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Proud of Her Charge—
At the Brisbane Royal Show.

LEADING FEATURES

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Sorghum Growing in Queensland.

(Including Grain Sorghums, Sweet Sorghums, and Sudan Grass.)

L. G. MILES, Senior Plant Breeder, Agriculture Branch.

THE SORGHUM GROUP.

General and Historical.

THE genus *Sorghum* includes a wide variety of grain-bearing plants, ranging in type from tall tussocky grasses to the thick juicy-stemmed sweet sorghums of the type of Saccaline and Imphee. The main groups which have been cultivated throughout the world are (i) grain sorghums (mainly for grain), (ii) sweet or fodder sorghums (for green feed or ensilage), (iii) broom millet (for brooms and brushware), and (iv) Sudan grass (for grazing, hay and ensilage).

Another member of this genus which is widely distributed throughout Queensland is Johnson grass, an important weed of cultivated crops. *Sorghum verticilliflorum* is a further species, which is frequently seen along railway embankments throughout coastal Queenesland; it has a similar appearance to Sudan and Johnson grasses but has no economic importance in the State.

It is proposed in this article to deal with the cultivation in Queensland of grain sorghums, sweet sorghums, and Sudan grass. Broom millet is not included because it is not grown as a food crop, and, on account of the special handling required, its culture is dealt with in another pamphlet.

Cultivated sorghum is a crop of great antiquity. It is claimed to have been grown by the Chinese earlier than 2000 B.C., and was grown in Egypt in biblical times. The main centres from which it has spread into modern cultivation are Southern Asia (including China and India), Asia Minor, and North and South Africa. In most of these countries it has provided a staple cereal for human food, in addition to both grain and fodder for animals. It is only in more highly civilised modern communities, where wheat, oats and other cereals are plentifully available, that sorghum grain has been relegated to the position of a stock food.

During the latter half of the nineteenth century, many sorghum collections were made by botanists travelling in Africa and Asia, most of which found their way to the United States of America, where conditions were much better suited to their growth than in northern and western Europe. In America they rapidly gained favour, particularly in the drier mid-western and south-western States, where rainfall was often insufficient for successful maize crops. It is from the United States that many of our most successful importations have come.

Climatic and Soil Requirements.

The sorghum group are generally regarded as summer-growing annuals, though Sudan grass may function as a biennial and grain sorghums have also been known to survive a mild winter and provide a ratoon crop during the subsequent spring. For reasons of pest control, however, such ratooning is regarded as highly undesirable in grain and fodder sorghums, which crops will here be treated purely as annuals.

The crop requires a warm summer growing period of three to five months with ample rainfall interspersed with sunny periods. It has been definitely established that plants of the sorghum group are relatively drought resistant and require less rainfall for a unit crop of grain or fodder than does maize. This does not mean, however, that sorghums will not respond to seasons of good rainfall. Sorghums in Queensland frequently fail (particularly in grain production) through insufficiency of soil moisture, and within certain limits the better the rainfall received during growth the better the crop will be.

It is prolonged periods of wet and overcast weather which are detrimental to the crop, particularly if they occur during the later stages of growth. The more important harmful effects of such wet conditions are (i) the development of leaf diseases which seriously affect the feeding value of the crop, (ii) the encouragement of insect pests within the seedheads, and (iii) the spoiling of mature grain through moulding or partial germination.

Sorghums are susceptible to frosts during the growing period and may be completely killed if temperatures are sufficiently low. As the plant approaches maturity the effect of frost is to kill the green portions and to arrest any further development of the grain. If frost is experienced just prior to maturity (when the grain is fully formed), maturity may be hastened but no loss in either yield or quality of the grain will result. Earlier frosts will cause premature ripening of partially formed grain, which will finish in a badly pinched condition. Such early frosts will result in serious loss or even in total failure of the grain yield. As stalks may become very brittle after frosting, heavy losses may also result from lodging of frosted crops; in this respect some varieties (for example, Kalo) are notably worse than others.

