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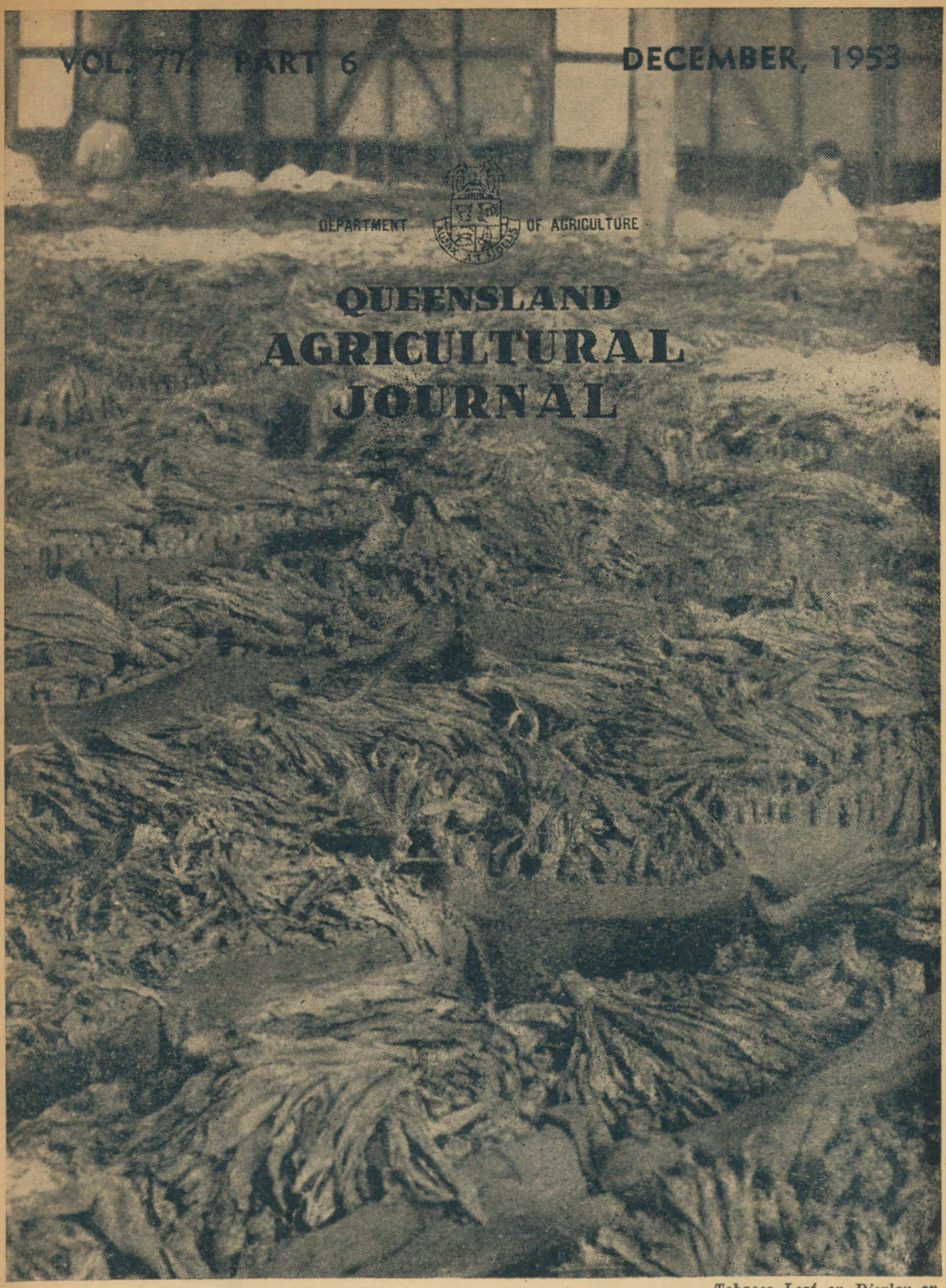

Tobacco Leaf on Display on a Brisbane Selling Floor.

LEADING FEATURES

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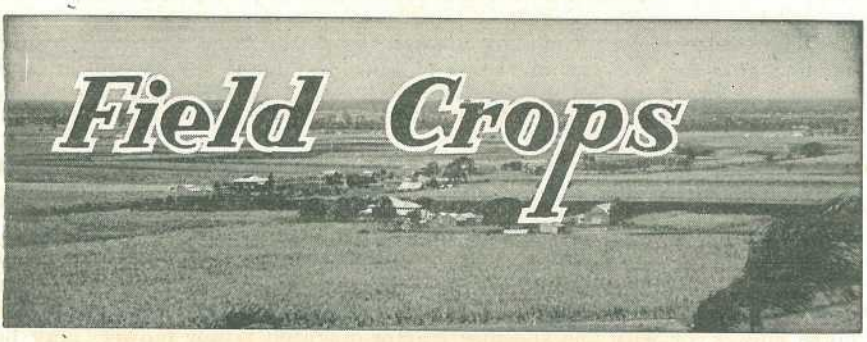


Conserving Lucerne as Hay and Silage.

J. L. GROOM (Agronomist), and E. C. DARLEY (formerly Assistant Agronomist), Agriculture Branch.

LUCERNE is the most valuable and most extensively grown leguminous fodder crop in Queensland. In recent years, however, there has been a downward trend in the acreage under lucerne. Continuation of this trend would be most undesirable from the point of view of the welfare of the stock industries of the State. The high fodder value and the fact that production can be handled mechanically from land preparation and sowing to harvest should recommend the crop to stock-owners. Increasing acreages should therefore be the objective.

HAYMAKING.

Lucerne must be cut at the correct stage and properly cured if a high-quality hay, containing a high percentage of leaf of good colour, is to be obtained. Early cutting will give a hay of slightly better quality, though curing at this stage may be more difficult. However, yields will be reduced and the life of the stand shortened by this practice.

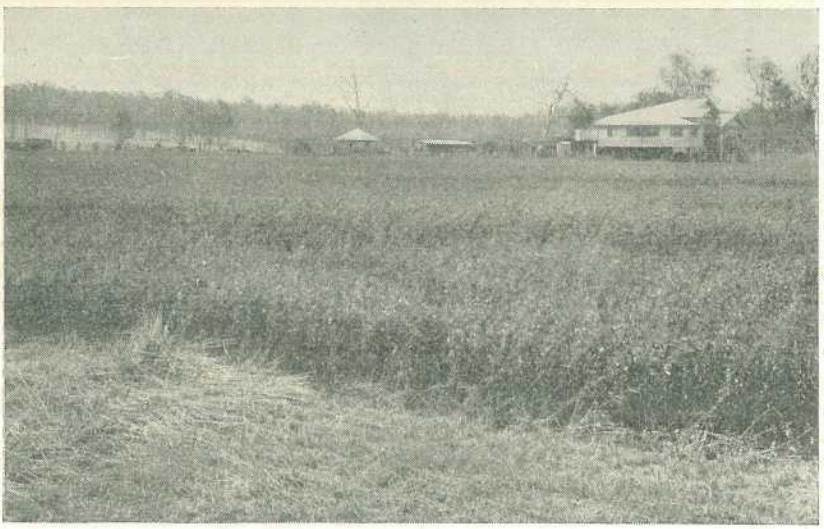


Plate 1.
A Vigorous Lucerne Stand in the Lockyer Valley.

The correct stage for cutting is when the plants are about one-tenth in bloom. In those seasons of the year when the basal shoots appear and elongate before flowering, lucerne should be cut immediately these shoots commence growth.

Delayed cutting gives inferior hay due to the increase in fibre content and to the greater loss of leaf. It may also mean partial lodging of the crop and a lower yield at the next cutting because of damage to the basal shoots.

The advent of modern machinery has reduced very considerably the time required for haymaking, but it is still desirable to be reasonably sure of a period of fine weather before commencing the job. Cutting with a horse mower, or with the speedier tractor-operated power mower, may be started as early in the day as possible, though a start should not be made until the dew has evaporated.

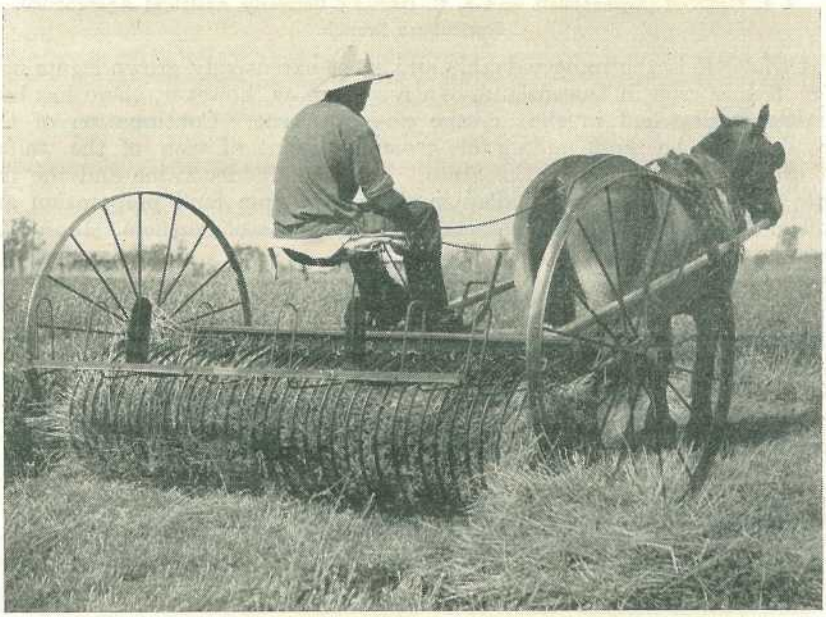


Plate 2.
Raking Lucerne.

The crop should be allowed to wilt in the swath as cut by the mower and then raked into windrows (Plates 2 and 3) for cocking. Where the hay is to be cured in the windrows without cocking, a side-delivery rake (Plate 5) should be used to construct the windrow, as the dump rake commonly used tends to compact the plant material unevenly, preventing uniform curing.

A recent development consisting of a pick-up head and roller crusher attached to the mower crushes the mown stems and evens up the rate of moisture loss from the stems and leaves, permitting much more rapid and uniform curing. In good curing weather this device often permits the cutting, curing and baling of the hay on the same day.

Where the hay is to be cocked it should be left in the windrows for a few hours after raking. The cocks should be tall and narrow and built to

shed water should rain occur (Plate 4). If the lucerne is too moist when cocked it may be necessary to loosen the cocks with a fork during the curing process. Curing takes from two to four days, according to the weather and to the condition of the hay at the time of cocking.

Plate 3.
Lucerne in Windrows.

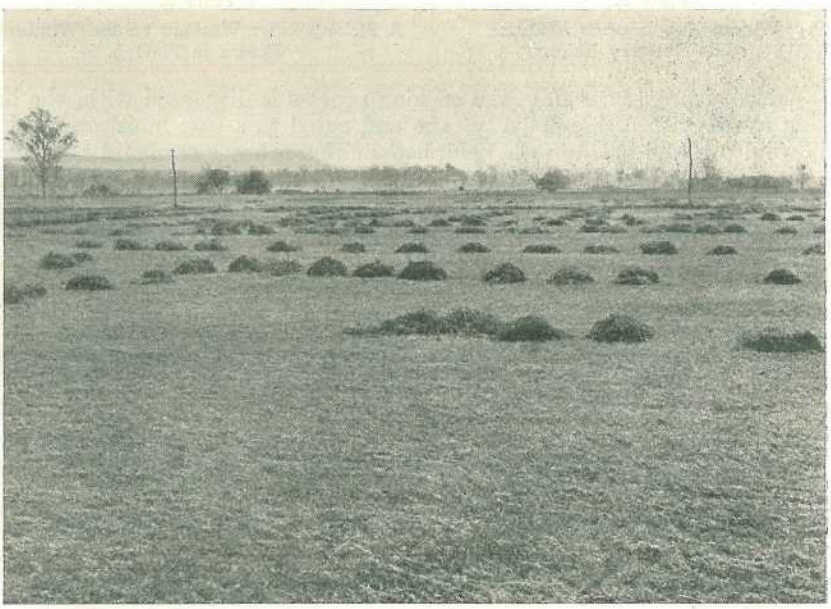


Plate 4.
Lucerne in Cocks.

With the reduction in the availability of seasonal labour, the manual labour previously required for carting and stacking is gradually being replaced by mechanical methods. However, where sweeps, loaders or balers are not available, hay may have to be forked onto trucks for cartage from the paddock. Where the hay is being stacked at the side of the paddock, a sweep or a buck-rake operated by horses or a tractor can be used to transport the hay quickly from the paddock to the stack site.

Hay is ready for stacking if no moisture can be extracted when a small handful is twisted in the hands. The bark should be difficult to peel off, and it should not feel cool to the touch.

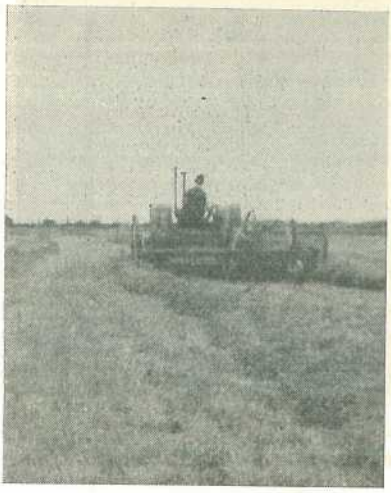


Plate 5.
Windrowing Lucerne With a Side Delivery Rake.

Plate 6.
A Pick-up Baler Working on the Windrows Shown in Plate 5.

More commonly to-day, the cocking process is dispensed with, the hay being raked with a side-delivery rake and cured to a safe moisture level in the windrow, and baled in the field, using either a hay sweep and stationary baler, or a pick-up baler (Plates 6 and 7). This method not only simplifies operations, but compresses the hay, enabling more hay to be stored in the same space and also generally resulting in less loss of leaf through the reduction in handling. The recently developed rolled-bale machine may be more efficient in retaining leaf than the rectangular bale, piston-press machines (Plate 8).

In many areas of Queensland, climatic conditions produce over-quick curing and excessive drying. This has influenced farmers to work on the crop only till noon, and again in the late afternoon. At these times the crop is generally tougher, and loss of leaf is reduced to a minimum.

Yields of lucerne hay vary considerably with growing conditions. By the use of irrigation, up to eight cuttings per year can be obtained and some cuts may yield as much as two tons of hay per acre. In the Lockyer Valley, five to six tons of hay per acre is the average yield per year from irrigated lucerne.

Up to three mowings may be obtained in good seasons from lucerne grown with rainfall only, with yields of 1½–2 tons of hay per acre per year.

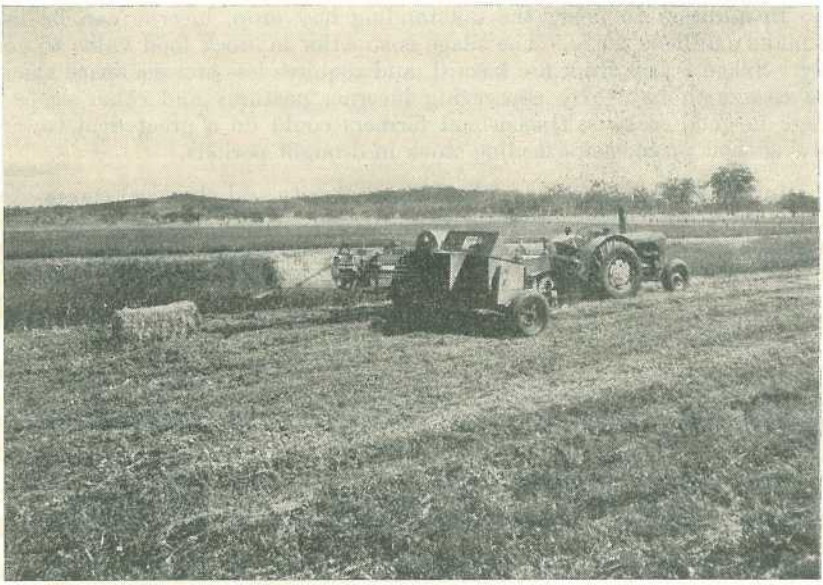


Plate 7.
An Automatic Hay Baling Machine That Produces Rectangular Bales.

Plate 8.
Portion of a Stack of Rolled Bales of Lucerne.

LUCERNE SILAGE.

In addition to being the outstanding hay crop, lucerne can be used to make excellent silage. The silage is superior in stock food value to good hay. Silage is free from fire hazard, and requires less storage space than is the case with hay. By conserving lucerne, pastures and other crops as silage in good seasons, Queensland farmers could do a great deal towards solving their problems of feeding stock in drought periods.

In the production of any silage, the maturity and chemical composition of the crop, the moisture content, the rapidity and completeness of the exclusion of air from the silo, and air temperatures all influence the type of fermentation and thus the quality of the silage. Few Queensland farmers conserve lucerne as silage, but it is considered that the practice is worthy of wider application.

Lucerne for silage should be cut at an early bloom stage (one-tenth to one-fourth in bloom). Grasses should be cut after the heads have emerged but before the plants have started to bloom. Lucerne-grass mixtures should be cut at a stage best suited to the predominant crop in the mixture.

The moisture content of the crop at the time of ensiling is most important in determining the type of fermentation, the amount of food losses, and the quality of the silage. A high moisture content causes high losses of the conserved material. When the moisture content is too low, moulding and spoilage ensue. Silos should be well drained to prevent the silage becoming waterlogged. Most crops at the stage of growth when cut for silage have moisture contents ranging from 74% to 80%, though during prolonged dry spells crop moisture may be down to 70%.

With crops of high carbohydrate but low protein content, good silage can be made at a high moisture content, provided all operations are carried out carefully. However, with high-protein crops such as lucerne, or grasses cut before heading, a high moisture level will result in poor silage with a strong offensive odour.

A mild silage of good quality can be produced from crops with a high protein content by simply wilting them in the field to a moisture content below 68%, or, when weather conditions prevent paddock wilting, by adding up to 15% dry hay as the crop goes through the silage cutter.

The best silage is made when the moisture content is between 60% and 68%.

Research in the U.S.A. has shown that preservatives may be fed through the ensilage cutter with unwilted grass or lucerne to improve the feeding quality of the resultant silage, molasses, ground wheat or maize being satisfactory for this purpose. They are most useful with crops of high moisture and high protein contents, but have little use with low-protein or low-moisture crops, often doing little more than increasing the palatability of the silage.

Molasses produces a more desirable type of fermentation and assists in raising the acidity of the silage, which is desirable also. Dry grains lower the moisture content a little, and reduce seepage from high-moisture crops.

The use of preservatives is seldom necessary when the crop has been wilted to below 68% moisture. The acceptable stage of wilting is that at which the leaves and stems have become limp, and when the stems can be readily twisted in two, the broken ends being dark and moist, but not juicy

TABLE 3.

SUGGESTED PRESERVATIVES FOR USE WITH LUCERNE AND GRASS SILAGE.

