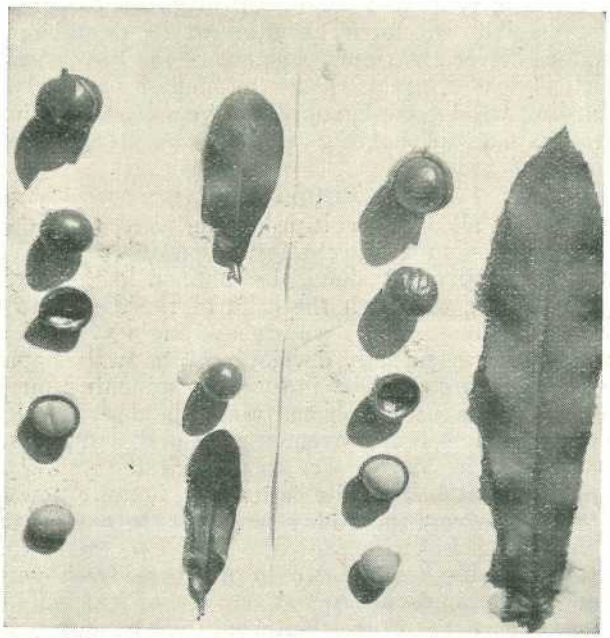


Plate 79.

Leaves, Nuts in Husks, Nuts Whole and Cracked, and Kernels.

In hare-infested districts, it is necessary to provide protection either by netting fences or wrapping the young trunks in protective material to prevent their being girdled. Hares have a liking for the recently hardened bark, and considerable losses have resulted from their activities.

Cultivation.

In the early years cultivation of the surface soil, particularly in the vicinity of the trees, is essential for the maintenance of vigorous growth. Where surface crops, such as beans and peas, or fruits similar to those

suggested elsewhere in these notes, are planted between the young trees, the preliminary preparation and subsequent cultivation of the land benefits nut trees and secondary crops alike. When the trees are five to six years old, deep cultivation in the immediate vicinity of the tree should be discontinued; however, the surface soil should be lightly worked to prevent packing, also as a measure of weed control. In older groves, animals are often used to eat down grass or succulent weed growth, and from observation this is a sound practice. Animal manure has an invigorating effect upon the trees, besides helping to keep the main lateral roots covered. As the grove ages, there is a tendency for these roots to work to the surface, due partly to natural growth and partly to the drift of surface soil, or, in the case of trees planted on slopes, erosion. When steep slopes, such as constitute the greater proportion of banana plantations, are planted with nut trees, provision should be made to prevent surface soil erosion by placing stones or logs in such a way that any wash will be caught and held in the vicinity of the trees, eventually setting up a series of small ledges and preventing the rich surface soil from being washed away. Attention also should be given to the growing of a good cover crop—legumes for preference—or, if this is not possible, succulent harmless weeds should be allowed to cover the surface before the commencement of the heavy seasonal rains. A good mulch of leaves, grass, rushes, or similar material benefits the trees by retarding weed growth, supplying very necessary humus to the soil, improving its moisture-holding capacity, and increasing its fertility.

Pruning.

In common with all other fruit-producing trees, pruning will direct the energy of the macadamia into the formation of a sturdy, stocky, well-balanced tree. Early pruning should be confined to the development of properly spaced limbs, on which the head of the tree is to be formed. If left to natural inclination, the young seedling will often continue to grow as a single stem, eventually developing into an ill-shapen, bodyless tree. Lateral branching may be induced by pinching out the young terminal buds when the seedling has attained the desired height—that is about 2 feet 6 inches to 3 feet from the ground. Subsequent growth must be carefully watched in order to prevent the young main limbs from growing immediately opposite each other, because new growth, for preference, will arise from the buds situated at the base of the terminal leaf axils. One bud should be permitted to develop; then on the removal of the remaining buds—usually two in number—fresh young growth will be promoted from buds situated at the base of leaf axils lower down the stem. Those permitted to develop should not be on the same side as other limbs, but alternatively opposite in order to overcome the possibility of splitting down the trunk during high winds or when carrying heavy crops. The young terminal growth should be regularly inspected and shortened off at intervals of upwards of 2 feet. It will then be found that secondary lateral growth will appear, assisting in the formation of a squat, bushy-headed tree possessing an abundance of short fruiting wood and preventing the domination of long, whippy growth, which is a natural proclivity of the macadamia apparently inherited from years of competition for light under natural growing conditions in the dense rain-forests. If the main stem of the tree is allowed to grow too high before being pruned, the subsequent growth often has a tendency to grow long and scantily branched, resulting in the formation of a high, ill-formed tree.

At times, young trees do not come away well on the original stem, this failure being due to a variety of causes, and a cluster of base shoots may arise as a consequence. In such cases, it is advisable to select the strongest and best-situated shoot to form the main stem of the tree, the others being cut cleanly away. Where young trees have grown very dense through too many shoots having been permitted to grow, thinning-out is necessary to open up the trees to light and air. After the foundation of the tree has been formed, little pruning is necessary beyond removal of dead or dying wood and badly placed limbs, in order to keep the centre open and promote an even distribution of fruiting on the interior.

As the tree grows older it will be possible to gradually lift the head by removing the lower limbs. Where large cuts are necessary, they should be smoothed off, and painted with tar or a good lead paint to prevent the possibility of dry rot setting in and so weakening the stem.

With care, the wounds soon callous over, and little effect is noticeable in the tree. The work should, however, be done after the crop has been removed and before the commencement of spring growth.

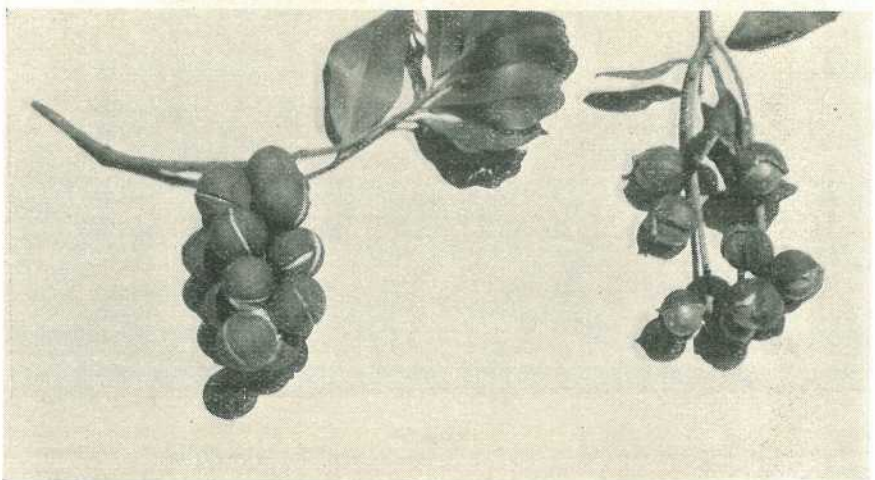


Plate 80.
Clusters of Nuts showing Husk's Splitting, indicating Maturity.

Bearing Habit and Harvesting.

In Australia and elsewhere it has been observed that the crop varies in quality throughout the season; usually the first few nuts which drop are poor in quality, small, and shrivel rapidly. If the trees are constitutionally strong and the season is fair, however, this represents a very small percentage of the crop.

Variations in nuts from different localities may be influenced by such factors as origin of seed, cultivation, climate, and location.

The present commercial demand tends towards the deep brown coloured, smooth-shell nut, because of its rich flavour. The medium to thin ovoid shell is attractive in appearance, with a uniformly full kernel.

There has been considerable controversy over the weight of nuts produced by a single tree, and from observations of known trees over several years the following may be taken as a fair average yield under normal conditions:—

First bearing (6 to 7 years)—3 to 12 nuts.
8 to 10 years—10 lb. to 30 lb.
12 to 14 years—40 lb. to 60 lb.

With increasing age the tree, according to local conditions, continues to increase in vigour.

In estimating yields, caution is advised. Calculations on a conservative basis allow for such contingencies as loss of portion of crop due to action of heavy winds and adverse seasonal conditions, falling of unripe nuts, and depredations of animals and insects.

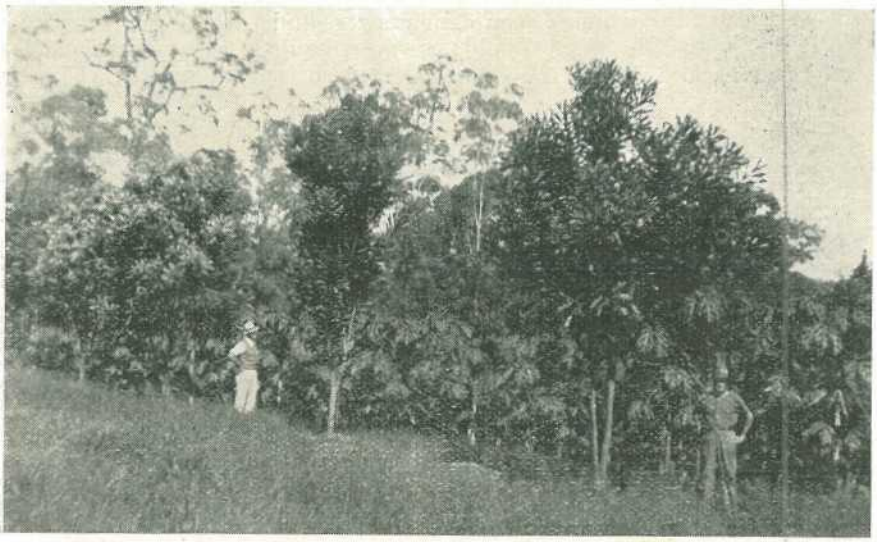


Plate 81.
MACADAMIA NUT TREES INTERPLANTED WITH PAPAWS.

Normally, blossoms appear in early September and flowering may continue until early October. Large quantities of young nuts are usually set, but are somewhat reduced by the influence of natural characteristics, wind, adverse seasonal conditions, caterpillar attack, and other causes, so that a cluster is rarely found containing more than twenty nuts—the average being about ten, while it is not uncommon to find clusters of only two or three. The nuts mature in from six to seven months. They must be allowed to ripen on the tree to attain proper maturity. Immature kernels quickly become affected with a mould rendering them unsuitable for consumption, so that nuts intended for market should be fully matured. The mixing of unripe with matured nuts must be avoided.

After harvesting, the nuts should be taken from the green husks and washed to remove any discolouration caused by adhesion to the husk, thus improving its appearance and leaving the shell a clean, even brown colour. A simple method is here suggested:—When husked, tip

the nuts into a kerosene tin or similar container until it is half-filled; then pour in sufficient water to cover them. By taking the handle and twisting the tin quickly from side to side, the movement of the nuts against each other has a cleansing effect; furthermore, any hollow nuts will float to the surface, to be easily rejected. The nuts should then be placed on benches or in shallow boxes for a day or two to dry.

Before marketing, at least a month should be allowed for the nuts to "harden off." Shallow trays or boxes are suitable for this purpose, and they should be stacked in a cool, semi-dark shed out of the weather.

When marketing, two main considerations should be size of nut and thickness of shell. There should be at least two sizes or grades. Small nuts should not be mixed with large ones, because one detracts from the appearance of the other and the price is reduced accordingly. Standard corn-shellers are easily adaptable for removing green husks.

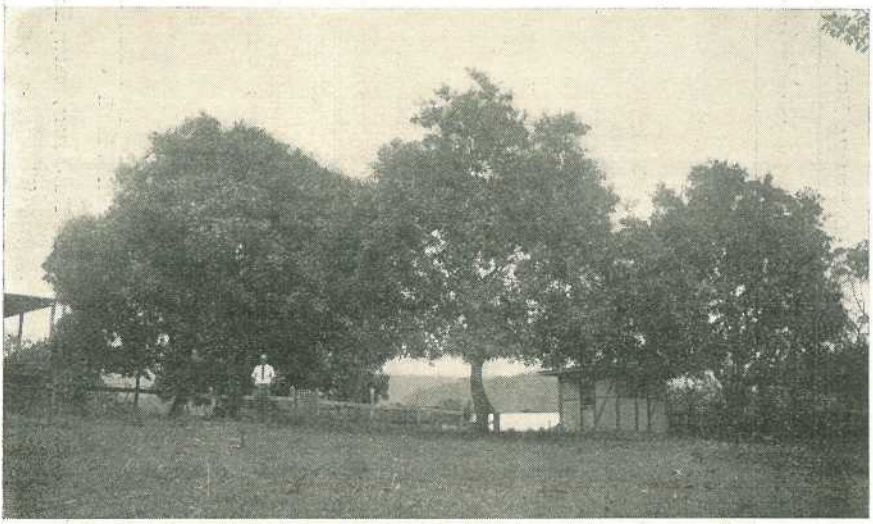


Plate 82.

THE MACADAMIA IS A WELL-SHAPED SHADE TREE AND, WHEN GROWN AS A GROVE, PROVIDES A PICTURESQUE SETTING FOR A FARM HOMESTEAD.

Thin-shelled nuts of any grade are in ready demand, and when marketed should be so labelled, provided the whole of the consignment is consistent with the label.

New nuts should not be packed with older ones. If possible, each week's harvesting should be kept separate. This ensures a uniform standard of maturity.

In most types the proportion by weight of shell to kernel amounts to about 65 per cent.; this, in addition to hardness of shell, suggests that marketing the kernels only would be the most satisfactory method. Machinery for cracking the shells and separating the kernels is now in use. Small home machines are obtainable. During the cracking process some kernels are unavoidably broken, but are acceptable by manufacturing confectioners.

Shelled kernels do not deteriorate to any appreciable extent if kept away from light and moisture, the flavour and oil content being maintained. As a roasted and lightly salted confection, they are in strong demand, and this treatment considerably enhances their naturally good keeping qualities.

CHARACTERISTICS OF TYPES OF MACADAMIA NUT.

—	*Ternifolia.*	*Ternifolia* (Mammoth).	Var. *Integrifolia.*	Var. *Integrifolia* Everbearing.
Tree	Rounded top; dense, vigorous growth	Upright; coarse, vigorous growth	Stocky; rounded top; open habit of growth	Vigorous, rounded top; well-spaced limbs plentifully supplied with fruiting spurs
Leaves	Rigid in texture; elliptical or long and narrow; excessively spiny; young leaves pink or red in colour	Coarse and large; elliptical or very long; excessively spiny; young leaves red	Rigid in texture; obovate; almost entirely free of spines; young foliage yellow to lemon	Rigid in texture; obovate or elliptical; free of spines; young foliage lemon green to yellow
Flowers	Pink to light reddish brown; blooms August-October	Pink; blooms August-September	Creamy yellow; blooms August-September	Creamy yellow; blooms periodically from June through to March
Bark	Light greyish green or brown	Browny grey	Greyish to green	Grey to green.
Age of bearing ..	5 to 6 years	5 to 6 years	6 to 7 years	6 to 7 years
Fruiting	One crop annually	One crop annually	Mostly one crop annually; sometimes a light second crop is set	Bears flowers and fruit more or less all the year
Shell and texture	Smooth to knobby; sometimes flecked; thick shell tough and coarse; thin shell smooth and fine; brown colour	Knobby, uneven surface; medium to thick shell; brown colour	Smooth surface; medium to to thick; brittle; brown colour	Smooth surface; medium thickness; brittle; brown colour
Nut unshelled ..	Ovoid to elliptical	Ovoid to elliptical	Mostly spherical	Ovoid to spherical
Quality	Fine; rich in oil	Brittle; rich in oil	Texture finer than *ternifolia*; rich in oil	Fine texture; rich in oil
Pests	Nut-borers, caterpillars, leaf-miners	Nut-borers, caterpillars, leaf-miners	Nut-borers, caterpillars, leaf-miners	Nut-borers, caterpillars, leaf-miners

Fertilizing.

No fertilizer experiments have been made to determine a suitable formula, but during the early years of growth organic manures and nitrogenous fertilizers should prove valuable as a stimulus, and will assist in maintaining a high humus content and fertility of the soil. Seedlings lagging in growth after transplanting will benefit from a dressing of blood and bone at the rate of 4 oz. to each tree in September and again in March.

Diseases and Pests.

Macadamia trees appear to be free from most forms of disease, but the larvæ of a moth (*Xylorycta lutætactilla*) may cause considerable damage. Information on these matters is obtainable from the Department of Agriculture and Stock, Brisbane.

Macadamia ternifolia var. integrifolia.

Some doubt exists as to whether this is a variety or merely a type, but for the purpose of these notes the more familiar term "variety" is used for distinction between the two—i.e., *M. ternifolia* and *M. ternifolia* var. *integrifolia*. The production of smooth-shelled nuts has been said to be restricted to the var. *integrifolia*. Such, however, is not the case, because trees of *M. ternifolia* can be cited as producing nuts with a smooth and brown-flecked shell. In common with *M. ternifolia*, a wide variation has been observed in the shape of leaves and nuts of the var. *integrifolia*.

The habit of bearing more than one crop a year is confined to var. *integrifolia*. Despite this heavier cropping, however, under natural conditions the most widely distributed variety is *M. ternifolia*, suggesting the possibility of its requiring less exacting soil conditions, although under cultivation *M. integrifolia* readily becomes established and flourishes equally as well as *M. ternifolia*.

The "Everbearing" type may carry blossoms and nuts in different stages practically throughout the year, the main flowering periods being June and November. The nuts are usually ovoid in shape, with brown, smooth shell of medium thickness and borne similarly to those of *M. ternifolia*. Maturity indications are identical and extend over a similar period of time. The kernels fill the shell and are rich in flavour, with an oil content equal to all other varieties. The tree is consistently robust, with full rounded top; main and secondary limbs growing somewhat laterally maintain an open habit of growth admitting light to the interior, thereby inducing a fairly even setting of nuts over the whole tree.

Possessing an extensive root system, development is mostly of a shallow nature, and young trees in exposed positions, unless well staked, often blow over during wet, stormy weather; while in aged trees the main lateral roots become exposed near the trunk, necessitating protection to keep them covered with soil. Should the roots become badly exposed through erosion and natural development, a diminution in cropping will be observed. On the roots being well covered again, a return to consistent heavy bearing is the usual result.

With this variety some immature nuts are always gathered, as it is difficult to harvest the whole crop at the correct stage; immature nuts are unpalatable and deteriorate quickly. Care should be taken to exclude these from matured nuts; otherwise they may adversely affect the disposal of the whole crop.

Propagation.

Propagation is mostly from seed, which should be planted as soon as possible after falling from the tree. Germination may extend from 30 to 120 days. When selecting seed from the "Everbearing" variety, best results will be obtained from seed which matures during April-May. If the nuts are planted immediately, young seedlings are then sufficiently well advanced for planting out during the following autumn.

Seedlings transplant as readily as those of other varieties under suitable conditions, and when once properly established rapidly develop into attractive and shapely trees.

Acknowledgments.

The assistance of the undermentioned growers in supplying information used in the preparation of these notes is cordially acknowledged:—Messrs. W. Hill and H. J. Latimer, of Gilston; Messrs. A. Barns, L. Grimshaw, and D. Tullock, of Mudgeeraba; also that of Messrs. G. F. Hinde, of Southport, and J. H. Gregory, of Brisbane, in supplying photographic illustrations.

LITERATURE CITED.

HAWAII AGRICULTURAL EXPERIMENT STATION, HONOLULU: Methods of evaluating the Macadamia Nut for commercial use and the variation occurring among seedling plantings in Hawaii. Bulletin No. 79, April, 1938.

TECHNOLOGICAL MUSEUM, SYDNEY.

EDWIN CHEEL, Curator and Botanist, Botanic Gardens, Sydney.

F. R. MORRISON, A.S.T.C., A.A.C.I., F.C.S., Asst. Economic Chemist, Sydney.—The Cultivation and Exploitation of the Australian Nut.

H. W. EASTWOOD, Senior Fruit Instructor, Dept. of Agric., N.S.W.—The Australian Nut.

C. R. WALLACE, B.Sc.Agr., Assistant Entomologist, Dept. Agr., N.S.W.—The Twig Girdler Moth of Australian Nut Trees.

W. D. FRANCIS, Botanist, Department of Agriculture and Stock, Queensland.—Rain Forest Trees (excluding North Queensland).

GROW MORE KURRAJONGS.

Grow more Kurrajongs. Nothing is better generally for inland work, and if good soil and decent growing conditions can be assured during their infancy, you can forget the story that Kurrajongs are slow growers.

By me, I have a report from the north-western slopes (New South Wales) of a young kurrajong tree which grew 10 feet in a little over twelve months. Is that slow? It had fertile soil, well prepared, and ample water to keep it going along steadily. The kurrajong makes a noble tree, is decorative, hardy, and can be used for stock food in emergency.

It responds well to cutting and should be pruned annually after flowering to prevent the heavy seed-setting, which somewhat exhausts the tree. This during the earlier years.

Along the coastal areas a variation can be made from jacarandas, with some of our native brush-forest trees—brilliant colourists and grand decoratives . . . .—*L. B. in the "Sydney Morning Herald."*

Ropiness in Milk and Cream.

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

MANY inquiries as to what ropiness really is and how it may be prevented have reached members of this laboratory during the past two years, and a number of samples have been examined for this defect. Some information, therefore, is put forward regarding its nature and the means of controlling it on the farm, which may be useful to the milk trade as well as to the cream supplier who experiences difficulty with regular or irregular outbreaks of ropy cream.

Very frequently in Queensland, among the cans of cream graded down to second-grade on the butter-factory platform, one or more is to be found which shows a typical slimy or ropy condition. This cream may otherwise be of good flavour and quality, but the grader has been forced to reject it because its condition makes it unfit for manufacture into choice-grade butter. Ropiness is also met with as a milk defect and has been known, though fortunately this is not common, to cause serious loss of trade through the housewife's confidence in her milk supply being destroyed. She at once associates the abnormal slimy condition of the milk with some disease, and, even though it may occur only once or twice, she is naturally suspicious of the quality of the entire supply and often decides to "change the milkman."

SYMPTOMS OF THE DEFECT.

In mild cases of ropiness, the milk or cream will show only a slight smooth thickening, viscosity, or sliminess, which is quite distinct from, and must not be confused with, the stringy appearance, often accompanied by small lumps, which is common in cases of mastitis. A ropy condition is of bacterial origin, but it is rarely associated with disease and often neither the flavour or aroma are altered. Often, again, unclean organisms accompany the ropy bacteria, when, of course, the flavour is deteriorated. Sometimes a can of milk or cream will show ropiness only at the surface, the lower portion being unaffected; more commonly the whole bulk will be affected (see Plate 87). Sometimes the milk will remain normal until delivered to the customer, or cream until it reaches the butter factory, but, if kept for an hour or two longer, the ropiness will become obvious; if kept after this—for twenty-four or forty-eight hours—the ropiness may completely disappear and souring or other deterioration take place.

OCCURRENCE.

The incidence of ropiness in Queensland is not limited to any definite season of the year, though a larger number of complaints appear to occur during the summer months. This may be an indirect effect of low water levels. The temperature at which bacteria causing ropiness may grow and flourish is not confined within definite limits owing to the fact that a number of different species have been found to be responsible for this trouble. Some grow well at 50 deg. F., so that even cooled milk and cream are not immune, while others develop well at 70 deg. and 80 deg. F., or even higher. As with any bacterial taint, development may be either delayed or prevented altogether if conditions are such that other organisms, as, for instance, the souring group, gain the upper hand, and, developing more rapidly, leave no food material available for the rest.

CAUSES OF ROPINESS.