The sorghum crops are suited to a wide range of soil types varying in texture from light loams to heavy clay soils. While best results can normally be expected from free-working soils of high fertility, useful returns are frequently obtained from second class agricultural lands. The relative drought resistance of these crops allows them to be grown on soils of lower moisture holding capacity than would normally be recommended for maize in the drier farming districts. Sorghum crops are also regarded as offering better crop prospects than maize on soils of medium or poor fertility.

On the score of climatic and soil requirements it will be seen that the sorghums are well adapted to summer planting over a wide range of the subcoastal agricultural districts from southern to central Queensland. Sweet sorghums have also been grown with considerable success in many of the coastal districts. The growing of grain sorghums in coastal areas is not generally favoured, because of the adverse effects of excessive rainfall. Where the mean annual rainfall in coastal districts is less than 45 inches, there is, however, some scope for expansion with openheaded varieties, which appear to be less subject to attack by caterpillars.

Seed-bed Preparation.

Although sorghums are able to grow under comparatively dry conditions, they require a moist seed-bed for satisfactory germination and early establishment. Ploughing should be carried out in winter or early spring with the object of leaving the soil in a rough condition for optimum absorption of storm rains and building up of sub-soil moisture. Subsequent cultivation should be aimed at maintaining a clean fallow and preparing a good surface tilth for the final seed-bed. The seed at planting should be placed in contact with good moisture at a depth of approximately 2 inches. If the final seed-bed is too cloddy it is likely to dry out to that depth before germination has occurred; this danger is considerably greater in summer time than in winter, necessitating the preparation of a finer seed-bed for sorghums than may be required for the winter cereals.

Seed.

The necessity for the use of seed of good quality cannot be too strongly emphasised with crop plants of the sorghum group. Uniformity of size, freedom from rubbish, a high germination percentage and trueness to varietal type should be prerequisites of planting seed of any agricultural crop. Members of the sorghum group readily intercross with each other, and the hybrid (or crossed) plants are nearly always taller and more vigorous than the parent varieties. This is particularly so in the case of crosses between a grain sorghum and a sweet sorghum or a grain sorghum and Sudan grass. The disadvantages of a mixed or badly hybridised seed supply are most apparent in grain sorghum crops (Plate 69), where uniformity of heading height is essential for efficient harvesting. The presence of tall strangers or hybrid plants in a field of grain sorghum slows up heading by frequent choking of the comb and elevator, and reduces yield because they contribute nothing to the grain harvest. In the case of Sudan grass it should be needless to stress the danger of introducing Johnson grass or hybrids between Sudan and Johnson grass with seeds of this widely grown crop.

The farmer's best guarantee of obtaining seed of good quality and uniform varietal type is the purchase of *certified seed.* All such seed is certified by Government officers as to its varietal purity, freedom from weed seeds and inert matter, and satisfactory germination percentage. It should be remembered, however, that certified seed can be legally sold only in unopened containers which bear the Government's seal and a certification label carrying the name of the variety and other details concerning the origin of the seed. Four varieties of grain sorghum are now eligible for seed certification, and it is intended to expand the scheme very soon to include five varieties of sweet sorghum and one or more varieties of Sudan grass. Where certified seed is not available,

Plate 69.

RELIABLE SEED IS ESSENTIAL.—The farmer asked for "Milo" seed, and this is what he got. Such crops are impossible to harvest satisfactorily, and provide ideal breeding grounds for midge and other pests.

seed should be secured only from a reliable source, preferably from a known pure stand which was free from disease and grown at least a quarter of a mile away from any other variety or any other plants of the sorghum group. Such seed should be bright, plump, and free from foreign matter, and should give a good strong germination of better than 70 per cent.

It is recommended that all seed of grain sorghum and sweet sorghum be treated with a protective dust prior to sowing, to ensure freedom from covered kernel smut. This precaution is unnecessary if the seed has been obtained from a perfectly clean crop and if there has been no risk of contamination through harvesting or cleaning machinery. The recommended treatment is a thorough dusting with copper carbonate, "Ceresan" or "Agrosan" at the rate of 2 oz. per bushel.

Growing Period.