Crop for Silage.	Molasses.	Ground Corn or Wheat.	Corn and Cob Meal.
	%	%	%
Green Lucerne	4	7	9
Wilted Lucerne	3	4·5	7
Green Lucerne and Grass, Before Heading ..	4	7	9
Wilted Lucerne and Grass, Before Heading ..	3	4·5	7
Green Lucerne and Grass, After Heading ..	3	4	4
Wilted Lucerne and Grass, After Heading ..	None	None	None
Green Grasses, Before Heading	3	7	9
Wilted Grasses, Before Heading	2	4·5	4·5
Green Grasses, After Heading	2	4·5	3·3
Wilted Grasses, After Heading	None	None	None

(Extracted from "Grass", U.S.D.A. Yearbook of Agriculture, 1948.)

Grass or lucerne for silage should be cut short to give better consolidation and exclusion of air. The silage cutter should be set to cut lengths of $\frac{1}{4}$ in. to $\frac{3}{8}$ in. A long cut will prevent tight packing and lead to mould development.

High temperatures are undesirable in silage; they can be prevented by rapid filling, even spreading and good consolidation. Unwilted material should be used for the top layer of the silo to give extra weight and pressure. The top of the ensiled material should be covered with a reinforced waterproof paper, well lapped at the seams and against the walls, and covered with an effective layer of fresh green crop or other material.

LIME PAINT FOR JUTE SHACKS.

Dissolve 12 lb. of common salt and 1 lb. of powdered alum in about four gallons of hot water. Add 1 quart of molasses. Make a thick cream by thoroughly mixing 50 lb. of lime with about seven gallons of hot water. Add the clear liquid to the lime cream, stirring vigorously. The desired consistency should be somewhat thicker than that of ordinary paint, so that it wil adhere without running, when applied.

It is essential to dampen the hessian almost to the point of saturation before applying the paint.

This recipe should make sufficient paint to give a shack of 105 square yards outside wall area one good thick coat.

FORMULA FOR CEMENTING BAGS.

A composition using cement and intended for painting over bags stretched tightly and securely tacked to a framework of timber can be prepared as follows:—

Water	1¼ gallons	Salt	1 lb.
Cement	12 lb.	Alum	½ lb.
Lime	2 lb.		

Sieve the salt and lime together through a fine sieve, add this to the water and follow with the cement, stirring thoroughly. Finally add the alum. The bags should be thoroughly wet and the mixture applied without delay, using a fairly stiff brush, first on the outside then on the inside. Before the mixture sets, but after the initial wetness disappears, apply a second coat to the outside.

When this sets the bags will be quite hard and stiff, something like plaster board.

Summer-Growing Annual Hay Crops Suitable For Coastal South-Eastern Queensland.

A. HEGARTY, Adviser in Agriculture, Agriculture Branch.

THE dry spring and early summer period which normally occurs each year results in a serious decline in dairy production. When these conditions extend and reach drought proportions, losses of producing animals are not unlikely. Farmers should therefore take precautions to make adequate provision for conserving fodder in the form of hay, grain or silage reserves to tide over this period.

Plate 1.

A Good Stand of Poona Pea/White Panicum Mixture Suitable for Haymaking.

A wide range of soil types is represented in coastal south-eastern Queensland, but the area is not well endowed with land of a convenient topography suitable for lucerne growing. Where soil and drainage are favourable, lucerne is recommended; otherwise for hay purposes in these coastal districts it is essential to give attention to annual summer-growing crops.

Annual summer-growing hay crops are not costly to produce and store. Their handling is well within the scope of the average farmer and they should therefore be part of general farming practice, particularly where livestock are raised.

Hay reserves are essential in most years for the months July to October, inclusive. Each milking cow requires a supplement to pasturage of at least 20 lb. of good hay per day for maintenance and production. For a 120-day feeding period, it is thus necessary to make provision for 2,400 lb. of hay for each animal as a drought hay reserve.

On average farms in the Gympie district, for example, approximately 30 cows would be in production over the critical period of acute pasture shortage. The hay reserve required would be 30–40 tons. In drought years such as 1951, a minimum reserve of at least 1½ tons of hay per milking cow would be needed, equivalent to 45 tons for a herd of 30 cows. In the latter case, the hay from about 10 acres of a good Sudan grass crop or 20 acres of a Poona pea/white panicum mixture would be needed.

Plate 2.

A Crop of White Panicum Just Prior to Seeding.

It is appreciated that there are a number of hillside farms on which there is little if any cultivable land. Nevertheless, even a small area can produce some hay to be set aside as a drought reserve. On the other hand, there are many farmers with sufficient arable land to produce sufficient hay for adequate drought reserves.

Favourable haymaking weather is usually present during the months of December and January, and often in the autumn. Poona pea/white panicum mixtures (Plate 1), white panicum (Plates 2 and 3) or Japanese millet and other annual millets, and Sudan grass have all been proved to

be suitable haymaking crops in the coastal districts. The careful farmer who has paid attention to his fodder reserves, will find hay from these crops to be of great value during dry periods and droughts.

Soil fertility is a major factor influencing the bulk of crop which can be produced. Naturally the heaviest yields can be expected from fertile land, but even the poorer soils can be made to produce successful crops with the aid of fertilizer and judicious management.

Plate 3.
Mowing an Excellent Crop of White Panicum for Hay.

Poona Pea/White Panicum Mixture.

The mixture of Poona pea and white panicum has given excellent results and is becoming increasingly popular. A sowing mixture of 20 lb. of Poona pea and 10 lb. of white panicum per acre can be used, broadcast and harrowed in with the first early summer storm rains. Experience may show that these seeding rates can be increased profitably in some instances. In all cases it is advisable to treat the Poona pea seed, before sowing, with the appropriate bacterial inoculum, which can be obtained free of charge on application to the Department of Agriculture and Stock, Brisbane.

Observations have also shown the value of using a phosphate-rich fertilizer to stimulate growth of legumes such as Poona pea. Most successful growers now use a fertilizer mixture containing nitrogen and phosphate, or a blood, bone and superphosphate mixture at 1½–2 cwt. per acre.

The crop should be cut for hay when the seed of the white panicum is in the milky stage and the Poona pea plants are commencing to flower. Haymaking is carried out in the conventional manner, though a longer period of drying in the windrow is necessary because of the thick nature of the Poona pea stems. Usually 10–14 days is required to complete drying, depending on weather conditions.

Yields of air-dry hay vary from 20 cwt. to 35 cwt. per acre, with good crops up to 2¼ tons of hay per acre.

A well made sample of this hay is very attractive and very palatable to stock. In feeding trials, dairy cattle have milked equally well on this hay as on fair lucerne hay. Based on feeding value and production, much greater use could be made of this hay crop, particularly where lucerne cannot be grown satisfactorily. The cost of production is low and the hay has been found to keep well under stack and shed conditions.

White Panicum, Japanese Millet, and Other Millets.

Grown as a straight hay crop, white panicum and Japanese millet have been much favoured by farmers and little interest has been shown in other varieties of this valuable crop. As with the previous mixture, the plantings are usually made on soils where lucerne cannot be grown successfully.

Broadcast sowings are made at the rate of 20 lb. per acre and are usually followed with a broadcast of fertilizer. The area is then thoroughly disc harrowed. Growth is generally rapid. The Japanese millet will reach the hay stage in 6–8 weeks from planting, with white panicum being 2–3 weeks later in maturity.

Cutting for hay is made as the seed is in the milky stage. The crop is hayed and stored in the conventional manner. The yield of air-dry hay per acre varies from 20 cwt. to 30 cwt., with good crops yielding in excess of 2 tons per acre. The time required to cure the hay properly varies from 8 days to 10 days.

Due to the lower cost of seed and less time and labour involved in harvesting, straight panicum hay is cheaper to make than Poona pea/white panicum hay. However, because of the absence of a protein-rich component such as the legume Poona pea, the protein value per ton of panicum hay is lower than that of the mixture.

General observations in the field indicate that the Poona pea/white panicum mixture is the better proposition. Not only does it consistently produce a higher quality hay at only a slightly increased cost per ton, but the crop, because of the legume component, is more likely to maintain soil fertility. It is therefore a better rotation crop than white panicum alone.

Sudan Grass.

Sudan grass has proved to be a very valuable bulk fodder for hay purposes. The crop is grown widely for grazing in coastal districts, but a number of farmers also conserve a quantity of the crop as hay each year. Farmers fortunate enough to have Sudan grass hay in hand during the 1951 drought found it extremely useful as maintenance roughage. The hay is much coarser and less palatable than Poona pea/white panicum hay and the feeding value is considerably lower. The high yield of hay per acre, however, is a distinct advantage.

Sowings are commonly made in early summer at the rate of 15 lb. per acre when broadcast. In general, fertilizer is not used with this crop, as it will give fair yields under harsher conditions than most other crops. It is a comparatively long-season crop, requiring approximately 3–3½ months before reaching the hay stage. Weather conditions affect crop yields to a large degree. Very heavy yields have been recorded under favourable conditions, but not infrequently only poor yields have been obtained.

Haying is carried out along standard lines, but due to the thick stalks, constant turning in the field is necessary to maintain even drying out and prevent moulding on the bottom of the windrow.

It is estimated that it takes up to a fortnight to cure a heavy crop of Sudan grass satisfactorily. In the wetter parts of the district, this extended curing period may present a weather hazard.

Yields of air-dry hay vary from 2 tons to 3 tons per acre from the initial cut, with the possibility of an additional cut of 1–2 tons from ratoon growth.

Soil Conservation in Pineapples.

L. J. MISSINGHAM, Horticulture Branch.

SOIL erosion is a major problem in the pineapple-growing areas of south-eastern Queensland. Its seriousness is shown by declining soil productivity, gullies in cultivated ground, silted watercourses and half-buried fences.

The steep nature of much of the land utilised for the crop presents a natural erosion hazard. Evidence of soil movement may be seen in runoff water which is discoloured by suspended soil, in small rills in the field and in silt deposits on headlands and grassed waterways.

Silt deposits on headlands and elsewhere represent only a fraction of the total loss, for the smaller soil particles are carried away in rivers and creeks. Should this loss of soil continue unchecked, much land may eventually become unsuitable for crop production. In the meantime, its productivity declines and costs of crop production increase. Therefore, soil conservation is an essential feature of permanent and successful farming.

Erosion is caused by the impact of rain on the surface of the soil and by runoff water. Raindrops striking bare ground break down the soil aggregates, the amount of damage to the soil structure being influenced by the intensity of the rain, the stability of the aggregates, and the type of ground cover. The smaller particles detached from the aggregates seal the surface of the soil, and this, in turn, increases water runoff. The greater the volume and velocity of runoff water, the greater will be the soil loss. Both depend upon the amount and intensity of rainfall, the length and degree of the slope, and the mechanical obstructions to the movement of water. Erosion can therefore only be arrested by measures which maintain or improve the structure of the soil and control the movement of runoff water.

MAINTAINING SOIL STRUCTURE.

A soil with good structure consists mainly of "crumbs," which are particles of soil bound together in such a way that they are not easily separated. Such soils absorb water freely, and as the crumbs or aggregates are not so easily carried away by water as smaller particles, erosion is reduced to a minimum. The degree of aggregation varies widely from one soil type to another; many of the sands and sandy loams used for pineapple growing contain few stable aggregates and are therefore highly erodible.

Cultivation.

The stability of the soil structure depends largely on the treatment that the soil receives. Excessive cultivation tends to break down the aggregates, and fast-moving implements, particularly those with a pounding action, can do a great deal of damage. For this reason, the rotary hoe, which is sometimes used for incorporating cover crops into the soil, should never be used on trash-free ground.

Thorough land preparation prior to planting pineapples is none the less necessary. On virgin soils, cultivation should commence several months before planting, and on replant land the inter-cycle cover crop should be turned in sufficiently early to allow time for its decomposition before planting begins. The amount of pre-planting cultivation required depends upon the soil type. Very little cultivation is needed on some sandy soils, but the sandy loams which are usually selected for pineapples require two ploughings. Some heavier loams may benefit from a third ploughing.

The pineapple block may extend from one waterway to another and roadways in between can be ploughed, as they are easily reconstructed and consolidated later. Care should be exercised when ploughing to prevent the formation of depressions at finishing-off furrows, particularly when they coincide with road positions or lie adjacent to waterways. When ploughing is finished, a large diversion drain should be opened above the area, and additional surface drains across the slope must be provided. These cross-drains are particularly necessary if the land is being prepared for an autumn planting, as heavy rains are likely to occur at that time of the year.

Mouldboard ploughs are preferred to disc ploughs for land preparation, as the former are less liable to form a hard pan, which slows down the rate of water penetration into the soil.

On some shallow soils, underground drainage may be improved by deep ripping. In land which is free from roots, ripping should be done when the soil is dry so that the subsoil is shattered and large spaces remain between the clods. If the soil is wet, it may be merely compacted on the sides of the ripper tines and little improvement in drainage is obtained. Ripping is particularly useful when a shallow sandy loam surface soil grades into a loam subsoil. Best results are obtained by ripping downhill or at a slight angle to the slope.

Should the soil be too cloddy for planting, the tilth can be improved by harrowing. Harrowing may not be necessary if the final ploughing is done when the soil contains sufficient moisture to make it friable, for under such conditions implements do the least damage to the soil structure.

CONSERVATION OF ORGANIC MATTER.

In a soil erosion control programme, the conservation of organic matter is particularly important. It can be achieved by working the old pineapple plant residues into the soil at the end of the crop cycle and by cover cropping during the inter-cycle period. The destruction of old non-commercial pineapple areas by burning is an undesirable practice.

Cover Cropping.

As far as possible, land should be kept under a cover crop or crops during the inter-cycle period until preplanting cultivation begins. In land

which is so protected, rain trickles slowly through the foliage to the ground, damage from raindrop splash is eliminated, absorption is at a maximum and runoff is reduced to a minimum.

The cover crops commonly used are legumes such as cowpeas, New Zealand blue lupins and pigeon pea, and cereals such as maize, Sudan grass, sorghum, wheat, oats, millet and panicum. Cowpeas (Poona pea is the common variety), pigeon pea, maize, sorghum, Sudan grass, millet and panicum are sown in the spring or early summer, while New Zealand blue lupins, oats and wheat are planted in the autumn. Pigeon pea may be grown as either an annual or perennial cover crop.

The more important cover crops are usually sown broadcast on prepared ground at the following rates per acre :—cowpea, ½ bus. ; pigeon pea, ¼ bus. ; New Zealand blue lupins, 1 bus. ; and maize, 1 bus. After sowing the land is harrowed and contour drains are opened up at half-chain intervals down the slope to minimise erosion should rain fall before the cover crop is established.

When a legume is selected for the cover crop and it has not been grown on the land previously, the seed should be inoculated with the appropriate strain of nitrogen-fixing bacteria.

On replant land which has become very acid following the use of fertilizers, an application of agricultural lime or dolomite is usually beneficial to the cover crop. It may be applied just before the land is ploughed. On the less fertile soils, a pre-planting dressing of fertilizer should be broadcast at the following rates before the crop is sown :—*Legumes*—2½ to 3 cwt. per acre of a 5–14–2 or similar mixture ; *cereals*—2 cwt. per acre of sulphate of ammonia. As bulk is desirable in any cover crop, fertilizer is required on all but the more fertile soils.

The cover crop should be turned in when the plants are in the flowering stage. Cutaway disc harrows and a rotary hoe are suitable implements for this purpose.

When a cover crop is turned in, the soil micro-organisms which decompose the organic matter utilize the soil nitrogen and the amount available for the following pineapple crop may be temporarily reduced. If, however, the pineapple crop is fertilized within two or three weeks of planting in accordance with standard practice, nitrogen deficiency symptoms should not appear. Nitrogen deficiency in a pineapple crop is easily recognised by the pale-green colour of the leaves and can be corrected by an application of sulphate of ammonia.

Mulches.

The pineapple plant is comparatively shallow-rooted and cannot compete successfully with an inter-row cover crop or weeds. Hence, although pineapple plants established in the usual double-row spacings afford some protection to the soil, a complete protective soil cover in the established plantation can be maintained only by surface mulching.

Stubble-mulching could be applied in pineapple-growing areas. The old crop residues and cover crops would then be chopped up and left mostly on the soil surface rather than completely buried in the ground as in normal practice. A disc harrow or a rotary hoe fitted with straight blades is a suitable implement for the job.

Sawdust, bagasse and other plant residues can be used as mulching materials when they are available at little or no cost to the grower. A

4-in. cover of sawdust or 6-in. cover of bagasse applied shortly after the pineapple crop is planted soon settles down to a 2–3 in. mulch. Should it be uneconomic or impracticable to mulch the whole plantation, strip mulching in the double-row is a worthwhile practice.

In lowlying plantations, mulches must be used with discrimination, as they tend to increase the risk of frost damage in a cold winter. In such areas, a light cover of some readily decomposable material may, however, be applied in spring on recently planted crops; it should rot down before the following winter.

Plate 1.
A North Coast Pineapple Farm Planted on the Contour.

CONTOUR PLANTING.

Soil structure and fertility cannot be maintained if some of the topsoil is lost each year. Contouring practices are therefore complementary to measures which maintain the structure of the soil. Much of the land used for pineapple growing in south-eastern Queensland is steep, but soil erosion can nevertheless be largely controlled by good land management and the application of contouring practices. On moderate slopes complete erosion control can be achieved.

Broadly, the object of planting pineapples on the contour (Plate 1) in conjunction with contour drains is to make the best use of light rains and to control surface water during heavy downpours. The plant rows and contour drains which run across the slope slow down the flow of water, allowing more time for its absorption into the soil and the safe disposal of any excess on grassed waterways.

In planning a soil conservation layout for a farm, the property should be considered as a whole, so that the work done in one area will conform with that carried out at a later date in adjacent areas. The existing farm

layout may require considerable modification. However, even if the permanent waterways provided for in the plans cut through areas already under crop, it may not be necessary to construct them immediately.

Roads should be designed to give ready access to all parts of the plantation without increasing the erosion hazard. To minimise the area occupied by them, the roads should, for preference, run directly down the slope. At least one road with a reasonable gradient to the highest part of the plantation is essential, however, and if it cannot follow the crest of a ridge, it may have to be constructed across the slope. This road would be connected by subsidiary access tracks to another all-weather road along the lower side of the plantation. Where possible, roads are placed on ridges so that water may drain away from them. This is not always practicable, as access tracks in pineapple plantations must be spaced not more than four chains apart to ensure ease of harvesting. The roads are therefore placed at convenient intervals and waterways are then constructed midway between them.

Waterways.

Owing to the steep gradient of some pineapple areas, the construction and maintenance of stable water disposal channels presents the main problem in any drainage system. Natural well-grassed watercourses are utilised but it is usually necessary to construct additional grassed waterways in natural drainage lines or in selected locations. These waterways should be carefully planned and well constructed, as they are permanent; they should on no account be ploughed.