Members of the lactic acid (souring) group are occasionally responsible for a ropy condition in dairy products; in addition to these, certain micrococci, members of the coliform and aerobacter group and others, are capable of producing slime either from the protein or more usually from the sugar (lactose) present. This slime is formed by each

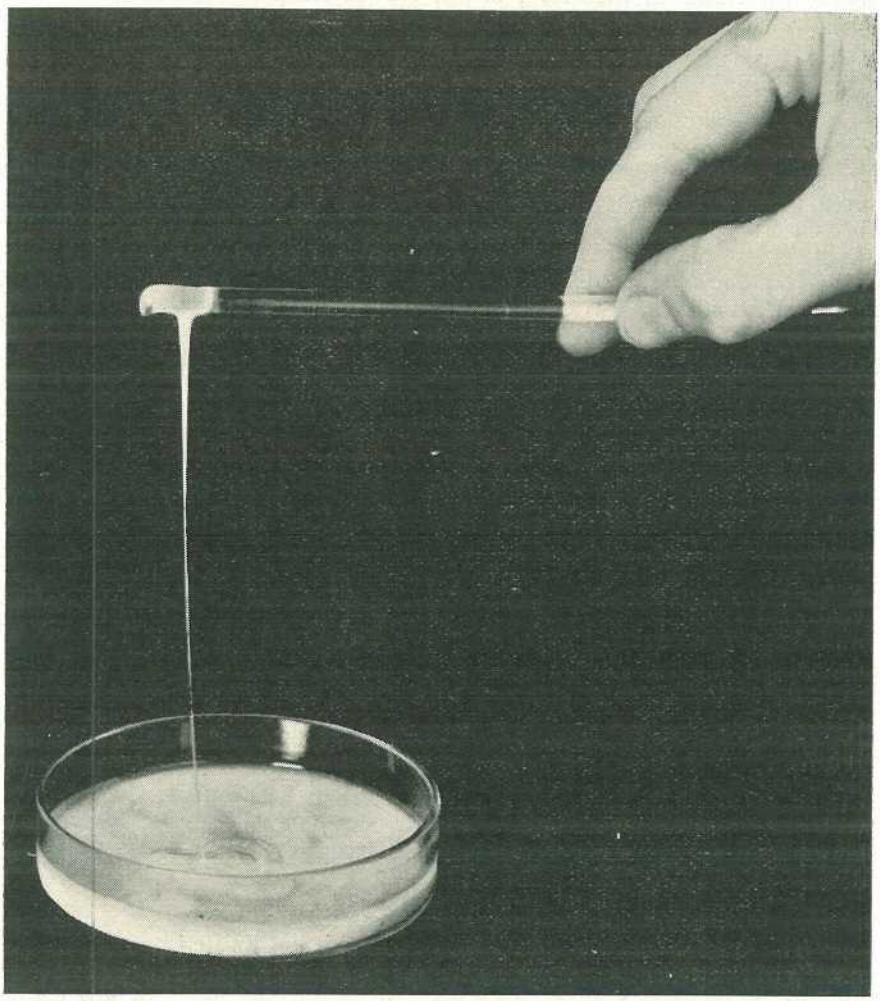


Plate 83.
ROPY MILK.—Sterile milk inoculated with farm water from Gladstone district, May, 1939.

cell in the young state, and under the microscope appears as a jelly-like capsule enveloping it. The illustration (Plate 85) shows a twenty-hours-old culture of a lactose-fermenting rod (an *Aerobacter aerogenes* strain) recently isolated from a water sample received from the Gladstone district, grown in sterile milk. As the culture becomes older more slime is formed (in a culture such as this a distinct joining-up of the

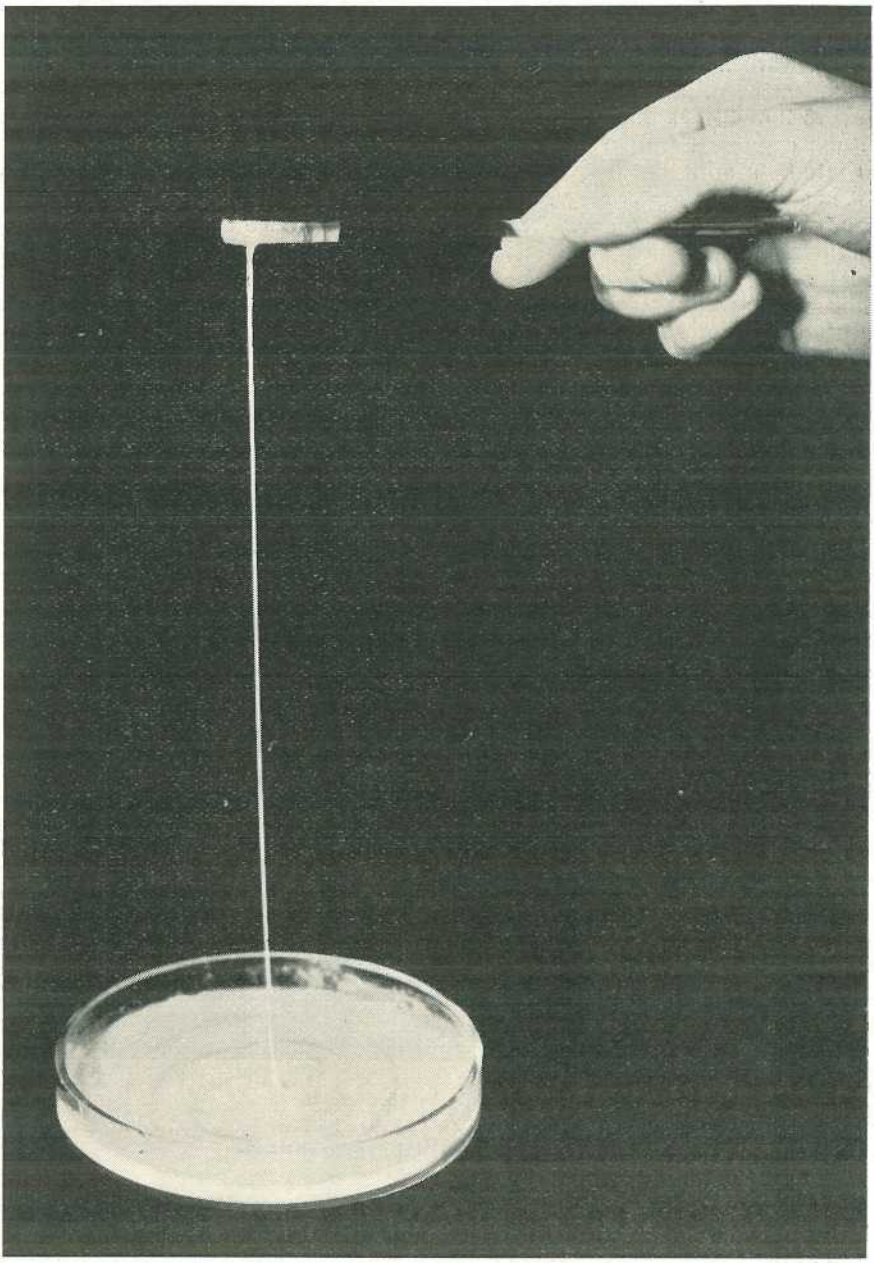


Plate 84.

Ropy Cream.—Cream inoculated with culture from farm water, Gladstone district, May, 1939.

single cells into groups or chains may be seen) so that, while the cells may remain distinct, they are bound together by a network within the gel (see Plate 86). In the case of streptococci, this is not so obvious since the organisms are already in chain formation. It is this network that enables the milk or cream to be pulled out in strings or ropes sometimes up to 2 or 3 feet in length. Plate 84 shows a cream inoculated with the same organism pulled out to about 9 inches in a uniform thread, and Plate 83 a milk showing nearly 6 inches of "rope." This capsulation as it is called is a temporary stage in the life of the organism, and will pass as the cells become older. Unfortunately in practice the dairyman whose bails and dairy have become infected with the trouble finds that it does not disappear, and this is because twice a day fresh milk is available for growth and activity, young cells are continually produced, and multiplication will be regular provided that temperature conditions are suitable.

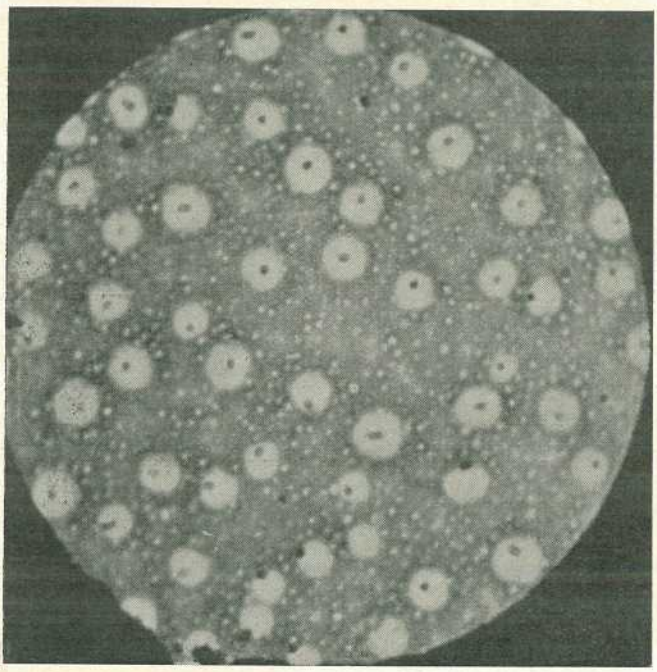


Plate 85.
TWENTY-HOUR CULTURE OF *Aerobacter aerogenes* STRAIN ISOLATED FROM LAGOON WATER, SHOWING CAPSULES FORMING.

SOURCES.

Until the source of the troublesome bacteria is known to the farmer, his dairy will not be completely freed from the defect, and the first step is to explore the possible sources. Among the commonest are the following:—

1. Lagoon or dam water, stagnant or slowly-flowing.
2. Water remaining stagnant in paddocks after flooding.
3. Neglected stock yards where manure accumulates.
4. Rain-water tanks contaminated by dust.

From these original sources the bacteria find their way into the milk by the following means:—

1. On cows' coats, udders and tails, if they have waded in the water.
2. In the first-drawn milk of each cow.
3. Dust blowing direct from yards into bails or dairy.
4. Through washing utensils with impure tank water.
5. Occasionally, through the splashing of water used for cooling purposes, or leaking of a cooler.

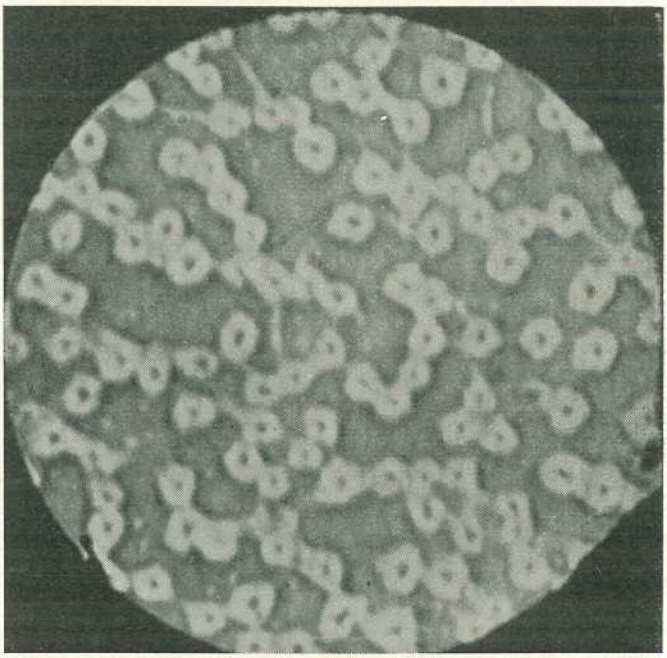


Plate 86.

TWENTY--SIX-HOUR CULTURE OF *Aerobacter aerogenes* AT 25 DEG. C., SHOWING CAPSULES STARTING TO JOIN UP TO FORM "ROPE."

CONTROL ON THE FARM.

Once the source has been determined, precautions can be taken to ensure that further infection is not allowed to enter. At the same time control measures in the dairy, which are very simple but which must be rigidly applied if the trouble is to be completely cleared up, can be put into practice immediately.

1. Fence off stagnant water, as far as possible, from dairy cattle, and provide a water trough for drinking.
2. Remove manure regularly from yards, and make a good surface so that mud and dust are minimised.
3. Clean the bails thoroughly, including floor, roof and walls; limewash roof and walls.

4. Examine milking machine parts, especially rubbers, and every utensil used for milk or cream. Replace or have repaired any which show crevices or cracks. (Kerosene tins, however clean, will spread ropiness regularly owing to their open seams, and they should not be used in the dairy except for skim milk.)
5. Boil all wash-up water if this is a suspected cause; wash utensils thoroughly.

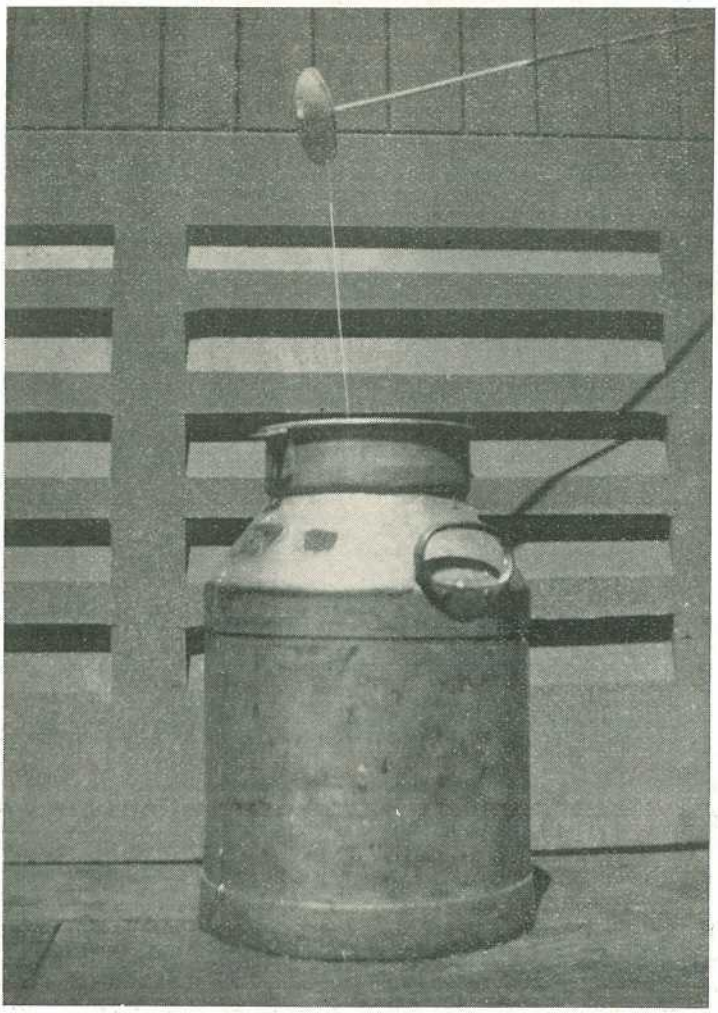


Plate 87.
A CAN OF CREAM SHOWING "ROPE" WHEN STIRRED WITH A PLUNGER.

6. Sterilize *all* utensils and milking machine parts in contact with milk, either by steaming or by immersion in boiling water for at least 10 minutes, and allow to dry—do not use cloths. (Cans may be effectively steamed by inverting over a perforated lid on the copper.)

7. Wash cows' udders thoroughly—a little disinfectant may be used in the water—and boil the cloths each day.
8. Discard two or three streams of milk from each teat, before milking, into a bucket or billy kept for the purpose.
9. Pasteurization of milk (to 145 deg. F. for 10 or 15 minutes) is an emergency control measure which will destroy ropy organisms, and which may be useful temporarily to the milk retailer to prevent loss of trade.

The bacteria are, for the most part, not resistant to heat, and are, therefore, readily destroyed by boiling water and steam—the slime, however, does form a protective layer around each cell which will enable any bacteria lodged in crevices of utensils or machine rubbers to survive and multiply in the next batch of milk. Utensils in good condition are, therefore, extremely important. Two persistent cases of ropiness recently came to the writer's notice, one from the Woodford district and one of a supplier to a Dalby factory, which were due to the daily use of kerosene tins for cream, and, so long as farmers persist in using second-rate dairy utensils, which include worn machine rubbers as well as cracked buckets and cans, they cannot reasonably expect to receive a choice grade for the article they produce.

If the abovementioned points receive attention, it should be possible to arrest an outbreak of ropiness immediately, and provided that this is followed up with daily care in production methods, a recurrence of the trouble should be avoided.

BORDER LINE CREAM.

Every factory manager should formulate a policy in regard to the lowest quality cream that can be manufactured into choice quality butter at his particular factory. Modern methods of manufacture and factory equipment have done much to enable the utilisation of cream which a few years ago would have been rejected. Nevertheless, the dairying industry still offers no exemption to the general rule—that the quality of raw materials directly influences the character of the manufactured product. The addition of a few faulty cans of cream to a vat may thus cause the spoilage of otherwise choice quality butter. Only a thorough knowledge of the origin and nature of a given defect can help in determining the fate of doubtful cream.

There is a limit to the capability of machinery and manufacturing technique to offset defects in cream quality, and no factory can afford to slur over defects in the cream received. Any laxity in this respect is really doing the farmer a disservice, for he may remain unaware that better quality cream is required, and takes less, instead of more, care on the farm.

First-quality butter can only be obtained when the farmer realises that the remedy for cream defects is essentially his responsibility.

Bacterial Spoilage of Processed Cheese.

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

DURING the recent summer, a large quantity of the output of cheese processed on three separate days in one month was returned to the factory concerned, with a taint so obnoxious as to make it entirely inedible. This serious taint developed two to three weeks after manufacture, the cheese showing obvious deterioration, either slight or advanced, but always accompanied by a penetrating putrefactive odour. From this cheese an anaerobic spore-forming organism was isolated.

Mean atmospheric temperatures in Brisbane at this period (December-January) showed a high average, being 72·8 deg. F. for the month of December, and 78·1 deg. F. for the month of January, with average maximum readings of 86·4 and 85·6 deg. F., and any bacterial defect would be likely to show rapid development. For this reason, although local complaints were few, many were received from other states, and from the north, where the cheese had been for a considerable time in transit.

NATURE OF THE DEFECT.

On removal of the tinfoil the cheese showed circular softened and bleached patches on the surface, and on cutting through the block at different points these patches were seen to be present throughout the whole length and depth of the block. In advanced cases, these areas were as much as 1½ inches in diameter and had become joined so that the major portion of the cheese had a bleached appearance and crumbling texture, and the minor part normal colour and firmness; in less fully-developed cases, the areas measured ¼ or ½ inch. It was possible to distinguish in the centre of some of the affected areas a small dark slit, which it is thought may possibly have been caused by the formation of gas. The appearance of the cheese is shown in Plate 88. In all cases, including milk cultures, a penetrating obnoxious odour, which may, perhaps, best be described as fæcal, accompanied the bleaching and crumbling.

FACTORY TREATMENT.

The origin of the raw cheese used in manufacturing the processed article on the three days in question, 13th, 14th, and 19th December, 1938, was investigated, and it was found that supplies from only one factory were common to all three days, cheese from two or three other different factories being used blended with it.

The whole of the cheese was processed under vacuum, at a temperature which would have a pasteurizing effect on the bacteria present. The taint was found to be confined to the 8-oz. packet size, which comprised the major part of the output, and for which an old machine was sometimes used. Precautions were taken for extra cleaning and sterilization of the factory plant as soon as the taint was found to be bacterial.

ISOLATION OF ORGANISM.

Emulsions were made from several affected patches of different samples of the cheese in sterile saline by grinding with sterile sand in a pestle and mortar sterilized by igniting with alcohol. Double plates

were poured from these emulsions, using whey agar pH 6·6, and incubated at atmospheric temperature (28 deg. C.). Both these and slope cultures on whey agar gave no growth, but shake cultures, using the same medium, showed enormous cleavages due to gas formation after four days, accompanied by yellowish fimbriate colonies in the lower half of the agar. A stab in whey agar revealed good growth under anaerobic conditions at the same temperature. The organism also grew well but not

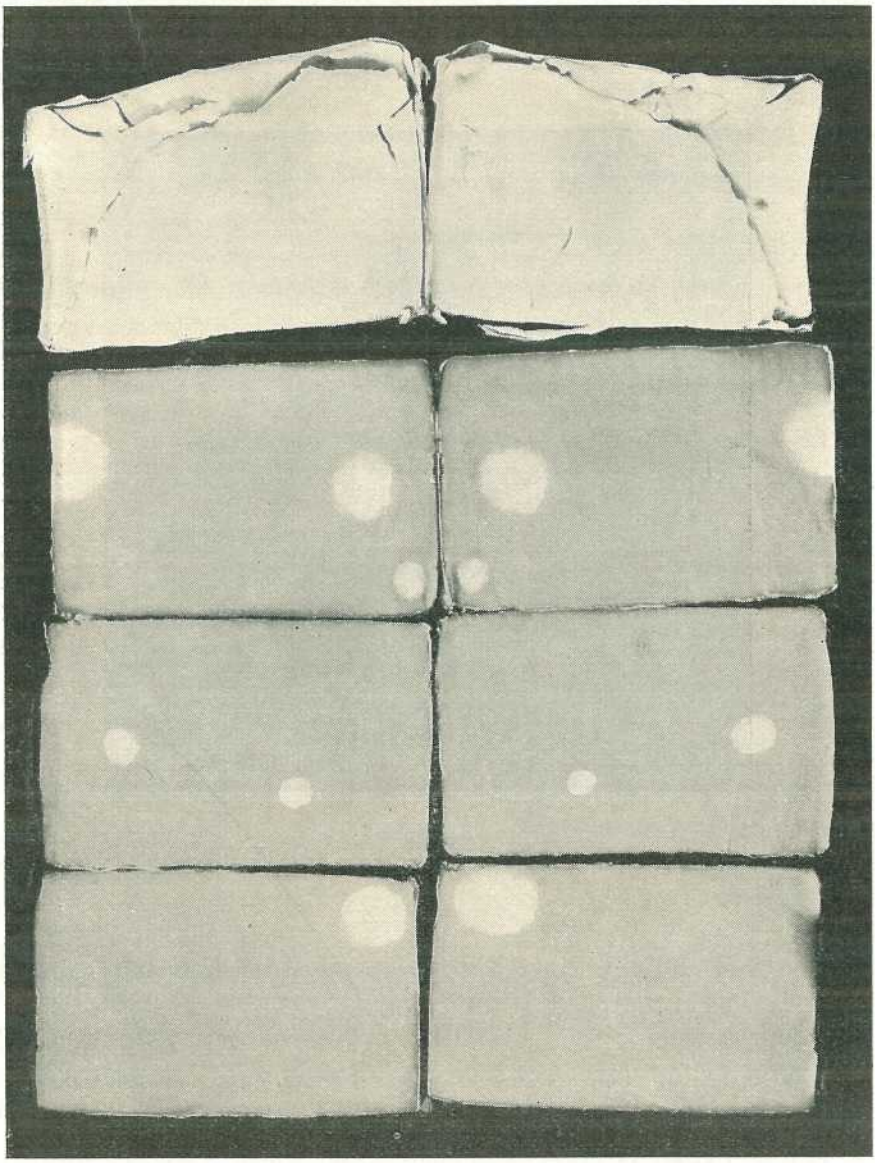


Plate 88.

PROCESSED CHEESE SHOWING DETERIORATION DUE TO INFECTION WITH ANÆROBIC SPORE-FORMING ORGANISM.

so readily on standard nutrient agar. Impression preparations made direct from small infected areas showed the presence of (*a*) isolated diplococci, and (*b*) slender rods singly and in pairs with free oval spores.

Seven deep colonies were removed from the shake culture and broken up with difficulty on a slide for microscopical examination. All these showed apparently identical free spores in large numbers, with a small proportion of rods, some showing bulging, with partially and fully-developed terminal spores. Plates 89 and 90 illustrate two stages of sporulation, with a number of immature rods. The stab culture was also examined and appeared to be a pure culture of the same sporing rod.

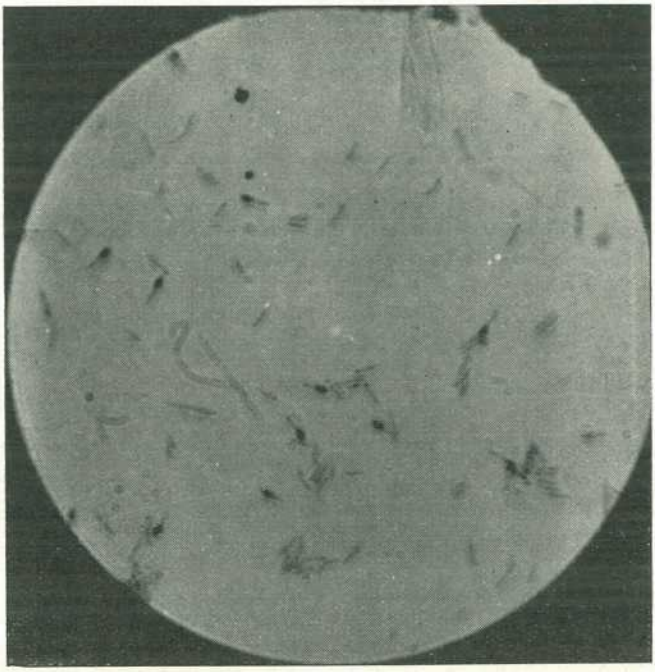


Plate 89.

CAUSAL ORGANISM SHOWING SWOLLEN RODS WITH INCIPIENT SPORES THREE DAYS IN WHEY AGAR AT 37 DEG. C.