Sorghum and Sudan grass crops normally require three to five months from planting to maturity, and virtually the whole of this growing period must be within a frost-free season. This latter consideration, coupled with the incidence or likely incidence of rain, governs the planting period in Queensland. Successful plantings have been made as early as August and as late as February, but planting either too early or too late is fraught with considerable risk and cannot be recommended. There is often a big inducement for dairy farmers to plant early in the spring to provide much needed grazing or grain. A further reason for early planting is the desire to avoid heavy grain losses due to sorghum midge. The main drawbacks to early planting are the irregular incidence of the spring storms, and the possible risks of frost injury to the young crop and of wet-season rains at harvest time. There is, however, quite a scope for early planting during most years, particularly on soils of good moisture-holding capacity following a suitable period of fallow. Such plantings should not be made until the soil has begun to warm up and until after the normal expectation of late frosts; September is often a good month for this purpose. Grain sorghum varieties planted at this time should either be very early-maturing (enabling them to be harvested before the risk of the wet-season rains) or very late-maturing (allowing them to tide over the wet season). For example, Early Kalo has been planted in Central Queensland in September and harvested successfully in January, prior to the advent of the main summer rains.

The main-season plantings are usually made from November to early January, although such plantings must often survive a severe dry heat-wave period during January-February. Such plantings usually receive sufficient rain to produce a payable crop, except of course in marginal areas, and should mature before the advent of early frosts. January and February plantings of sweet sorghum are frequently made, particularly in coastal areas, where it is desired to have feed for stock during the early winter months.

Poisonous Properties of Sorghums.

Stems and leaves of all plants of the sorghum group may possess poisonous properties prior to the flowering stage. These properties are due to the presence in the plant of a complex substance termed a glucoside which yields prussic acid under favourable conditions. The grain, of course, is in no way affected by the presence of this poison in the growing plant. Much has been written about the soil and weather conditions likely to promote prussic acid development in toxic quantities, and it is generally held that stunted growth or growth that has been frosted prior to flowering is particularly dangerous. Indications are also that Johnson grass and crosses between Johnson grass and Sudan grass are usually highly toxic. On the other hand, there are known examples, covering periods of more than 30 years, in which pure strains of Sudan grass have been grazed annually at all stages of growth without stock loss. Also, there is no evidence of stock poisoning from feeding on sorghum or Sudan grass which has passed the heading stage.

It must be remembered, however, that serious stock losses have from time to time occurred as a result of their feeding on Sudan grass, sweet sorghum or grain sorghum (the latter both in the early stages of growth

and in the stubble stage following harvesting). The risk incurred does not deter numbers of dairy farmers and graziers from grazing their stock on plants of this group at many stages of growth. They regard these crops as too valuable on account of their hardiness to be ignored on the score of the risk of poisoning. It is therefore emphasised that the greatest caution should always be used in the feeding-off of these crops, particularly as there is no easy means of detecting the presence of prussic acid in dangerous amounts.

It is known that individual animals differ from each other in their ability to withstand dangerous doses of prussic acid. It is also known that most animals can acquire a certain degree of immunity to this poison by being accustomed to it gradually in small quantities. It is therefore essential when stock are first grazed on young sorghum or Sudan grass, or on grain sorghum stubble (which may contain considerable re-growth), to watch them carefully for the first few grazing periods. It is recommended that such stock should first be given their fill of other roughage before being allowed to commence their grazing on the sorghum crop. It is also recommended that they be allowed to graze the crop for a very short period the first day, and for somewhat longer periods on succeeding days until they are apparently quite safe with the crop. As soon as any of the stock show the slightest sign of going down, the herd should be immediately removed for the day, and remedial measures applied if necessary.

A number of antidotes for prussic acid poisoning have been suggested from various sources both within Australia and overseas. Only one of these treatments (the first) has been at all widely used in Queensland, and this is the treatment which is generally recommended. It must be remembered, however, that the action of the poison may be very rapid, and that the necessary ingredients must be on hand and must be administered swiftly if affected stock are to be saved. The dosages given are those which have been proposed for cattle.

(1) Drench with a solution of photographic "hypo," 2 oz. to a pint of water per beast, repeated if necessary at 3-hour intervals.

(2) Drench each beast with ½-teaspoonful of permanganate of potash and 2 lb. of glucose (or molasses) in a quart of water.