Water disposal channels should be of sufficient capacity to cope with the water that will be diverted into them and wide enough to prevent scouring. They will run more or less directly down the slope to simplify construction and ensure sufficient width and capacity. The width will depend upon the slope and the effectiveness of the protective grass cover. As a rough guide, the effective width (that is, from bank to bank) is calculated on a basis of 4–6 ft. for each acre of catchment. The bottom of the water channel should be nearly level to spread the water and reduce its scouring effect on the soil. In practice, a slight dish towards the centre with the lowest point about 12 in. below ground level is satisfactory. Without this fall from the drains to the channel, water tends to bank up behind the grass cover, and during heavy downpours may spill over and scour the edge of the cultivation.

The use of waterways as roadways is undesirable because of possible damage to the grass cover, but where such use is necessary, a pronounced depression between the wheel tracks is essential. Pneumatic-tyred vehicles do least damage to waterways and roads, but "slides" often open up gutters, which erode quickly.

A creeping perennial grass which thrives in the locality should be chosen for stabilising watercourses. Species with a vigorous underground runner system are undesirable as it is difficult to prevent them from encroaching on the pineapple plantation during the wet season. Satisfactory control, however, can be exercised over species with surface runners only, such as buffalo grass, blue couch and broad-leaved carpet grass, also known as mat grass. All weeds and grasses that germinate when the waterway is built should be allowed to remain until the permanent cover is established. Planting sods of the chosen grass in strips across the channel is the best way of establishing the permanent cover.

Contour Drains.

Contouring practices vary with the slope, the erodibility of the soil and the equipment available for drain construction. Generally, it is necessary to rely on contour banks, spaced at suitable intervals across the slope and supplemented by inter-row drains (Plate 2). If the slope extends uphill beyond the pineapple area, a large diversion drain is required to prevent surface water entering the plantation from above.

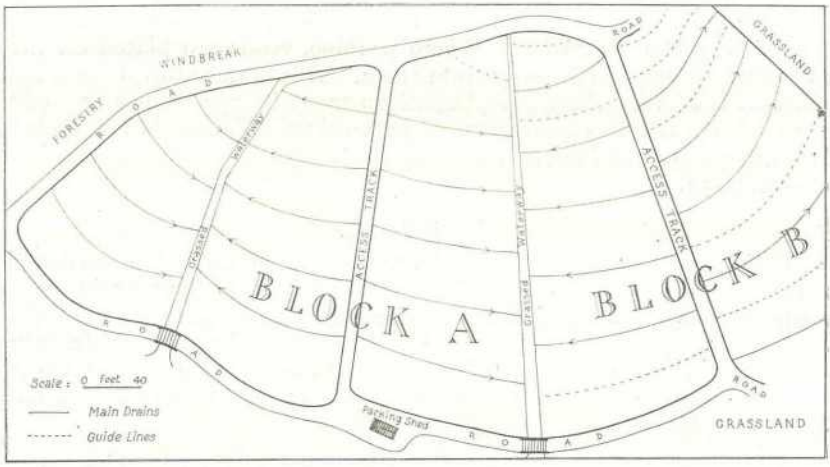


Plate 2.

Farm Plan Showing Contour Layout. In block A, survey lines are made at intervals of about 42 ft. for the main drains above the contour banks. In block B, a base line is struck for the main drain near the top and inter-row drains are marked parallel to it until the gradient deviates from the permissible limits; a second base line is then drawn for another main drain and further inter-row drains are marked out below and parallel to it. The procedure continues down the slope.

A contour bank consists of a large drain with the soil banked up on the lower side. The completed drain should be at least one foot deep and 18 in. wide at the base (Plate 3). Where a tractor can safely cross the slope, the bank may be constructed by means of a grader-ditcher or large plough and little or no hand work is necessary. However, the drains are usually opened up with the largest horse-drawn plough available and then cleaned out with a shovel. On relatively flat land, the soil may be thrown up on both sides of the drain. A tractor with suitable attachments can construct two drains and two beds parallel to the main drain and mark the position of the next drain in the one operation. On moderate slopes, the land can be cultivated between the contour banks, which are then permanent structures. On slopes with a gradient of more than 15% it is usually necessary to plough downhill across any existing contour banks, which must then be reconstructed before each planting; this involves a new survey.

The gradient of the drain above each contour bank should be sufficient to allow water to flow freely without ponding or overflowing its banks. On steep slopes, the gradient may be as much as 3%, that is, a fall of 3 ft. in 100 ft. of drain length. This fall provides a fair margin of error

for minor irregularities in the soil surface and minor deviations from the true gradient caused by side slips when the contour line is opened up with the plough. On lesser slopes, contour gradients may be reduced.

Plate 3.

Contour Banks Established at Intervals of Approximately 42 Feet Down the Slope.

On comparatively easy slopes, contour banks alone may be sufficient to control the runoff, but on steeper ground inter-row drains are necessary to prevent soil movement between the main banks; otherwise silting of the drain, topping-over and a breakdown of the system will result. The shorter the drain, the safer it is.

Inter-row drains (Plate 4) are usually constructed with a 10-in. mouldboard hillside plough and each should be capable of draining the 6 ft. space carrying a double-row of pineapples above it without topping-over. If water does break through these drains, it will be stopped at the first contour bank below and the damage will be confined to a limited area. It is usually necessary to re-open inter-row drains which have been temporarily blocked by soil drift; a 1-horse plough or some similar implement is a decided asset for this purpose. Reopening may not be necessary if the initial capacity of the inter-row drain is sufficient to cope with minor silting. Care should be taken to see that pineapple trash on replant land does not block the drain during the first heavy downpour.

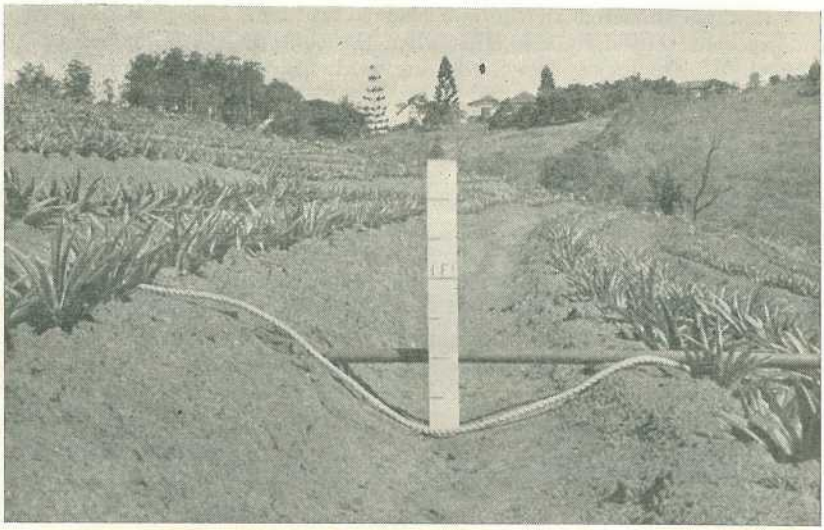


Plate 4.

Inter-row Drains in Contour-Planted Pineapples. These drains are established between adjacent paired rows.

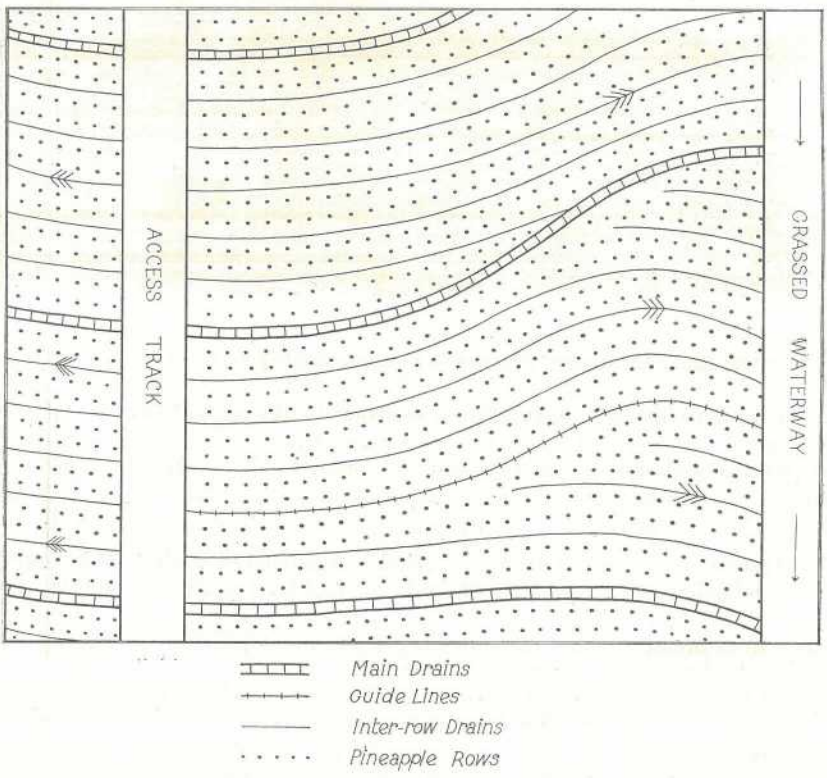


Plate 5.

Contour Layout A. Contour banks are at approximately 42 ft. intervals. The inter-row drains are parallel to one of the main drains.

Layout.

Several simple and inexpensive levelling devices may be used for marking out contours. A level of some kind is essential. The best for use in pineapple areas, where short-distance readings are taken, is possibly the Cowley Automatic Level; it can be easily set up and the work in progress is easily checked. Home-made apparatus incorporating a spirit level and boning rods, staff or an A-frame can also be used effectively.

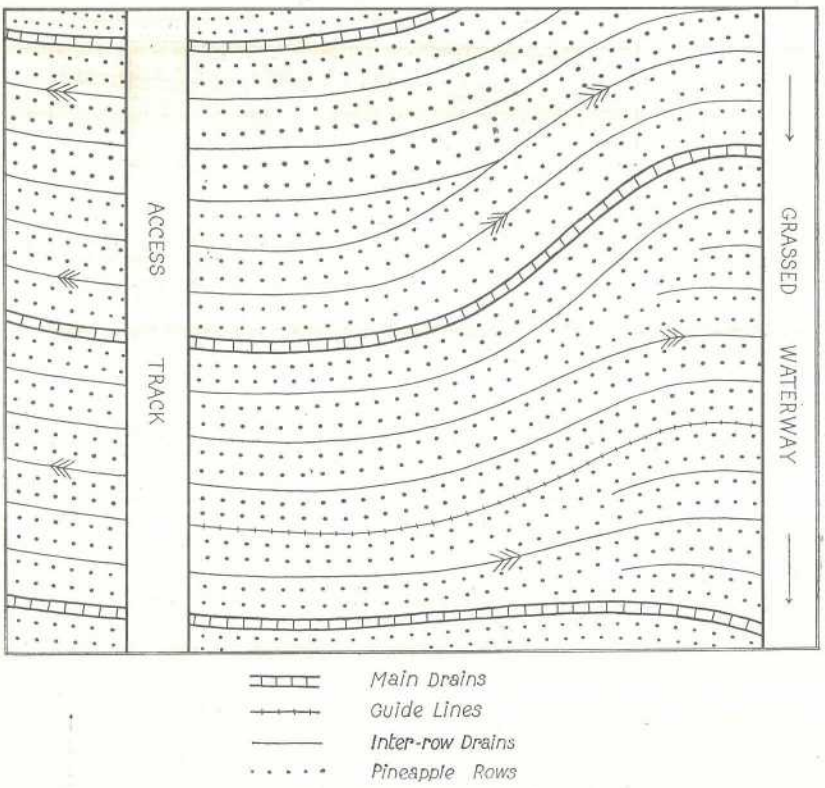


Plate 6.

Contour Layout B. Contour banks are at approximately 42 ft. intervals. The inter-row drains run parallel to both the upper and the lower main drains.

Perhaps the simplest method (Plate 5) of laying out the area is to strike off contour lines from the access track at intervals of about 42 ft. (or equivalent multiples of the row spacing to be used) for the main drains above the contour banks. Staff readings are usually taken and marking pegs are placed at intervals of 20 ft. or 25 ft. along the survey line; they may be much closer where sharp curves occur in the contour. Inter-row drains are marked out parallel to one of the main drains, so that where the space between main drains is greatest, the short spur rows used to fill it will all be adjacent to a main drain and have a slightly higher gradient. Should the inter-row drains be marked out parallel to the wrong guide line, the gradient of the spur rows will decrease and may become unsafe. The rule to follow is: When the space between surveyed lines for main drains is greater at the outlet than at the access track, inter-row drains are marked parallel to

the lower line ; but when the space between main drains is less at the outlet than at the access track, inter-row drains are marked parallel to the higher line (Plate 5).

The procedure is sometimes varied, the main drains being surveyed and the inter-row drains marked parallel to them (that is, up the slope from the lower main drain and down the slope from the upper). The open spaces between converging rows are filled in by spur or point rows (Plate 6).

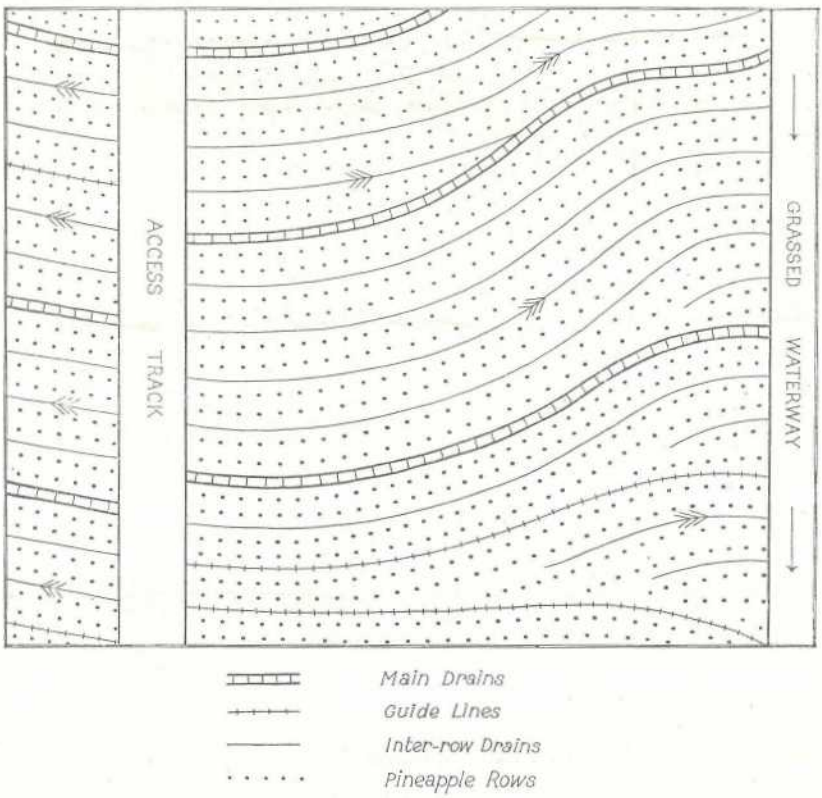


Plate 7.

Contour Layout C. Contour bank constructed near the top. The inter-row drains are marked parallel to it until the gradient exceeds permissible limits; a new base line is then struck for either another main drain or another inter-row drain as may be necessary.

In these methods of contouring, the drains on one block are in line with those of the adjacent block on the other side of a road. They can therefore be ploughed in together by crossing the access track without a break. The furrows crossing the track are later filled in but shallow depressions are left in the main drain positions to divert water from the road.

Another method (Plate 7) of marking out a pineapple area is to proceed down the slope from a base line (that is, surveyed graded contour for a main drain) near the top of the area, and marking out inter-row drains parallel to it until either the maximum or minimum permissible gradient is reached. A new base line is then surveyed and the same procedure followed. This

method gives a reasonably accurate contour layout as all drains are kept within the required gradient limits. However, on irregular land it involves the construction of more main drains than other methods.

Whatever method of contour layout is used, minor variations in spacing between the contours or sharp bends in contour lines may be smoothed out by variations in the spacing and gradient of inter-row drains. These variations must be used with discrimination, for if they exceed certain limits there is a risk of topping-over during heavy rain. Minor irregularities in the ground can also be troublesome and it is best to level off the surface as much as possible before commencing contour work.

All drains should be constructed before planting commences. They may then be used as guides in planting and no planting line is necessary. A double row of pineapples is planted on the large (lower) bank of the main drains. The other double rows should be established nearer the drain above than the drain below, so that minor soil drift will not expose the roots of plants in the lower row.

Cultural Problems in Contoured Pineapples.

The application of contouring principles to the pineapple crop may present some cultural problems on steep slopes and on poorly drained soils. Sub-surface tile drains may be required in shallow soils which are subject to waterlogging, but not in the deep open-textured soils normally selected for the pineapple crop.

Bad drainage can be offset by constructing raised beds on the contour for each double row of plants. However, if the beds are placed directly down the slope, as is sometimes done, the runoff is concentrated in the furrows between them and the erosive force of water is increased. In the long run, therefore, this latter practice defeats its object; as the land is washed away it becomes shallower and less suitable for cropping at each successive planting.

If the inter-row drains are fouled during chipping operations, recleaning is necessary. However, with the general use of weedicides such as PCP, hand-pulling is usually sufficient to control the surviving weeds. Should it become necessary to use a hoe for the destruction of weeds, a chip hoe is preferable to a push hoe, and the soil should be drawn towards the plants.

Some of the fertilizer placed on the lower side of the plants may be washed away if the crop is planted on the contour. To offset this, the fertilizer can be distributed on the higher side of plants until the inter-row space is overgrown. After that, base leaf applications may be made with less risk of loss.

These minor disadvantages of contour planting in the pineapple crop are also characteristic of plantations planted in straight rows across the slope—a common practice in some areas. In such plantations, the crop may be more easily handled but erosion still occurs.

The Honey Flora of South-Eastern Queensland.

S. T. BLAKE (Botanist) and C. ROFF (Adviser in Apiculture), Science Branch.

(*Continued from page 257 of the November issue.*)

Banksia or Honeysuckle Oak.

Botanical Name.—*Banksia integrifolia* Cav.

Other Common Names.—Bottle-brush, grey or white honeysuckle.

Distinguishing Characters.—A small tree with leaves very white underneath, and thick dense spikes of yellow flowers (Plates 56–58).

Description.—This is a small bushy or sometimes straggling tree usually less than 30 ft. in height, with a light-grey, roughened bark. The leaves are broadest a little below the tip and taper to the short stalks, and are quite white underneath except for the yellowish veins; they measure about 2½–4 in. long and about ½–¾ in. wide. The yellow flowers are borne in dense spikes about 2–5 in. long and 2–2½ in wide; each flower has 4 very narrow spreading "petals," each with an anther seated in a little depression near the end, and a long, curved style.

Distribution.—Chiefly on sandy soil in coastal districts; occasionally met with inland. The species is fairly common in eastern Australia.

Usual Flowering Time.—April to May.

Colour of Honey.—Dark amber.

Importance as Source of Honey.—Medium.