Anaerobic cultivation, at 37 deg., 28 deg. and 20 deg. C., of the organism isolated from one of the abovementioned deep colonies growing in a whey agar shake culture was undertaken, using a few crystals of pyrogallol moistened with $\frac{N}{1}$ NaOH in a double-plugged test tube closed with a vaselined rubber stopper. This method gave very satisfactory results for individual cultures. Where it was required to incubate a large number of tubes, a wide-mouthed glass jar was inverted over a beaker containing the inoculated tubes, which stood in alkaline pyrogallol. The whole was placed in a glass dish and sealed from the air with liquid paraffin. The organism proved to be a strict anaerobe with an optimum temperature of 37 deg. C.

The thermal death time of the sporing culture was investigated by the following method:—A suspension was made in 0·9 per cent. saline and a number of capillary tubes were filled and sealed. Two of these were heated in water for varying times at different temperatures. They were then removed, sterilized by placing in alcohol for thirty seconds, and broken with sterile forceps into separate tubes of previously boiled and cooled litmus milk, which were plugged, treated with alkaline pyrogallol and sealed before incubating at 37 deg. C. They were examined after ten days and three weeks. Results are given in Table I.

TABLE I.

Thermal Death Point of Spores.

Time.	Temp. °C.	(°F).	Growth in Litmus Milk.	
			Tube 1.	Tube 2.
10 min.	70	(160)	+	+
10 min.	82	(180)	+	+
10 min.	93	(200)	+	+
10 min.	100	(212)	+	— (capillary not broken)
15 min.	100	(212)	+	+
20 min.	100	(212)	—	—
25 min.	100	(212)	—	—
30 min.	100	(212)	—	—
1 hour	100	(212)	—	—

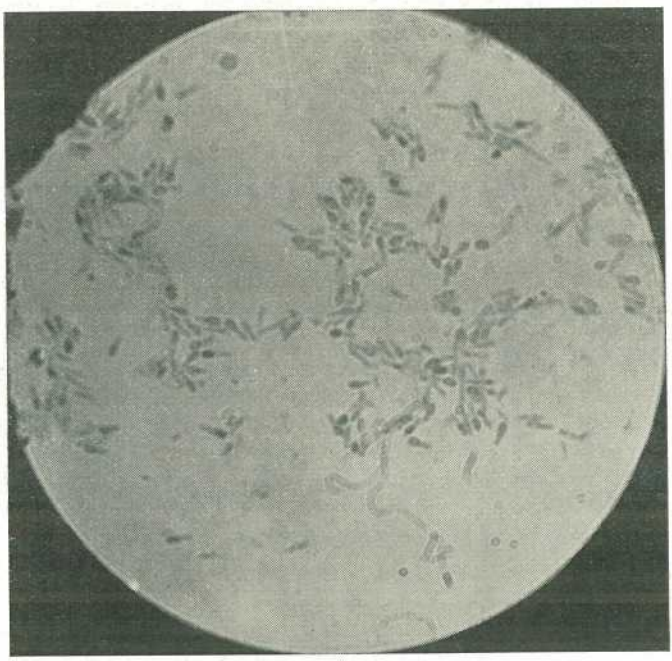


Plate 90.

Causal Organism showing Rods and Fully-developed Spores Five Days in Whey Agar at 37 Deg. C.

CULTURAL AND BIO-CHEMICAL CHARACTERISTICS.

Microscopical appearance.—Rod, approximately 6 x 1, occurring singly and occasionally in pairs, sporing after three to four days at room temperature.

Size.—1·4 x 0·3 to 2·5 x 0·4 microns.

Spores.—Oval, terminal, rods swollen at sporulation.

Motility.—Active.

Gram stain.—Positive, becoming negative.

Thermal Death Time (spores).—100 deg. C. for twenty minutes.

Optimum Growth Temperature.—37 deg. C. Will grow also at 20 deg., 28 deg., and 46 deg. C.

Nutrient or Whey Agar Slope.—No growth.

Nutrient or Whey Agar Stab (Anaerobic).—Good after three days at 37 deg. C. Filiform growth.

Nutrient or Whey Agar Shake (Anaerobic).—Well-defined deep colonies; tough, granular, fimbriate, yellowish in colour.

Litmus Milk.—Bleaching coagulation, complete peptonization with gas and putrefactive odour, rapid at 37 deg. C.

Blood Serum.—Good growth with slow liquefaction and clearing.

Coagulated Egg Albumin.—Slow softening and clearing, complete after five weeks at 25 deg. to 28 deg. C.

Carbohydrates.—Acid and gas in dextrose, maltose, lactose, slight fermentation of adonite, starch not hydrolised.

Nitrates.—Not reduced.

Indol.—Not formed.

Odour.—Putrefactive or fæcal.

From the above characteristics, the organism appears to be a strain of *Clostridium coagulans,* described by Bergey (1) as of fæcal origin.

REPRODUCTION OF THE TAINT.

An effort was made by inoculating spores of the organism with a sterile needle direct into a fresh block of processed cheese, to reproduce the taint. This failed it is thought on account of conditions being insufficiently anaerobic, although rods and spores of the organism were isolated after five weeks from one stab. A second attempt was made, in which fresh processed cheese was steam-heated to melt it and 1·5 ml. of a milk culture containing spores was added and mixed in while the cheese was still semi-solid. The cheese was divided into eight portions, which were placed in small sterile porcelain crucibles and sealed with paraffin wax immediately. After three weeks, the first two of these were examined. Both had the characteristic putrefactive odour, with streaks of pale colour running through them, but no localised zoning; a characteristic coagulation and digestion were given in milk, and plectridia were isolated from portions of this "cheese." The remaining six "cheeses," unfortunately, showed the presence of mould under the wax, due to the ravages of mites, and had to be discarded.

DISCUSSION.

Infection of processed cheese with *Clostridium coagulans* does not appear to have been experienced by other investigators, and, since in the instance described the trouble disappeared completely and no more has been experienced during the last six months, it was not found possible to trace the source of the organisms. They may have come through in the raw cheese of one factory whose output was not made from pasteurized milk and some of which had recently been condemned as unfit for use. This is considered to be the most likely source. Alternatively, infection from a worker might be responsible, and, once the *Clostridia* reached the vacuum machines in the factory, they might remain protected in crevices under conditions sufficiently anaerobic for growth. After preliminary investigation of the taint, a daily check of production was started at the factory by incubating packets of cheese from each day's make at 37 deg. C., in order to encourage the appearance of the defect as quickly as possible. No further trace was found of the trouble, which appears to have been an isolated case.

Bleaching of annatto-coloured cheese due to bacterial activity is well known, and has been associated with both oxidation and reduction (2). Completely anaerobic conditions are present in a cheese preheated, processed under vacuum and immediately packed, and a moderately resistant sporing anaerobe, which can cause degradation of casein at atmospheric temperature, is dangerous under such conditions. The end-products formed were not investigated—milk was completely digested in 5 to 6 days at 37 deg.—and the putrefactive odour, which suggested scatol, was present in all cultures grown in the media mentioned. There was only a slight difference in pH between the affected areas and the normal cheese.

SUMMARY.

1. A case of bleaching and taint production in processed cheese has been described.

2. The responsible organism, a strictly anaerobic sporing bacillus, whose characters correspond to those of *Clostridium coagulans* (2) was isolated.

3. Cultural and biochemical reactions of this organism are given, including the thermal death point of the spores.

4. The source of infection was not found, but is likely to have been milk of inferior hygienic quality used for making some of the cheese used in processing.

REFERENCES.

1. D. H. Bergey. Manual of Determinative Bacteriology. Family V., Genus II., No. 36.

2. G. M. Moir. J. Dairy Research 4. 1932-33, p. 240.

WHEN THE COW IS IN FULL MILK.

A cow usually reaches the peak of production six or eight weeks after calving. Then she begins to drop off. The drop varies with the individual cow, but the average is about 2 per cent. a week. It cannot be prevented, but it can be kept at a minimum by proper feeding.

Trials with Gambia Pea.*

H. W. KERR.

IN recent issues of the *Bulletin* reference has been made to the promise shown by a species of Crotalaria—which we have called "Gambia pea"—as a long fallow green manure crop. During the past summer the small quantity of available seed was allotted to the planting of small plots on selected farms in a number of the major cane growing areas. The seed was not of specially high quality, as much of it had been gathered at the Bundaberg Station during showery weather and mould damage was considerable. Allowance was made for this defect in seeding the trial areas, but in practically all cases a good stand was obtained.

The seed is very small, being appreciably smaller than the Poona pea; if an even broadcast could be assured, less than 10 lb. would seed an acre of land. Our experiences were that it germinated rapidly where soil moisture was favourable. It soon became established but thereafter followed a period during which the young plants appeared to "hang fire," while weeds and grasses threatened to choke out the young crop. However, the pea suddenly displayed a vigour of growth which was remarkable: by February (3 months after planting) it had attained a height of over 5 feet in certain plots, without showing any signs of flowering. Where the seeding had been heavy, and the individual plants were overcrowded, the growth was almost entirely confined to a single stem with few small branches. But where space permitted, the plants branched profusely, and in all cases provided an excellent cover (*see* Plates 91-93).

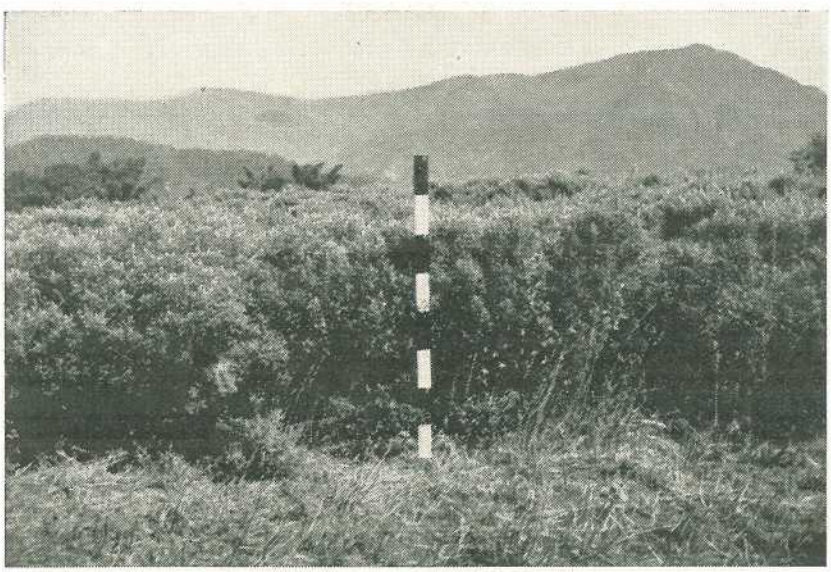


Plate 91.
A GOOD CROP OF GAMBIA PEA AT THE MERINGA STATION, FIVE MONTHS OLD.

* From *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations), July, 1939.

Plate 92.
Another Crop of Gambia Pea on the Farm of Mr. A. H. Reichardt, Silkwood.

By April the pea plants on some of the trial plots were 7 feet high and seeding. The seed pods are short and thick, and are arranged in clusters at the upper extremity of the main stem. Normally the crop would be ploughed under before this stage; but we are attempting to save as much seed as it is possible to obtain, in order that a more extensive distribution may be made during the coming spring. However, even at this stage the main stems were not so excessively woody that they would not decompose at a reasonable rate when ploughed under.

Plate 93.
An Excellent Crop of Gambia Pea on Mr. T. Chappell's Farm, South Isis.
It Yielded 25 Tons of Green Matter Per Acre.

Sections of the crop were cut off at ground level on several of the plots, and the weight of green matter per acre estimated. Samples of the material were later dried and analysed for nitrogen content. Results of some of the yields and analyses are shown in Table I.

TABLE I.

YIELDS AND COMPOSITION OF GAMBIA PEA CROP.

Location.	Weight of Green Matter per Acre.	Nitrogen Content of Green Matter.	Equivalent to Sulphate of Ammonia per Acre.
	Tons.	%	Lb.
Meringa	**24·0**	..	..
South Johnstone	**23·2**	0·40	**980**
Childers	**24·6***	0·49	**1,260***

* In addition, leaf mould which had fallen from the plants provided further 1¾ tons per acre (dry).

The influence of such a body of material on the fertility and humus content of the soil will be readily appreciated. Certainly the plant cane which follows should find in the soil an abundance of available nitrogen for its full requirements. It will be borne in mind that the major portion of this nitrogen (equivalent in one case to over 260 lb. of sulphate of ammonia per acre), was gathered from the air by the root nodule bacteria associated with this legume, and represents a net gain to the soil. The roots of all plants which were examined carried clusters of well-formed nodules, although no steps had been taken to inoculate the seed before sowing.

It is well recognised that Gambia pea possesses pronounced drought resisting qualities, and in this respect should be specially valuable for spring planting in the Queensland cane areas. Moreover, it is found that when cut off near ground level at a certain stage of growth, it will ratoon strongly and provide a further crop without the necessity for re-seeding. This is a particularly valuable point, for it suggests that the species is ideally suited for long fallowing purposes. With the introduction of rigid production control in all districts, many farmers will find that they have excess areas which could well be treated to say —18 months fallow. If such a policy were regularly practised as each block is ploughed out, and leguminous cover crops retained on the land throughout the resting period, the fertility of the soil would be speedily built up. Further, it would be found that substantial savings could be effected in the purchases of artificial manures; following such a fallow, the plant crop of cane may require little if any fertilizer, and ratoons only would require this treatment.

Finally, it should be pointed out that the blocks selected for the trial plantings represented a fair range of soil types, and were not confined to the better lands. On one dry red volcanic soil farm, the grower broadcast the seed on what he considers the poorest block on the farm. A heavy crop resulted—up to 6 feet in height—and the cover was excellent.

The Development and Value of Irrigation in Southern Queensland.*

C. G. STORY.

IRRIGATION water has aptly been termed "the lifeblood of the plantation," especially when sugar-cane is the crop concerned, as this is a crop which will literally grow in proportion to the water supplied to it when the mean air temperature ranges above 70 deg. The sub-tropical southern area, with an annual average rainfall of 44 inches, is highly dependent on the providence of nature if favourable crops are to be produced, as was shown by the disastrous season experienced in 1931-32. The realisation that irrigation is one of the safest insurances a farmer can have if he wishes to be certain of a favourable crop every year, is gaining in the south, where even under the conditions existing during the last two years, the rainfall, although plentiful, has been late, and due to dry checks experienced in late spring and early summer, when temperatures were admirable for growth, many tons of cane have been lost under dry farming conditions, due both to checking of growth in the young cane, and loss in standover crops.

This loss demonstrates clearly that irrigation is practically essential to this area if production, as warranted by the soil and varieties, is to be obtained. Taking a case in support of this, the South Kalkie area was, a few years ago, an area from which the mill could not be assured of a reasonable crop, but to-day the opposite situation prevails, due to the fact that the district is fast becoming an irrigation centre with a high farm average of cane per acre, with the present day varieties.

The results achieved by the large plantations prove conclusively that irrigation may be successfully conducted on a range of soils in the southern area. These plantations, which differ in the method of obtaining their water supply, have carried out a considerable amount of experimental work on irrigation, and have set a high standard for irrigation practice.

Excluding plantations, there are upwards of ninety irrigation plants in the Southern district, a large proportion of these being in the Millaquin area. The following may prove of interest as showng the distribution of plants in some of the mill areas:—

Millaquin area	45 irrigation plants.
Qunaba area	5 irrigation plants.
Fairymead area	5 irrigation plants.
Isis area	3 irrigation plants.
Bauple area	5 irrigation plants.

In the Bingera area upwards of thirty farmers use irrigation.

Most of the irrigation plants in the south are located on forest lands, on which are very often available large supplies of good quality water at shallow depths. Further, this particular type of soil possesses another advantage with irrigation, as it generally gives good returns from applications of sulphate of ammonia and mixed fertilizer rich in superphosphate, which fertilizer materials are generally less costly than those necessary for volcanic loams.

* From *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations), July, 1939.

Just as soil types in the south vary, so does the quality of water found in the areas embraced by these soil types. Waters obtained on the red volcanic soil area are, on the whole, unsuitable from an irrigation point of view, as very few samples show an analysis below 50 grains of salt per gallon, and some are as high as 400. Up to 100 grains per gallon is considered safe, but the use of any thing over this figure might give rise to trouble. At the Southern Sugar Experiment Station the bore water contains only 3 grains of salt per gallon, and is therefore excellent quality for irrigation purposes. Unfortunately for most of the Woongarra area, large supplies of underground water suitable for irrigation purposes are apparently not available at pumping costs which would be economical.

Analyses of waters from forest lands show that the salt content varies from 3-15 grains per gallon with an average of 7 or 8 grains per gallon. The water found below old alluvial country by one of the plantations in the Bundaberg district is, on analysis, suitable for irrigation.

Waters in the Bauple area generally contain an excessive proportion of magnesium salts which in time may have a deleterious effect on the soil, if not corrected by suitable soil treatment. The same remarks as apply to the red volcanic soils of Bundaberg apply also to those of the Isis area.

The soil is the reservoir in which is stored the water which falls as rain or is applied as irrigation. Different soils vary in their water retentive capacity, while they also differ in the proportion which they can yield up to the crop for growth purposes. The difference between the water content of a well-drained soil and that present when the crop can extract no more moisture from the land (the so-called "*wilting point*") is a measure of the available moisture for the particular soil. This is demonstrated by the following figures:—

	Maximum Field Capacity. Per cent.	At Wilting Point. Per cent.	Amount Available. Per cent.
Red volcanic loam.. ..	30	20	10
Red forest loam	24	12	12

From these figures it is seen that a soil may still be holding a large amount of moisture, but it is not available for plant growth. The red volcanic soil has the higher water holding capacity, but cane on this soil type will cease growth before that on the red forest.

Growth measurements on canes grown on the red volcanic soil have shown that the crop receives a definite check in growth ten days after a liberal fall of rain, when conditions were otherwise favourable for growth; so that heavy irrigations at ten day intervals, or shorter periods, would be necessary on this type of soil if crop growth is to be maintained continuously under summer conditions.

Although the moisture available for growth may be 10 per cent. of the weight of soil, other factors, such as evaporation from the soil surface, contribute to further losses. Windy conditions during the hot months of the year have a very distressing effect on crops under unirrigated conditions, as they increase evaporation both from the plant and the soil.

The results which have been obtained from red volcanic lands under irrigated conditions, speak for themselves. Growth measurements carried out on this type of soil adequately fertilized and irrigated have shown stalk elongations of 7 inches and more per week during the hot summer months, when the mean temperature of the air has been over 75 deg. The forest soils, which constitute the larger part of the irrigated area, may, and do, produce heavy crops of cane under irrigation as will be shown later.

P.O.J. 2878, the "Wonder Cane" of the southern areas, is a most suitable irrigation cane, and some excellent crops results are obtained with it when adequately fertilized, both as standover and 12 months crops. On irrigated farms, it appears general that 65-70 ton yields per acre may be produced economically in two years.

P.O.J. 2725 is another excellent irrigation cane for the south, although apparently few farmers have so far given this cane a worthy trial. On the Experiment Station under irrigation conditions it outyielded P.O.J. 2878 both on frosted and non-frosted plots by 12·5 tons per acre. Admittedly the cane arrows, and would in that case not be suitable for standover; but that is no reason why it should not be grown as a March plant, and 12 months ratoon cane, as excellent results have been obtained with this variety under these conditions on the red forest soils. As examples of the results which are obtained with P.O.J. 2725, the following figures are presented:—

Season.	Class of Cane.	Age when Cut.	Yield per Acre.	C.C.S. in Cane.
		Months.	Tons.	%
1937	March plant	18	75	14·7
1938	First ratoon	12	42	14·4
1938	February plant	20	82	14·4

All crops were fertilized at the rate of 7 cwt. per acre, of which 4 cwt. was sulphate of ammonia.

One distinct advantage which P.O.J. 2725 has over P.O.J. 2878 is its better resistance to downy mildew. This is a matter of considerable importance in the Bundaberg area at the present time.

While good results are obtained from the use of fertilizer in the south, provided rain falls, under irrigation it is absolutely necessary if heavy crops are to be harvested, and the fertility of the soil is to be maintained. One point which should be borne clearly in mind by farmers irrigating is that they should apply heavier applications than are used in general farm practice, especially in the case of sulphate of ammonia, which will provide big crop increases under irrigation conditions.

The Isis, a district of red volcanic soil with forest soil on the fringes, is an area which is virtually entirely dependent on rainfall to produce a crop. There are very few irrigation plants in the Isis, but the farmers who are fortunate to have them are to be commended on their enterprise in attempting to place their crops beyond the range of climatic conditions. One plant in particular in this area, belonging to

Mr. M. Brand, Cordalba, is worthy of special mention because of the difficulties which have had to be overcome to get the water to the farm. The supply is obtained from a site on Woco Creek, and the plant consists of a 57 B.H.P. crude oil engine driving a 4-inch, 4-stage centrifugal pump, the capacity of which is slightly over 20,000 gallons per hour. This large engine is necessary as the water is pumped through 1½ miles of 6-inch pipe line, traversing undulating country; it includes the crossing of several gullies and one creek, over which a framework had to be erected to carry the pipeline. The water is delivered into a dam at the highest point of the farm, and can also be taken off at various points along the pipeline. Sixteen hours of direct pumping on to the field from these points is the general practice; during the remaining eight hours the water is discharged into the dam which has a capacity of 250,000 gallons.

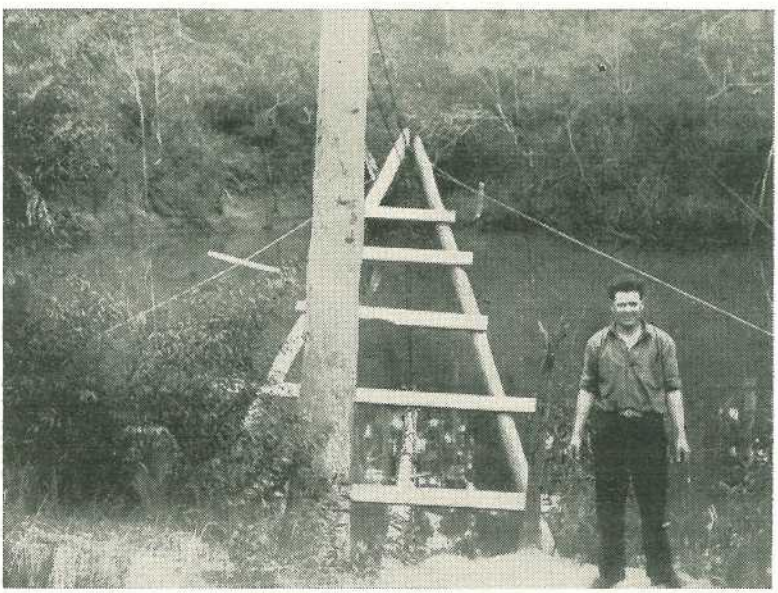


Plate 94.
SHOWING THE HOLE IN WOCO CREEK FROM WHICH IRRIGATION WATER IS PUMPED BY MR. M. BRAND.

The plant on this property is not being used to produce record crops on a small area, but to prevent the check in growth of a large area, the watered section showing a definite benefit from these applications. A comparison, which illustrates the value of water, is afforded by a 25 months old standover second ratoon crop of P.O.J. 2878, watered once, which produced 34·5 tons per acre as against 23 tons per acre from similar unwatered cane, with the c.c.s. in favour of the former.

During the 1938 season a 12 months plant crop of P.O.J. 2878 harvested 50·8 tons per acre with c.c.s. of 14·8, and 12 months first ratoon P.O.J. 2878 gave 45·6 tons per acre at 15·5 c.c.s. Although weather conditions for the past 18 months of the plant's operation have been the best experienced for some years, the increase from irrigation is definitely apparent.

Plate 95.
Showing the Supply from the 4-inch 4-stage Pump Discharging into the Storage Dam Located on the Highest Ridge of the Farm.

Now that definite production limits have been placed on the sugar industry, with the probability of farm peaks, intensive cultivation of cane on reduced acreages, and a long range agricultural rotation suggest themselves as a natural and logical consequence. It is here that the farmer with irrigation can control his production irrespective of seasonal conditions; he may devote portion of his land to alternative crops, or at least give his blocks, in turn, a rest under long fallow, aided by leguminous cover crops.

BOUNTIFUL SEASONS FOLLOW A DROUGHT.

The record of past seasons confirms the opinion of farmers and graziers—an opinion that is widely held—that after the land has been subjected to a period of compulsory rest by drought, nature makes up for this harsh treatment by providing bountiful harvests in following years. In Southern wheat areas, this experience is fairly general and is borne out by production figures in the years of plenty.