(3) Use molasses alone, diluted sufficiently to make a drench; administer 1 quart per beast.

Sorghum Crop Rotations.

Much has been written in the past concerning the adverse effects of sorghum crops upon the crops immediately following them. It was noted in the United States that many crops following sorghums were stunted in growth and showed signs of a pale yellow colouring in the leaves. Such experience led to the suggestion that sorghum roots secreted a toxic substance which remained in the soil for some months afterwards. This theory is now discredited, as it has been shown that such symptoms in crops following sorghums are often due to a temporary shortage of available nitrogen. Sorghum residues when ploughed under frequently contain a quantity of sugars which encourage microbial activity in the soil, such activity locking up most of the available nitrogen. When the

sugary material has all been utilised, the micro-organisms cease to multiply, and as they die and decompose the nitrogen is gradually made available again for succeeding crops.

In Queensland it is not recommended that a summer crop of sorghum or Sudan grass be immediately followed by a winter crop such as wheat. Fortunately this practice is seldom attempted, particularly as most farmers retain their stubble for grazing well into the winter period. Where sorghum residues are ploughed under during winter, a period of fallow should be allowed during the warm spring months before any non-leguminous crop is planted on the same land. In Central Queensland, where decomposition of crop residues and nitrification take place rapidly in moist soils during spring, no deleterious effects have been noticed when sorghums have been grown annually on the one field for a period of years, or when sorghum crops have been followed by other summer crops. In cooler districts, or in any areas in which other crops are considered to be harmfully affected by previous sorghum crops, the latter should be followed by a long fallow or by a leguminous crop grown preferably from inoculated seed.

Attack by Birds.

All crops of the sorghum group are subject to serious loss of grain through depredations of birds. As with a number of cultivated and native grasses, the seedhead is carried at the top of the plant where it is clearly visible from the air and unprotected from attack. All grain-eating birds are particularly fond of sorghum or Sudan grass seed, and few crops entirely escape their attention. In the neighbourhood of the larger centres of population sparrows may be a real menace, while in the more remote country areas parrots are of overwhelming importance. Grain may be attacked from the soft dough stage right through to maturity and many small seed crops have been entirely ruined through this cause. Where large areas are grown, either in the one planting or in closely adjacent smaller areas, the attack would normally be spread and the percentage loss minimised. Where areas are small and isolated, however, and particularly where there is ample timber in the vicinity, special precautions must be taken if a seed crop is to be harvested.

GRAIN SORGHUMS.

General and Historical.

Grain sorghums were introduced into Queensland at quite an early stage in our agriculture, but never attained a position of prominence until the present decade. The main reason for the slow initial development of this crop was the fact that the only varieties available in early years were relatively tall, and had to be harvested by hand. Isolated areas of Standard Yellow Milo, Feterita and a few other varieties might be found on widely scattered farms, but the crop was regarded more as a curiosity than as a grain crop of potential importance.

The question of mechanical harvesting of grain sorghums was never seriously considered even in the United States until dwarf and double-dwarf types were eventually discovered within such tall varieties as Standard Yellow Milo. While the standard variety averaged 5 feet or more in height, Dwarf Yellow Milo (first recorded in the early years of this century) averaged 4 feet, and Double-dwarf Yellow Milo (first

noticed about 1920) ranged from 2 to 3 feet high. These shorter growing Milo strains were not altogether suited for direct heading, particularly on account of their tendency to the "crook-neck" habit. Such types were, however, crossed with tall erect-growing Kafir strains, and selections from these crosses resulted in the straight necked dwarf varieties Wheatland and Beaver. It is from the time of liberation of these erect sturdy dwarf varieties (1928-1931) that the period of mechanical harvesting of grain sorghums really dates.

During 1932 and 1933 some 30 varieties of grain sorghum were introduced into Queenslnad by the Department of Agriculture and Stock from South Africa, Egypt and the United States. Included within this group were the dwarf varieties Wheatland, Kalo, Hegari, Day Milo and Brown Yolo. This range of varieties was tested in southern Queensland during the 1933-34 and 1934-35 seasons, and small seed increases were made of the most suitable dwarf varieties for distribution in 1935 to the Darling Downs and Biloela, and a few years later to Kingaroy. It is from these original distributions, of a few pounds of seed each, that Queensland's grain sorghum industry has developed.