Importance as Source of Pollen.—Medium.

General Remarks.—This tree provides ample nectar and pollen. It flowers often in association with paper-barked tea-trees, and the properties of the honey are usually masked in the natural blend obtained by colonies working these two species. In good banksia locations colonies breed heavily, and it is advantageous for migratory beekeepers to select coastal tea-tree sites that have banksia within flight range.

A pure sample of this honey has weak density and a strong flavour typical of the *Banksia* group. It candies with a coarse hard grain and is difficult to reliquify. Such honey sells slowly on the market unless it is the minor honey of a blend.

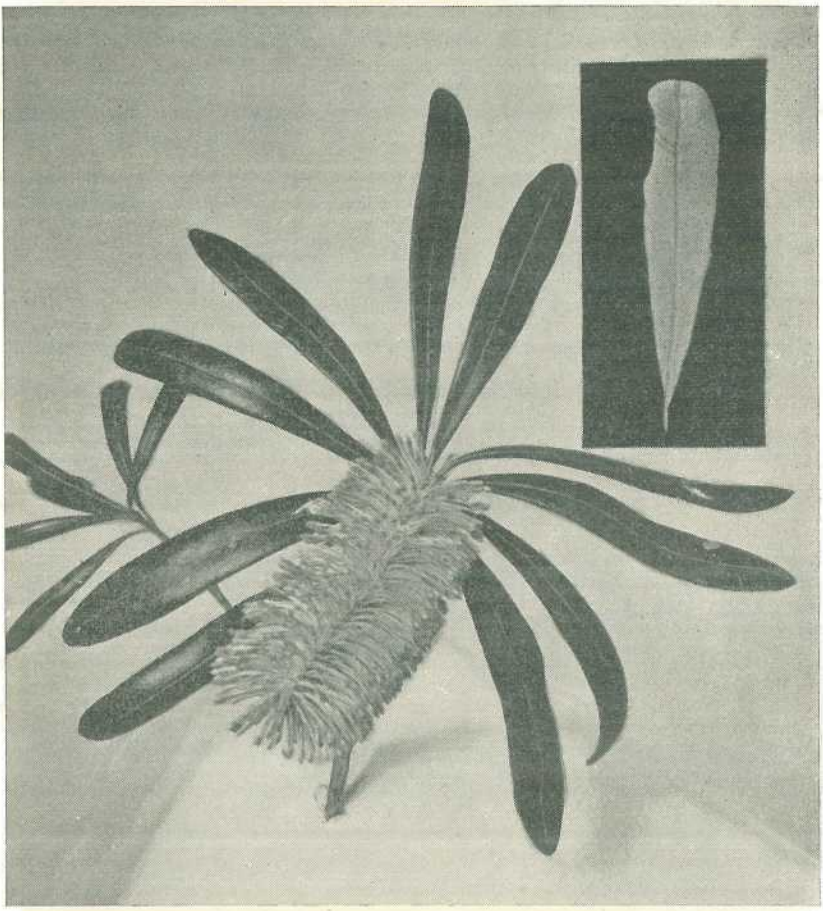


Plate 56.

Banksia (Banksia integrifolia). Leaves with spike of flower buds. The leaf is white underneath, as shown in the inset.

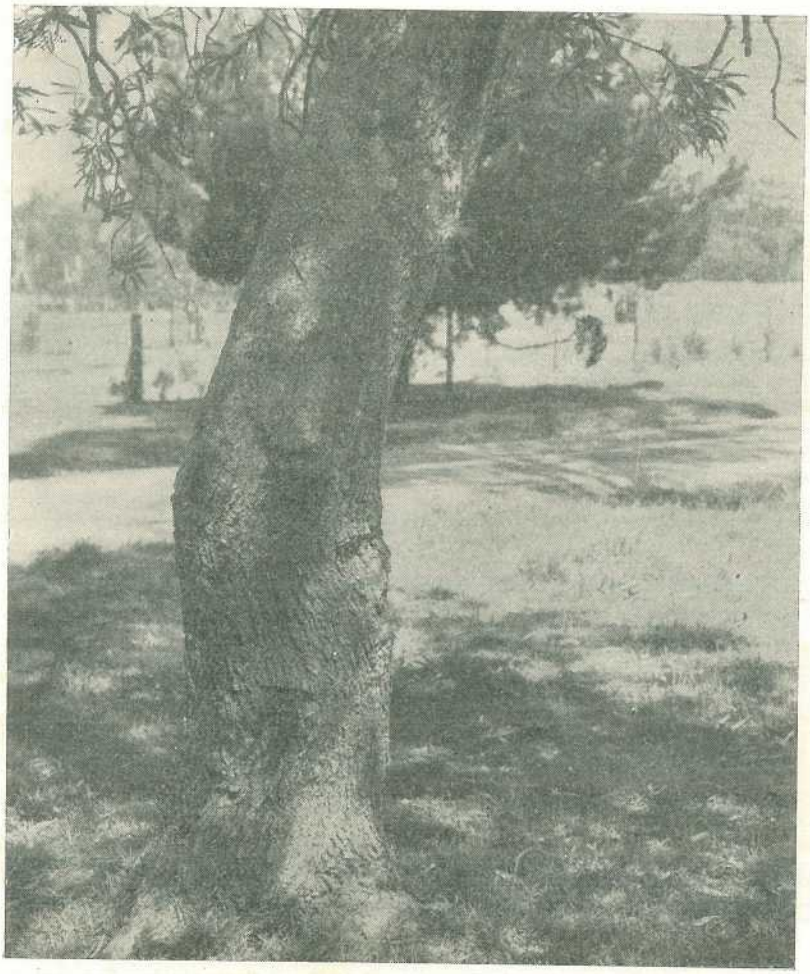


Plate 57.

Banksia (Banksia integrifolia). Portion of trunk.

Plate 58.

Banksia (Banksia integrifolia). Deception Bay.

Narrow-leaved Ironbark.

Botanical Name.—*Eucalyptus crebra* F. Muell.; sometimes called *Eucalyptus racemosa* Cav.

Distinguishing Features.—This is an ironbark (Plates 59–60) with very narrow leaves, often resembling the grey ironbark (see under that species).

Description.—A tree up to 100 ft. high, with hard, thick, very deeply furrowed, very dark grey to black bark, and a fairly compact dull, often greyish crown of slender twigs and drooping leaves. The leaves are 7 or more times longer than wide, about 3–6 in. long and $\frac{1}{3}$–$\frac{3}{4}$ in. wide. The flowers are produced in bunches at and near the ends of the twigs, and are about $\frac{1}{2}$ in. wide when fully out; the buds have a blunt or pointed lid from half as long to about as long as the rest of the bud. The seed-capsules are roughly cup-shaped, about $\frac{1}{5}$ in. long and wide.

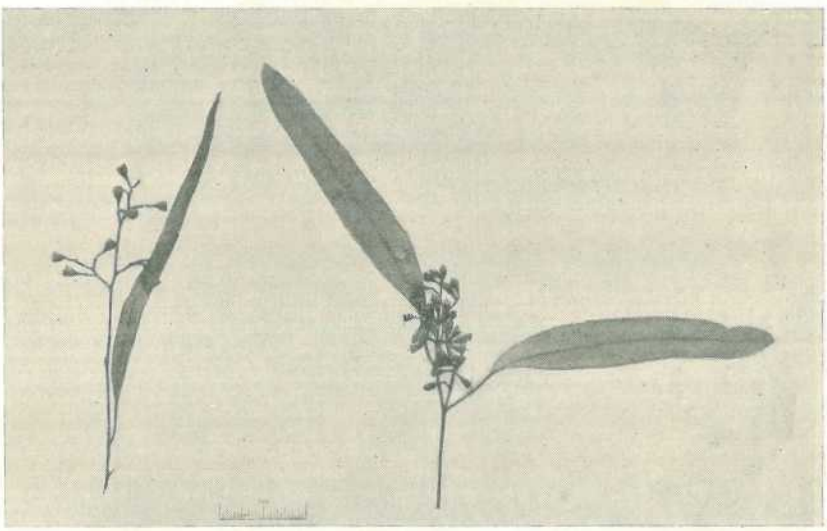


Plate 59.

Narrow-leaved Ironbark (Eucalyptus crebra). Left, branchlet with leaf and seed-capsules. Right, branchlet with leaves and flower buds.

Distribution.—Throughout south-eastern Queensland, but not common near the coast. It often forms stands in stony or sandy soil, especially in the districts of Burnett and Darling Downs. The species is widely spread in eastern Queensland and eastern New South Wales.

Usual Flowering Time.—August to December.

Colour of Honey.—Light amber.

Importance as Source of Honey.—Minor to major.

Importance as Source of Pollen.—Major.

General Remarks.—This tree is an erratic producer of nectar, yielding good harvests in only one of four or five years. On the Darling Downs, however, up to 160 lb. of narrow-leaved ironbark honey may be harvested by each colony when conditions are favourable. Such good nectar flows

usually occur when rain falls shortly before flowering. In the Maryborough district this species has a good reputation, whereas in other coastal areas its status is that of a minor producer.

Narrow-leaved ironbark is one of the few ironbarks which produce pollen in quantity, and this feature enhances its value to the beekeeper.

This choice honey is dense, has excellent colour and a mild sweet flavour ; it granulates slowly with a whitish coarse grain.

Plate 60.

Narrow-leaved Ironbark (Eucalyptus crebra). Chinchilla district.

Blackbutt.

Botanical Name.—*Eucalyptus pilularis* Sm.

Other Common Name.—Grey blackbutt.

Distinguishing Features.—A tall tree with grey or dark grey bark rather like that of a stringybark on the lower or greater part of the trunk, smooth and whitish elsewhere, and with nearly rounded, woody-looking seed-capsules about ½ in. long and wide (Plates 61–62).

Plate 61.

Blackbutt (Eucalyptus pilularis). Left, branchlet with seed-capsules. Right, branchlet with leaves and flower buds.

Description.—This is a tree up to 150 ft. or more high with a compact crown. The bark on the lower or greater part of the trunk is rough and fibrous, somewhat like that of some stringybarks, naturally grey or grey-brown but often black as the result of fires ; on the rest of the tree the bark is smooth, whitish, and often marked with scribbly lines like that of the scribbly gum. The leaves are glossy green on both sides, tapering upwards to a point, about 5–8 times as long as wide, usually 4–5 in. long. The flowers are borne in small bunches among the leaves and are about ½ in. wide when

fully out; the lid is about as long as the rest of the bud and often has a distinct point. The seed-capsules are on short stalks, nearly rounded, with thick walls, and $\frac{1}{3}$–$\frac{1}{2}$ in. long and wide.

Distribution.—Chiefly in the higher rainfall areas of the Moreton and Wide Bay districts, sometimes forming nearly pure stands. It also occurs in eastern New South Wales and eastern Victoria.

Usual Flowering Time.—February to April.

Colour of Honey.—Medium amber.

Importance as Source of Honey.—Minor.

Importance as Source of Pollen.—Medium.

Plate 62.

Blackbutt (Eucalyptus pilularis). Clump at Caloundra.

General Remarks.—Blackbutt is not a good honey tree and beekeepers do not depend on it for honey production. Occasionally, however, it will yield useful but moderate quantities of nectar, although as many as seven or eight years may separate such flows. On such occasions the harvest may often be quickly and adversely affected by apparently small changes in the weather. A fair supply of pollen is obtained regularly from blackbutt and this stimulates breeding.

This second-grade honey has a strong sharp flavour and poor density. As it does not candy readily it is quite useful for blending with choicer honeys.

Narrow-leaved Grey Gum.

Botanical Name.—Eucalyptus seeana Maiden.

Other Common Names.—Narrow-leaved cabbage gum, forest red gum, blue gum, grass gum.

Distinguishing Features.—This is usually a crooked tree with smooth greyish white blotchy bark, pendulous twigs, and pendulous, narrow dull green leaves, very long lids to the buds and long pointed valves to the seed-capsules. It resembles the blue gum in bark, foliage and the long lids of the buds, but it is often a crooked tree, the leaves are narrower, especially on young trees and suckers, and the valves of the seed-capsule are erect, not curved inwards (Plates 63–64).

Plate 63.

Narrow-leaved Grey Gum (Eucalyptus seeana). Branchlets with leaves, flower buds and seed-capsules.

Description.—Usually a crooked tree and rarely higher than 50 ft. The bark is smooth, greyish white, usually with darker patches. The crown is somewhat sparse with long, drooping twigs and leaves. The leaves are very narrow (7 or more times longer than wide), mostly 4–7 in. long and

mostly less than 1 in. wide, flexible. The flowers are borne in clusters among the leaves and are about $\frac{3}{4}$ in. wide when fully out; the lid is at least twice as long as the rest of the bud, narrow and pointed. The seed-capsules are more or less cup-shaped with 3 or 4 erect, sharp-pointed valves about $\frac{1}{4}$ in. long and wide.

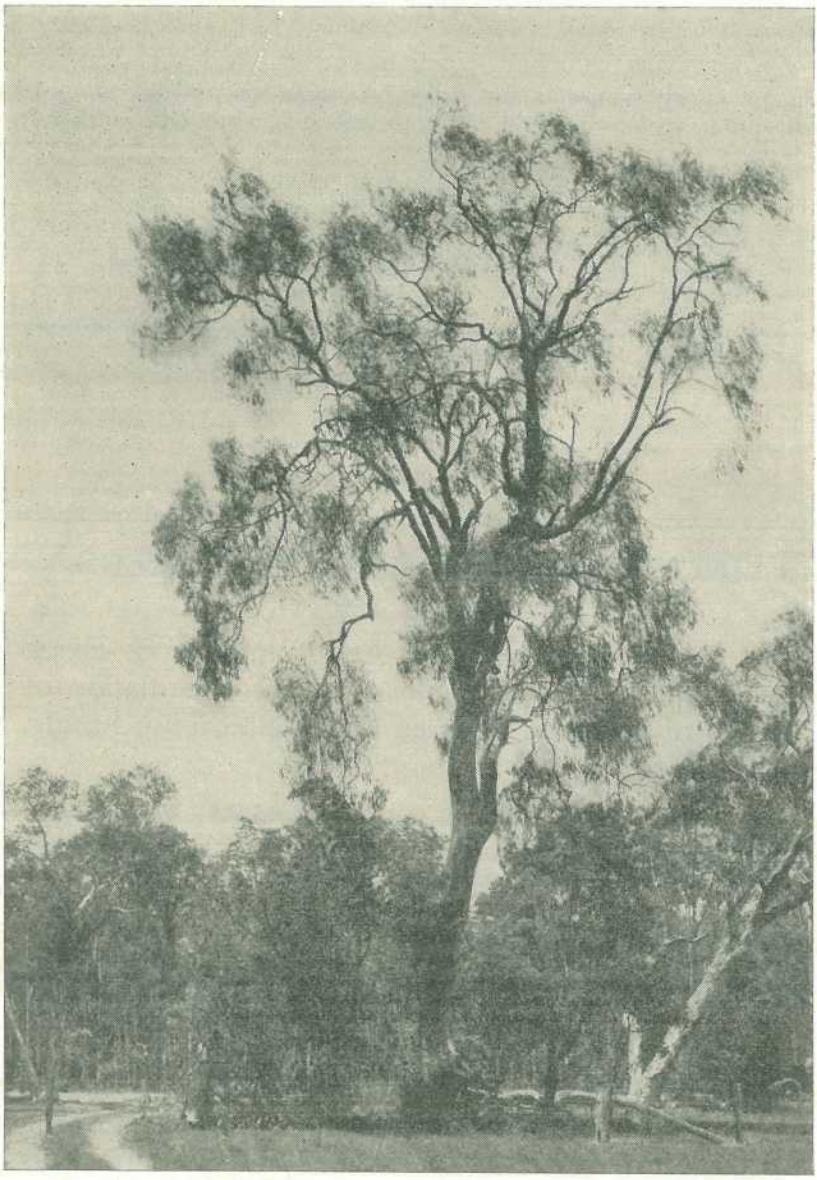


Plate 64.

Narrow-leaved Grey Gum (Eucalyptus seeana). Deception Bay.

Distribution.—Moreton, Wide Bay and eastern parts of the Darling Downs Districts, chiefly on ill-drained sandy soil in mixed forest country. It is also in north-eastern New South Wales.

Usual Flowering Time.—September to December.

Colour of Honey.—Clear medium amber.

Importance as Source of Honey.—Medium.

Importance as Source of Pollen.—Medium.

General Remarks.—This species flowers heavily and produces an abundant supply of nectar and pollen. As some trees bloom more or less every spring, colonies are stimulated to build up in strength quickly, thus ensuring that the subsequently more important nectar flows of other species are worked fully. During a favourable season colonies may gather a surplus of narrow-leaved grey gum honey. This honey is marketed usually as " blue gum " honey, few beekeepers realising that it is slightly different from that obtained from the blue gum (*Eucalyptus tereticornis*), which often flowers at the same time.

Narrow-leaved grey gum honey has a pleasant aromatic flavour and moderate density. Its granulating properties are not known.

[TO BE CONTINUED.]

Good Yards For Cattle Drafting.

P. ROUND, Senior Adviser, Cattle Husbandry Branch.

MANY graziers have devoted a lot of thought and ingenuity to devising suitable yards for cattle, and many good yards are to be found, but the yards on some properties leave much to be desired.

The accompanying ground plan illustrates a yard designed and built by Mr. Geo. L. Smith, of "Lucona Downs," Wallumbilla, which is suitable for the drafting of up to 400 mixed cattle by one man without assistance.

The area covered by these yards is 100 ft. square, but the size and layout could be enlarged or modified to suit larger or smaller herds.

It will be noticed that for convenience of drafting many of the gates swing both ways, and where they are in adjacent corners they can overlap to divert cattle into the various yards.

The gates of the pound yard are operated from the raised platform by overhead swords, and this enables cattle to be drafted four ways from the pound without the operator leaving his position on the platform.

The diameter of the pound yard is 16 ft. and the centre 3 ft. inside the main fence line.

Holding paddocks abut onto the yards, providing wing fences onto the ingress and egress gates.

Yard fences are 5 ft. 6 in. high, with three rails and cap. Panels are 10 ft. from centre to centre.

The gate in the side of the calf crush swings inside to force the calf into the branding machine, and a light iron garden gate is hung from the yard fence in front of the branding machine. This can be pulled across if the calf has a tendency to bolt through the machine, and is retracted automatically by a spring.

It is felt that the ideas incorporated in this plan could be used to advantage in many other yards.

Mr. Smith has not found a sword bail necessary, but this could be inserted in the crush without difficulty; it is found very useful where operations such as dehorning are practised.