To the farmer, the soil is working capital and nature, in spite of her capriciousness, provides elements of incalculable value—air, sunshine, and moisture—generously and free to all. The extent of the producer's profit on the year's work depends on how wisely the farmer uses those indispensable additions to his working capital, especially if his efforts are to survive nature's test—the survival of the fittest—when lean years come round again.

A Disc-sharpening Outfit.*

D. L. McBRYDE.

ORDINARILY, the sharpening of plow discs is a job for skilled labour, and for this reason, the vast majority of farmers have to send their dull discs away to their local blacksmith or mechanic, when they are no longer sharp enough to give reasonably good work. In fact, because of the trouble, delay, and expense discs are kept in operation much longer than is good for the quality of the plowing, and standards of cultivation fall away as a consequence.

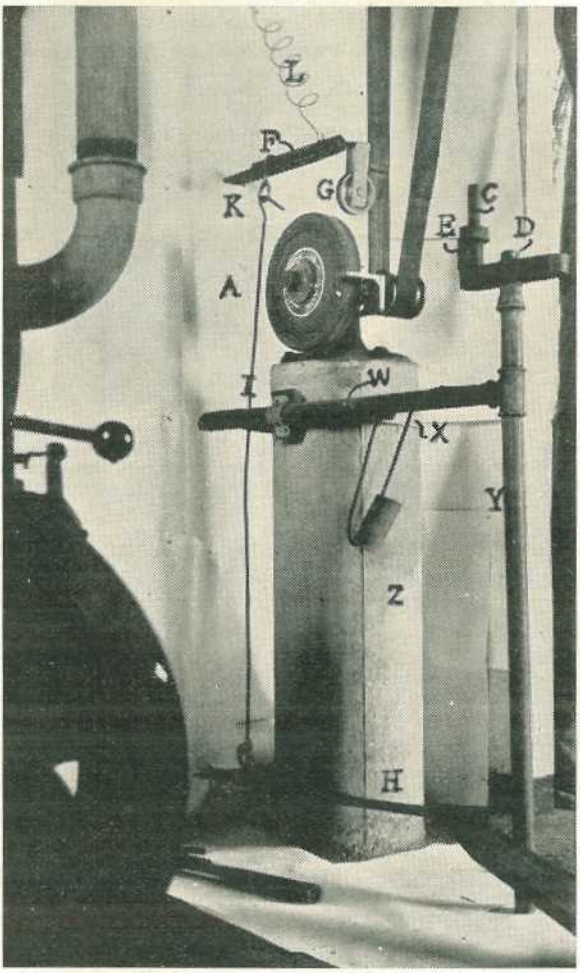


Plate 96.

ILLUSTRATING THE DISC-GRINDING FITTING, SHOWING THE COMPLETE ASSEMBLY.

Some years ago, the writer devised a layout whereby disc sharpening became a simple operation, and, provided certain precautions were

* From *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations), July, 1939.

taken by the operator, there was not any damage done through loss of temper of the sharpened discs. This apparatus could be installed easily and cheaply by any practical farmer, to be driven by his stable engine.

The efficiency of the layout is dependent upon three main points:—

Firstly, a disc pivot-pin which is readily adjustable to suit the particular diameter of the disc to be ground; *secondly,* the pivot-pin should also be readily adjustable so that the disc height may be made to suit the disc being ground; and *thirdly,* an easy method of applying pressure of the disc upon the stone to suit the nature of the work being done.

The accompanying photographs (Plates 96 and 97) illustrate the apparatus erected at the Mackay Experiment Station, and plans (Plates 98-101) show the details of the manner in which various parts of the apparatus are built into the assembly. In the plans the parts are as follows:—

A Emery wheel.
B Plow disc (in position for grinding).
C Pivot-pin (shown in detail in Plate 98).
D Pivot-pin adjusting bolt and nut.
E Height-adjusting rings or washers.
F Upper pressure regulating arm.
G Pressure regulating wheel.
H Lower pressure regulating arm, or pedal.
I Rod connecting pressure arms *F* and *H*.
K Hinges of arms *F* and *H*.
L Recoil spring, lifting arm *F*.
M Wall stud or post.

The emery-stone at the station is placed in a position where the disc-grinding fitting would be in the road of traffic if it were to be permanently fixed in the position shown in the illustrations. So that it may be moved out of the way when not in use the pivot-pin is mounted on a frame of 1 inch water pipe, and this frame is clamped to the foundation column of the stone. When not in use, the frame (*Y*, Plates 96 and 97) is released by slackening the long-threaded bolt on strap *X* when it may be swung away to a position at right angles to that illustrated, against the shed wall.

Where the fittings would be an obstruction, the pivot-pin could best be attached to the top of a post sunk in the ground in front of the stone, and the pressure regulating arms (*F* and *H*) could easily be hinged to another post at the back of the stone.

The recoil spring should be powerful enough to pull the pressure arms up several inches from the working position, but not so strong that undue weight is needed on the pedal *H* to bring the pressure wheel *G* into operation while grinding discs.

To set up a disc for grinding, first slacken the pivot-pin bolt *D*. Place the disc on the pin, and move the pin towards or from the stone until the rim of the stone is against the rim of the disc, and their positions show that the resulting bevel edge would be as required. If any

difficulty is experienced in getting a correct bevel, adjust the height of the disc upon the pivot-pin by taking off, or putting on, one or more rings, or washers, *E*. Thus, by varying radius and/or height adjustments, the angle at which the disc makes contact with the stone may be varied to give a wide range of bevelling to the sharpened edge, and a bevel to suit the work to which the disc will be put may be had. Later, some remarks on bevels for special jobs will be made.

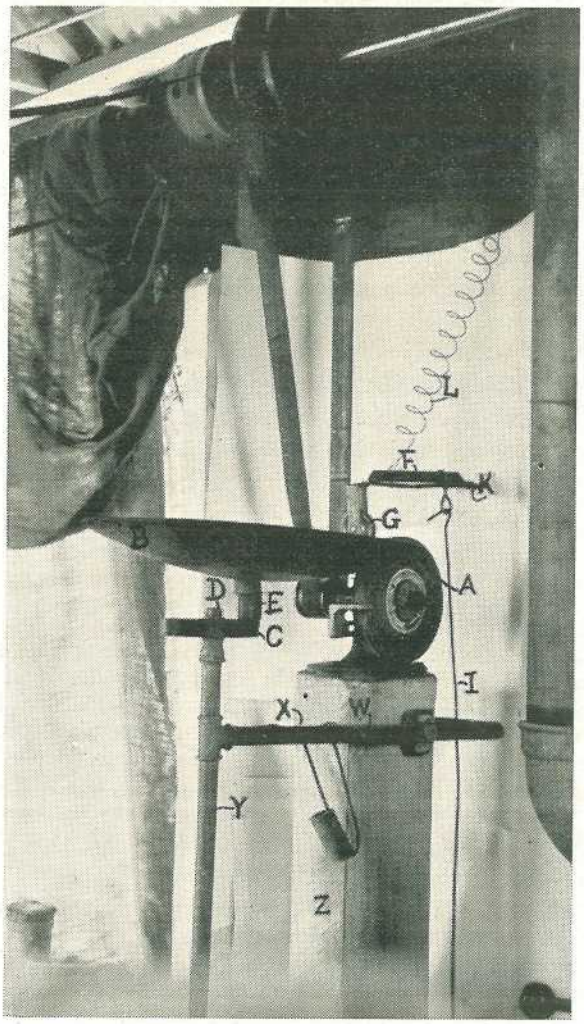


Plate 97.

SHOWING THE DISC-GRINDING FITTING, WITH THE DISC IN POSITION FOR SHARPENING.

When setting up a disc for grinding, it must be remembered that the disc falls towards the stone as the shoulder is ground away. Also, the friction of the stone tends to push the disc away from the stone. These two points should be allowed for when adjusting height and radius. The pivot-pin holding-down bolt *D* should be tightened before

commencing to grind. After these adjustments have been made the stone may be set in motion, but for the preliminary setting-up the stone should be idle.

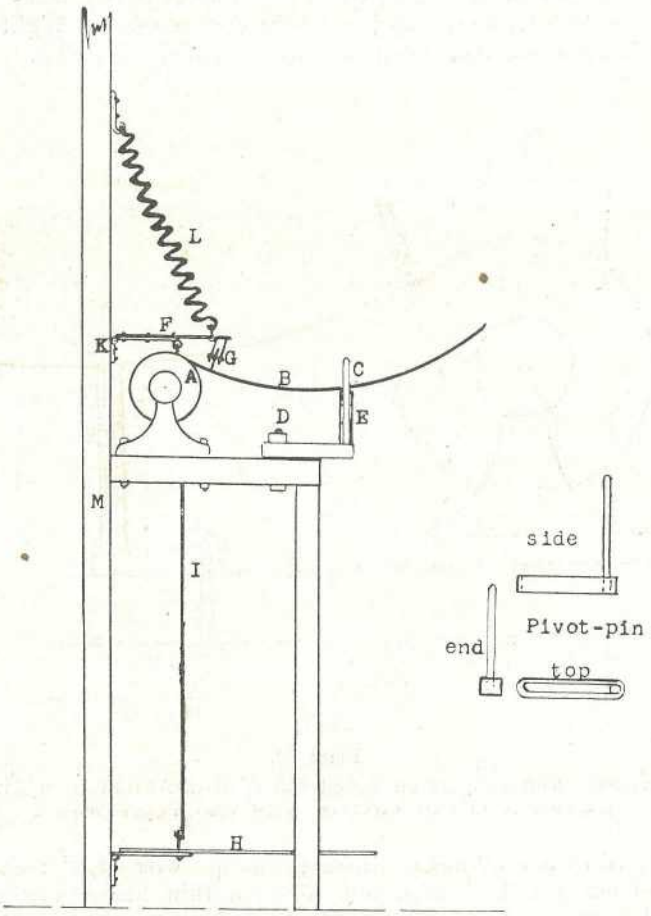


Plate 98.

Drawing showing the Essential Features of the Set-up.

The operator, who should wear a strong pair of gardening gloves for protection of his hands, holds the disc edge in both hands and imparts a continuously revolving motion to the disc, and at the same time presses on the pedal with one foot, thus causing the disc to be pressed against the stone. It is very important to keep a constant movement of the disc, more especially as the grinding is nearing a finish and the edge of the disc gets thin. If the disc remains stationary for even a second or two, hot spots will be formed on the edge, and the temper of the metal will thus be spoiled. After a few revolutions of the disc, it is advisable to examine the angle of the cut and see that it is as desired.

When grinding very dull discs heavier pressure may be placed on the disc, but the entire rim of the disc will soon become heated to an extent which causes discomfort to the hands. In such cases, grinding

should be stopped before serious heating occurs, and the disc should be allowed to cool, or be cooled by pouring water along its edge. In cases of badly worn discs it is necessary to readjust the pivot-pin, by bringing it closer to the stone, when grinding is partly completed, and this may be done while a stop is made to cool the disc. Light grinding pressure is recommended when nearing the finish of a disc.

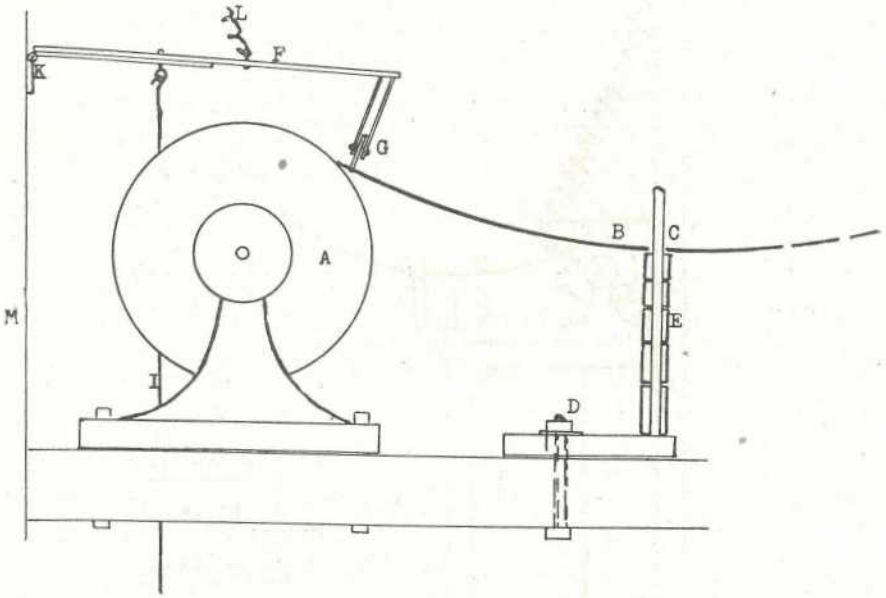


Plate 99.

ILLUSTRATING THE MANNER IN WHICH THE DISC IS ADJUSTED TO GIVE THE CORRECT ANGLE OF CONTACT WITH THE EMERY WHEEL.

Some discs are of metal which forms a "wire-edge"; that is, the edge does not grind cleanly, but forms a thin filament which turns inwards, away from the stone. When this occurs, it is best to cease grinding when almost finished, and then rub the disc with a fine file, placing the file flatly on the inner face of the disc whilst filing. When the wire-edge has been removed, grinding may be completed.

Discs which have been badly neglected or are very badly worn, will generally develop a shoulder on each side of the disc. A definite shoulder on the inner face is a serious fault, and should be corrected by hammering. The disc should be ground until the outer shoulder is removed completely. Place the disc on an anvil, or solid block, as shown in Plate 100, so that the extreme edge of the newly-ground face touches the anvil, but with the inner edge slightly off the anvil. Hammer the disc at a slight distance back from the edge (at *X* in Plate 100) and keep turning the disc while hammering. If there is a serious error to correct it is better to make several revolutions of the disc, hammering out a little more at each turn, than to hammer heavily with the object of taking out the entire shoulder in one turn. In fact, to attempt to take out a bad shoulder by hammering heavily may cause the edge of a

hard disc to chip or crack, more especially if done during cool weather when the disc is cold. Under cold conditions it is recommended that the disc be warmed up to a temperature which is uncomfortable to the touch, but which does not burn the skin, before hammering is done. A better and quicker job will thus be effected, and there will be no risk of damage to the disc. Dents in the rim of a disc should be hammered out before sharpening.

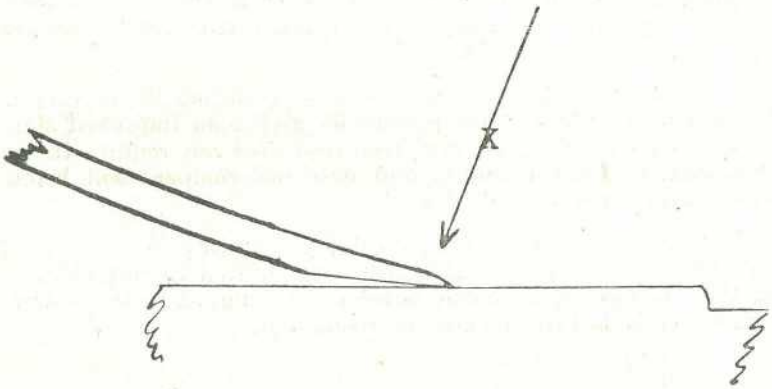


Plate 100.
Showing the Method Employed for Beating Out the Disc Shoulder on an Anvil.

As regards bevels, it may be stated that the best bevel is a long, narrow one, but while this is true in theory, it is often preferable to sacrifice something of the sharpness to obtain an edge which will last a longer period before requiring to be re-sharpened. In practice it is recommended that a wider or coarser bevel be made whenever the disc is to go into hard soil, and a really fine bevel be made for soft work only, and where the soil is free of stone.

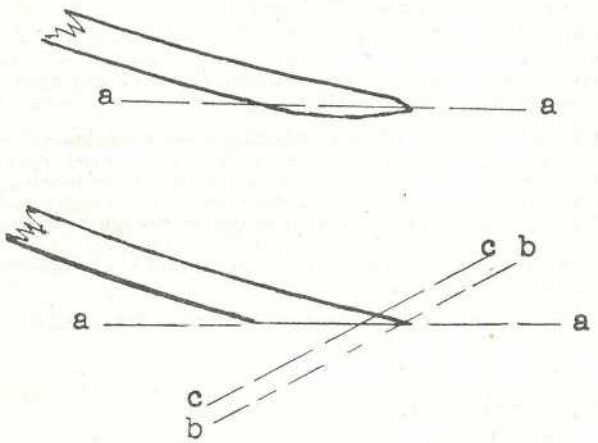


Plate 101.
Illustrating a Suitable Bevel for the Sharpened Disc, and the Method of Resharpening as the Edge becomes Worn.

Plate 101 depicts the section of a disc on which the edge has been worn, and line *a*—*a* represents what might be thought a satisfactory

bevel for the finished, sharpened edge. Such an edge would be satisfactory under soft soil conditions, and if the soil were free of stones. For hard working conditions, it is suggested that a final grinding be given after bevel *a*—*a* has been made. If a very light grinding is done to give a bevel as shown by the line *b*—*b* this will result in a keen, and much more lasting edge than the finer one. After some wear, another light grinding at say *c*—*c*, parallel to *b*—*b*, will re-sharpen the disc with only slight loss of metal, but the time will come when a shoulder of serious proportions will again develop, and further heavy sharpenings on the bevel *a*—*a* will be required.

The time taken to keep a disc in good condition is not very great, and will more than repay the grower by giving an improved standard of work from his plow. Also, a keen disc does not require the power for plowing at a given depth, and does not compact soil below the plowed depth, as does a dull disc.

The cost of an emery-stone, with single mounting, is about £3. With a light belt and a few fittings which are required to put in an outfit along the above lines, £4 should cover everything, and any grower who is handy will have little trouble in erecting it.

CRANKCASE OIL—ITS USE AND ABUSE.

Most people dislike to see the oil drained from the tractor and auto crank case go to waste, as it accumulates rapidly when the tractor is being used during the busy season. The first thought is to use it on other machinery having less delicate mechanism, and proceed to use it on the binder, mower, manure spreader, or thresher, This practice is distinctly dangerous.

Oil drawn from an engine crank case contains a certain amount of fuel which has not burned and has found its way past the piston into the crank case and the oil. This is especially true of the less volatile oils. Only a small percentage of fuel mixed with the oil will greatly lower its lubricating qualities.

Dust, carbon, and other foreign matter find their way into the crank case, gradually building up a grinding mixture. The drained-out oil, with its lowered viscosity and grit, combined with useless particles of oil broken down by use and heat, has generally passed its usefulness in lubrication by the time it is drained.

The reasons for not using this oil to lubricate other machinery can be summed up under three main objections. First, the oil has been thinned down and may not have the lubricating qualities necessary to prevent injury to the bearing on which it is used; second, it contains solid impurities which act as an abrasive and cause undue wear on the bearing; and, third, the fine particles of foreign matter will ultimately close up the oil holes and cut off the supply of oil to vital parts. A few shillings put in the bank by the use of this oil will nearly always come home to roost in the shape of expensive repair and service bills.

The drained oil can profitably be used, however, for a number of purposes, including—

As an anti-rust coating for the protection of metal exposed to the weather.

As a preservative for wood.

As a dust-layer—lightly sprinkled over the ground.

As an insecticide for spraying pig pens, fowlhouses, and similar structures, and by use in automatic oilers.

As a grass destroyer in places where weeds or grass are not desired.

As a rust preventive for chains, sprockets, and other parts when machinery is stored after harvest.

Fibre in Cane.*

H. W. KERR.

THE price received by the canegrower for a ton of cane is inevitably governed by the quantity of sugar which it contains. Where the grower is paid directly on analysis this is determined by the mill chemist when the cane is delivered for crushing. Actually, it is the *cane juice* which is analysed, and the quantity of such juice in the cane is then calculated in accordance with the amount of fibre in the particular consignment.

The manner in which the last-named adjustment is made has probably been responsible for more contentious discussion than any other question which mutually affects grower and miller. *Firstly,* the method of selection and preparation of sample sticks for the fibre test has given rise to much contention. This has been very extensively investigated, and it may confidently be stated that the technique at present laid down by the regulations under the Sugar Cane Prices Acts, does assure that the fibre percentage as determined is as accurate as can reasonably be expected, when the sampling difficulties involved are appreciated. *Secondly,* it is recognised that, for a given variety, there exists normally a variation in fibre content between plant, ratoon and standover crops. It is therefore customary for the mill to determine periodical (usually weekly) fibre values for each class of each major cane variety, and to apply these average figures to the respective consignments of cane falling within each class. The farmer supplying a crop of well-grown cane will protest against the application of an average fibre figure which must certainly be inflated by the inclusion of cane from other lands which has been produced under adverse conditions, and he often claims that he is entitled to a fibre figure determined for his special parcel of cane. *Finally,* a wide variation occurs in the care with which growers prepare their cane for milling purposes. While some pay special attention to the topping of the stalks, and guard against any soil or trash being loaded on the trucks, other farmers give little heed to this important question. The miller naturally objects to paying cane prices for trash, roots and soil, and claims that these factors should be given due weight in arriving at a true basis of calculating from juice analysis to cane composition. Again, the grower supplying clean cane objects to being penalised for the careless farmer. Doubtless the cane-cutting gang is in a measure directly responsible for the quality of cane as supplied, but it is the farmer's duty to see that all conditions are rigidly observed in this respect.

It should, theoretically at least, not be a difficult matter to appease all parties in such disputes; but in practice, any attempt to meet the wishes of miller and grower in matters of detail would introduce so many complexities, that the cost of carrying the project into effect would probably more than outweigh any of the benefits secured.

With a view to assessing the possibilities of such a plan, a comprehensive series of investigations in fibre determination were commenced some three years ago. The results of these tests have been issued by the Bureau in two technical bulletins—one prepared in 1937, and the other which was published recently. Copies of both bulletins are available to any canegrower wishing to study the technical aspect of the problem, and the conclusions which may be drawn from the results

* From *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations), July, 1939.

obtained. For the present, it is proposed to present the major conclusions in a broad manner, so that farmers generally may be acquainted with the present status of the problem.

Results of Investigations.

1. Fibre Variation within the Stick.

The unit taken in preparing a sample of cane for the fibre test is, of course, the stick of cane. The Cane Prices Regulations set out the manner in which stick samples are to be taken, and sub-sampled for analytical purposes. It will be obvious, then, that the precision with which the average fibre content for a given variety and class of cane can be determined will be governed in the first place by the variation *within the stick* of cane. Tests have shown that, early in the season, the fibre is highest in the butt section of the stick, is sensibly uniform throughout the major portion of the length, and is slightly lower than the average in the top portion. As the crop matures, the normal sequence is for the fibre in the top section to rise, so that the butts and tops both give values higher than that for the mid-section.

2. Fibre Variation between Sticks.

When the values of the fibre for individual sticks are compared, it is found that there is a wide variation also from stick to stick, even when drawn from the same field of cane. On a test involving twenty-four sticks of P.O.J. 2878 ratoon cane, for example, the highest test was 13·3 per cent. and the lowest 9·9 per cent. This is characteristic of the variation experienced. In the mill, however, sample sticks are grouped for cane drawn from a *number* of fields. When parallel tests were carried out with cane sticks from different sources, it was found that the difference between extreme tests for individual sticks was even greater. Thus, for sticks of P.O.J. 213 from three fields, the extreme single-stick tests were 17·5 per cent. and 13·4 per cent. respectively.

When it is remembered that all of these tests were made on clean sticks of cane, uniformly topped, it will be realised that the selection of sufficient sticks from all consignments of a variety as usually delivered, to give a true average figure, involves no little trouble and time. Certainly these results bear out the contention that the cane from all farms does not conform with the average fibre figure awarded to them; thus two farmers harvesting P.O.J. 2878 at the same time were delivering crops with 11·9 and 9·8 per cent. average fibre respectively, while a similar comparison for P.O.J. 213 gave values of 16·6 and 14·8 per cent. But, from what has been presented, the magnitude of the sampling and testing job will be appreciated, when it is realised that cane of one variety and class is being delivered daily from perhaps fifty or more farms; how could each expect to receive the true figure based on individual tests? An augmented laboratory staff would be fully engaged in this work alone.

3. Fibre Variation—Plant v. Ratoon v. Standover Cane.

The tests under discussion bore out the normal mill finding that ratoon cane shows, *on the average,* a higher fibre figure than plant cane. This is, of course, not uniformly true for all individual consignments, but is governed chiefly by the condition of the cane in question. Many fields of well-grown ratoon cane showed a lower fibre content than poorly grown plant cane of the same variety.

Standover cane is generally higher in fibre than one-year-old cane, whether plant or ratoon. This is to be expected, as the short "notches" of standover cane are very high in fibre, while age is also a factor contributing to woodiness.