The crop attained rapid popularity, particularly amongst dairy farmers on the Darling Downs and in the Burnett, Callide and Dawson Valleys. In the drier districts it soon began to displace maize as the major summer grain crop, because of (i) its greater security under conditions of irregular or insufficient rainfall, and (ii) its ability to be mechanically harvested. Although the first commercial plantings of these dwarf varieties were not made until about 1938, the annual production had risen within five years to over a million bushels. The table below indicates the development of production in Queensland during the 7-year period from 1941-42 to 1947-48.

Year.	Area.	Yield.
	Acres.	Bushels.
1941–42	40,630	693,437
1942–43	54,868	1,341,305
1943–44	54,709	1,110,477
1944–45	49,451	918,780
1945–46	68,775	1,295,442
1946–47	116,079	3,355,322
1947–48	69,431	1,472,793

The high production figures for 1946-47 resulted very largely from the failure of the wheat crop in 1946. As wheat yields during the years 1947 and 1948 have been at a high level during a period of high wheat prices, there has been little inducement since 1946 for the large scale grain growers of the western Darling Downs to grow further crops of sorghum. It will readily be seen, however, that the annual production of this grain could be stepped up tremendously if occasion demanded. Queensland's present production should be greatly enhanced during favourable seasons by the operations of the Queensland-British Food Corporation in addition to a number of graziers in the Emerald district of Central Queensland.

The bulk of the grain produced by dairy farmers is for local consumption. When ground and fed with skim milk it forms the staple diet for pigs throughout much of sub-coastal southern Queensland. It is regarded as being almost the equal of maize in its food value, but it requires to be fed with some animal protein or with a legume such as lucerne for its own nutrients to be most effectively utilised.

Selection and seed purification have been applied to the original introductions, and a plant breeding programme was commenced at Biloela Regional Experiment Station in 1941. This programme, which has since been transferred from Biloela to Kingaroy, aims at producing new varieties better suited to Queensland conditions by means of selection and hybridisation. Many new strains have already been produced and tested, and four of these are described under the heading "Varieties" in subsequent pages.

Sowing.

Grain sorghum is almost wholly machine-planted in Queensland, using either a seed drill or a corn-planter. On the Darling Downs, as would be expected, the grain drill or combine is by far the most widely used seeder for sorghums. Since the planting runs of the drill are spaced 7 inches apart, it is possible to plant in rows at this spacing if so desired. Where a 14-inch row spacing is required, alternate runs are blocked; for a 21-inch spacing two runs out of every three are blocked, and so on. By this means it has been possible to obtain good stands in rows up to 3 ft. 6 in. apart, merely by blocking off the appropriate number of grain runs. It is often found when using a combine drill behind a rubber-tyred tractor, particularly on heavy black soils, that a poor strike occurs in rows following the heavy rear tyres. This is due to the compacting of the soil behind the tyres resulting in poor penetration of the seeding tynes following these tracks. A suggested remedy is to replace the standard planting hoes running in the tyre tracks with hoes approximately one inch longer; these enable better penetration of the seed to moist soil, resulting in stands comparable with the other rows.

In maize growing districts, such as the South Burnett, maize planters are still very popular for the planting of sorghums. Both 2-row and 4-row planters are commonly used, and suitable sorghum plates are substituted for the maize plates in the planting mechanism. Excellent results have been obtained from planters both of the press-wheel type and of the tyne-cultivator type, but the method is only adapted to the wider row spacings. Some farmers have made their own sorghum combine by bracing together two planters of the high wheel, tyne-cultivator type. The resulting implement is then used both as a 4-row planter and as an inter-row cultivator.

Seeding Rates and Row Spacings.