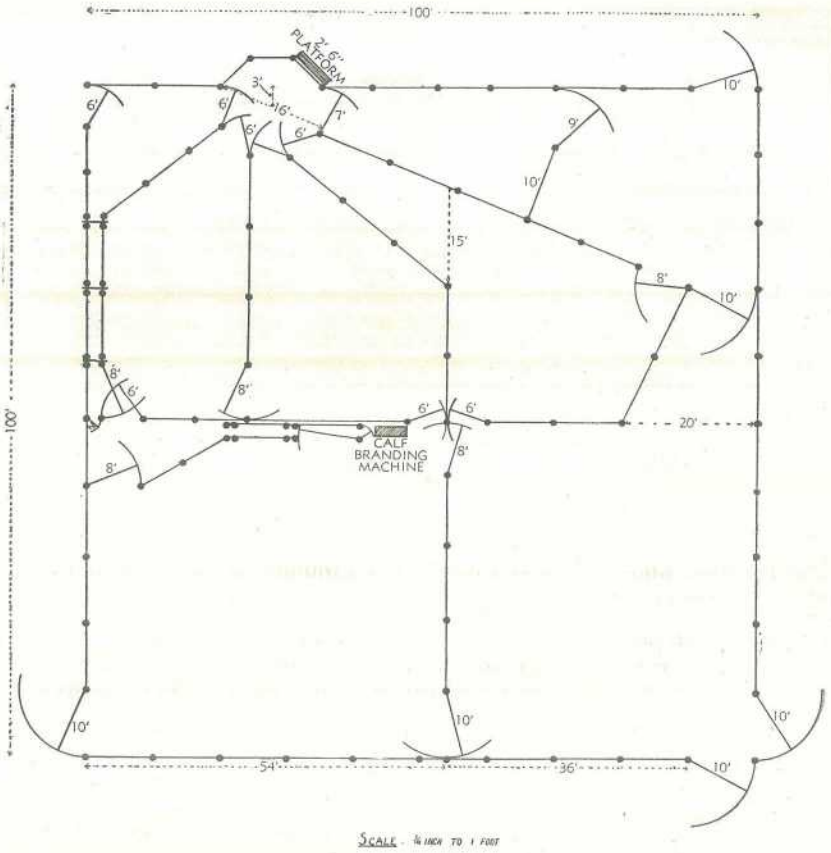


Plate 1.

Plan of Drafting Yards on "Lucona Downs," Wallumbilla.

A Crush Bail for Dairy Cows.

P. ROUND, Senior Adviser, Cattle Husbandry Branch.

WHEN operations such as dehorning, bleeding, inoculation, branding and drenching have to be performed on dairy cows, the need for a crush in which to secure the animal becomes obvious.

A cow should never be upset when in the milking bail, and when operations other than milking have to be performed they should never be carried out in the milking bail.

A special crush bail should be built. It should be so constructed that cows can be easily driven into it and safely secured without danger or distress to either man or beast.

The accompanying illustrations are of a crush bail that has been designed for use in conjunction with the combined dairy shed. It is simple and

effective, and being constructed off the exit race from the bails obviates the necessity of building a forcing yard. The cows walk through the bails in the ordinary way, and are diverted into the crush by closing a gate at the end of the exit lane.

Where no exit lane is provided on the milking shed, the crush can be constructed in a suitable corner of the yard, but a forcing yard is then required.

Materials Required for Construction of Crush.

SAWN TIMBER.

6″ x 1″	150 lin. ft.	= 75 sup. ft.
5″ x 2″	32 (4/8) lin. ft.	= 27 sup. ft.
6″ x 3″	6 (1/6) lin. ft.	= 9 sup. ft.
5″ x 3″	6 (1/6) lin. ft.	= 7 sup. ft.
4″ x 2″	16 (4/4) lin. ft.	= 12 sup. ft.

POSTS.

5 posts ..	10″ x 9′
1 post ..	12″ x 9′

BOLTS.

¾″ x 4″	12
⅜″ x 3½″	40
½″ x 10½″	9
½″ x 7½″	5
½″ x 4″	1

HINGES AND GUDGEONS.

1 pair ..	2′ 6″
1 pair ..	1′ 8″

FLAT IRON.

Two lengths (bored).

Materials for Gate at End of Race.

SAWN TIMBER.

6″ x 1″ .. .. 50 lin. ft. = 25 sup. ft.

BOLTS.

⅜″ x 4″	6
⅜″ x 3½″	9

HINGES AND GUDGEONS.

1 pair .. .. 1′ 8″

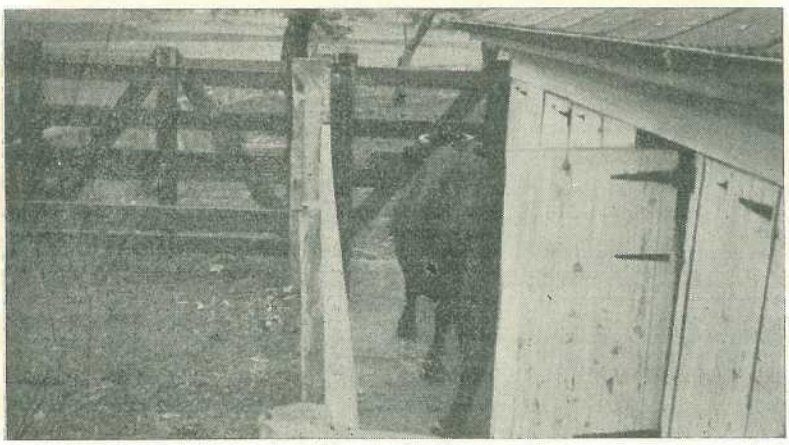


Plate 1.

Cow Leaving the Bails and Approaching the Crush.

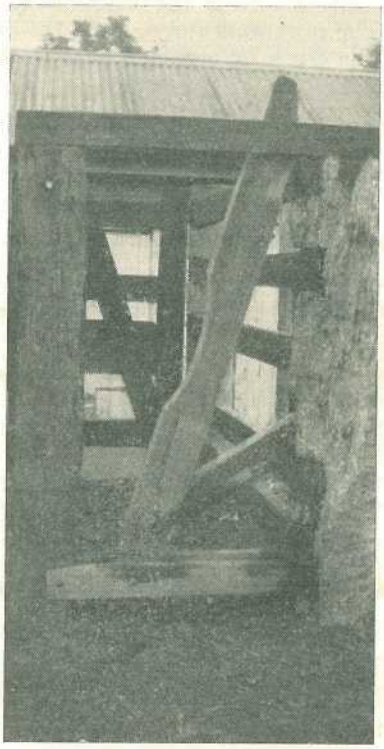


Plate 2.
Front of the Crush, with the Bail Open.

Plate 3.
Cow Being Bled in the Crush.

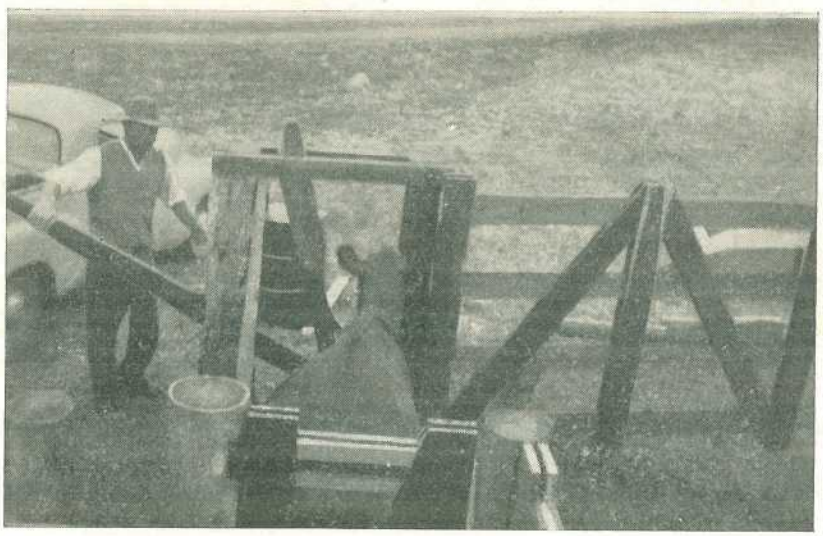


Plate 4.
Cow Being Released from the Crush.

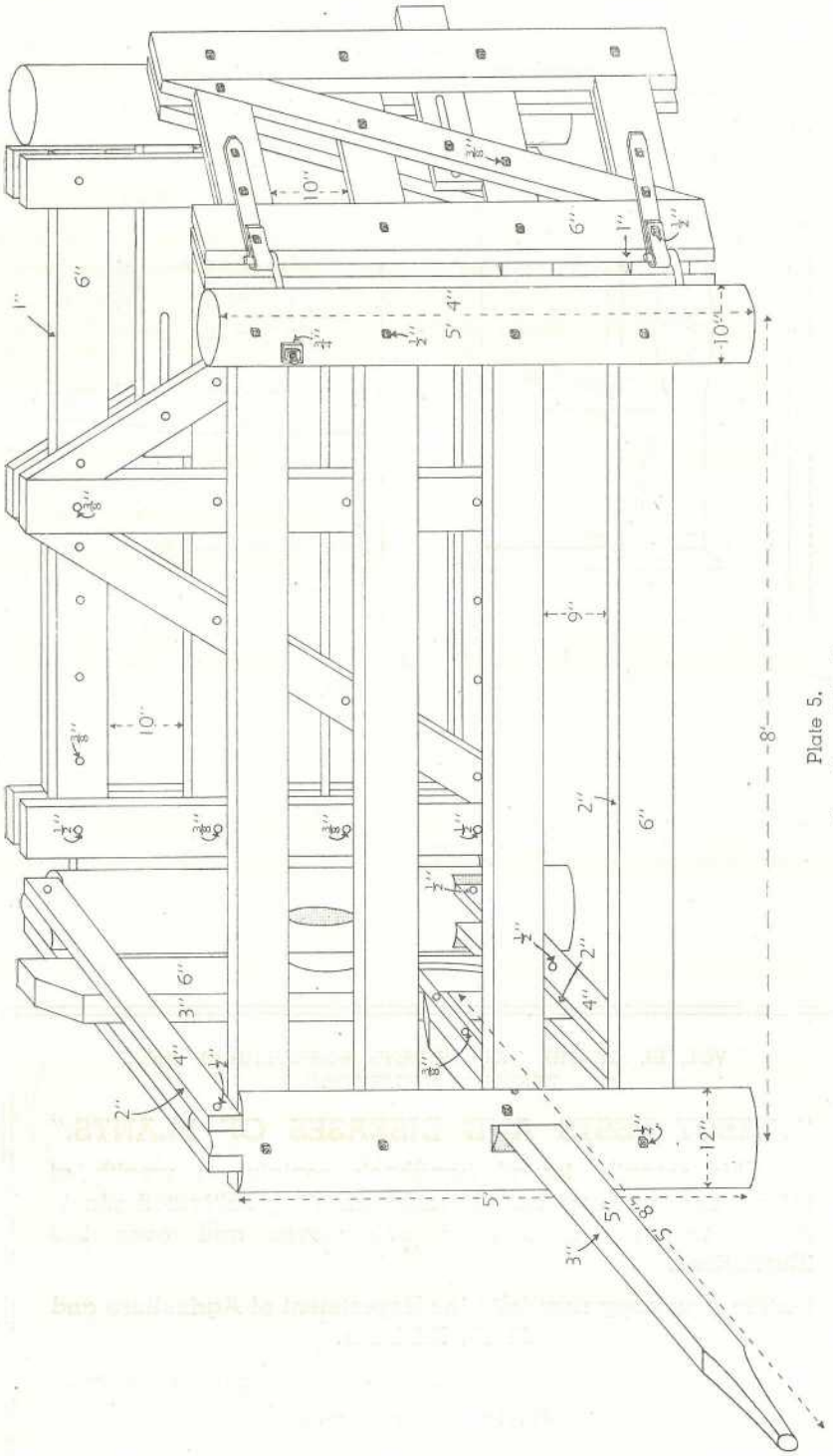


Plate 5.
Elevation of Crush.

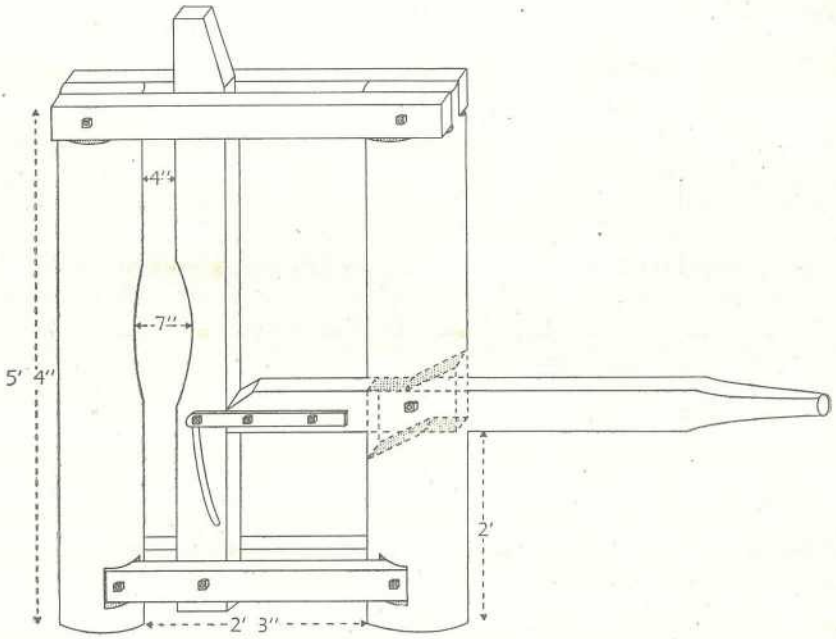
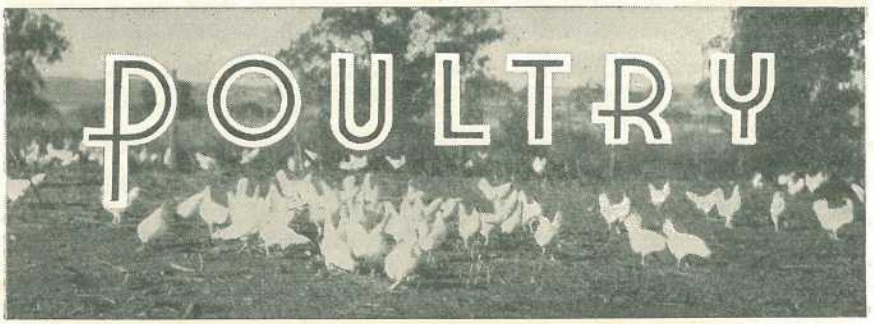


Plate 6.
Front Elevation of Bail.



Feeding Fowls From Day-Old to Maturity.

F. N. J. MILNE, Assistant Husbandry Officer, Poultry Branch.

IT should be realised by poultry raisers that the nutrition of a chicken does not begin at hatching. The diet of the breeding hen can have a marked influence on the growth of the chicken during its first few weeks of life. Perhaps the vitamin A content of the breeder's ration has the greatest effect on livability of the chicken, and it is therefore necessary to use succulent green feed or fish oils (or both, if necessary) in the ration of breeding hens.

It is proposed in these notes to discuss the feeding of fowls in the brooder period, the weaning period, and the period from weaning to maturity.

The Brooder Period—Day-old to 4 Weeks.

The first four weeks of life could be called the critical period because this is the brief space in which the chick (*a*) is dependent on yolk sac reserves (for the first week or so), (*b*) can only eat a limited amount of food, and (*c*) grows at relatively faster rates than at any other time. It is during and generally towards the end of this period that we find vitamin and mineral deficiencies appearing very quickly and with disastrous results. Such rapid growth calls for rapid assimilation of all food constituents, whether they be protein, carbohydrate, fat, vitamins, or minerals. Rapid assimilation therefore requires a special type of ration—a chick starter mash which should have the following characteristics :—(1) high protein content (a minimum of 18%), (2) low fibre content (5% is a good level), (3) adequate supplies of vitamins A, D3 and riboflavin, and (4) minerals such as calcium, phosphorus and manganese.

Protein.—A high-protein mash with a minimum level of 18% is needed. If vegetable proteins such as soybean meal and peanut meal are used, at least 5 lb. of meatmeal would have to be added to improve the "protein quality" of the mash and to supply sufficient vitamin B12. If vegetable proteins were freely available in Australia, then such a ration would still need a riboflavin and vitamin B12 rich supplement such as livermeal to ensure a full supply of vitamins.

Fibre.—Chicks have their limitations with respect to the amount of fibre they can digest. For this reason, mill-offals should not be used to the same extent in starter rations as in those for older birds.

Lucerne meal or fine chaff could be fed at the rate of 2% to supply the chick's requirements of vitamin K (the anti-haemorrhagic vitamin)

but recent research has shown that lucerne meal or chaff has a growth-depressing effect on chickens, not related to its high fibre content, when fed at levels of 5% or more.

Vitamin A.—Because chickens do not eat a lot of food during the first few weeks of life, it is questionable whether they can eat sufficient green feed to supply their wants; also it is not certain how much "carry-over" of vitamin A there has been from the parent birds. It is therefore a wise precaution to *always* include cod-liver oil or fish-oil emulsion in chick starter rations. It may increase the cost of feeding slightly, but it is better to be sure than sorry.

Vitamin D3.—Vitamin D3 is present in cod-liver oil and in fish-oil emulsions fortified with vitamin D3. It can also be synthesised by the chick through the action of the ultra-violet rays of sunlight on certain fatty substances in the skin. Vitamin D3 promotes absorption of calcium and phosphorus and helps in their combination and deposition as bone.

"Rickets" in young chickens is easily detected by the presence of soft, rubbery beaks, "beaded" ribs, ragged-looking feathering and a desire by the chicks to squat down as often as possible to "rest their rickety bones." It is caused by a lack of vitamin D3, calcium, or phosphorus, or too much calcium or phosphorus in the ration. Generally the most frequent cause is brooding chickens in the absence of sunlight without a vitamin D3-rich fish-oil or emulsion being added to the mash. It is essential therefore to supply cod-liver oil or fish-oil emulsion A and D3 for battery-brooded chickens. This recommendation could be carried further to include *all chickens irrespective of how they are brooded*, because there are many occasions during the early rearing period when a farmer would not expose very young chickens to cold westerly winds or bleak overcast days encountered in outside runs.

Riboflavin.— A deficiency of this vitamin produces "curly-toe" paralysis in chickens. Just as riboflavin deficiency, affecting hatchability, will occur in breeding birds fed a laying mash instead of a suitable breeder's mash, so in young chickens this deficiency generally occurs when laying or growing mashes are fed to chickens in place of a good chick starter ration.

As the chickens grow older their requirements of riboflavin decrease. Livermeal (5%), buttermilk powder (7%) and whey powder (7%) will ensure adequate amounts of riboflavin in the ration. In their place, synthetic riboflavin may be used. In experimental work carried out by the Poultry Branch at the Kairi Regional Experiment Station in North Queensland over the past five years, synthetic riboflavin has been used exclusively in chick rations because the riboflavin-rich foods mentioned above are unobtainable there. However, it must be kept in mind that synthetic riboflavin supplies only one vitamin whereas livermeal, for example, supplies highly valuable protein and a whole range of B-complex vitamins, including riboflavin.