4. Effect of Topping on Fibre Content.

In certain of the tests, sticks were topped "high," so as to show a well-defined "bull's eye." It was found, unexpectedly, that this added section often possessed a lower fibre content than the balance of the stick; in general, however, inclusion of the immature section increased the average fibre. It must be remembered, of course, that this is not a justification of the policy followed by some growers, in the expectation that it will prove profitable. Moreover, the tests here reported were carried out on freshly topped sticks. When such were dried out, as they usually are on arrival at the mill, it would be expected that the fibre would be markedly higher in the immature portion of the cane.

The Problem of Trash and Dirt.

Though it is concluded that the employment of any but average fibre figures in computing cane values would be impracticable, it does appear that something might be done to adjust the figure, according to the freedom or otherwise of the particular consignment from trash and other extraneous matter. That is, instead of attempting to include adhering trash in the material prepared for the fibre test, as is sometimes done, it is suggested that the test be made exclusively on clean cane, and a "correction" added to this figure to allow for the degree of impurities included on the trucks with the cane sticks. This at least would provide a well-merited bonus for the supplier of clean cane, and duly penalise the grower who is not so particular.

For this purpose it would be necessary to classify all cane on appearance, at the time of its discharge on to the carrier. Three classes are proposed—A. "Clean" cane, B. "Medium trashy" cane, and C. "Dirty" cane. The standards of cleanliness would, of course, vary from mill to mill, as would also the corrective factor to be applied.

As an example of the amounts of field trash bought by the miller as cane, the following are the average figures obtained from a large series of cane cleaning tests made at a number of Queensland mills last year:—

	Extraneous Matter. Per cent.
"Clean" cane	1·2
"Medium trashy" cane	2·0
"Dirty" cane	3·4

It is confidently suggested that the adoption of this proposal would result in a speedy improvement in the quality of the cane supply. Moreover, it would remove what has long been a contentious subject between miller and grower, as well as amongst growers themselves.

Efficiency of Germicides and Disinfectants.

F. B. COLEMAN, Registrar of Veterinary Medicines, and R. A. TAYLOR, A.A.C.I., Inspector and Examiner, Seeds, Fertilizers, Veterinary Medicines, Pest Destroyers, and Stock Foods Investigation Branch.

ON the Queensland market—and elsewhere—there are numerous proprietary articles which, it is claimed, are useful for purposes of promoting the health and hygiene of humans or stock; these include disinfectants, germicides, antiseptics, and deodorants.

The lastnamed, as the name implies, are of use only for destroying offensive odours.

Antiseptics are preparations useful for preventing the putrefaction or decomposition of animal or vegetable matter, or preventing the development of bacteria. They may be classed with preservatives used for preventing the decomposition of foodstuffs. They are not necessarily efficient in killing bacteria.

Germicides and disinfectants—the terms are taken here as being synonymous—are preparations which are capable not only of preventing the development of, but also of destroying the germs of disease.

Now, with germicides and disinfectants it is necessary to know how efficient the preparation is in destroying germs or bacteria. There are various methods of comparison. Most germicides and disinfectants contain as the active constituent, phenol or its homologues. The percentage of the active constituent is declared on the labels of these preparations when they are packed for pest destroying or veterinary purposes. This provides a method of comparison; however, the phenol or homologues—tar acids—may vary in quality or differ in the proportions of the homologues present—phenol, cresols, and in some cases xylenol and other higher boiling point homologues. The bactericidal efficiency of these phenols varies. Further, certain properties of the preparations, such at wetting power, also affect the efficiency.

Then there are preparations which contain active constituents other than phenols—such as various essential oils and synthetic organic bactericides.

A method of comparison of bactericidal efficiency based on the proportion and type of active constituent present is thus unsatisfactory.

A method has been evolved, however, which does away with the necessity of comparing the constituents and properties of the preparations, and relies on an actual practical evaluation of the killing power on certain bacteria under set conditions.

This is the Rideal-Walker test, and the value obtained from such test is called the Rideal-Walker co-efficient.

It relates only to the value of the preparation on dilution with water. It can only apply, therefore, to water soluble or water-miscible preparations; the Rideal-Walker co-efficient of oils is obtained by using an emulsifying agent, to enable dilution with water to be effected—with proprietary preparations, however, water solubility or miscibility is a necessary feature.

In actual application, the co-efficient is used only with liquid germicides or disinfectants.

In carrying out the test the method laid down by the British Standards Institution is followed. A special culture of typhoid bacteria (*Bacillus typhosus*) obtained from the Lister Institute is used, and 1 per cent. carbolic acid (phenol) is taken as the standard of comparison against the germicide or disinfectant being tested. A standard broth is used as a medium. The actual result obtained is the rate of dilution in hundreds, at which the germicide will effect the same kill as 100 per cent. carbolic acid diluted with water 1 in 100, in the same time.

The time which the diluted (1 in 100) carbolic acid takes to effect a kill averages five minutes.

A germicide which, at a dilution of 1 in 300, would effect a kill in the same time as the standard diluted carbolic acid would be given a Rideal-Walker co-efficient of three. A germicide killing at a dilution of 1 in 1,800 would be given a co-efficient of eighteen.

As the co-efficient is a comparative value, a variation in the time taken by the standard solution (as occurs) does not affect the accuracy of the figure.

Different workers in different laboratories, although obtaining times varying from 2½ to 7½ minutes, agree fairly accurately on the co-efficient obtained for similar preparations tested.

It should be understood, however, that the Rideal-Walker co-efficient merely indicates the value of the preparation as compared with standard carbolic acid under test conditions, against a specific bacteria; it does not necessarily indicate the value under all conditions and against all bacteria.

Nevertheless, for disinfectants and germicides for general purposes, it is a very useful figure, and a knowledge of the principles involved in the method used for its determination should lead to its more widespread use both by manufacturers and purchasers of preparations concerned.

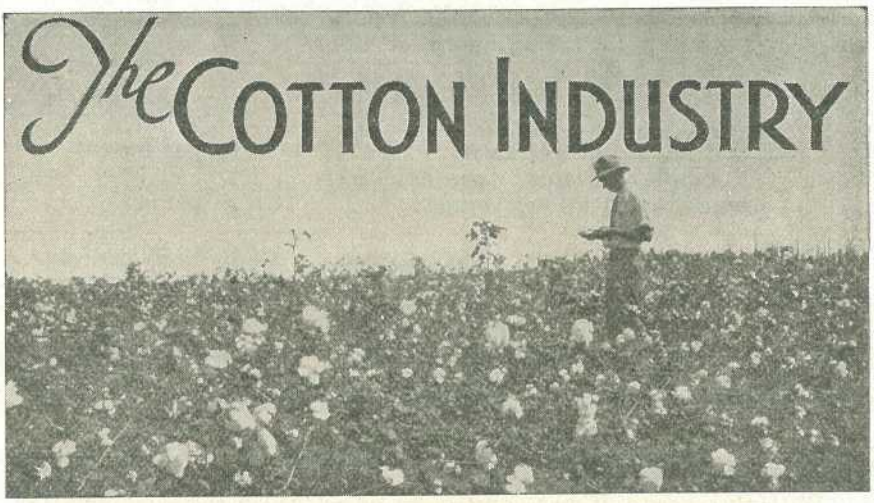
The following table sets out details relating to the liquid germicides, disinfectants, and antiseptics registered under the Queensland Veterinary Medicines Acts for the current period as at 30th June, 1939:—

LIQUID GERMICIDES, DISINFECTANTS, AND ANTISEPTICS.

Registered under the "Veterinary Medicines Acts" for the period, January, 1939, to December, 1941.

List Published: 30th June, 1939.

Name of Preparation.	Rideal-Walker Co-eff.	Active Constituents. (As declared on label.)	Name and Address of Primary Dealer.
Germicides and/or Disinfectants—			
Acco Savol	3·5	10 per cent. High B.P. Phenols and Cresols	The Australian Chemical Co. Ltd., South Brisbane
C. N. Disinfectant	6·5	25 per cent. Cresols	Norris Agencies Pty. Ltd., Brisbane
Cresola No. 1	7	20 per cent. Tar Acids	United Chemical Co. Pty. Ltd., South Brisbane
Cylol	1	5 per cent. Cresols	J. H. Eden and Co., Brisbane
Germacol	1	5 per cent. Meta-Cresols	United Chemical Co. Pty. Ltd., South Brisbane
Globe Disinfectant	..	30 per cent. Phenols	W. Lovelock and Co. Pty. Ltd., Brisbane
Harton Veto-cide	0·2	7 per cent. Cresylic Acid	Goldsborough Mort and Co. Pty. Ltd., Brisbane
Havcol	0·58	5 per cent. Phenols and Cresols	Hayes Veterinary Company, Brisbane
Kerol	18	46 per cent. Phenol Homologues	Dalgety and Co. Ltd., Brisbane
Mactaggarts Carbol	1	5 per cent. High B. P. Cresols	Mactaggarts P.P. Co-op. Assn. Ltd., Brisbane
Moase's Famous Antiseptic Disinfectant Deodorant	18	20 per cent. Phenols	W. E. Moase, Wynnum
Osmonds Zenos Fluid Disinfectant	4	18 per cent. Phenols	Flynn Bros., Brisbane
Pegasol	0·6	10 per cent. Higher Phenols	Bryce Ltd., Brisbane
Safonia	0·2	5 per cent. Cresylic Acid	Australian Disinfectant Co., Brisbane
Sapocarb	3	50 per cent. Cresylic Acid	Surgical Supplies Ltd., Brisbane
Sidolia	1·9	10 per cent. Cresols	Norris Agencies Pty. Ltd., Brisbane
Antiseptics—			
Carbox	..	7 per cent. Cresols	Henry Berry and Co. Pty. Ltd., Brisbane
Judge's Vettoll	..	4·6 per cent. Carbolic Acid	D. Maclean and Co., Brisbane
Nobles Vettoll	..	4·6 per cent. Carbolic Acid	W. A. Noble and Sinnamon, Toowoomba
Safa	..	4 per cent. Cresols	Campbell Bros. Pty. Ltd., Brisbane



The Value of the Cotton-Grassland Rotation.

RESULTS obtained in experiments and by farmers in commercial crops have shown definitely that a cropping programme, in which cotton is grown in rotation with grassland, increases largely the chances of obtaining satisfactory yields of cotton under a wide range of climatic and soil conditions.

What it means in yields.

The yields of cotton produced by means of this rotation vary, of course, according to the soil and the conditions under which the crops are grown. However, gains up to even 100 per cent. can be obtained from cotton planted during the three years following the ploughing of a pasture, as compared with yields from land cropped year in, year out, with cotton for longer periods.

The following table of seed cotton yields illustrates the gains that have been obtained from cotton-grassland rotations on the Biloela Research Station, in the Callide Valley, during the 1938-39 season:—

1. Fertile forest clay loam. Second year of cultivation out of grassland averaged	1,483 lb. per acre.
Fourteenth year of continuous cultivation averaged	1,227 lb. per acre.
Difference =	256 lb. = 20 per cent. gain.
2. Fertile forest loam. Third-year cotton following three years of Rhodes grass preceded by eight years of cotton averaged	1,033 lb. per acre.
Similar land with its fourteenth successive crop of cotton averaged	856 lb. per acre.
Difference =	177 lb. = 20 per cent. gain.

3. Infertile sandy clay in the fourteenth year after the breaking-up of the original grassland.

Third-year cotton following three years of Rhodes grass preceded by cotton averaged ..	643 lb. per acre.
Similar land continuously cropped with cotton averaged ..	401 lb. per acre.
Difference =	242 lb. = 60 per cent. gain.

The increased cotton yields produced during the first three years after the breaking-up of grassland are due to the suitable balance of the plant foods in the soil for cotton and the ability of the soil to absorb rain sufficient for the needs of the growing crop.

What it does to the soil.

With the growth of successive crops of cotton on the same area for several years, the soil becomes progressively less satisfactory for the production of cotton, except in the best of seasons. The growing of seven successive cotton crops on the same area at the Biloela Research Station impaired the absorptive power of the surface layers of clay loam soils, so much that not more than 35 to 40 per cent. of a storm rain penetrated to a depth of 9 inches into dry soil during the growth of cotton plants in the seventh year.

This amount of moisture provided only temporary benefit for the plants. The repeated ploughing and cultivation of the soil during the seven-year period also stimulated bacterial activity to such an extent that, in the latter years, the rate of nitrification provided an excessive supply of nitrate nitrogen for the cotton plants in the early part of the mid-summer wet season. Under such conditions, the cotton plants tend to make an undesirably rank growth if wet weather is experienced at mid-season, especially if late sowings have been made on fertile soils.

The Rhodes grass in the cotton-grassland rotation reduces the supplies of nitrate nitrogen in the soil to a very low level, which permits the growing of at least three good crops of cotton following the breaking-up of the Rhodes grass sod. This is not the only benefit, for the incorporation of the Rhodes grass stubble in the soil by the ploughing operations improves appreciably the permeability of the surface layers of the soil, which allows of a greater penetration of rainfall. Both effects favour the production of better yields of cotton than are obtained on old cultivations.

How it helps the dairy farmer.

The cotton-Rhodes grass rotation is particularly suitable for the farmer who combines cotton-growing with dairying. The quantity and quality of the Rhodes grass that is produced in the rotation is superior to the production obtained in adjacent old-established areas of Rhodes grass.

Yields of up to 3½ tons of air-dried Rhodes grass hay have been produced at the Biloela Research Station in the second year of growth of the grass on forest alluvials. The hay is rich in milk-producing

protein, while the grass when grazed is much more palatable to live stock than that on old-established pastures.

How it works on the farm.

It is strongly recommended, therefore, that the rotation should be practised by both cotton-growers and dairy farmers. Old grasslands should be ploughed up and sown to cotton for three successive seasons. Old cotton cultivations should be sown to Rhodes grass for preferably three seasons and then ploughed for three seasons of cotton. Both the yield of cotton and butter-fat per acre will be appreciably increased. In addition, the texture of the soil will remain capable of absorbing even storm rains, and the loss of the fertile surface soils through water erosion will be greatly reduced.

Where farmers have not grown cotton, full details concerning cotton culture can be obtained from either the district instructor in cotton culture or agriculture or by writing to the Department of Agriculture and Stock, Brisbane.

Grow cotton—it is a profitable crop, and an increasing Australian market requires a greater production of Queensland raw cotton.

Plate 102.

An Illustration of the Benefit of Cotton-Rhodes Grass Rotation.—This area of Rhodes grass on old cotton land yielded 3½ tons of air-dried hay in the second year of establishment.

Fat Lamb Production.

GRATIFYING results have followed the scheme initiated by the Minister for Agriculture and Stock with the object of stimulating the production of fat lambs. Rams of British breeds, comprising Border Leicesters, Southdowns, Dorset Horns, Shropshires, and Romney Marsh, were purchased in the South and distributed to farmers who had cultivation available, or who were prepared to cultivate. In certain cases in which a farmer owned a stud ram of a particular breed, stud ewes were supplied with the idea of fostering the breeding of pure stock. All sheep supplied to farmers are on loan, and remain the property of the Department. The progeny and wool, however, become the property of the farmers concerned.

The greatest drawback to the production of fat lambs on the Darling Downs in quantity has been, and still is, the difficulty of purchasing good crossbred ewes as the mother flock.

If a start has to be made with merinos, the best ewe for fat lamb raising is bred by the introduction of one of the long wools, such as Border Leicester, Lincoln, or Romney Marsh, into the strong-woolled, robust type of merino ewe. The ewe lambs of this drop should then be retained as the future dams of the lamb-raising flock.

As to suitable ewes for the fat-lamb industry, it is believed that graziers on the fringe of the Darling Downs or further out would find it profitable to join long-woolled rams of British breed with their cast-for-age ewes with the idea of selling the progeny annually as fat lamb ewes on the Downs. Into the crossbred ewe flock, as described, should be introduced a ram of the Downs type. Opinions necessarily differ in the matter of crosses. The Southdown is the fashionable lamb at the present time, but it should be remembered that this cross must suffer no check from birth to block. The Dorset Horn gives a very nice lamb, early-maturing and hardy. The use of the Border Leicester should be encouraged in every way. In addition to producing an early-maturing lamb that fills every want, it must be remembered that the skin value of this lamb is worthy of consideration to a far greater extent than either the Dorset or the Southdown.

Purebred Corriedale ewes are hard to come by, but should the opportunity occur a farmer would be well advised not to let it slip. Pure Corriedales are hard to beat, good mothers and heavy milkers, besides growing a profitable fleece.

Generally, the wool from a flock retained for fat lamb breeding is a secondary consideration when compared with the production of fat lambs.

WORMS IN SHEEP.

In recent times, the problem of control of the parasitic worms in sheep has claimed attention in different parts of the world, more especially in South Africa, Great Britain, and Australia. Previously, drug treatment was successful only in the case of the stomach worm. Worms inhabiting the small intestine—e.g., the hair worms—and the large bowel—e.g., the nodule worm—were practically unaffected by drugs given in the ordinary way through the mouth. This was due to the fact that, under the conditions usually accompanying treatment, the drug passed into the first stomach or paunch and thus became diluted to such a degree that, by the time it passed through the three remaining stomachs of the sheep, it reached the small intestine in too weak a concentration to be in any way effective against the worms situated there or lower down in the gut.

The process of swallowing in sheep is governed by a groove which passes from the gullet along the roof of the first and second stomachs and eventually into the fourth stomach, which then leads directly into the small intestine. When the sheep grazes, the food is passed directly into the paunch, to be later brought back into the mouth, chewed as a cud, and then swallowed again. This time, however, the groove closes and the thoroughly masticated food goes direct to the third stomach or bible and then is passed on with little delay into the fourth stomach. When the sheep drinks, the groove is again closed, and the water passes almost directly into the fourth stomach. It was therefore considered that if some way could be found of getting this groove to close during treatment, the drug would pass directly into the fourth stomach, and would reach the worms in the small intestine and large bowel in a sufficiently high concentration to kill most of them.

After a large number of experiments, copper sulphate was found to produce this effect. Various strengths from 1 per cent. to 10 per cent. were tried, and it was found that a very small quantity of a 5 to 10 per cent. solution gave very consistent results. This work was carried out simultaneously in Australia and South Africa. For the small hair worms, nicotine sulphate was then combined with the copper sulphate, with very excellent results. This drench was found to be effective against both stomach worms and tape worms. Another point which was brought out by this was that starvation before drenching was not desirable. It was previously considered that by a starvation period prior to drenching, the locality in which the worms were present would be rendered free of ingested food and better contact of the drug with the worms would be given. It was subsequently found that this was more likely to be achieved without starvation, for with starvation the animals brought up the food from the first stomach, ruminated it, and then swallowed it, thus surrounding the worms in the third and fourth stomachs and in the small intestine with the ingested material. Details of this treatment may be obtained on application to the Animal Health Station.

UNIFORMITY IN FAT LAMBS.

From the point of view of the export lamb raiser, uniformity is of very great importance.

There is a growing tendency in Queensland to use too many breeds. With all the other States sending lambs overseas, we share the disability of a lack of the right type of ewe from which to produce the true sucker lamb. This may be overcome to some extent by saving the ewe portion of a drop got by the long wools. With these as the future mothers in a fat lamb raising flock, and joined with the Southdown or Dorset Horn, a good deal of the irregularity of carcase shape would disappear. Add to this the use of the better class rams and we would go far to correct a fault which is admitted, and which proves costly in some cases to individual growers and to the reputation of the State as a producer of export sucker lambs.

MERINO TYPES FOR COUNTRY.

One frequently hears amongst sheepmen the old argument as to the best type of merino wool to breed. The advocate of the fine wools is usually most emphatic, likewise those who hold a brief for the strong and medium. As a matter of fact, there is a useful place for all three types, but it is a fatal error to try to breed a type on country unsuited to it. Thus in the far west, north-west, and central areas, where sheep have certain hardships to withstand, and there are periodical droughts, the fine-woolled merino is not considered suitable. Remembering that to a very large extent constitution goes with strength of fibre, a strong-woolled merino does best in those regions.

Nearer in, in the south-west and Maranoa districts particularly, a strict medium may be found most profitable, but it should be recollected that, to maintain this medium, rams slightly stronger than the desired type should be used. On the Darling Downs, Stanthorpe, and Border areas a fine wool may be grown with profit. Thus fine, medium, and strong all have their uses and habitats.

SHEEP LAND FOR SELECTION AT LONGREACH.

A resumption from Maneroo has been surveyed as portion 5, parish of Millgetta, and will be opened for Grazing Homestead Selection at the Land Office, Longreach, on Thursday, the 7th September, 1939. The portion, which has an area of 29,700 acres, is situated about 40 miles west from Longreach, and the term of the lease will be twenty-eight years at an annual rental of 2½d. per acre for the first period of seven years.

A condition will be that the selection must be stocked to its reasonable carrying capacity with the applicant's own sheep within the first three years.

The portion, which is good woolgrowing and fattening and fairly good breeding country, is watered by several waterholes, and an earth tank of about 17,500 cubic yards capacity.

The country consists mainly of nice open pebbly downs, fairly well shaded and grassed principally with Mitchell, Flinders, and button grasses. There is an area of lancewood and yapunyah along the south-western boundary of the portion.

Free lithographs and full particulars may be obtained from the Lands Department, Brisbane, the Land Agent at Longreach, and the Queensland Government Tourist Bureaux at Sydney and Melbourne.

Washing of Dairy Utensils.

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

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

There are, then, three stages necessary to the thorough cleaning of dairy utensils, as distinct from the sterilising, which must follow in

order to destroy the harmful bacteria. These three stages are as follows:—

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

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

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

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

FLUSHING THE SEPARATOR.

The test or percentage of fat required in cream should be not less than 38 per cent. during the hot summer months and not less than 34 per cent. during the cooler months of the year. Whatever make of separator is used, during the process of separating satisfactory results can only be obtained when the cream screw is adjusted so that the driven speed of the separator conforms with the corresponding number of revolutions per minute recommended by the maker of the machine.

At the completion of separating, flushing with cold or warm water so as to remove the last of the cream from the patties is an undesirable practice. If the cream bucket is not removed during the process some of the impurities and slime adhering to the bowl may be removed and deposited in the cream. This applies particularly if warm water is used. When separated milk is used for flushing, excessive milk solids are introduced into the cream and these will have a detrimental effect on quality, as well as lowering the fat test. Thus the proceeds of flushing should be fed to the pigs or calves on the farm. The maintenance of cream quality is too important to be impaired by laxity in this respect.

Sweet Potatoes and Arrowroot for Pigs.

WITH the approach of spring, farmers are planning their cropping programmes, and so the time is opportune for considering the value of such root crops as sweet potatoes and arrowroot as pig foods. These two crops are well known to most coastal pig farmers, and can be grown in most places where there is a sufficient rainfall and a long summer season.

Under similar conditions, the yield of pig feed per acre from arrowroot and sweet potatoes is several times that from maize grain. This fact alone makes these crops worthy of consideration, but they also have the advantage of being more or less drought-resistant and are usually freer from pests. In the case of sweet potatoes, some growers claim that they are worth growing for the vines alone. The vines of the sweet potatoes and the stalks and leaves of the arrowroot provide a large quantity of succulent green food.

If it is necessary to harvest and feed these crops by hand, the labour involved is considerable; but both crops can be fed off by pigs, and where the paddocks are made pig-proof, and some temporary fencing is used to partition off a small portion of the crop for the pigs to harvest, excellent results are obtained. If pigs are allowed to run over the whole crop a good deal of waste results. They should, therefore, be confined on an area which they can clean up in about one week.

Arrowroot is frequently boiled before being fed to pigs; but, although the boiling does increase its nutritive value somewhat, it is doubtful whether the increase warrants the labour required to dig, cart, and boil the bulbs, especially when it has been demonstrated that pigs do remarkably well by harvesting the crop for themselves.

Sweet potatoes and arrowroot are not complete foods in themselves, and must be fed in combination with foods rich in protein, such as separated milk or meatmeal. The more extensive use of these two crops, in conjunction with the separated milk at present available, would enable coastal dairy farmers to increase their output of pigs.

A SUBSTITUTE FOR MILK IN PIG-FEEDING.

It is known generally that meatmeal is a good substitute for separated milk in the pig's diet, but unless it is used carefully meatmeal may prove an expensive food.

Meatmeal, which is a by-product of abattoirs and meatworks, is sold under several trade names, and some varieties contain a small percentage of bonemeal. It is a wholesome food, convenient to use, and costs from 9s. to 10s. 6d. per 100-lb. bag, Brisbane, the higher-priced brands containing a higher percentage of protein.

As meatmeal is expensive in comparison with pig foods grown on the farm, it should not be used more freely than is necessary.