Row spacing trials and rate-of-seeding trials have shown that during seasons of ample rainfall there may be little difference in yield from row spacings from 7 inches up to 3 ft. 6 in. or seeding rates from 20 lb. down to 4 lb. per acre. Under such conditions the wider spaced plants tend to tiller more freely and to produce larger heads, thus compensating for the higher plant populations obtained by closer spacings. Under drought conditions, however, the wider spacings have often enabled the plants to set a grain crop where closer spacings have

failed entirely. The main benefit of the closer row spacings and heavier seed rates is in the suppression of weed growth and elimination of the necessity for inter-row cultivation. Closer spacings also tend to promote a more even heading height, which makes for ease of harvesting.

On the fertile, heavy black soils of the Darling Downs, excellent results have frequently been obtained with close row spacings ranging from 7 inches to 21 inches, particularly when moisture has been conserved by fallowing. On poorer soils, however, or in areas of lighter rainfall or heavier evaporation, wider row spacings ranging from 28 inches to 42 inches are strongly advocated.

The following table gives an idea of the seeding rates per acre commonly attainable by the use of the seed-drill (or maize planter for the wider spacings) for varying row spacings:

Row Spacing. Inches.	Seeding Rate. Lb. per Acre.
7	20
14	10
21	7
28	5
35	4
42	3½

It is generally felt, however, that 20 lb. per acre is an excessively high seeding rate, and attempts have been made, quite successfully, to reduce the plant population in the row under the closer row spacing conditions. This has been achieved by running a leather thong or a hook of fencing wire down each grain outlet in use. Planting rates per row can also be successfully reduced by replacing cog-wheels in the planting gear to alter the gear ratio. By the latter means a planting rate of 5 to 6 lb. per acre has been achieved at Peak Downs with a 14-inch row spacing.

Cultivation of the Crop.

When the crop is planted in drills which are wider apart than 21 inches, inter-row cultivation becomes a necessity on most soil types. Such cultivation assists in the aeration of the soil, controls young weed growth, and provides a broken surface to trap further rains. During the early stages of growth, cultivation is frequently carried out very cheaply and efficiently by means of the combine or tyned planter which was used for planting the crop. All that is necessary is to remove the planting tynes and follow the same course as was used when planting (Plate 70). For smaller areas, single-row and 2-row cultivators may conveniently be used as for maize. With larger areas in which wide row spacings have been used, tractor cultivating attachments provide a quick and efficient means of carrying out the work. Early cultivations may be deep, but later operations should be shallower so as not to injure the surface roots of the plants. The number of cultivations required cannot be specified, as so much depends upon the soil type, the prevalence of weeds and the incidence of rainfall.

Where spacings of 21 inches or less have been adopted, particularly on soils where weeds are likely to be a problem, it is advisable to harrow the young crop at right angles to the direction of the rows. This harrowing should be carried out during the heat of the day when the young sorghum plants are not inclined to be brittle. The young plants

Plate 70.

Inter-row Cultivation of a Young Grain Sorghum Crop, Using the Three-row Planter which had Previously been Used for Planting the Crop.

so treated should be well established, but not tall enough to be seriously injured by the harrows. This operation gives the crop an excellent advantage over weed competitors, and even the loss of a percentage of the sorghum plants may be a decided benefit where the stands within the rows are excessively heavy.

While hormone weedkillers have not yet been extensively used for weed control in sorghums, it is known that they are effective against many of the common weeds of cultivation. Should their use prove economic, they may conceivably supplant crop cultivation as a means of weed control where suitable spraying equipment is available.

Harvesting.

Sorghum grain in Queensland is almost universally harvested by means of the mechanical harvester-thresher (Plate 71). The old American method of hand-cutting of the heads followed by threshing in a stationary thresher has seldom been adopted in this State, and is never seen today on farm-scale plantings. Australian headers have handled the dwarf varieties with conspicuous success right from the outset, and it is upon this factor that the expansion of the crop has largely depended.

Harvesting should not be attempted until the bulk of the grain is thoroughly dry and cannot be dented with the fingernail. Sorghum grain is very susceptible to deterioration in storage, particularly in bulk storage, if it carries excessive moisture at harvest time. Grain with a moisture content of over 14 per cent. is almost certain to spoil if stored immediately.