Vitamin B12.—The quantity of Vitamin B12 inherited from the hen depends (as with, for example, vitamin A) on the amount present in the breeders' ration. Vitamin B12 is essential for growth and provided good quality chick-starter mashes with the protein supplied by animal protein are fed, a deficiency should never be encountered.

Calcium.—This is not a real problem in chick feeding but it is a good idea to give the young chickens a small amount of finely crushed shell grit (2 lb. to 100 lb. mash) during the early period of life.

Phosphorus.—The quantity of meatmeal or other animal proteins used in chick starter mashes in Queensland to give a minimum protein level of 18% will ensure an ample supply of phosphorus.

Manganese.—A few cases of "perosis" or "slipped tendon" have been diagnosed by the Animal Health Station, Yeerongpilly. But because these are so few it does not mean that there may not be "marginal" deficiences in some of our rations. A ration in which bran and pollard are not present or are used in limited quantities (under 40%) has a borderline manganese content. To offset a possible manganese deficiency, 6 oz. of commercial grade manganese sulphate should be added to every ton of mash.

Of the grains, wheat is the best source of manganese, but the manganese content of any grain is insufficient for the birds' needs. Maize has the lowest manganese content of all grains and the addition of manganese sulphate is necessary where maizemeal forms 50% or more of an all-mash chick starter ration.

The Weaning Period—4 Weeks to 8 Weeks.

Although the rate of growth is beginning to slow down, no differentiation is made in the type of ration required during the brooder and post-brooder stage, so the requirements that appertain to the first four weeks of life apply equally in the ensuing four weeks.

With regard to vitamin A, it is well to bear in mind that although the chicken's capacity for food is increasing, so are its requirements for this vitamin and that it is reaching a stage where it may have to face the hazards of coccidiosis (both caecal and intestinal), fowl pox (if vaccination is not practised) and roundworm infestation. Vitamin A does confer some resistance on the growing chicken to enable it to withstand these troubles. For that reason it is a wise precaution *to continue the use of cod-liver oil or fish-oil emulsion for the first eight weeks of life.*

Weaning to Maturity.

During this period growth decreases while the amount of food eaten increases. A mash and grain system or an all-mash system of feeding may be adopted, but in either case, the protein content of mash or mash and grain should be about 16%. More fibrous foods may be used in greater quantities.

Growing stock after weaning do not require the previous high levels of riboflavin and thus the amounts of such costly riboflavin-rich foods as livermeal, buttermilk powder and whey powder may be reduced in or deleted from the ration. Vitamin A supplements such as cod-liver oil or a fish-oil emulsion are necessary only if green feed is in short supply, an adequate amount being 5 lb. of fresh green feed per 100 birds per day. It must be stressed again that a shortage of vitamin A during this period can undo all the care and attention given to young pullets and cockerels during the brooder and weaning stages.

As the pullets approach maturity their calcium requirements increase in anticipation of their natural function—egg production. Most of the calcium is deposited as extra bone in the skeleton, to be used from this "bank" when production commences. During this stage the growing pullets should have shell grit or non-dolomitic limestone grit before them

at all times. Should the pullets be housed intensively, proper absorption and utilisation of calcium and phosphorus cannot take place unless cod-liver oil or a fish-oil emulsion containing vitamin D3 is added to the ration.

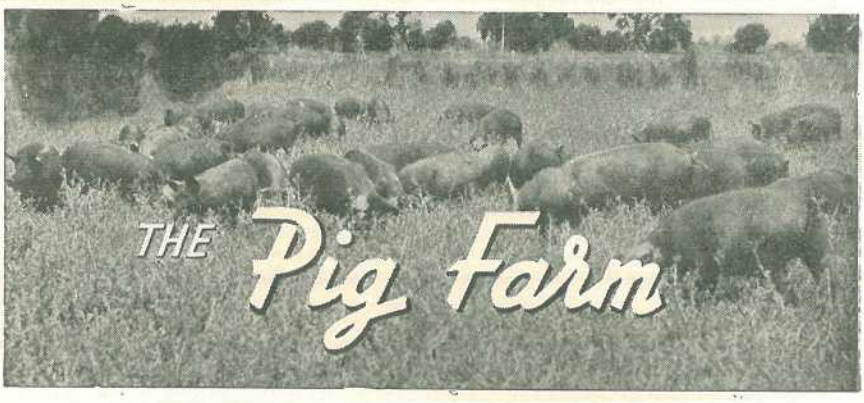
Adequate Feeding Space for all Age Groups.

Unless chickens have enough "elbow room" at the feed hopper, the full beneficial effect of a correct feeding programme and brooder and weaning technique cannot be realised. Too little feeding space results in an unruly, heaving mass of jostling chickens. The bigger ones, by virtue of their size and possible aggressiveness, are "first in and first served." The smaller chickens, when they do manage to get to the hopper, may only have sufficient time for a few beakfuls of mash which has been picked over by the stronger chickens, before they are chased away by bullies. Over a period of time, inadequate feeding space can cause much unevenness in size and development of a growing flock. The following amounts of feeding space for various age groups are necessary:—day-old to 3 weeks of age, 10 linear feet; 4 weeks to 6 weeks of age, 20 linear feet (or 10 feet of a double-sided hopper length); and 7 weeks onwards, 30 linear feet (or 15 feet of double-sided hopper length).

COMMON NAMES OF GRASSES.

The following are the standard common names recently adopted or confirmed by agricultural authorities throughout Australia for some native and introduced grasses found in Queensland. The names are taken from "Standardized Plant Names," Bulletin No. 272 of the Commonwealth Scientific and Industrial Research Organization.

Botanical Name.	Standard Common Name.
Alloteropsis semialata	Cockatoo grass
Aristida arenaria	Kerosene grass
Aristida latifolia	Feather-top wire grass
Aristida leptopoda	White spear grass
Astrebla elymoides	Hoop Mitchell grass
Astrebla lappacea	Curly Mitchell grass
Astrebla pectinata	Barley Mitchell grass
Astrebla squarrosa	Bull Mitchell grass
Axonopus affinis	Narrow-leaf carpet grass
Axonopus compressus	Broad-leaf carpet grass
Bothriochloa ambigua	Red-leg grass
Bothriochloa decipiens	Pitted blue grass
Bothriochloa ewartiana	Desert blue grass
Bothriochloa intermedia	Forest blue grass
Brachiaria foliosa	Leafy panic
Brachiaria miliiformis	Green summer grass
Brachiaria mutica	Para grass
Cenchrus australis	Hillside burr grass
Cenchrus ciliaris	Buffel grass
Cenchrus echinatus	Mossman River grass
Cenchrus pauciflorus	Spiny burr grass
Cenchrus pennisetiformis	Slender buffel grass
Cenchrus setigerus	Birdwood grass
Cenchrus tribuloides	Dune sand burr or Innocent weed
Chloris acicularis	Curly windmill grass
Chloris barbata	Purple-top chloris
Chloris divaricata	Slender chloris
Chloris truncata	Windmill grass
Chloris ventricosa	Tall chloris
Chloris virgata	Feather-top Rhodes grass



The 1953 Baconer Carcass Competitions.

F. BOSTOCK, Officer in Charge, Pig Branch.

THE championship in the 1953 Baconer Pig Carcass Competition conducted by the Australian Meat Board in Queensland was awarded to Mr. R. S. Postle, "Yaralla," Pittsworth, for a purebred Large White carcass which secured a record Queensland score of 89½ points. The carcass was nicely proportioned and of good type. It scored well in all points, but a more finished appearance would have been presented had there been slightly more fat development.

Results.

Prize-winners in their respective districts were as follows :—

Prize.	Owner.	Breed.	Weight.	Points.
			Lb.	
	NORTH QUEENSLAND (JUDGED AT MAREEBA).			
1st	W. Hastie and Sons	Berkshire	120	88½
2nd	W. Hastie and Sons	Berkshire	135	88
3rd	P. J. Neal	Wessex Saddleback x Large White/Berkshire	140	87
	CENTRAL QUEENSLAND (JUDGED AT ROCKHAMPTON).			
1st	D. and L. Keleher ..	Wessex Saddleback x Large White	129	89
2nd	E. E. C. Goodland ..	Large White	142	80
3rd	F. N. and G. Baxter	Berkshire	138	79½
	DARLING DOWNS (JUDGED AT TOOWOOMBA).			
1st	R. S. Postle ..	Large White	150	89½
2nd	L. and H. Koch ..	Berkshire x Large White ..	164	85½
3rd	C. H. Ingleton ..	Large White x Berkshire / Large White	128	85
	SOUTH QUEENSLAND (JUDGED AT BRISBANE).			
1st	S. Schulz	Large White x Berkshire ..	129	89
2nd	H. L. Larsen ..	Large White	134	86
3rd	H. W. Schimke ..	Berkshire	158	85½

Comments.

As usual, field days were held to coincide with the judging at each centre, and attendances were good at all places except Brisbane.

TABLE 1.

AVERAGE FOR EACH SECTION OF JUDGING.

Section.	Possible Points.	1948.		1949.		1950.		1951.		1952.		1953.	
		Average Points Obtained.	Percentage of Possible Points.	Average Points Obtained.	Percentage of Possible Points.	Average Points Obtained.	Percentage of Possible Points.	Average Points Obtained.	Percentage of Possible Points.	Average Points Obtained.	Percentage of Possible Points.	Average Points Obtained.	Percentage of Possible Points.
By Inspection—													
Hams	8	5·604	70·050	6·27	78·40	6·097	76·213	6·44	80·52	6·286	78·571	6·67	83·37
Shoulders	7	5·562	78·029	5·92	84·57	5·849	83·564	5·92	84·60	5·947	84·959	6·02	86·00
Streak	12	6·764	56·367	5·57	46·40	7·766	64·724	7·41	61·79	6·982	58·185	8·29	69·08
By Measurement—													
Eye Muscle Thickness	28	11·775	58·875	18·04	64·42	14·262	50·936	20·15	71·96	19·114	68·265	19·15	68·39
Backfat Thickness	20	15·489	77·445	15·26	76·30	14·572	72·864	15·45	77·23	14·729	73·643	15·97	79·85
Body Length ..	20	12·500	44·643	13·06	65·30	13·388	66·941	12·98	64·92	14·814	74·072	14·99	74·95
Leg Length ..	5	3·111	62·220	3·02	60·40	3·281	65·631	3·21	64·22	2·757	55·142	3·27	65·40
Total	100	60·805		67·97		65·218		71·57		70·629		74·87	

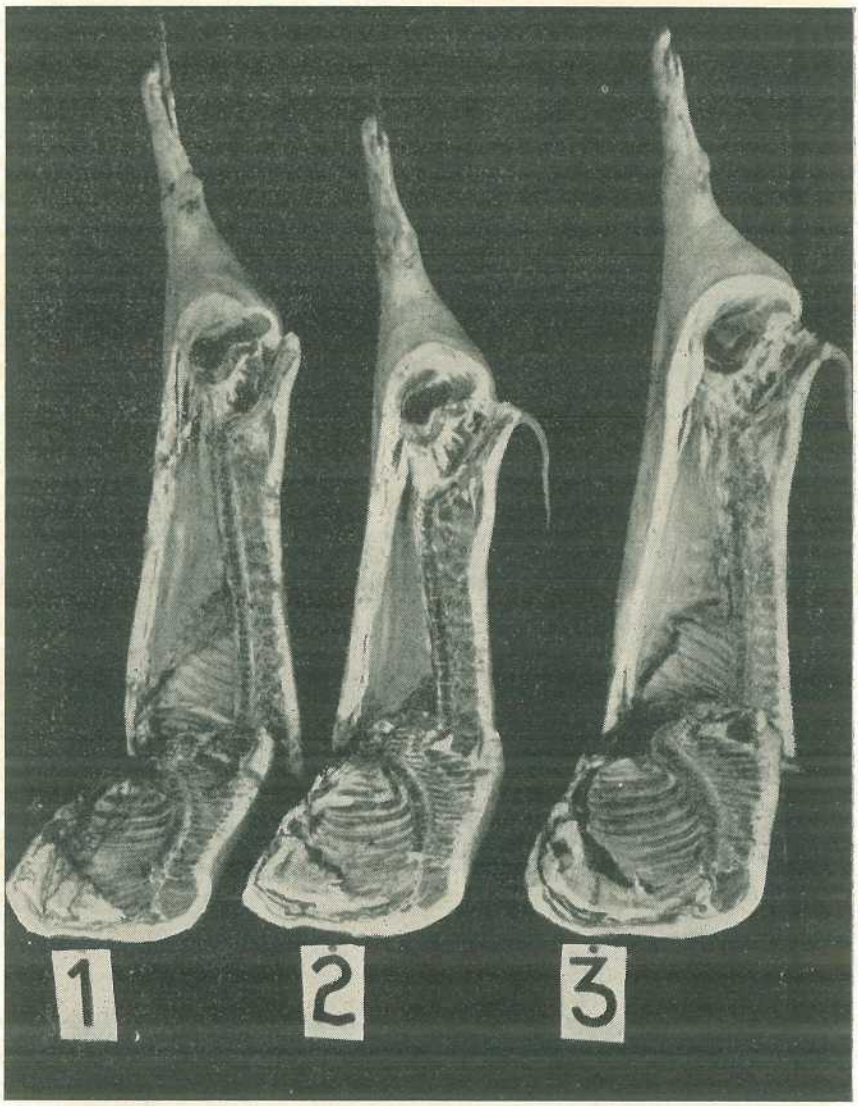


Plate 1.

Winning Entries in the Northern District.

To qualify for entry into the competition, the pig must have been sired by a purebred boar and the dressed carcass was required to weigh not less than 120 lb. and not more than 180 lb. Entries totalled 160, of which nine were disqualified (8 underweight and 1 a rig).

The 1st class certificate was gained by 79·47% of the competing carcasses, the 2nd class by 17·22%, leaving only 3·31% receiving no recognition. These figures indicate the high standard attained by the competitions. A further analysis of the results shows that 25·83% secured 80 points or better, 53·64% 70 points and over, 17·22% 60 points and over, and 3·31% under 60 points.

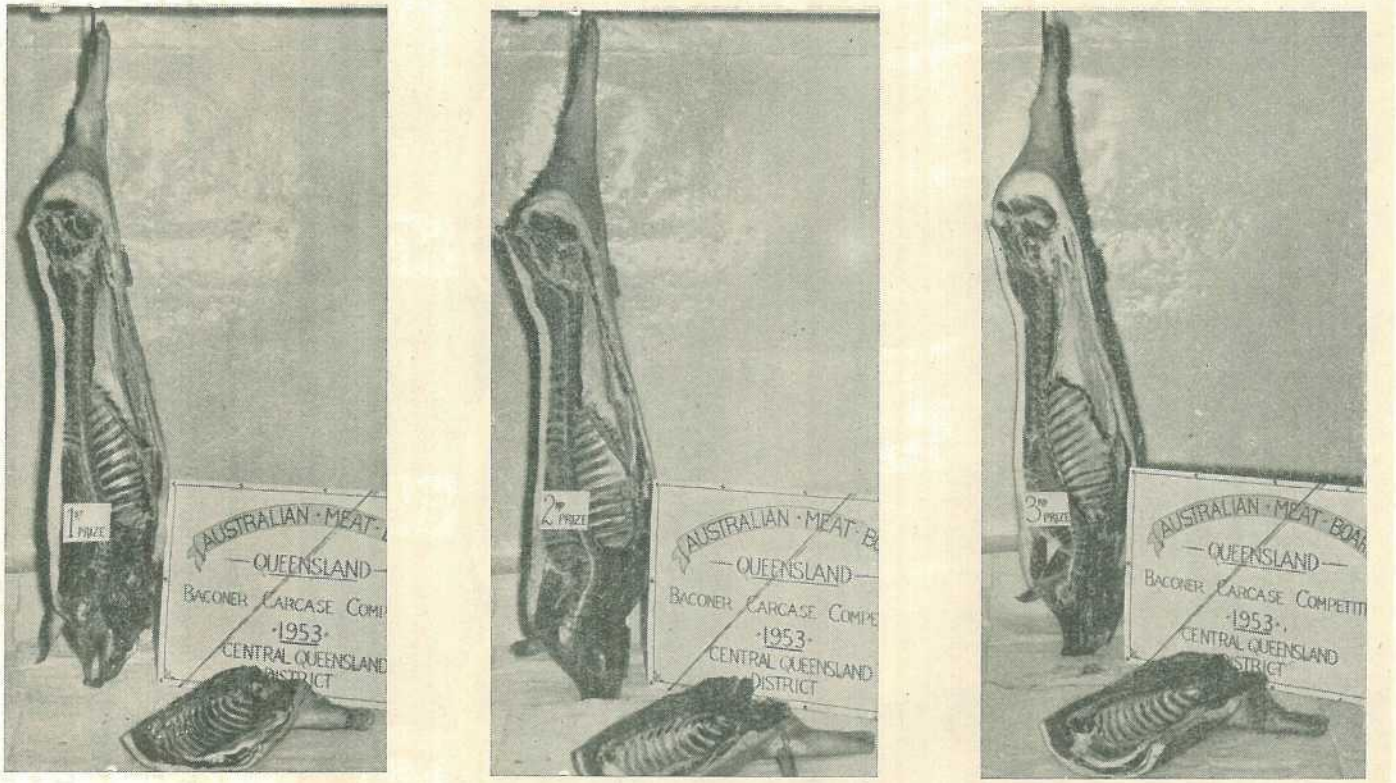


Plate 2.
Winning Entries in Central Queensland.