Separated milk, which meatmeal replaces, is used according to its availability, pigs sometimes receiving milk as their sole diet, but pigs will thrive on small quantities of milk used in combination with grain and other foods, such as pumpkins and sweet potatoes; the milk supplies a part of the protein necessary to balance the ration. Each pig from weaning until baconer stage and each dry sow should receive a minimum of ¾ of a gallon of separated milk daily, and each sow with a litter double that quantity.

When these minimum quantities of separated milk are not available, meatmeal may be substituted, using about ½ lb. of meatmeal to replace each ¾ of a gallon of separated milk.

Pigs thrive on a mixture of milk and meatmeal, or meatmeal alone as the protein-rich portion of the diet. The quantities used should not exceed from ¼ to ½ lb. daily per pig from weaning to baconer stage, according as to whether good lucerne is available or not; and ½ lb. for each dry sow and 1 lb. daily for each sow with litter.

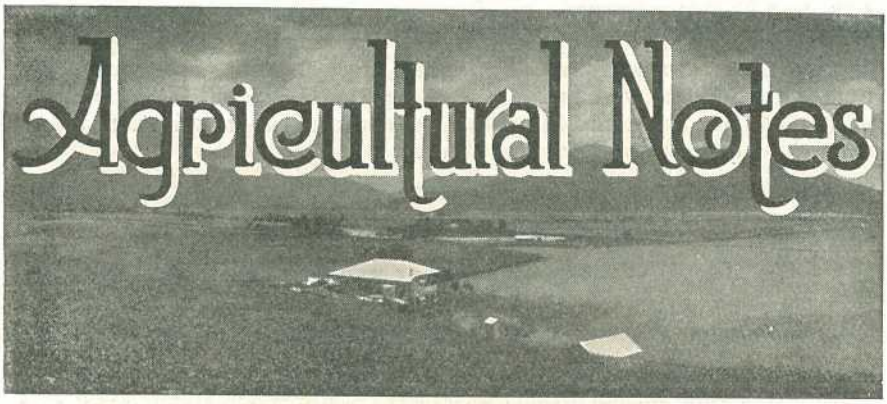
By feeding a constant quantity of separated milk or meatmeal, and increasing the grain and other foods according to the pig's appetite, the nutritive ratio is widened automatically as the pig grows and satisfies its requirements.

In cases where pigs have access to good, young pasture or green crops, the minimum quantity of separated milk or meatmeal stated above may be reduced by up to 50 per cent., depending on the quality of the green foods.

Meatmeal may be fed dry or mixed with milk or water.

Name and Address.	Name of Hatchery.	Breeds Kept.
G. Adler, Tinana	Nevertire ..	White Leghorns, Australorps, Rhode Island Reds, and Langshans
F. J. Akers, Eight Mile Plains	Elmsdale ..	White Leghorns and Australorps
E. J. Blake, Rosewood ..	Sunnyville ..	White Leghorns, Australorps, White Wyandottes and Rhode Island Reds
R. H. & W. J. Bowles, North Rockhampton	Glenmore Poultry Farm and Hatchery	White Leghorns and Australorps
J. Cameron, Oxley Central ..	Cameron's ..	Australorps and White Leghorns
M. H. Campbell, Albany Creek, Aspley	Mahaca Poultry Farm and Hatchery	White Leghorns and Australorps
J. L. Carrick & Son, Manly road, Tingalpa	Craigard ..	White Leghorns
N. Cooper, Zillmere road, Zillmere	Graceville ..	White Leghorns
R. B. Corbett, Woombye ..	Labrena ..	White Leghorns and Australorps
T. G. Crawford, Stratford ..	Rho-Isled ..	Rhode Island Reds
Dr. W. Crosse, Musgrave road, Sunnybank	Brundholme ..	White Leghorns, Australorps, and Rhode Island Reds
Dixon Bros., Wondecla	Dixon Bros. ..	White Leghorns
Rev. E. Eckert, Head street, Laidley	Laidley ..	Australorps, White Leghorns, and Langshans
Elks & Sudlow, Beerwah ..	Woodlands ..	Australorps and White Leghorns
W. H. Gibson, Manly road, Tingalpa	Gibson's ..	White Leghorns and Australorps
Gisler Bros., Wynnum	Gisler Bros. ..	White Leghorns
G. Grice, Loch Lomond ..	Kiama	White Leghorns
J. W. Grice, Loch Lomond ..	Quarrington ..	White Leghorns
Mrs. M. Grillmeier, Mount View, Milman	Mountain View	Australorps, Minorcas, and Rhode Island Reds
C. & C. E. Gustafson, Tannymorel	Bellevue ..	Australorps, White Leghorns, and Rhode Island Reds
P. Haseman, Stanley terrace, Taringa	Black and White	Australorps and White Leghorns
C. Hodges, Kuraby	Kuraby ..	Anconas and White Leghorns
J McCulloch, Whites road, Manly	Hindes Stud Poultry Farm	White Leghorns, Australorps, and Brown Leghorns

Name and Address.	Name of Hatchery.	Breeds Kept.
A. Malvine, junr., The Gap, Ashgrove	Alva ..	White Leghorns and Australorps
H. L. Marshall, Kenmore ..	Stonehenge ..	White Leghorns and Australorps
W. J. Martin, Pullenvale ..	Pennington ..	Australorps, White Leghorns, and Langshans
J. A. Miller, Racecourse road, Charters Towers	Hillview ..	White Leghorns
F. S. Morrison, Kenmore ..	Dunglass ..	Australorps, Brown Leghorns, and White Leghorns
Mrs. H. I. Mottram, Ibis avenue, Deagon	Kenwood Electric Hatcheries	White Leghorns
J. W. Moule, Kureen	Kureen ..	White Leghorns and Australorps
D. J. Murphy, Marmor ..	Ferndale ..	White Leghorns, Brown Leghorns, Australorps, Silver Campines, and Light Sussex
S. V. Norup, Beaudesert Road, Cooper's Plains	Norup's ..	White Leghorns and Australorps
H. W. & C. E. E. Olsen, Marmor	Squaredeal Poultry Farm	White Leghorns, Australorps, Black Leghorns, Brown Leghorns, and Anconas
A. C. Pearce, Marlborough ..	Marlborough Stud Poultry Farm	Australorps, Rhode Island Reds, Light Sussex, White Wyandottes, Langshans, Khaki Campbell and Indian Runner Ducks, and Bronze Turkeys
E. K. Pennefather, Oxley Central	..	Australorps and White Leghorns
G. Pitt, Box 132, Bundaberg ..	Pitt's Poultry Breeding Farm	White Leghorns, Australorps, Langshans, Rhode Island Reds, and Brown Leghorns
G. R. Rawson, Mains Road, Sunnybank	Rawson's ..	Australorps
J. Richards, Atherton	Mount View Poultry Farm	White Leghorns and Australorps
H. K. Roach, Wyandra	Lum Burra ..	White Leghorns and Australorps
C. L. Schlencker, Handford road, Zillmere	Windyridge ..	White Leghorns
A. Smith, Beerwah	Endcliffe ..	White Leghorns and Australorps
A. T. Smith, The Gap, Ashgrove	Smith's ..	White Leghorns and Australorps
T. Smith, Isis Junction	Fairview ..	White Leghorns and Langshans
H. A. Springall, Progress street, Tingalpa	Springfield ..	White Leghorns
A. J. Teitzel, West street, Aitkenville, Townsville	Teitzel's ..	White Leghorns
W. J. B. Tonkin, Parkhurst, North Rockhampton	Tonkin's Poultry Farm	White Leghorns and Australorps
W. A. Watson, Box 365, P.O., Cairns	Hillview ..	White Leghorns
G. A. C. Weaver, Herberton road, Atherton	Weaver's Stud Poultry Farm	Wyandottes, Indian Game, Barred Rocks, Australorps, White Leghorns, Anconas, Rhode Island Reds, Buff Orpingtons, Black Orpingtons, and Buff Leghorns.
T. Westerman, Handford road, Zillmere	Zillmere ..	Australorps and White Leghorns
H. M. Witty, Kuraby	..	White Leghorns and Australorps
P. A. Wright, Laidley ..	Chillowdeane ..	Brown Leghorns, White Leghorns and Australorps
R. H. Young, Box 18, P.O., Babinda	Reg. Young's ..	White Leghorns, Brown Leghorns and Australorps



Protect the Potato Crop against Irish Blight.

IRISH blight is a disease which is well known to most experienced potato and tomato growers. Black, water-soaked areas of decay make their appearance on leaves and stalks during cool, showery weather. These will become dry and papery if there is a dry change, but when rain or misty weather continues the disease will rapidly spread until the whole of the foliage becomes blighted and the plant dies to the ground. The disease may pass down the underground stems and infect the tubers, or these may be infected direct through exposed surfaces before or after digging. The symptoms in the tuber consist of a sunken and darkened condition of the skin, beneath which is a varying area of brown decay extending into the flesh. When stored under moist conditions, affected tubers may rot completely.

The development of this disease is closely bound up with weather conditions. The causal agent is a fungus which, in Queensland, is unable to grow during the warm summer months. Hence, blight only appears during the late autumn, winter, and spring. The fungus is also dependent on moist, showery weather for the production of its delicate spores and its rapid development and spread. It is for this reason that the disease is sporadic in its appearance, and varies in severity with the nature of the season.

The fact that Irish blight is not serious every year tends to make many farmers somewhat lax in regard to doing anything for the control of the disease. There is, however, a definite risk attached to this attitude, and potato-growers are strongly advised to give serious attention to the control measures outlined below.

Spray the plants thoroughly with Bordeaux mixture. Commence when the plants are young, before the disease becomes well established, and repeat the application during the growth of the crop so as to keep the foliage well covered. About three applications during a dry season and five during a wet one are usually sufficient. Plants should not be sprayed when they are wilting from want of water, as some spray burn may result.

The spray should be made up at the strength of 4 lb. bluestone and 4 lb. hydrated lime to 40 gallons of water. Approximately 150 gallons of spray are required for 1 acre of fair-sized plants. Spraying can be carried out with a knapsack pump, but a larger outfit such as a barrel pump is more convenient for treating large areas. Directions for preparing Bordeaux mixture may be obtained on application to the Department of Agriculture and Stock.

EXPORT OF CAGE-BIRD SEED TO NEW ZEALAND.

Recent amendments to regulations under the New Zealand Stock Act, which governs the importation of agricultural seeds from Australia, make special provision for the importation from Queensland—subject to conditions in respect of fumigation and branding—of agricultural seeds grown in Queensland which are suitable for use as cage-bird feed. Except for this special provision for the admission of cage-bird feed, which is the outcome of representations made last year to the New Zealand Minister for Agriculture by the Minister for Agriculture and Stock (Hon. F. W. Bulcock), the importation into New Zealand of agricultural seed grown in Queensland is totally prohibited.

The conditions under which cage-bird seed from Queensland may be admitted to New Zealand are—Before shipment to the Dominion the seed must be fumigated with carbon bisulphide at a strength of 10 lb. to 1,000 cub. ft. of chamber space for a period of not less than twenty-four hours. Each package must be branded with the words "Cage-bird Seed." Each consignment of seed must be accompanied by statutory declarations in the prescribed forms by the consignor and an inspector of the Department of Agriculture, declaring that the seed is the produce of Queensland, its exact locality of production, and that it has been fumigated in accordance with the New Zealand regulations.

EFFECTS OF DOWNY MILDEW AT MACKAY.

Some time ago the Bureau announced the yield results for three of the seedlings raised at the Mackay Station. Of these a new variety known locally at "C. 83" was of outstanding merit in respect of tonnage yield per acre. For three crops (plant, first and second ratoon), it yielded 17·3 tons of C.C.S. per acre, as compared with 12·3 tons of C.C.S. for the standard, Q. 813.

The new cane is a seedling of P.O.J. 2878, and unfortunately carries the susceptibility to downy mildew disease exhibited by its parent. It is, therefore, not possible to have this cane released for general distribution, solely for the reason that the presence of this disease in Mackay would render it a ready victim in virtually all areas.

Growers will therefore appreciate that the ill effects of cane diseases lie not only in their influence on the present standard canes, but also in the restrictions they place automatically on new canes which do not happen to be resistant. Again, it is evident that diseases are costly from whichever aspect they are viewed, and all farmers should exert a strenuous and concentrated effort to eradicate them. This seedling will be maintained in isolation but will not be released for planting until such time as the downy mildew situation is satisfactorily cleaned up.

—H.W.K., in "The Cane Growers' Quarterly Bulletin."

Control of Cabbage Pests.

IN common with other crop plants, the cabbage is subject to the attacks of a number of insect pests which, if not adequately controlled, are capable of completely destroying the plants or at least rendering them unfit for market. Every grower should know these insect pests, and should be prepared to carry out the necessary control measures. It is now generally recognised that, as a health safeguard, a poison such as arsenate of lead, formerly in common use, must not be applied to edible foliage. As there is available on the market a range of insecticides containing derris, which is toxic to most leaf-eating insects of the cabbage but non-poisonous to man, the use of arsenate of lead on this type of plant is unnecessary. Derris is sold under various trade names ready for application as a dust, or in a form suitable for mixing into a spray, and is marketed by most dealers in insecticides.

During the period of seed-bed growth the young plants should be given frequent applications of derris in either spray or dust form. Such treatment will reduce any incipient infestations of cabbage grubs or cabbage aphis.

In the field the young transplants may be destroyed during their early stages of growth by either cutworms or false wireworms. Both of these insects feed at night, the young plants being usually cut down at ground level. Cutworms are particularly injurious in the spring months, but damage by false wireworms has been experienced at other times in the year. Whenever this cutting of seedlings is noticed, an immediate application of the well-known cutworm bran bait should be made; late afternoon is the best time for the application.

The commonest insect pest of the half to full grown plant is the cabbage moth, whose caterpillars eat numerous holes into the foliage. The caterpillars are small, green in colour, and, owing to their activity when disturbed, they are often referred to as green wrigglers. This insect breeds more rapidly in the summer, but it may be found on the plants throughout the year.

Thorough application of derris sprays or dusts once a week on the plants throughout their period of field growth will give adequate protection against this insect and also prevent any noticeable infestations of cabbage aphis. This aphis usually occurs in clusters of small, slow-moving insects covered by a whitish mealy secretion, the clusters being associated with curled and malformed foliage. These insects feed by sucking the sap, and, both because of the malformation and the lowered vitality of the plant that accompany infestation, their control is necessary.

In the summer months a caterpillar generally referred to as the centre grub is frequently serious. This insect may burrow down the centre of young transplants into the stalk, and thus kill out the growing point. As the root system of the plant is usually established by this time, a number of suckers will be produced. By cutting away all but the best of these, a satisfactory plant may later be produced. Derris applications are less effective against this insect than against larvæ of the cabbage moth.

Unfortunately, that well-known pest, the corn-ear worm, occasionally causes serious injury to cabbages. The only line of attack that can be suggested is to grow cabbages as far as possible from alternative host crops, such as tomatoes, maize, and cotton, and to eliminate weed growth in and near the cabbage area.

As general measures, crop residues should, as far as possible, be gathered and destroyed at the end of a crop and, if practicable, successive plantings should not be made on closely adjacent areas. These precautions will reduce the carry-over of the various insects.

CULTIVATION OF CANE FOR FODDER PURPOSES.

The amended "Sugar Experiment Stations Act" provides that within a mill area only approved varieties of sugar-cane may be planted, whatever the purpose for which the cane is intended. In this case growers are reminded that a mill area comprises all the land, whether assigned or not, within the general area over which the assigned land is distributed.

Lists of approved varieties for each mill area have already been issued and given due publicity. In addition, however, the Act provides that the Governor in Council may gazette varieties of cane which may be grown for fodder purposes, and it is proposed to gazette such varieties in the near future.

Accordingly it is asked that all persons who desire to plant for fodder purposes any variety of cane not otherwise approved for planting in their particular mill area, should communicate immediately with the Director, Bureau of Sugar Experiment Stations, Brisbane, giving the mill area and the variety it is desired to plant.

It should be pointed out that owing to the Fiji disease situation in Southern Queensland no canes of the Uba type will be approved for fodder purposes within a mill area in those parts.

—*H.W.K.*

The Fruit Market.

JAS. H. GREGORY, Instructor in Fruit Packing.

THE weather during the month made it difficult to maintain the upward trend in prices. Intermittent showers affected adversely the carrying quality of the softer fruits to distant markets. In some pineapple consignments there were traces of blackheart, and cases of rubbery bananas were reported. Notwithstanding these handicaps, good fruit was in firm demand.

The following were the ruling market prices during the last week of the month of July, 1939:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Cavendish: Small, 8s. 6d. to 9s. 6d.; sixes, 9s. 9d. to 11s. 6d.; sevens, 12s. to 14s.; eights and nines, 15s. to 16s. per acre.

Sydney.—Cavendish: Sixes, 12s. to 15s.; sevens, 15s. to 18s.; eights and nines, 18s. to 20s.

Melbourne.—Cavendish: Sixes, 12s. to 15s.; sevens, 14s. to 17s.; eights and nines, 16s. to 19s.

Adelaide.—Cavendish: Sixes and sevens, 16s. to 22s.

Newcastle.—Cavendish: Sixes and sevens, 13s. to 20s.

Reports of squirter from Sydney.

Lady's Finger, 2½d. to 6d. per doz.; Cavendish, to 8d. per dozen.

Pineapples.

Brisbane.—Smoothleaf, 4s. to 7s. per case; loose, 1s. 6d. to 5s. per dozen; Ripley, 4s. to 6s. per case; loose, 1s. 6d. to 3s. per dozen.

Sydney.—Smoothleaf, 8s. to 12s.; specials higher.

Melbourne.—Smoothleaf, 7s. to 12s.

Newcastle.—7s. to 12s.

Papaws.

Brisbane.—Yarwun, 5s. to 8s. tropical case; Gunalda, 3s. 6d. to 4s. 6d. bushel; locals, 1s. 6d. to 3s. bushel.

Sydney.—6s. to 12s. tropical case; many lines green.

Melbourne.—7s. to 14s. tropical case.

Newcastle.—9s. to 10s.

Custard Apples.

Brisbane.—2s. 6d. to 3s. per half-bushel.

Sydney.—6s. to 8s. half-bushel.

Melbourne.—5s. to 7s. half-bushel.

Passion Fruit.

Brisbane.—Firsts, 7s. to 9s.; seconds, 5s. to 6s.

Sydney.—3s. to 7s.

Melbourne.—8s. to 12s.

Other Tropical Fruits.

Cape gooseberries, 5d. to 6d. per lb.

CITRUS FRUITS.

Oranges.

Brisbane.—Gayndah, 7s. to 11s.; locals, 6s. to 9s.; Howard, 6s. to 10s.; New South Wales navels, 8s. to 10s.

Mandarins.

Brisbane.—Emperors, 6s. to 9s.; Scarlets, 6s. to 9s.; Gayndah Glens, 8s. to 14s.

Grapefruit.

Brisbane.—6s. to 8s. bushel.

Lemons.

Brisbane.—Locals, 4s. to 7s.; Gayndah, 6s. to 12s.

DECIDUOUS FRUITS.

Apples.

Brisbane.—Jonathan, 6s. to 12s.; Granny Smith, 8s. to 12s.; Cleopatra, 8s. to 10s.; Aromatic, 5s. to 8s.; French Crab, 4s. to 7s.; Rome Beauty, 9s. to 12s.; Scarlets, 6s. to 9s.; Sturmer, 6s. to 8s.; Yates, 10s. to 13s.; Democrat, 6s. to 9s.

Pears.

Brisbane.—Josephine, 8s. to 13s.; Packham's Triumph, 6s. to 11s.; Winter Cole, 9s. to 15s.

OTHER FRUITS.

Tomatoes.

Brisbane.—Ripe, 3s. to 6s.; coloured, 4s. to 8s.; green, 3s. to 5s.

Sydney.—Cleveland, 4s. to 6s.; Bowen, 5s. to 7s.

Melbourne.—Adelaide tomatoes, 13s. to 15s.; West Australian, 6s. to 10s.; repacked higher.

MISCELLANEOUS, VEGETABLES, &c.

Cucumbers.—*Brisbane:* 5s. to 7s.

Pumpkins.—4s. to 5s. 6d. bag.

Marrows.—1s. 6d. to 2s. dozen.

Lettuce.—6d. to 1s. 6d. dozen.

Cabbages.—1s. 6d. to 2s. 6d.; prime to 5s. dozen.

Cauliflowers.—1s. 6d. to 3s. 6d.; large, 8s. to 12s.

Beans.—*Brisbane:* 6s. to 8s. sugar bag. *Melbourne:* 4d. to 7d. lb.

Peas.—*Brisbane:* 8s. to 10s. sugar bag.

Beetroot.—4d. to 1s. bundle.

Chokos.—9d. to 1s. dozen.

Plate 103.

DEMONSTRATING THE POINTS OF A BERKSHIRE BOAR AT THE FARMERS' WINTER SCHOOL, QUEENSLAND AGRICULTURAL COLLEGE.—In the group (left to right) are Mr. E. J. Shelton, H.D.A. (Senior Instructor in Pig Raising, Department of Agriculture and Stock, demonstrator), Messrs. W. Ley, C. Nothling, R. Parsons, W. O'Connor, W. T. Jones, Wm. Robb, W. Svendsen, G. Murphy, H. Svendsen, A. H. Calvert, C. R. Maunsell, A. H. McKell, W. Adlem, and N. W. Briton, B.V.Sc. (Lecturer in Animal Husbandry, Queensland Agricultural High School and College).