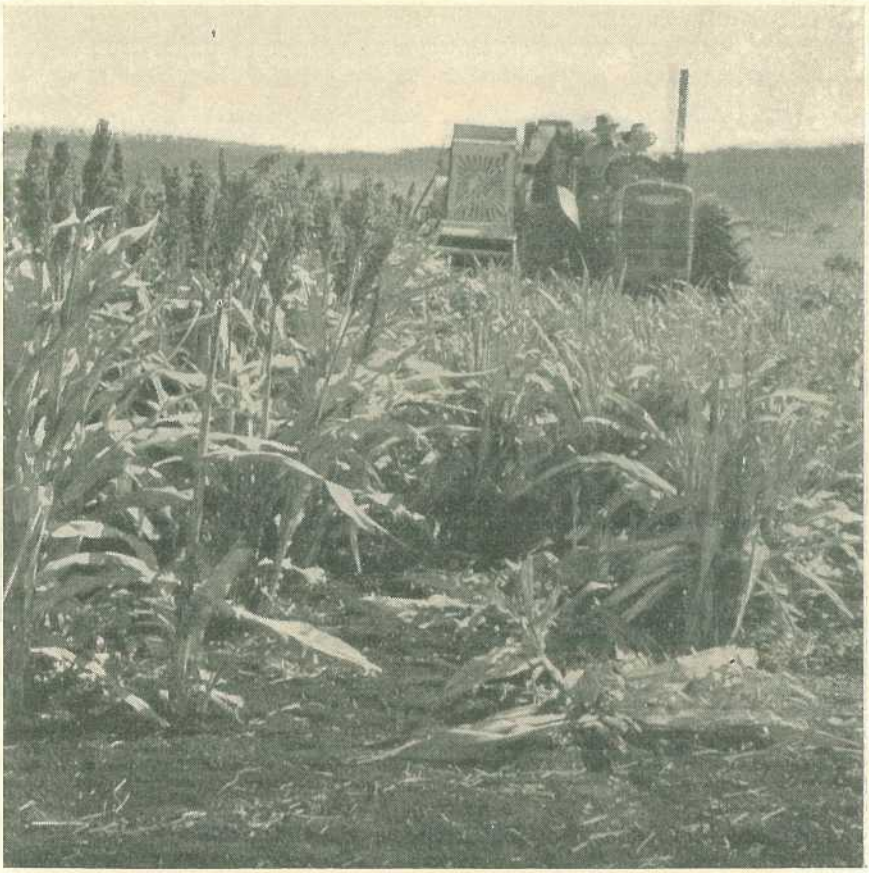


Plate 71.

Harvesting of Grain Sorghum at Hermitage Regional Experiment Station, near Warwick.

Most of our dwarf grain sorghum varieties can be harvested successfully without racking up the comb of the header to its full height. Where certain varieties, such as Kalo or Hegari, exceed 4 feet in height under good growing conditions, it is often necessary to use the full height of the comb and to use a roller in front of and above the comb to push the heads over to a suitable cutting level. The need for using good quality seed is particularly apparent at harvest time, for if the heads occur at several levels the comb must be racked down to accommodate the lowest heads, and as a result much useless trash is taken through the elevator and drum. Where a field presents a uniform level of heading, the harvesting process need be no more difficult than the handling of wheat or oats. It should always be remembered, however, that the proportion of trash taken in with sorghum heads is much higher than with the winter cereals. Thus in harvesting heavy crops or uneven crops it may be necessary to reduce the cut to half or two-thirds of the full comb in order to avoid stoppages due to congestion of the elevator, drum and riddles.

The adjustments made to harvesters for sorghum heading are normally very simple and may comprise: (i) wider spacing of the fingers of the comb to permit the entry of the relatively coarse stalks to the cutting blade; (ii) a slight reduction in the threshing speed to avoid excessive cracking of the grain; (iii) intensification of the blast to provide more effective winnowing of the bulky trash from the grain; and (iv) inversion of the top riddle to further facilitate clearing of the trash. Though relatively clean samples of sound grain are frequently obtained by the use of a well adjusted machine on a uniform and well matured crop, it is always advisable to reclean any seed required for planting purposes. Relatively small quantities can be readily cleaned by the use of hand sieves and the pouring of the grain from one tub to another on a windy day. Larger quantities are normally handled by special seed-cleaning machinery, or by pouring the grain on to the riddles of a clean header the machinery of which is driven by a power take-off from the tractor.