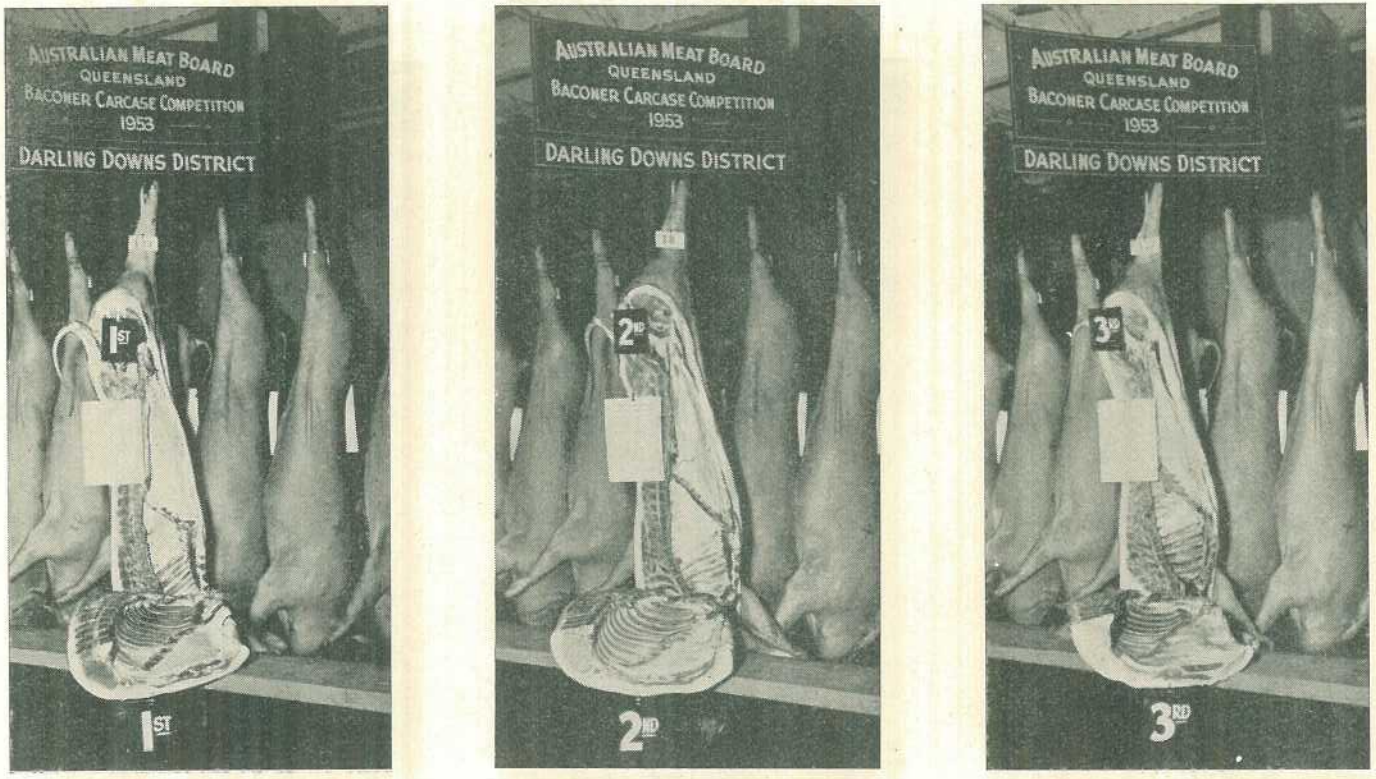
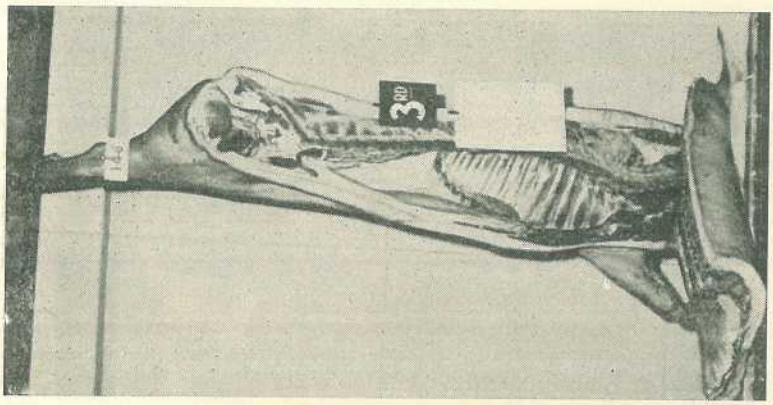
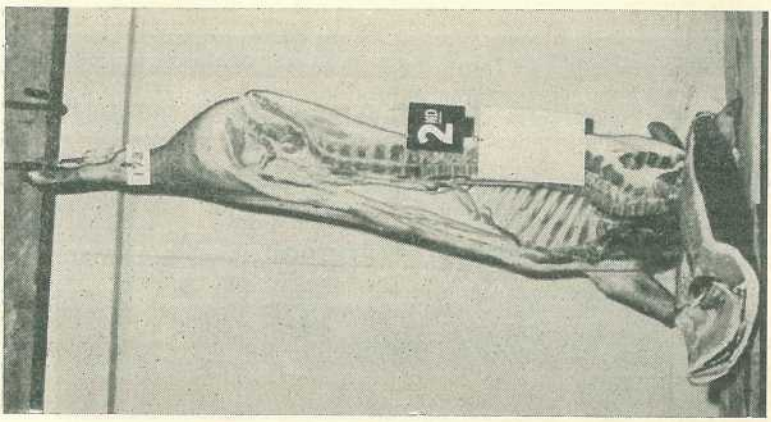


Plate 3.
Winning Entries in the Darling Downs District.





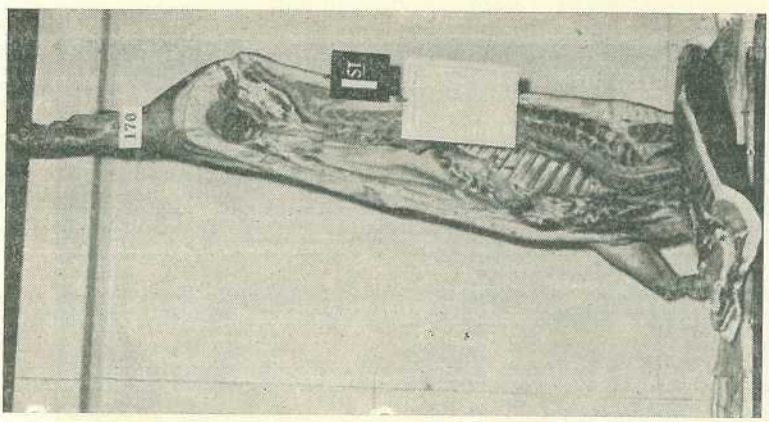


Plate 4.
Winning Entries in South Queensland.

The top score of 89½ points is the highest so far registered in any of the competitions, as is also the average score of 74·87%. A perusal of the average score in each section of the judging (Table 1) reveals an improvement in all sections, though eye muscle thickness and backfat thickness, both important features, are still capable of improvement.

Hams showed a marked improvement, there being less shank and better fleshing.

There was an apparent improvement in shoulder development in all districts except South Queensland, where shoulders appeared in the main to be heavy.

Streak or belly scored well, with a greater proportion of good streaks in evidence than in previous years. However, there is still too large a proportion of overfat and thin streaks.

Eye muscle thickness scored reasonably well. The proportion of really well developed eye muscles is, however, still small, the majority scoring between half and three-quarters of the maximum points.

The absence of excessively overfat carcasses was again noticeable, there being a larger proportion of entries measuring less than standard for backfat.

Body length scored particularly well, indicating a steady improvement. Full points for measurements equal to or greater than the standard were scored by 13 carcasses in North Queensland, 6 in Central Queensland, 2 in the Darling Downs and 9 in South Queensland. Up to 33 mm. in excess of the standard was recorded.

Leg length also showed evidence of some improvement, 27·8% of all carcasses scoring full points. There appears to be still a tendency for breeders to overlook the importance of leg length.

CARE NEEDED WITH PERENNIAL SORGHUM.

While a new perennial sorghum (*Sorghum almum*) shows promise of being a hardy plant in the drier parts of Queensland, farmers and graziers are advised to be cautious in planting and using it, as Departmental tests have shown that it may carry a considerable amount of prussic acid.

Perennial sorghum is a natural hybrid of Johnson grass and Sudan grass and has the tall, luxuriant growth characteristic of Sudan grass combined with the perennial nature of Johnson grass. Its seed germinates readily wherever it is dropped or scattered, even on hard soil.

While controlled grazing reduces the risk of poisoning from annual sorghums such as Sudan grass, grazing is much more difficult to handle in large paddocks of permanent pasture in which perennial sorghum may become established. For this reason, care should be taken with plantings until such time as it is known whether the plant can be safely handled under grazing conditions.

A Pig Breeding and Feeding Programme for the Dairy Farm.

F. BOSTOCK, Officer in Charge, Pig Branch.

Where pig production is largely dependent on the dairying activities of a farm, careful planning of production is necessary to ensure that the dairy by-product, skim milk, is used to the best advantage. The farmer should as far as possible avoid being caught with an insufficient number of pigs to cope with the flush of skim milk; on the other hand, he should not be caught with a large number of pigs on the farm when skim milk is in short supply.

The following table has been drawn up to assist farmers in planning their pig raising operations. It applies to a 30-cow dairy farm, but dairy farmers with fewer or more cows will be able to use it as a guide. By following such a programme in a normal season, the farmer can obviate the purchase of stores during the flush of milk production and the sale of unfinished pigs because of insufficient feed.

The provision of green roughages is quite important in the feeding of pigs, and an endeavour should be made to have such crops available throughout the year for grazing, cutting or digging. For winter and spring green feed a succession of sowings should be commenced in February, using wheat, oats, barley, rape or other suitable green crop. In normal seasons if fed judiciously these will provide green feed through to early summer, when early spring plantings of millets would normally be ready for feeding. Wherever possible, lucerne should be available for grazing, and sweet potatoes also should feature for both grazing and hand-feeding of the tubers.

In calculating the amounts of fodder crops to be fed from November through to June, note that the column of "Fodder Crops Grain Equivalent" gives the numbers of pounds of "grain equivalent" which should be fed. For example, in December No. 1 sow needs 4 lb. grain equivalent, which is given by 16 lb. of sweet potatoes or 28 lb. of pumpkins if these foodstuffs are available.

SUGGESTED BREEDING PLAN AND FOOD REQUIREMENTS OF PIGS ON A 30-COW HERD DAIRY FARM.

Month.	Stock.	Separated Milk.	Meatmeal.	Grain.	Fodder Crops Grain Equivalent. (See note at end).	Suggested Crops when Available.
		Gal.	Lb.	Lb.	Lb.	
July	No. 1 sow farrowed 5th July ..	As available	1	5	Grazing Green feed cut	Wheat, barley, oats, rape, grazing lucerne as available
	No. 2 sow with litter		1¼	7		
	No. 3 sow dry		¼	2		
	No. 4 sow dry		¼	2		
	6 porkers from No. 3 sow		¾	4		
	6 slips from No. 4 sow		¼	2		
	Daily Total		7¼	52		
	Total for 31 days		224¾	1,612		

SUGGESTED BREEDING PLAN AND FOOD REQUIREMENTS OF PIGS ON A 30-COW HERD DAIRY FARM.—*continued.*

Month.	Stock.	Separated Milk.	Meatmeal.	Grain.	Fodder Crops Grain Equivalent. (*See* note at end).	Suggested Crops when Available.
August	No. 1 sow with litter	As available	1¼	7	Grazing Green feed cut	Wheat, barley, oats, rape, mangolds, grazing lucerne as available
	No. 2 sow mated 10th August ..		¼	2		
	No. 3 sow dry		¼	2		
	No. 4 sow dry		¼	2		
	6 weaners from No. 2 sow ..		¼	1		
	6 light baconers from No. 3 sow ..		¼	5		
	6 porkers from No. 4 sow		¼	4		
	Daily Total		8	73		
	Total for 31 days		248	2,263		
September	No. 1 sow mated 10th September ..		¼	2	Grazing Green feed cut	Wheat, barley, oats, mangolds, grazing lucerne as available
	No. 2 sow dry	..	¼	2		
	No. 3 sow farrowed 5th September	1	¼	5		
	No. 4 sow dry	..	¼	2		
	6 weaners from No. 1 sow ..	1	..	1		
	6 slips from No. 2 sow	1	..	2		
	6 baconers from No. 3 sow (sell) ..	1	..	6		
	6 light baconers from No. 4 sow ..	1	..	5		
	Daily Total	25	1¼	95		
	Total for 30 days	750	37½	2,850		
October	No. 1 sow dry	1	..	2	Grazing Green feed cut	Lucerne, mangolds, grazing lucerne as available
	No. 2 sow dry	1	..	2		
	No. 3 sow with litter	3	..	7		
	No. 4 sow farrowed 5th October ..	3	..	5		
	6 slips from No. 1 sow	1	..	2		
	6 porkers from No. 2 sow	1	..	4		
	6 baconers from No. 4 sow (sell) ..	1	..	6		
	Daily Total	26	..	88		
	Total for 31 days	806	..	2,728		
November	No. 1 sow dry	1	..	1	4	Millet, sweet potatoes, grazing lucerne as available
	No. 2 sow dry	1	..	1	4	
	No. 3 sow mated 10th November..	1	..	1	4	
	No. 4 sow with litter	3	..	5	8	
	6 porkers from No. 1 sow	2	..	2	8	
	6 light baconers from No. 2 sow ..	2	..	2	12	
	6 weaners from No. 3 sow ..	2	..	½	2	
	Daily Total	42	..	35	152	
	Total for 30 days	1,260	..	1,050	4,560	

SUGGESTED BREEDING PLAN AND FOOD REQUIREMENTS OF PIGS ON A 30-COW HERD DAIRY FARM.—*continued.*

Month.	Stock.	Separated Milk.	Meat Meal.	Grain.	Fodder Crops Grain Equivalent. (See Note at End.)	Suggested Crops when Available.
		Gal.	Lb.	Lb.	Lb.	
December	No. 1 sow dry	1	..	1	4	Millet, sweet potatoes, pumpkins, maize, cowpeas, grazing lucerne as available
	No. 2 sow farrowed 5th December	2	..	3	8	
	No. 3 sow dry	1	..	1	4	
	No. 4 sow mated 10th December	1	..	1	4	
	6 light baconers from No. 1 sow	2	..	2	12	
	6 baconers from No. 2 sow (sell)	2	..	3	12	
	6 slips from No. 3 sow	2	..	1	4	
	6 weaners from No. 4 sow	2	..	½	2	
	Daily Total	53	..	45	200	
	Total for 31 days	1,643	..	1,395	6,200	
January	No. 1 sow farrowed 5th January	2	..	2	8	Millet, sweet potatoes, pumpkins maize, cowpeas, grazing lucerne as available
	No. 2 sow with litter	3	..	5	8	
	No. 3 sow dry	1	..	1	4	
	No. 4 sow dry	1	..	1	4	
	6 baconers from No. 1 sow (sell)	2	..	3	12	
	6 porkers from No. 3 sow	2	..	2	8	
	6 slips from No. 4 sow	2	..	1	4	
	Daily Total	43	..	45	168	
	Total for 31 days	1,333	..	1,395	5,208	
February	No. 1 sow with litter	3	..	5	8	Millet, sweet potatoes, pumpkins, maize, cowpeas grazing lucerne as available
	No. 2 sow mated 10th February	1	..	1	4	
	No. 3 sow dry	1	..	1	4	
	No. 4 sow dry	1	..	1	4	
	6 weaners from No. 2 sow	2	..	½	2	
	6 light baconers from No. 3 sow	2	..	2	12	
	6 porkers from No. 4 sow	2	..	2	8	
	Daily Total	42	..	35	152	
	Total for 28 days	1,176	..	980	4,256	
March	No. 1 sow mated 10th March	1	..	1	4	Millet, sweet potatoes, pumpkins, maize, cowpeas, grazing lucerne as available
	No. 2 sow dry	1	..	1	4	
	No. 3 sow farrowed 5th March	2	..	3	8	
	No. 4 sow dry	1	..	1	4	
	6 weaners from No. 1 sow	2	..	½	2	
	6 slips from No. 2 sow	2	..	1	4	
	6 baconers from No. 3 sow (sell)	1	..	3	12	
	6 light baconers from No. 4 sow	1	..	2	12	
	Daily Total	41	..	45	200	
	Total for 31 days	1,271	..	1,395	6,200	

SUGGESTED BREEDING PLAN AND FOOD REQUIREMENTS OF PIGS ON A 30-COW HERD DAIRY FARM.—*continued.*

Month.	Stock.	Separated Milk.	Meatmeal.	Grain.	Fodder Crops Grain Equivalent. (*See* note at end).	Suggested Crops when Available.
		Gal.	Lb.	Lb.	Lb.	
April	No. 1 sow dry	1	..	1	4	Sweet potatoes, pumpkins, maize, arrowroot, cowpeas, grazing lucerne as available
	No. 2 sow dry	1	..	1	4	
	No. 3 sow with litter	3	..	5	8	
	No. 4 sow farrowed 5th April ..	2	..	2	8	
	6 slips from No. 1 sow	2	..	1	4	
	6 porkers from No. 2 sow	1	..	2	8	
	6 baconers from No. 4 sow (sell) ..	1	..	3	12	
	Daily Total	31	..	45	168	
	Total for 30 days	930	..	1,350	5,040	
May	No. 1 sow dry	1	..	1	7	Pumpkins, maize, arrowroot, cowpeas, grazing lucerne as available
	No. 2 sow dry	1	..	1	7	
	No. 3 sow mated 10th May ..	1	..	1	7	
	No. 4 sow with litter	2	..	6	7	
	6 porkers from No. 1 sow (sell) ..	1	..	3	7	
	6 light baconers from No. 2 sow (sell)	1	..	4	7	
	6 weaners from No. 3 sow ..	1	..	1	..	
	Daily Total	23	..	57	112	
	Total for 31 days	713	..	1,767	3,472	
June	No. 1 sow dry	1	..	1	7	Pumpkins, arrowroot, rape, grazing lucerne as available
	No. 2 sow farrowed 5th June ..	2	..	4	7	
	No. 3 sow dry	1	..	1	7	
	No. 4 sow mated 10th June ..	1	..	1	7	
	6 slips from No. 3 sow	1	..	1	7	
	6 weaners from No. 4 sow ..	1	..	1	..	
	Daily Total	17	..	19	70	
	Total for 30 days	510	..	570	2,100	

NOTE.—Grain equivalent : 1 lb. grain = 4 lb. sweet potatoes ; 5 lb. arrowroot 7 lb. pumpkins ; 10 lb. green forage.

Brucellosis Testing of Swine.

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

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

TESTED HERDS (As at 15th November, 1953).

Berkshire.

J. J. Bailey, "Lucydale" Stud, East Greenmount
S. Cochrane, "Stanroy" Stud, Felton
G. Handley, "Handleigh" Stud, Murphy's Creek
J. L. Handley, "Meadow Vale" Stud, Lockyer
R. G. Koplick, "Melan Terez" Stud, Rochedale
O'Brien and Hickey, "Kildurham" Stud, Jandowae East
E. Pukallus, "Plainby" Stud, Crow's Nest
G. C. Traves, "Wynwood" Stud, Oakey
E. Tumbridge, "Bidwell" Stud, Oakey
Westbrook Farm Home for Boys, Westbrook
H.M. State Farm, "Palen" Stud, Palen Creek
A. R. Ludwig and Sons, "Cryna" Stud, Beaudesert
H. H. Sellars, "Tabooba" Stud, Beaudesert
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
D. T. Law, "Rossvill" Stud, Trouts road, Aspley
R. H. Crawley, "Rockthorpe" Stud, *via* Pittsworth
F. R. J. Cook, "Alstonvilla," Wolvi, *via* Gympie
Mrs. I. M. James, "Kenmore" Stud, Cambooya
H. L. Stark, "Florida," Kalbar
J. H. N. Stoodley, "Stoodville," Ormiston
H.M. State Farm, Numinbah
V. G. M. and A. G. Brown, "Bardell," Goovigen
R. E. Paulsen, "Crest" Stud, Binjour Plateau, M.S. 670, Gayndah
M. G. and R. H. Atkins, "Diamond Valley" Stud, Mooloolah
L. Puschmann, "Tayfeld" Stud, Taylor
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
W. F. Ruhle, "Felbar" Stud, Kalbar
C. E. Edwards, "Spring Valley" Stud, Kingaroy
G. J. McLennan, "Murcott" Stud, Willowvale
H. M. Wyatte, "Deepwater" Stud, Rocky Creek, Yarraman
C. F. W. and B. A. Shellback, "Redvilla" Stud, Kingaroy
R. J. Webber, "Webberberry" Stud, 35 Caxton st., Petrie Terrace
J. C. Lees, "Bridge View" Stud, Yandina
B. J. Jensen, "Bremerside" Stud, Rosevale, *via* Rosewood

Large White.