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of The Australian Illawarra Shorthorn Society, Jersey Cattle Society, Ayrshire Cattle Society, and Friesian Cattle Society production charts for which were compiled during the month of June, 1939 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORN.				
MATURE COW (STANDARD 350 LB.).				
Penrhos Pansy II.	A. Sandilands, Junr., Penrhos, Wildash	13,950·6	662·653	Rosenthal Pendant's Prince
Rosenthal Lilac III.	S. J. H. Mitchell, Rosenthal, Warwick	12,063·1	481·462	Rosenthal Handsome Boy
Happy Valley Lovely 2nd	R. R. Radel, Happy Valley, Coalstoun Lakes	11,145·2	457·753	Molly's Hero of Glenthorn
Fairlie Fuchsia 11th	C. B. Mitchell, Fairlie, Rosenthal	9,820·72	404·487	Rosenthal Dividend
Sunnyside Ruby 21st	P. Moore, Wooroolin	8,942·1	388·913	Countess Lad of Cosey Camp
Murray's Bridge Choice	A. T. Paull, Bowenville	8,557·6	372·561	Valiant of Greyleigh
Braemar Sunray	A. T. Paull, Bowenville	7,929·75	357·585	Braemar Keith
Palmeto Polly	Rex Tweed, Kandanga	7,780·95	352·805	Glengallan Mayor
SENIOR, 4 YEARS (STANDARD 330 LB.).				
Fairlie Princess 24th	C. B. Mitchell, Fairlie, Rosenthal	8,032·08	379·593	Rosenthal Carbine
JUNIOR, 4 YEARS (STANDARD 310 LB.).				
Brundah Cora	C. O'Sullivan, Ascot, Greenmount	9,945·58	395·727	Karawarra Enchanter
SENIOR, 3 YEARS (STANDARD 290 LB.).				
Trevor Hill Twinkle	Geo. Gwynne, Umbiram	9,624·65	377·441	North Glen Emblem
Fairlie Princess 25th	C. B. Mitchell, Fairlie, Rosenthal	7,877·78	349·973	Rosenthal Carbine
Rosenthal Maggie 14th	S. J. H. Mitchell, Rosenthal, Warwick	7,098·04	300·003	Rosenthal Carbine 2nd
JUNIOR, 3 YEARS (STANDARD 270 LB.).				
Trevor Hill Satin	Geo. Gwynne, Umbiram	9,043·26	385·116	North Glen Emblem
Brundah Fancy	C. O'Sullivan, Ascot, Greenmount	8,211·76	316·429	Greyleigh Eros
Pilton View Countess	P. D. Feichtner, Pilton View, Greenmount	7,529·2	309·194	Navillus Venus Shiek
Palmeto Mary	Rex Tweed, Kandanga	7,902·5	302·012	Glengallan Mayor

	SENIOR, 2 YEARS (STANDARD 250 LB.).			
Sunnyside Clover 27th	P. Moore, Wooroolin	7,724·8	316·934	Patrol of Cosey Camp
Brundah Norma 3rd '	C. O'Sullivan, Ascot, Greenmount	7,492·71	309·885	Greyleigh Eros
Brundah Myra	C. O'Sullivan, Ascot, Greenmount	7,136·06	292·39	Greyleigh Eros
Murray's Bridge Sadie 2nd	P. D. Feichtner, Pilton View, Greenmount	5,725·05	287·453	Greyleigh Winall
	JUNIOR, 2 YEARS (STANDARD 230 LB.).			
Pilton View Little Prim	P. D. Feichtner, Pilton View, Greenmount	7,518·7	332·606	Navillus Venus Sheik
Pilton View Red Queen	P. D. Feichtner, Pilton View, Greenmount	7,886·6	306·024	Navillus Venus Sheik
Rosenthal Hope 19th	S. J. H. Mitchell, Rosenthal, Warwick	7,314·25	298·498	Rosenthal Peggy's Admiration
Pilton View Dolly	P. D. Feichtner, Pilton View, Greenmount	6,703·6	280·689	Navillus Venus Sheik
Valera Bonny 2nd	Sullivan Bros., Pittsworth	6,652·59	257·306	Kilburnie Royalist
Navillus Vision 3rd	C. O'Sullivan, Ascot, Greenmount	6,971	250·798	Parkview Mars
Highfields Perfect 8th	J. A. Heading, Highfields, Murgon	6,068	241·81	Greyleigh Legend
Pilton View Fussy	P. D. Feichtner, Pilton View, Greenmount	5,858·05	230·13	Navillus Venus Sheik
	JERSEY.			
	MATURE COW (STANDARD 350 LB.).			
Brooklands Royal Lily	W. S. Conochie, Sherwood	8,558	465·513	Retford Earl Victor
Glenview Sunflower	F. P. Fowler and Son, Glenview, Coalstoun Lakes	9,100·2	420·67	Trinity Officer
Westbrook Tulip 23rd	Farm Home for Boys, Westbrook	7,519·55	414·769	Carnation Scot's Noble
Trecarne Madieraette 3rd	J. Schull, Lermont, Oakey	6,828·6	377·025	Trecarne Golden King
	SENIOR, 4 YEARS (STANDARD 330 LB.).			
Glenview Hopeful	F. P. Fowler and Son, Glenview, Coalstoun Lakes	9,548·35	544·868	Trinity Governor's Hope
Westbrook Sultane	Farm Home for Boys, Westbrook	7,489·45	361·048	Westbrook Prince
	JUNIOR, 4 YEARS (STANDARD 310 LB.).			
Lady May of Inverlaw	R. J. Crawford, Inverlaw, Kinagroy	7,523·1	380·552	Woodside Felucca's Gamboge
	SENIOR, 3 YEARS (STANDARD 290 LB.).			
Bellgarth Viola II.	D. R. Hutton, Bellgarth, Cunningham	7,319·23	398·895	Trecarne Renown II.
Trinity Golden Rosena	A. H. O. Koppen, Peeramon	6,345·85	384·006	Trinity Nobly Born
Glenview Design	F. P. Fowler and Son, Glenview, Coalstoun Lakes	6,403·05	326·592	Trinity Governor's Hope
Lermont Fairy	J. Schull, Lermont, Oakey	6,051·35	324·399	Woodside Golden Volunteer
Day Dawn of Peeramon	A. H. O. Koppen, Peeramon	6,006·9	317·379	Trinity Segunda's Prince
Nancy of Windy Way	Wakefield Bros., Upper Barron, Atherton	5,417·7	292·686	Royal Emblem 2nd of Rosedale

Production Recording—*continued.*

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	JERSEY—*continued.*			
	JUNIOR, 3 YEARS (STANDARD 270 LB.).			
Lermont Silver Bell (Twin)	J. Schull, Lermont, Oakey	7,385·1	424·278	Woodside Golden Volunteer
Brooklands Sultan's Tea Cake	W. S. Conochie, Sherwood	7,391·6	352·106	Brooklands Royal Sultan
Carnation Dainty Aster 2nd	R. J. Crawford, Inverlaw	5,201·62	313·478	Vinchelez Golden Victory
Westbrook Tulip 71st	Farm Hone for Boys, Westbrook	6,001·35	297·729	Oxford Golden Dreamer
	SENIOR, 2 YEARS (STANDARD 250 LB.).			
Pineview Spotted Queen	E. Burton and Sons, Wanora	6,024·8	349·667	Oxford Peer
Oxford Golden Rosina	R. J. Crawford, Inverlaw, Kingaroy	4,760·26	273·105	Oxford Golden Remus
	JUNIOR, 2 YEARS (STANDARD 230 LB.).			
Glenview Mischief	F. P. Fowler and Son, Glenview, Coalstoun Lakes	7,723·8	421·767	Trinity Governor's Hope
Grange Vale Patricia	T. R. Gillespie, Ravenshoe	6,660·85	383·211	Eclipse of Brook Lodge
Lermont Kitty	J. Schull, Lermont, Oakey	7,439·3	375·346	Woodside Golden Volunteer
Lermont Dawn	J. Schull, Lermont, Oakey	7,121·6	320·288	Lermont Officer
Inverlaw Daisybelle	R. J. Crawford, Inverlaw, Kingaroy	6,228·55	319·817	Oxford Royal Lad
Lermont Chime	J. Schull, Lermont, Oakey	6,137·3	313·296	Woodside Golden Volunteer
Lermont Madiera	J. Schull, Lermont, Oakey	5,686·2	310·952	Woodside Golden Volunteer
Wyreen Gentle	C. W. Barlow, Spring Creek, Toowoomba	5,189·16	274·119	Lyndhurst Majesty
Oak Park Marina's Maid	Miss J. Nolan, Lindum	5,250·2	268·379	Banyule Lord Tiddlewinks
Inverlaw Princess Victorious	R. J. Crawford, Inverlaw	4,959·63	267·27	Carnation Gentle Prince
Bellgarth Bertha 3rd	P. Kerlin, Killarney	4,936·15	262·321	Trecarne Renown 2nd
Glenview Sultane's Royal	F. P. Fowler and Son, Glenview, Coalstoun Lakes	5,029·75	262·078	Trinity Governor's Hope
Inverlaw Celia	R. J. Crawford, Inverlaw, Kingaroy	5,474·22	246·14	Oxford Royal Lad

AYRSHIRE.

MATURE COW (STANDARD 350 LB.).

Fairview Lady Bess (242 days)	R. M. Anderson, Southbrook	12,924·55	472·786	Longlands Bonnie Willie

JUNIOR, 3 YEARS (STANDARD 270 LB.).

Myola Joy 2nd	R. M. Anderson, Southbrook	9,188·95	339·914	Benbecula Bonnie Willie

FRIESIAN.

JUNIOR, 3 YEARS (STANDARD 270 LB.).

Maroombin Dulcie	A. Brown, Fullham, Toogoolawah	9,883·6	288·894	Burndral Alcartra Pietje

Sugar Levies.

(Abbreviated Notice.)

1939 SEASON.

Regulations under "*The Primary Producers' Organisation and Marketing Acts,* 1926 *to* 1938," have been approved, providing for levies on suppliers of cane to sugar-mills at the following rates for the season 1939 [the figures for 1937 and 1938 are given for comparison purposes]—

Name of Mill.	General Levy by Queensland Canegrowers' Council.	Administrative Levy by District Executive.	Administrative Levy by Mill Suppliers' Committee.	Special Levy by Mill Suppliers' Committee.	Total Levies for 1939.	Total Levies for 1938, given for comparison.	Total Levies for 1937, given for comparison.
	d.	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*
Mossman Central	½	2	..	..	2½	2	2
Hambledon	½	¼	¼	..	1	1¼	1¼
Babinda Central	½	¼	¼	..	¾	1 1/16	1 3/16
Mulgrave Central	½	¼	..	..	¾	1	1
South Johnstone Central	½	1½	..	..	2	2¼	2¼
Goondi	½	1½	..	..	2	2¼	2¼
Mourilyan	½	1½	..	..	2	2¼	2¼
Tully River Central	½	1¾	..	..	2¼	2½	2½
Macknade	½	1½	½	..	1½	1¾	1¾
Victoria	½	½	½	..	1½	1¾	1¾
Kalamia	½	..	..	..	2	1¾	2¼
Pioneer	½	..	1	..	2¼	2½	2½
Inkerman	½	..	½	..	1	1¼	1½
Invicta	½	..	1½	..	2	2¼	2¼
Proserpine Central	½	1	..	..	1½	1¾	1¾
Cattle Creek Central	½	½	½	..	1½	1¾	1½
Plane Creek Central	½	½	½	..	1½	1¾	1¾
Marian Central	½	½	½	..	1½	1¾	2¼
North Eton Central	½	½	..	..	1	1¼	1¼
Pleystowe	½	½	¼	½	1¾	2	2½
Racecourse Central	½	½	½	..	1½	1¾	1¾
Farleigh	½	½	½	..	1½	1¾	1¾
Qunaba	½	1¼	½	..	2¼	2¾	1¾
Bingera	½	1¼	½	..	2¼	2¾	1¾
Fairymead	½	1¼	½	..	2¼	3	2
Gin Gin Central	½	1¼	½	..	2¼	3	3¼
Millaquin	½	1¼	¼	..	2	2½	1¾
Isis Central	½	½	½	..	1	1¼	1¼
Maryborough	½	½	½	..	1½	1¾	1¾
Mount Bauple Central	½	½	½	..	1½	1¾	1¾
Moreton Central	½	¼	1	½	2¼	2¾	2¼
Rocky Point	½	¼	½	..	1¼	1¾	1¾
Eagleby	½	¼	¼	..	1½	1	¾

No poll will be taken in respect of the General Levy of ½d. per ton (first column) for the Queensland Cane Growers' Council, or for the administrative levies by District Executives or Mill Suppliers' Committees (second and third columns).

In the fourth column, the levies on cane supplied to the Kalamia, Pioneer, Pleystowe, and Moreton Central Mills will be used in defraying the costs of employing farmers' representatives at those mills for the

current season. In the case of these levies, growers may petition for a poll, and the petition must be signed by at least 100 or 50 per cent. (whichever shall be the less) of the growers who are suppliers of cane to the five mills concerned.

In addition to the foregoing levies, the undermentioned Mill Suppliers' Committees are empowered to make particular levies on growers within each of the following districts, at the following rates:—

Name of Mill Suppliers' Committee and Mill to which Cane is Supplied.	Description of District upon the Growers wherein Levies will be made and description of Cane upon the Growers whereof Levies will be made.	Amount of Levy per ton of Cane Supplied.	Purposes of Levy.
		d.	
Isis Central ..	All cane consigned on the railway by Government trucks from Booyal, Junien, and Marule Sidings on the Dallarnil Railway	¼	To be used for administrative purposes by Booyal Branch of Isis Central Mill Suppliers' Committee.
Mount Bauple Central	Mount Bauple district within the boundaries of the parishes of Gundiah, Tiaro, Gootchie, Curra, and St. Mary	¼	To be used for administrative purposes by Mount Bauple Branch of Mount Bauple Mill Suppliers' Committee.
Mount Bauple Central	Yerra-Mungar district within the boundaries of the parishes of Gungaloon, Denison, Doongul, Woocoo, and Young	¼	To be used for administrative purposes by Yerra-Mungar District Branch of Mount Bauple Mill Suppliers' Committee.
Maryborough ..	That part of the Pialba district within the boundaries of the parishes of Urangan, Vernon, and Bingham, county March, which comprises lands which were heretofore assigned to the Isis Mill, but are presently assigned to the Maryborough Mill	1½	To be used for administrative purposes by the formerly Isis section of the Pialba District Branch of Maryborough Mill Suppliers' Committee.
Maryborough ..	That part of the Pialba district within the boundaries of the parishes of Vernon, Urangan, and Bingham, county March, which comprises lands which were heretofore and are presently assigned to the Maryborough Mill	¾	To be used for administrative purposes by the original Maryborough section of the Pialba District Branch of Maryborough Mill Suppliers' Committee.
Maryborough ..	Maryborough district within the boundaries of the parishes of Tinana, Maryborough, Bidwell, Elliott, Young, and Wallicbum, county March	¼	To be used for administrative purposes by Maryborough District Branch of Maryborough Mill Suppliers' Committee.
Racecourse Central	All cane hauled over Silent Grove tramline	2	To defray the costs of employing a farmers' representative of the section of growers concerned at the Racecourse Mill for the current season.
Marian Central ..	All cane loaded at Dow's Creek and Langdon Siding	¾	To be used for insurance and weighbridge maintenance by the Dow's Creek and Langdon Branch of the Marian Central Mill Suppliers' Committee.

Growers are given the opportunity of petitioning for a poll to decide whether or not the above levies shall be made. The petition must be signed by at least 100 or 50 per cent. (whichever shall be the less) of the growers who are cane suppliers within any of the areas concerned.

All petitions must reach the Secretary for Agriculture and Stock, Department of Agriculture and Stock, Brisbane, on or before the 14th August, 1939.

Full particulars of these Regulations appear in the *Government Gazette* of the 15th July, 1939, or may be obtained on application to the managers of the various sugar-mills in Queensland or to the undersigned—

R. P. M. SHORT, Acting Under Secretary,
Department of Agriculture and Stock,
Brisbane.

General Notes

Staff Changes and Appointments.

Mr. C. Schindler, inspector under the Diseases in Plants Acts, has been transferred from Stanthorpe to Warwick.

Mr. J. F. Emerick (Bundaberg) and Miss M. Whitla have been appointed assistant cane testers for the current sugar season at the Plane Creek and Invicta mills, respectively.

The following members of the Proserpine District Cane Growers' Executive have been appointed honorary protectors under "*The Fauna Protection Act of* 1937":—Messrs. G. Telford (Strathdickie), T. G. Mann (Lethebrook), E. D. Beck (Conway), R. W. Brown (Kelsey Creek), W. D. Dodd (Crystalbrook), A. Johnson (Preston), H. W. Holmes (Cannon Valley), R. T. Fahey (Bowen road, Proserpine), H. Considine (Bloomsbury), and G. Yorke (Elaroo).

Mr. A. H. Strohfeldt, Quarry street, Woolloongabba, has been appointed an inspector under the Diseases in Stock Acts, the Slaughtering Act, and the Dairy Produce Acts, Department of Agriculture and Stock, and will be stationed at the Oxley bacon factory.

Sergeant M. Forry (Clermont) has been appointed also an inspector under the Brands Acts. Constable A. J. Haines, of the same station, has been given the additional appointments of inspector under the Brands Acts and inspector under the Slaughtering Act.

Mr. P. S. Bleney, Dingo, has been appointed an honorary protector under the Fauna Protection Act in respect of the sanctuary comprising the property of J. P. Landsberg, near Dingo.

Mr. C. C. Barth, District Inspector of Stock, Townsville, has been appointed also an inspector of dairies.

Constable T. W. Weller, Hungerford, has been appointed also an inspector under the Slaughtering Act.

Mr. K. Livingstone, secretary of the Herbert River Cane Growers' Association, Ingham, has been appointed canegrowers' representative on the Macknade Local Sugar Cane Prices Board.

Mr. A. W. England, Biloela, has been appointed an honorary protector under the Fauna Protection Act.

Mr. J. M. Harvey, assistant to analysts, Agricultural Chemical Laboratory, Department of Agriculture and Stock, has been appointed analyst in the Agricultural Chemical Laboratory.

The appointment of Mr. Joseph Pedelty, loader for the Committee of Direction of Fruit Marketing at Burrum, as an inspector under the Diseases in Plants Acts has been cancelled, and Mr. John Pedelty, of Burrum, has been given a similar appointment.

Sergeant W. J. Barrett (Injune) and Constable T. R. Doyle (Mount Larcom) have been appointed also inspectors under the Brands Acts.

Egg Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts, amending the constitution of the Egg Board to provide that election of growers' representatives on the board shall be held triennially, and that members of the board shall hold office for a period of three years.

C.O.D.—Sectional Group Committees.

Regulations have been issued under "*The Fruit Marketing Organisation Acts,* 1923 *to* 1934," constituting the electorates for the purpose of electing members of the banana, pineapple, citrus, deciduous, and other fruits sectional group committees.

Wild Life Preservation.

Two sanctuaries have been declared under the Fauna Protection Act—the first, an area comprising portion of the Nogoa River, adjacent to the town of Emerald; and the second, the bed and banks of the Ross River, Townsville, from its confluence with Five-mile Creek downwards to its mouth.

Bundaberg-Childers District Quarantine Area.

A Proclamation has been issued under "*The Sugar Experiment Stations Acts, 1900 to 1938,*" amending a Proclamation issued in March last declaring the Bundaberg-Childers quarantine district to be a quarantine area, and prohibiting the removal of sugar-cane which has been Fiji and/or downy mildew disease infected within three years of the time of removal, by providing that a permit in writing must be obtained from the Director of Sugar Experiment Stations before any such removal can be effected.

Sugar-cane as Fodder.

An Order in Council has been issued under "*The Sugar Experiment Stations Acts, 1900 to 1938,*" declaring that the undermentioned varieties of sugar-cane, which are used solely as fodder for animals and not for the manufacture of cane sugar, may be grown for fodder purposes only in the mill areas as set forth hereunder:—

Variety of Sugar-cane: Uba, Co. 290, and "Improved Fodder Cane."

Mill Area: Mossman, Hambledon, Mulgrave, Babinda, Goondi, Mourilyan, South Johnstone, Tully, Macknade, Victoria, Invicta, Kalamia, Pioneer, and Inkerman.

Variety of Sugar-cane: Uba and "Improved Fodder Cane."

Mill Area: Proserpine, Farleigh, Racecourse, Pleystowe, Marian, Cattle Creek, North Eton, and Plane Creek.

Variety of Sugar-cane: 90 Stalk, "Improved Fodder Cane," and C.S.R. 1 (also known as E.G.).

Mill Area: Bingera, Fairymead, Millaquin, Qunaba, Gin Gin, Isis, Maryborough, Mount Bauple, Moreton, Eagleby, and Rocky Point.

Apiaries Act.

Section 21 of "*The Apiaries Act of 1938*" prohibits the introduction into Queensland of any bees, bee combs, beeswax, honey, or appliances unless they are accompanied by a certificate, as prescribed, from an approved officer of the Department of Agriculture in the country or State of origin certifying that the same come from a district in which foulbrood or "Isle of Wight" disease, or any disease proclaimed by the Governor in Council to be a disease, do not exist.

A Proclamation issued under the abovementioned Act declares that, in addition to the diseases abovementioned, nosema disease, bee louse, and sacbrood shall be diseases to which section 21 shall apply.

Pineapple Levy.

It has been approved by the Executive Council that the Pineapple Levy Regulation which was issued in April, 1936, and which has been extended from time to time, be further extended for twelve months from 21st August. The Regulation empowers the Committee of Direction of Fruit Marketing to make a levy, in the interests of the pineapple fruit section of the fruitgrowing industry, on all pineapples—

(*a*) Sold or delivered, whether by rail, road, or boat, to factories, at the rate of 1d. per case;

(*b*) Sold or delivered by rail to any agents or persons other than factories at the rate of 1s. 4d. per ton, with a minimum of 1d., but no levy is collected on single-case consignments;

(*c*) Sold or delivered otherwise than by rail to any Queensland railway station to any agents or persons other than factories, at the rate of ½d. per case, with a minimum of 1d.

Banana Levy.

An Order in Council has been issued under "*The Banana Industry Protection Acts, 1929 to 1937,*" providing for a levy on banana-growers to be used for the maintenance of the Banana Industry Protection Board.

The levy is similar to that issued last year, and is at the rate of 1½d. per case for bananas marketed in the case, or 2d. in the £1 or part thereof for bananas marketed in the bunch.

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of Mr. W. D. Francis, Botanist.

Mimba Seed. A Mangosteen.

S.C.T. (Townsville)—

The Mimba seed comes from the fruit of *Azadirachta indica*, a native of India and Java. The tree resembles our white cedar, to which it is closely allied. In India the bitter oil of the fruit is used as an anthelmintic (to expel worms), and is used to kill insects. This is the only record we can find of its use.

The other specimen has been determined as *Garcinia Xanthocynmus*, a mangosteen of an inferior type which is grown to a limited extent in North Queensland. It is known in the tropics as egg tree, on account of the shape of the fruit. The yellow pulp of the fruit is edible, and possesses an acid flavour. The tree is propagated by seed. It is a native of Southern India.

Trees Suitable for the Fassifern and Lockyer Districts.

W.S. (Kalbar)—

Trees suitable for your district are:—Black Bean (*Castanospermum australe*); Tulip Wood (*Harpullia pendula*); Hill's Fig (*Ficus Hillii*); Moreton Bay Fig (*Ficus macrophylla*); *Cassia Brewsteri*; Portuguese Elm (*Celtis sinensis*).

All are natives of Eastern Australia, except the Portuguese Elm, which comes from Eastern Asia. Young trees of these species could be purchased from the Botanic Gardens, Brisbane, or from the Brisbane City Council, who have a tree nursery at Hamilton. The Botanic Gardens also are under the administration of the Brisbane City Council. In each case, a charge of two shillings per tree is made.

Marshmallow.

G.B. (Cambooya)—

The specimen is Marshmallow (*Malva parviflora*), a very common weed on farms in Southern Queensland, but perhaps not so abundant as it is in other States. In New South Wales this mallow has been accused of causing shivers or staggers in stock, but, although the plant is moderately common here and very abundant on some farms, we have never heard of it causing any trouble.

Gall Weed.

K.M.F. (Tara)—

The specimen has been determined as the gall weed or twin leaf, *Zygophyllum apiculatum*. Up to the present, this plant has not shown itself to be a particularly noxious or spreading plant. However, it is left untouched by stock as a rule, and, because of this, should not be allowed to encroach any further. The best way of eradicating it is by mattocking. This plant has been accused of poisoning stock, but feeding experiments at the Animal Health Station, Yeerongpilly, failed to confirm the assumption of its poisonous properties. It is a native plant.

Jack Bean.

P.O.T. (Didcot)—

The pods come from the native jack bean (*Canavalia obtusifolia*). The seeds are reported to be poisonous to human beings, but the leaves and green stems have recently been reported as good fodder for stock. It is common on some of the sandy coastal lands, and is also found in some areas such as the Gayndah district.

A Mallow.

M.M. (Brisbane)—

The specimen from Aramac has been identified as a mallow, and is known botanically as *Malva parviflora*. This plant has been proved by experiment to be the cause of staggers or shivers in sheep. However, the peculiar symptoms characteristic of this affection are exhibited only when animals which have eaten the plant are driven or exercised. Because of this characteristic, this plant cannot be recommended as a good fodder. Nevertheless it would probably be useful when eaten in limited quantities, along with other herbage and grasses in the paddock, when the stock are not being driven.

Fish Weed.

O.L.H. (Rockhampton)—

The weed from The Caves, Rockhampton, is fish weed (*Chenopodium triangulare*). This plant belongs to the saltbush family and is eaten by stock. It is reputed to be more palatable when it is partly dry. However, it is not a suitable food plant for dairy cows, as it imparts its peculiar fishlike flavour to the milk, cream, and butter.

Prickly Jack.

J.J.S. (Allora)—

The specimen is *Emex australis*, sometimes called devil's thorn, more usually known as cape spinach or prickly jack. It is a native species, and is not known to be poisonous to stock.

Emu Apple.

N.G.W. (Tara)—

Your specimen is from the emu apple, a common western tree which is known botanically as *Owenia acidula*. This tree is a favourite shade tree, because of its ornamental appearance. It does well on brown and black loamy soils. One peculiar property of the tree is that no one has succeeded, so far, in germinating the seeds, which are extremely hard. It is not known to be poisonous to stock.

Teosinte.

N.B.S. (Brooloo)—

The seeds are from *Euchlæna mexicana*, a native of Mexico, and is known there as teosinte. It is often cultivated as a green fodder, and has been introduced into most warm countries. Horses are said to be fond of it, but it has the disadvantage of not being able to stand drought very well.

A Wild Millet. Rice Grass.

Inquirer (Brisbane)—

The specimens from the Aurukun Mission, Gulf of Carpentaria, have been determined as follows:—

(*a*) *Echinochloa Turneriana*, a wild millet. This species is widely distributed in Queensland from the Central-West to the Gulf country. It has generally been stated to be a good fodder. In view of the fact that it is closely allied to such well-known cultivated crops as Japanese millet and white panicum, this is not hard to understand.

(*b*) *Leersia hexandra*, rice grass. This is widely spread over the tropical and subtropical regions of the world in swampy or moist situations. It is usually looked upon as quite a useful fattening grass.

Feather Top Rhodes Grass.

M.F.S. (Clermont)—

The specimen has been identified as Feather Top Rhodes Grass (*Chloris virgata*). This is a native of tropical America. It is spreading in many parts of the State. It is particularly common along the railway line at Emerald. Generally, it is looked upon as an inferior grass. Although it is allied to Rhodes Grass (*Chloris gayana*), it is much less nutritious than that grass.

Rural Topics

Keeping that Spade's Depth of Top Soil.

Trials for control of erosion which are of great interest to farmers as well as graziers are being carried out on a pastoral property just below the Queensland border. On the property, contour furrows have been opened on 200 acres of grazing land. So far, the results have been very pleasing, for not only has the erosion been checked, but also the feed on the treated area is very much better than it was before the erosion trial was started.

The contour furrows prevents the loss of top soil and reduces the run-off of rain water, thus ensuring a good soaking whenever a substantial shower falls.

Two New Fodder Plants.

Here is a very interesting extract from a letter from a grazier in the Goondiwindi district. Referring to a recent visit to his property of a well-known agrostologist, he writes:—"I pointed out a very prolific shrub which I had not noticed elsewhere, and which has taken possession of a large piece of land. He was delighted to see it and named it as a legume, and pointed out the nitrate sacs on the roots—nitrate taken from the air by the plant. The plant is unknown to science . . . . . and as stock eat it readily and it is deep-rooted and drought-resistant, the grass expert thinks it may be the thing we are all looking for.

"Another plant is what we call 'honeysuckle,' which the visiting man of science had not seen before. It is growing on a sand ridge in one of my paddocks, and my visitor thinks it to be the most perfect form of natural drought insurance he has seen.

"Incidentally, he was impressed and pleased, I think, with the system of rotational grazing which I have started on the run."

Grass to Arrest Erosion.

A Russian grass, which was imported from the United States Department of Agriculture, has given good results in arresting sanddrift in the mallee in South Australia. Seed of a number of other grasses which have been found useful in checking soil erosion in the United States, and obtained originally from Russia, has also been imported for trial in Australia.

Many of the grasses are now growing in plots at Canberra, but the best of them are, unfortunately, poor seeders. Cuttings have, however, been made available in limited quantities.

Storage of Surplus Pasture.

A Southern farmer has made a regular practice of conserving the surplus grasses and herbage as silage, with satisfactory results. Last season he mowed the paddocks where possible, leaving the cut on the surface for ten days to dry out before pitting. By using a disc ploughshare to which is attached a heavy crowbar, he has devised an effective method for removing the silage from the pit for feeding to his stock. With this gadget, the material is cut into squares, which can be removed easily by hand or with a fork.

A neighbouring farmer demonstrated the practicability of natural pasture conservation some years ago, when he mowed and stacked as hay 1,400 tons of Mitchell and coolah grass, which was a great drought standby.

Here is the experience of a Riverina grazier: Pits of natural silage, which had been down for more than seven years, and had even been flooded on several occasions, opened up in nutritious condition. The silage not only sustained in good health a large flock of lambing ewes, but fattened the lambs for market under drought conditions.

Baled Straw for Silo Construction.

Here is an idea from New Zealand: The instructor in agriculture at Rangiora High School applied a plan for fodder conservation which had been tried out in America, and that was the use of baled straw for the construction of a silo for storing a fodder crop. In building his silo, he used 4 tons of baled straw in circular formation and he found the job quite simple. The enclosed space was filled to the top with the silage crop. The success or otherwise of the experiment cannot, of course, be judged until the silo is opened, but at present it appears that the silage will be of good quality. It is hoped, of course, that all loss due to the drying-out of the edges of a stack will be eliminated.

Farm Notes

SEPTEMBER.

WITH the coming of warmer weather, weeds of all kinds will be making their appearance on cultivated land and among row crops, but in the latter case they can be effectively dealt with by inter-row cultivation, and, where necessary, by the use of the hoe.

Where crops are sown on thoroughly fallowed land, the greater freedom from weed infestation is at once apparent when compared with adjacent paddocks which have merely received a hurried preparation, so that sowing clean seed on clean land may be amply rewarded in the resultant clean crops and higher returns.

Potatoes planted during July and August will now be making growth, and should be sprayed with Bordeaux mixture as a preventative of blight, particularly if cool, moist weather is experienced. Bordeaux and Burgundy mixtures are not regarded as a cure for blight, but the spray forms a satisfactory protective covering, which, if applied at intervals during growth, will effectively prevent the disease. Where land has received adequate preparation, forming a satisfactory seed-bed, and has a sufficiency of subsurface moisture to induce germination, early sowings of maize, sorghum, Sudan grass, millets, cowpeas, and pumpkins and the planting of sweet potato cuttings may be proceeded with, the farmer's chief concern being to provide a sufficiency of summer-growing fodder and grain crops both for current needs and for storage as seasonal reserves.

The spring maize crop is usually considered an uncertain proposition for grain, as the warm, moist conditions desired during the tasselling period do not always eventuate, but as excellent crops are sometimes obtained the risk is well worth while, especially as the fodder provided can always be put to good use in the event of a failure for grain.

Early-maturing Yellow Dent varieties, such as "Funk's 90-Day," will be found the best for early sowing, as they have the capacity of making the best use of available moisture.

The market prices obtainable are also a consideration, as although early sown maize is usually intended for farm use, any surplus can be disposed of at higher prices than may be obtainable for the main crop at a later date.

Sweet potato cuttings will now be obtainable, and attention is directed to this valuable crop, which will thrive over a much greater range of climatic and soil conditions than the English potato. There is scarcely a farm throughout the State which would not benefit from a patch of sweet potatoes, for either culinary or stock-feeding. They are not always profitable as a market proposition, but considerable improvement in this direction is possible if well-graded tubers of suitable cooking varieties only are marketed.

Orchard Notes

SEPTEMBER.

THE COASTAL DISTRICTS.

IN the North Coast and Gayndah districts most of the citrus crops have been harvested, with, perhaps, the exception of Valencia Lates. Orchard work this month includes pruning, cultivation, fertilizing, and spraying. Some trees may be showing signs of impaired vigour, and these will require a severe pruning, both in thinning and shortening back, removing superfluous growths and diseased and weakly woods. Healthy and vigorous orange trees will require little attention beyond the removal of crowded lateral growths.

Mandarins will need special treatment, particularly Glen Retreats and Scarlets. These varieties usually produce a profusion of branches, and as the trees mature the growths harden and the fruit-bearing shoots make short, weakly growths, which usually result in an over-production of small fruits and a weakening of the trees. This is noticeable particularly in the case of the former variety, for which the annual pruning should consist of a heavy thinning and shortening back. Mature mandarin trees require attention towards assisting them to produce new and vigorous fruit-bearing growths.

Unprofitable trees should receive attention and be prepared for top-working. They may be headed back to three or four main arms radiating from the stem and whitewashed to prevent bark scald. Such trees may be grafted or later budded when suitable growths have matured.

Before working up the soil, fertilizing should receive attention. The spring application should carry a high percentage of nitrogen.

In the warmer districts, which are free from frosts, plantings of young trees may be made. Serious consideration should be given only to the selection of commercial varieties and, having due regard for local conditions, selections may be made from the following varieties:—Washington, Navel, Joppa, Siletta, Valencia Late, Beauty of Glen Retreat, Emperor, Scarlet, Solid Scarlet, Marsh Seedless or Thompson grapefruit, and Villa Franca, Lisbon, and Genoa lemons.

Where melanose and black spot are present in orchards, preparations for control measures should be made and Bordeaux sprays applied at the correct times.

Most citrus trees would benefit considerably by the application of a strong lime-sulphur wash, 1-18.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

BLACK aphis should be attacked wherever it makes its appearance by spraying with a tobacco wash, such as black-leaf forty. If these very destructive insects are kept well under control, the young growth of flowers, leaves, wood, and fruit will have a chance to develop.

The working-over of undesirable varieties of fruit trees may be continued. The pruning of grape vines should be done during this month, delaying the work as long as it is safe to do so, as the later the vines are pruned the less chance there is of their young growth being killed by late frosts. Keep the orchards well worked and free from weeds of all kinds, as the latter not only deplete the soil of moisture, but also act as a harbourage for many serious pests, such as the Rutherglen bug.

New vineyards can be set out, and, in order to destroy any fungus spores that may be attached to the cuttings, it is a good plan to dip them in Bordeaux mixture before planting. The land for vines should be well and deeply worked, and the cutting should be planted with one eye only out of the ground and one eye at or near the surface of the ground.

In the warmer parts which are suitable for the growth of citrus fruits, the land must be kept well cultivated, and if the trees need irrigating they should be given a good soaking, to be followed by cultivation as soon as the land will carry a horse without packing.

Fruit fly should be systematically fought, as it will probably make its appearance in late citrus fruits and loquats; and if this swarm of flies is destroyed, there will be every chance of the early crops of plums, peaches, and apricots escaping without much loss.

Our Babies.

Under this heading a series of short articles, by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

THE EXPECTANT MOTHER.

HEALTHY MOTHERHOOD.

TO be the strong, healthy, happy mother of a strong, healthy, happy child should be the ambition of every woman. There are many such women living to-day, but there would be many more if every expectant mother realised the importance of keeping herself fit. In order to do this, she needs to exercise a little thought and be prepared to take a little trouble to learn how to care for her own health and, by so doing, the health of her developing infant.

Ante-natal Care.

The care given to the expectant mother is known as ante-natal care. The want of ante-natal care may lead to a mother being seriously ill and possibly an invalid after her confinement, just when health and strength are most needed for the sake of herself and her family. Most women are never healthier or happier than during pregnancy. For some it is a time of discomfort, which may be much relieved by ante-natal care.

Medical Supervision.

The wisest plan that an expectant mother can adopt is to put herself at once under the care of a doctor or to pay a visit to the nearest ante-natal clinc. There are at least two reasons why she should do this. One is for her own comfort, many of the milder ailments of the expectant mother being easily corrected or prevented by simple medical or nursing means. The other is for her safety and that of the expected child. One of the great advantages that she will derive from obtaining skilled advice in good time will be peace of mind. She will know what

she may safely do, and she will be able to do it quietly and without worry. She will feel that someone who knows is sharing her responsibility, and that she is doing what is best for her unborn infant.

An expectant mother should welcome and not avoid a thorough medical examination for the prevention of any possible dangers to herself and her expected baby. In this way she will be doing her best to ensure an easy and safe confinement, to preserve her own health and the health of her baby.

Care of the Teeth, &c.

Her teeth should be carefully examined, for no one with defective teeth can digest food satisfactorily. Apart from this, they may produce poisons which are liable to be absorbed into the body and to cause ill-health. Every woman should realise the value of having her urine tested and her blood pressure taken at regular intervals.

Diet.

It is most important that the expectant mother should eat food of the right kind.

The baby is entirely dependent on his mother for his health and nourishment during the nine months before he is born, and for some time after his birth. Therefore, she must eat the foods which will provide his requirements, and which at the same time will nourish and agree with her.

For instance, the baby from a very early stage needs lime and phosphorus to form bones and teeth. If the mother does not take food containing sufficient of these minerals, he will draw on the stores of lime and phosphorus in her bones and teeth. Even so, he may go short, and the result will be that the baby will be born with soft bones and his teeth will decay early. The mother will suffer, too, for her teeth will be liable to decay and she may complain of cramps.

The food taken by the expectant mother must (1) be sufficient in amount, (2) include minerals adequate for the nutrition of herself and her baby, (3) contain vitamins or accessory food factors in sufficient quantity.

What she needs is a balanced diet—that is, one containing suitable quantities of the various food substances.

Three meals a day are sufficient and should include—

Milk.—1½ to 2 pints. If fresh milk cannot be obtained, full-cream dried milk may be used. It may be flavoured with cocoa. Some will be taken with porridge or in junket or milk puddings.

One egg.

Cheese.—1 oz.

Butter.—1½ to 2 oz. If there is a deficiency of butter, fresh beef dripping may be used.

Meat should be taken in moderation and should include poultry, liver, and fish. Liver and fish are valuable and should be eaten once or twice a week. Tinned salmon and herring should be included.

Vegetables.—A liberal allowance of vegetables, both raw and cooked, is necessary. Raw vegetables as salads should include lettuce, tomatoes, celery, scraped carrot, finely-cut raw cabbage heart, and sweet peppers. Many of these can be grown in a small vegetable patch. Sweet pepper

is commonly known as sweet capsicum or chili, and is distinguished by its mild and pleasant flavour, in contrast to the burning, acrid flavour of the ordinary chili. The sweet pepper is easily grown, takes up very little room, and is a valuable food. Potatoes should be cooked in their jackets and eaten every day. Other wholesome vegetables are spinach, silver beet, Chinese cabbage, French beans, peas, turnips, turnip tops (as a green cooked vegetable), swede turnips, and sweet potatoes.

Post-natal Care.

It is well known that the new baby is cared for at the clinics, but it is not generally realised that the care of the mother is undertaken at the ante-natal clinics after the birth of the child. The mother should present herself to her doctor or the clinic about six weeks after her confinement, in order to be examined to see that her organs are again in their right position. So frequently simple treatment prescribed by her doctor can prevent small troubles developing into big ones which may in the end need operation to restore her to comfort and good health.

The Expectant Father.

First of all, the husband must try to realise that, because his wife is going to have a baby, she must not be treated as an invalid, but must be treated so as to fit her for the task which lies before her. This means that she will require to be properly fed, to have regular exercise, recreation, sleep, fresh air, sunshine, and freedom from worry—in fact, to have everything a normal healthy woman requires.

Women who have previously been accustomed to leading active out-of-door lives should modify their habits sufficiently to avoid over-exertion and fatigue. Those who have been accustomed to leading quiet indoor lives will find it wise to begin their open-air exercise gradually.

The husband should encourage his wife to attend the ante-natal clinic or her own doctor regularly from the earliest months, and to carry out the instructions given her. Actual treatment advised is usually very little and aims at preventing disease, discomfort and pain, and keeping her comfortable.

Until recently ante-natal clinics in connection with the Maternal and Child Welfare Service, provided by the Department of Health and Home Affairs, were held in Brisbane at the Woolloongabba Baby Clinic on Monday evenings and at the Fortitude Valley Baby Clinic on Thursday evenings. These are under the supervision of a woman doctor.

Through an extension of this service, ante-natal clinics have been established at the following centres:—

		In each month.
Caboolture ..	School of Arts ..	First and third Tuesday.
West End ..	Baby Clinic ..	Second and fourth Tuesday.
Corinda ..	Shire Hall ..	First and third Wednesday.
Yeronga ..	Progress Hall ..	Second and fourth Wednesday.
Enoggera ..	Memorial Hall ..	First and third Thursday.
Herschel street	Baby Clinic ..	Second and fourth Thursday.
Morningside ..	School of Arts ..	First and third Friday.
Nundah ..	Baby Clinic ..	Second and fourth Friday.

Hours.—2 p.m. to 4.30 p.m., with the exception of Caboolture, which is from 12.45 p.m. to 3 p.m.

At each of these clinics a sister fully qualified and having special experience in ante-natal work will be in attendance.

It is expected that mothers living in these districts will be glad to take full advantage of this service, which has been established entirely for their benefit in order to keep guard over their health and fit them for the task which lies before them.

For further information call at the ante-natal clinic or write to the Sister in Charge, Ante-natal Clinic, Alfred street, Fortitude Valley, Brisbane.

CHILDREN'S LIBRARIES—EXAMPLES IN VICTORIA.

Recent activity suggests a greatly awakened interest in the children's library movement in Victoria. By purely citizen effort libraries for children have been established in Heidelberg and Geelong, to name only two centres. In each case the library is controlled and operated by voluntary workers; in each instance also civic support is lacking. These two libraries are purely book exchange rooms, no facility being available for other library functions, such as reading circles and lectures. A commendable feature of their work, however, is the distribution of books to schools in their areas. The only Victorian children's library effectively performing its function is that at Prahran, which for over twenty years has been serving the library needs of the children of Prahran, both as regards books, guidance for children in reading, story hours, and the like. The Prahran library is fortunate in the generous support given by the local municipal council, and in the trained personnel operating it. Hawthorn and Footscray councils also give splendid support to children's libraries. The work done by these municipalities is an example in civic realisation of the cultural value of the library that could well be followed by every other municipality in the metropolitan area, and many country municipalities. As yet, however, their library conscience has not been awakened. For this the citizens are possibly largely to blame, as they, too, fail to realise the advantages of properly equipped children's libraries.

—*The Leader*, Melbourne.

TREES.

They stand to shade,
To purify:
To shelter all
Who would draw nigh.
To bid the birds
And cattle come
And rest awhile
Within their home.
I'm glad I know
Something of these:
That rare companionship
Of trees.

—(*Author unknown.*)

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF JULY IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1939 AND 1938, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	July.	No. of years' records.	July, 1939.	July, 1938.		July.	No. of years' records.	July, 1939.	July, 1938.
North Coast.	In.		In.	In.	*South Coast—contd.*	In.		In.	In.
Atherton	1·14	38	0·91	2·85	Gatton College ..	1·40	40	..	1·32
Cairns	1·58	57	0·53	2·03	Gayndah	1·48	68	2·75	2·67
Cardwell	1·39	67	0·47	2·66	Gympie	2·09	69	2·81	2·44
Cooktown ..	0·96	63	0·58	0·71	Kilkivan	1·60	60	2·00	2·35
Herberton ..	0·90	53	0·32	2·37	Maryborough ..	1·95	68	2·89	3·98
Ingham	1·69	47	1·33	4·58	Nambour	2·70	43	3·41	3·99
Innisfail	4·80	58	3·78	8·17	Nanango	1·68	57	1·81	3·39
Mossman Mill ..	1·34	26	..	2·20	Rockhampton ..	1·77	68	0·45	2·05
Townsville ..	0·66	68	0·07	3·68	Woodford ..	2·34	52	2·37	2·64
Central Coast.					*Central Highlands.*				
Ayr	0·72	52	..	3·30	Clermont ..	1·06	68	1·42	2·80
Bowen	0·94	68	0·10	2·61	Gindie	1·10	40	1·33	0·95
Charters Towers ..	0·66	57	0·26	1·91	Springsure ..	1·21	70	1·20	0·71
Mackay P.O. ..	1·69	68	0·32	3·03	*Darling Downs.*				
Mackay Sugar Experiment Station	1·50	42	0·15	2·43	Dalby	1·73	69	2·17	2·19
Proserpine ..	1·58	36	1·85	2·68	Emu Vale ..	1·59	43	1·94	1·50
St. Lawrence ..	1·38	68	0·20	1·68	Hermitage ..	1·69	33	..	0·88
South Coast.					Jimbour	1·53	51	1·48	1·91
					Miles	1·64	54	1·66	1·47
Biggenden ..	1·41	40	2·64	3·24	Stanthorpe ..	2·03	66	1·50	1·74
Bundaberg ..	1·88	56	1·47	4·29	Toowoomba ..	2·09	67	2·14	2·30
Brisbane	2·21	87	2·00	1·43	Warwick	1·83	74	1·50	1·34
Caboolture ..	2·15	52	2·80	2·04	*Maranoa.*				
Childers	1·73	44	2·18	2·98					
Crohamhurst ..	2·95	46	3·80	3·21	Bungeworgorai ..	1·37	25	..	0·45
Esk	1·97	52	2·37	2·86	Roma	1·45	65	1·64	0·34

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—JUNE, 1939.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Mean Atmospheric Pressure at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·96	79	67	82	29	60	20	405	6
Herberton	..	72	54	80	30	43	8	354	7
Rockhampton	30·06	67	53	81	30	43	22, 23	267	7
Brisbane	30·07	69	52	76	26	43	25	244	5
Darling Downs.									
Dalby	30·14	66	43	73	12, 15	33	10, 11, 24, 25	310	8
Stanthorpe	..	59	36	71	11	22	10	233	8
Toowoomba	..	62	47	68	26, 29	33	10	334	7
Mid-Interior.									
Georgetown	30·00	82	54	90	27	41	7	276	3
Longreach	30·08	73	48	84	29	39	3, 7, 23	104	3
Mitchell	30·10	67	40	77	4	30	7, 11	64	4
Western.									
Burketown	30·00	80	58	89	27	47	6	163	2
Boulia	30·10	71	49	82	28	41	3, 4, 5, 7	192	4
Thargomindah	30·06	66	46	75	25	38	6	62	4

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	August, 1939.		September, 1939.		Aug. 1939.	Sept., 1939.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	6·35	5·21	6·7	5·37	6·17	7·37
2	6·34	5·22	6·6	5·37	7·6	8·30
3	6·33	5·23	6·5	5·38	7·54	9·23
4	6·33	5·24	6·4	5·38	8·50	10·16
5	6·32	5·25	6·3	5·39	9·39	11·11
6	6·31	5·26	6·2	5·39	10·33	..
					a.m.	a.m.
7	6·31	5·26	6·0	5·40	11·28	12·5
8	6·30	5·27	5·59	5·40	a.m.	1·4
9	6·29	5·27	5·58	5·41	12·23	2·0
10	6·28	5·28	5·57	5·41	1·19	2·53
11	6·28	5·28	5·56	5·42	2·20	3·43
12	6·27	5·29	5·54	5·42	3·17	4·29
13	6·26	5·29	5·53	5·43	4·13	5·16
14	6·25	5·30	5·52	5·43	5·6	6·2
15	6·24	5·30	5·50	5·44	5·57	6·46
16	6·23	5·31	5·49	5·44	6·43	7·30
17	6·22	5·31	5·48	5·45	7·27	8·15
18	6·21	5·32	5·47	5·45	8·11	9·2
19	6·20	5·33	5·45	5·45	8·55	9·50
20	6·19	5·33	5·44	5·46	9·38	10·42
21	6·18	5·33	5·43	5·46	10·21	11·33
					p.m.	p.m.
22	6·18	5·34	5·42	5·47	11·8	12·26
23	6·17	5·34	5·41	5·47	11·58	1·17
					p.m.	
24	6·16	5·34	5·40	5·47	12·49	2·10
25	6·15	5·35	5·39	5·48	1·38	3·0
26	6·14	5·35	5·38	5·48	2·31	3·51
27	6·13	5·35	5·37	5·49	3·22	4·37
28	6·12	5·36	5·36	5·49	4·12	5·32
29	6·11	5·36	5·35	5·50	5·4	6·24
30	6·10	5·37	5·34	5·50	5·55	7·18
31	6·9	5·37			6·46	

Phases of the Moon, Occultations, &c.

8th Aug., ☾ Last Quarter 7 18 p.m.
15th „ ● New Moon 1 53 p.m.
22nd „ ☽ First Quarter 7 21 a.m.
30th „ ○ Full Moon 8 9 a.m.

Apogee, 2nd August, at 10 a.m.
Perigee, 15th August, at 6 p.m.
Apogee, 29th August, at 1 p.m.

On the 10th, Mercury will be in line between the Sun and Earth, setting 10 minutes after the Sun. Mounting higher night after night, it will attain its greatest altitude on the 28th, which, however, will be only 18 degrees above the horizon, three times the length of the Southern Cross.

Mars and the Moon, rising in daylight, will accompany each other on the 26th. Technically, a "conjunction" will occur at midnight, when Moon and planet are at the same right ascension or celestial longitude.

Mercury rises at 7.15 a.m., 40 minutes after the Sun, and sets at 6.33 p.m., 1 hour 12 minutes after it, on the 1st; on the 15th it rises at 5.47 a.m., 37 minutes before the Sun, and sets at 4.39 p.m., 31 minutes after it.

Venus rises at 6.1 a.m., 34 minutes before the Sun, and sets at 4.35 p.m., 46 minutes before it, on the 1st; on the 15th it rises at 6.7 a.m., 17 minutes before the Sun, and sets at 5.1 p.m., 29 minutes after it.

Mars rises at 4.18 p.m., and sets at 6.32 a.m., on the 1st; on the 15th it rises at 3.10 p.m., and sets at 5.16 a.m.

Jupiter rises at 9.54 p.m., and sets at 9.50 a.m., on the 1st; on the 15th it rises at 8.55 p.m., and sets at 8.55 a.m.

Saturn rises at 11.35 p.m., and sets at 10.57 a.m., on the 1st; on the 15th it rises at 10.38 p.m., and sets at 10.6 a.m.

Of our glorious morning stars, Venus and Jupiter, which for so long have filled all lovers of stars with admiration, Jupiter has become an evening star and Venus, near the Sun, is invisible. On 5th September, Venus will be in line with the Sun and Earth, setting a few minutes after our luminary, so that we can now look forward to the sudden appearance of Hesperus, perhaps in the afterglow of the Sun.

News came to hand that a third-magnitude comet was visible to the naked eye in Arizona, U.S.A., last April. The discovery was made at Oslo Observatory, Norway.

7th Sept. ☾ Last Quarter 6 24 a.m.
13th „ ● New Moon 9 22 p.m.
20th „ ☽ First Quarter 8 34 p.m.
29th „ ○ Full Moon 12 27 a.m.

Perigee, 13th September, at 4.0 a.m.
Apogee, 25th September, at 7.0 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.