H. J. Franks and Sons, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
J. A. Heading, "Highfields," Murgon
K. B. Jones, "Cefn" Stud, Pilton
R. G. Koplick "Melan Terez" Stud, Rochedale
R. Postle, "Yarralla" Stud, Pittsworth
E. J. Bell, "Dorne" Stud, Chinchilla
L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
H. R. Gibson, "Thistleton" Stud, Maleny
H.M. State Farm, Numinbah
K. A. Hancock, "Laurestonvale" Stud, Murgon
V. P. McGoldrick, "Fairymeadow" Stud, Cooroy
R. S. Powell, "Kybong" Stud, Kybong, *via* Gympie
S. T. Fowler, "Kenstan" Stud, Pittsworth
H. L. Larsen, "Oakway," Kingaroy
C. Allison, "Colrene" Stud, Lake and Reserve roads, Slacks Creek
E. G. Evans, "Lauraven" Stud, Box 22, Maleny
Mrs. I. G. Utting, "White Lodge," Mountain road, Cooroy
N. E. Meyers, Halpine Plantation, Kallangur
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
G. I. Skyring, "Bellwood" Stud, *via* Pomona
O. J. Horton, "Manneum Brae" Stud, Manneum, Kingaroy
M. E. Bryant, "Maryland Brae" Stud, Blunder road, Oxley
Miss G. R. Charity, Coondoo, Kin Kin.
W. J. Blakeney, "Talgai" Stud, Clifton

Tamworth.

S. Kanowski, "Miecho" Stud, Pinelands
N. R. Potter, "Actonvale" Stud, Wellcamp
D. F. L. Skerman, "Waverley" Stud, Kaimkillenbun
A. C. Fletcher, "Myola" Stud, Jimbour
Salvation Army Home for Boys, "Canaan" Stud, Riverview
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
A. J. Surman, "Namrus" Stud, Noble road, Goodna
Department of Agriculture and Stock, Regional Experiment Station, Kairi
E. C. Phillips, "Sunny View," M.S. 90, Kingaroy
T. A. Stephen, "Withcott," Helidon
W. F. Kajewski, "Glenroy" Stud, Glencoe
A. A. Herbst, "Hillbanside" Stud, Bahr Scrub, *via* Beenleigh
R. G. Koplick, "Melan Terez" Stud, Rochedale
H.M. State Farm, Numinbah
D. B. Alexander, "Debreczen" Stud, Kinleymore, *via* Murgon
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
M. E. Bryant, "Maryland Brae" Stud, Blunder road, Oxley
G. H. Sattler, Landsborough

Wessex Saddleback.

W. S. Douglas, "Greylight" Stud, Goombungee
D. Kay and P. Hunting, "Kazan" Stud, Goodna
J. Gleeson, "Iona Vale" Stud, Kuraby
C. R. Smith, "Belton Park" Stud, Nara
H. H. Sellars, "Tabooba" Stud, Beaudesert
H. Thomas, "Eurara" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trout road, Aspley
J. B. Dunlop, "Kurrawyn" Stud, Acacia road, Kuraby
A. Curd, "Kilrock" Stud, Box 35, Jandowae
C. Allison, "Colrene" Stud, Lake and Reserve roads, Slacks Creek
R. A. Collings, "Rutholme" Stud, Waterford
M. Nielsen, "Cressbrook" Stud, Goomburra
G. J. Cooper, "Cedar Glen" Stud, Yarraman
M. E. Bryant, "Maryland Brae" Stud, Blunder road, Oxley
A. H. Groves, "Kinvara" Stud, Ingleside, West Burleigh
J. E. Heath, "Springlea" Stud, Murgon

The Manufacture of Cheddar Cheese in Queensland.

E. B. RICE and T. A. MORRIS, Division of Dairying.

(*Continued from page 284 of the November issue.*)

Pasteurisation of Milk for Cheddar Cheese Making.

Owing to the varying quality of the milk received and the high atmospheric temperatures in the subtropical climate, particularly during the summer months, pasteurisation of milk may be regarded as essential for the manufacture of cheese in Queensland.

The milk is normally flash pasteurised in regenerative double-dome or plate types of pasteuriser. The double-dome type (Plate 5) has to be connected to a separate cooler for reducing the temperature of the milk to that required in the vat, whereas with the plate machine (Plate 6) pasteurisation and cooling are performed fully enclosed in the one unit.

Operation of the Pasteuriser.

The principles involved in the operation of a pasteuriser for cheese-milk are independent of the type of machine employed. In general the procedures are as follows :—

Sterilizing and Starting.

Before pasteurising begins the machine is sterilized by pumping a chlorine solution through it or by circulating water at a temperature of 180–185° F. for about 5 minutes.

When sufficient milk is available, and with the return to the receiving vat open, the milk flow is commenced. Water is turned on to the cooling section and steam is slowly turned on to the heating section of the pasteuriser. The steam supply is increased until the thermometer registering the temperature of the hot milk indicates that the desired temperature is being attained. The thermometer registering the temperature of the cooled milk is read, and if necessary the flow of cooling water is adjusted until the correct milk temperature is attained.

When the temperatures are steady at the desired levels the by-pass to the receiving vat is closed by the opening of the line to the cheese vats.

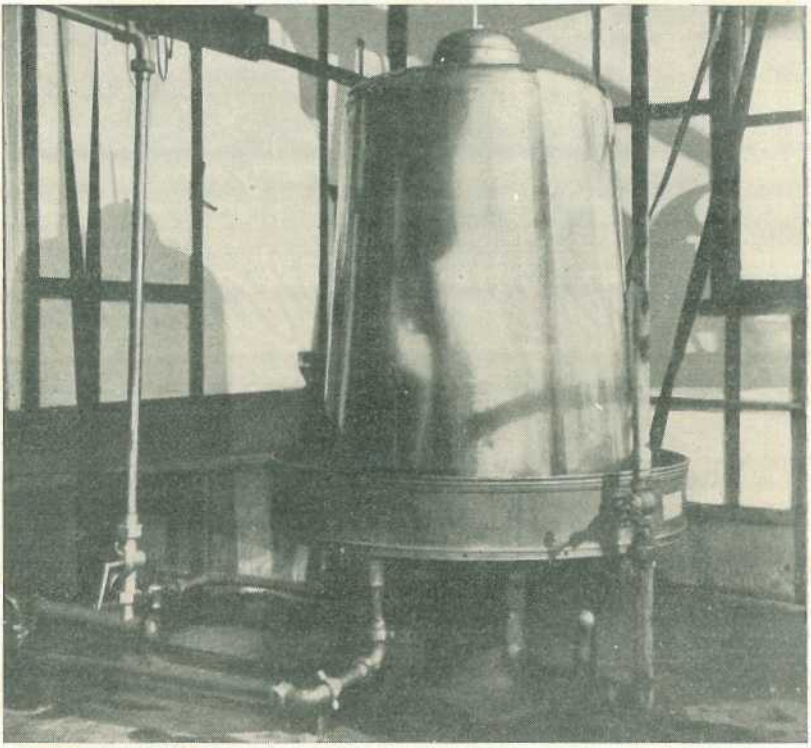


Plate 5.

A Dome Pasteuriser. This type has to be connected to a separate milk cooler.

Running.

The running of the pasteuriser involves maintaining a supply of milk and controlling the heating and cooling temperatures. Cheese-milk pasteurisers are usually manually operated and the control of the pasteurising temperature is by direct adjustment of the steam valve. The steam-line to the machine should be fitted with a reducing valve and should not be lagged. This will ensure a steady supply of low pressure, wet steam and thus facilitate the holding of steady temperatures as well as minimise the amount of burning-on of the milk in the heating section. Where the steam-line to the pasteuriser is short it might be necessary to bend it back on itself to provide a sufficient length of unlagged pipe-line to allow adequate condensation of the steam. Hot water circulating sets similar to those used with ordinary milk pasteurisers are being used in some instances. They are found to reduce both the amount of supervision required during pasteurising and, because of the absence of burnt-on milk, the labour involved in cleaning the machine.

If it becomes apparent that the pasteuriser will be without milk flow for a short time (for example, as a result of a delay in milk reception), the by-pass to the receiving vat may be opened and the milk then circulated until sufficient is on hand to allow a continuation of the filling of the cheese vats. For longer stoppages the milk should be followed through with water and the machine should then be closed down and left filled with water until pasteurising can be recommenced. If the machine is allowed to drain during such stoppages the milk deposits will dry out and be very difficult to remove.

Stopping.

The last of the milk is followed through with water from a specia balance tank or the receiving vat. As soon as the milk running into the cheese-vat appears watery the flow is diverted to allow it to run to waste. The steam is turned off and the pump supplying the cooling water is stopped. The cleaning of the pasteuriser may now be proceeded with.

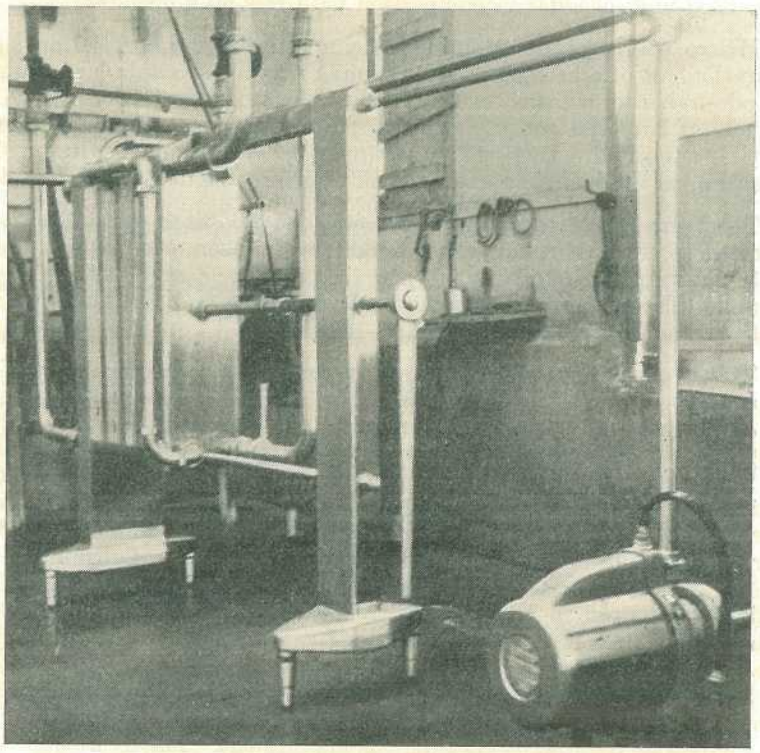


Plate 6.

A Plate Pasteuriser and Cooler. Pasteurisation and cooling of the milk are carried out fully enclosed in the one machine.

Advantages of Pasteurisation.

The advantages of pasteurisation may be listed as follows :—

(1) Pasteurisation greatly simplifies the bacterial flora of the milk, as only heat-resistant organisms survive. Thus most of the natural souring organisms and many of the organisms which may produce off flavours and openness in cheese are eliminated or at least reduced below the level of importance. Therefore, this practice allows a reasonably standardised starting point so that the cheesemaker can more easily attain uniformity in his cheese.

(2) Cheese made from pasteurised milk has a cleaner and better average flavour than raw-milk cheese and has superior keeping qualities. Some feed flavours are eliminated or reduced.

(3) A slightly increased yield is brought about by reduction of fat losses and precipitation of some of the whey-soluble protein.

(4) The heating of milk results in the formation of certain substances which stimulate the growth of lactic acid bacteria.

Effects of Pasteurisation on the Cheesemaking Process.

Only minor changes of technique are needed in the manufacture of pasteurised-milk cheddar in comparison with raw-milk cheddar.

Where poorly produced milk is being handled, pasteurisation simply makes the best of a bad job, and dirty milk may still contain large numbers of undesirable organisms even after efficient pasteurisation. The by-products of bacterial activity prior to pasteurisation also remain after the milk is pasteurised. High-acid milk (over 0·25 per cent. acidity) will not pasteurise, as the high temperature will result in coagulation of the milk.

The temperature to which cheese milk may be flash pasteurised varies according to seasonal conditions (drought, wet season, etc.), which directly affect the percentage of total solids and vary the fat : casein ratio. Temperatures may also require attention to deal with early and late lactation milk. The usual range in Queensland is 155–162° F.

Slower curdling with rennet may be noticed, particularly if the temperature of pasteurisation exceeds 160° F., but this is easily remedied. The curdling of milk with rennet requires the presence of soluble calcium salts ; certain of these salts are precipitated by the action of heat, and if milk is heated to too high a temperature coagulation may be slower. Overheating also results in a soft mushy curd, poor drainage, and a weak-bodied cheese. The soluble calcium salts may be replaced by the addition of calcium chloride or dilute hydrochloric acid before renneting. Calcium chloride is added to the milk at the rate of 1–3 oz. per 100 gallons of milk. It should be dissolved in 10 times its weight of water and added by a drip method as the milk is entering the making vat, or direct to the vat of cheese milk.

Hydrochloric acid is used at the rate of 3–5 oz. per 100 gallons of milk. It should be diluted with 10–20 times its weight of water and added by the drip method as the milk is entering the making vat. The hydrochloric acid dissolves some of the precipitated calcium salts, thus increasing the amount of soluble calcium present.

Calcium chloride is usually preferable to hydrochloric acid in obtaining faster coagulation and a firmer curd. Many naturally soft-curd milks are improved by the addition of calcium chloride.

Because of the destruction of lactic acid bacteria, it is necessary to use a greater amount of starter for pasteurised milk. A pure active starter is essential.

The disadvantage of pasteurised milk cheddar is the slightly reduced rate of ripening in comparison with raw-milk cheddar. The *Lactobacillus* species of organisms (which are important in the latter ripening stages of cheddar) are reduced by pasteurisation, but sufficient survive for proper ripening, although it takes place at a slightly slower rate.

[TO BE CONTINUED.]

Agricultural Chemistry

The Structure of Soils.

F. CHIPPENDALE, Senior Soils Technologist.

A GOOD concrete is made up of a mixture of coarse, medium and fine particles so that when mixed, rammed and set there are few air bubbles and the mass is hard and almost impervious to water. Should the fines be left out of the mix, then the final mass has numerous air spaces and is relatively porous.

In the same way, a soil composed entirely of coarse particles always has a reasonable amount of pore space which can only be reduced by grinding up some of the coarser material or introducing fine particles from an outside source.

Since the normal soil contains an infinite variety of particle sizes, it is possible to get it to form a very compact mass which has little space for the air and water required by plants. This happens when a soil is puddled by working it in an over-wet condition or when it is cultivated in a dry state by an implement which mechanically destroys the structure.

Aggregates.

The term structure is used to denote the grouping together of a number of the ultimate soil particles into an aggregate. These aggregates may vary in size from a clod to very fine grains. The ideal structure to give best conditions for plant growth is considered to be strongly developed crumbs.

This means that although the soil may contain a large number of particles too small to be seen even with the aid of a strong lens, many of these have stuck together and to the coarser particles until the mass has the appearance of bread crumbs. As each crumb has minute spaces that can hold water and there is ample space between crumbs for air, this soil can well support plant growth.

On the other hand, some soil types (for structure is a characteristic of a soil type) may be structureless. They may then be either powdery (when the bulk of the individual particles may be fine sand or silt ranging from 1/125th to 1/12,500th of an inch in diameter), or massive, if there is a high proportion of clay present. In the latter case, the soils can be like a lump of plasticine when moist but on drying out form huge clods which are difficult to deal with in a cultivation.

Cementing Materials.

The force with which aggregates are held together depends on the cementing material. It may be organic matter (such as fungous strands), clay or substances such as oxides of iron and manganese.

If clay is the cementing material, the strength of the aggregate can still depend on the type of clay present. Dark-coloured Darling Downs soils have a clay which is capable of holding a large proportion of calcium and so can retain a good structure, often in spite of misuse.

The red loams of the rain forests, on the other hand, have a good crumb structure which is due largely to organic matter. When the original high amount of organic matter has been used up because of repeated cultivation, the structure is poor though the same amount of clay remains in the soil. This type of clay cannot retain large quantities of lime, and apart from restoring the organic matter an excess of lime would be needed to improve the structure.

Stability of Soil Aggregates.

To be of most value, therefore, aggregates must be capable of withstanding cultivation and the action of water. This is referred to as stability. An index of the stability of the soil structure can be obtained in the laboratory by subjecting a soil sample to repeated washings on a set of standard sieves. The amounts of soil retained on the various sized sieves are a measure of the water-stable aggregates. The difficulty is to obtain a suitable soil sample. It is essential to take the sample without destroying any of the aggregates and to do this special precautions are necessary. Special skill is required also in selecting a suitable sampling site.

The water-stable aggregate figure is a useful quantity to know for any soil type, for besides being a characteristic of the particular soil type it is of value in recommending suitable rotations and cultivation techniques and in assessing the erosion potential of that soil. A structure which slakes on wetting makes cultivation difficult and makes erosion a certainty if slope and cover are favourable to the surface movement of water.

With a good agricultural soil the aim must therefore be to retain or improve the stability of the aggregates. This can best be done by cultivating over the correct moisture range—neither too wet nor too dry—and using long rotations. Permanent pastures can usually maintain a structure indefinitely, while intensive row cropping can result in a rapid deterioration of structure.

Stability can be destroyed by mechanical means, chemical changes or biological action. Examples of these three actions are—

(1) The use of too heavy equipment.

(2) The replacement of lime in clay by excessive amounts of sodium (from saline waters or nitrate of soda) or ammonium (from sulphate of ammonia); high temperature, such as in the light-coloured sandy soils of the coastal strip.

(3) The using up of vegetable remains by lower organisms which provide no cementing material to replace that which they destroy.

Restoring Stability.

Stability can be restored in many instances by a method of soil husbandry, such as changing from continuous cropping to a ley-farming system, or merely lengthening a rotation to ensure that row crops are not planted more than once in any year.

A more rapid and therefore often spectacular method of restoring stability is by applying a food such as molasses for the micro-organisms or one of the recently released soil conditioners. The action of molasses depends on suitable fungi or bacteria being present in the soil, while the soil conditioners require a relatively high percentage of clay to be present and do not act the same on all types of clay. They have been tried on several soil types of the Brisbane area and on the heavier Burdekin Valley soils with good results, but as yet they are too expensive for use on a large scale.