Yields of grain vary greatly from one season to another and one district to another, depending largely on the soil fertility, the incidence of rain and the presence or absence of insect pests. Many crops in drought seasons have failed completely in grain production, while yields of over 100 bushels per acre have been recorded under good conditions. Good average yields of 30 to 60 bushels per acre are frequently obtained on the better farms throughout the main sorghum districts, while quite useful yields of 15 to 30 bushels per acre may be anticipated in many of the more marginal areas in the majority of seasons.

Grain Storage.

Prolonged storage of any type of grain presents considerable problems. Some of the more important of these are deterioration of the grain due to excessive moisture content, serious damage due to weevil attack, and loss through the depredations of mice. The first of these problems can only be safely overcome by allowing the crop to mature thoroughly in the field. Here, however, difficulty often arises because secondary heading frequently occurs following rains late in the season. These secondary heads, which result from belated tillering or from actual branches from the primary stems, may carry immature grain at the time the main crop is fully mature. Under these conditions it is sometimes imperative to harvest the crop without delay, as the primary crop might well be a good one and excessive delay might cause considerable loss through grain weathering or through weakening and collapse of the old stalks. The presence of the green grain in such sample will raise the over-all moisture content and definitely rule out immediate bulk storage. Such grain can be readily dried out in fine weather by spreading in thin layers and stirring occasionally, but this treatment is beyond the scope of the large-scale grower. Samples which are only slightly above the critical moisture content will dry out satisfactorily in the bags provided the latter are not sewn for a few days and are exposed to fine weather in the field.

Bagged grain can be safely stored on the farm at a somewhat higher moisture content than that allowable for bulked grain in tanks or bins. Such bags, however, are preferably stored in an open dump upon a mouse-proof floor and with effective covering from weather. This arrangement is particularly suitable on farms where the bulk is to be utilised within the ensuing year for feeding pigs, poultry or other stock.

An adjacent crusher with a receiving bin at a handy height enables bags to be emptied from the top of the stack as required, and the grain to be ground for stock food. Moreover, experience has shown that the activities of weevils in such a stack cause little loss in actual feeding value throughout a 12-month period.

Where grain is to be stored for longer periods—for example, as a reserve against future droughts or seasonal shortages—tank or bin storage is the only safe means. The tanks used should be capable of being made airtight when filled, and the grain of course should be thoroughly dry before storage. Weevils can be effectively controlled in storage tanks by fumigation with carbon bisulphide at the rate of ¼ lb. per 1,000 gallons of filled storage space. Full details on the tank-storage of grain are to be found in the Department's bulletin on maize, and in Pamphlet No. 114, entitled "Stored Products Pests."

Feeding of Crop Residues.

The feeding-off of crop residues following the harvesting of the grain has often been criticised because of (i) the danger of sorghum poisoning and (ii) the doubtful food value of the stubble. The fact remains, however, that dairy farmers have for some years regarded grain sorghum stubble as one of their most useful roughages, particularly during the autumn and early winter. Many farmers have definitely been influenced in their choice of varieties by the quantity and the palatability of the residues after harvesting. Grazing of course in such paddocks is not restricted solely to the drying stalks and leaves of the primary crop, but also includes young suckers from the sorghum plants, and grasses and herbage which have grown within the crop. It is certainly safe to say that many dairy farmers in the past would have been forced to sell their stock or have them agisted during dry periods if they had not had available ample areas of grain sorghum stubble.

The palatability of the grain sorghum plant, though not as high as that of sweet sorghum, has also enabled dairy farmers and graziers to turn crop failures to profitable use during dry periods. Many grain sorghum crops which have been written off for grain production owing to excessively dry seasons have provided weeks of useful feed for dairy cows or breeding stock at periods when no other green feed was available.

On account of the proven fodder value of the crop (either before or after grain production) this aspect of its usefulness cannot be overlooked. It is, however, reiterated here, and cannot be stressed too much, that the greatest caution must always be exercised in the grazing of sorghum plant material because of the definite risk of sorghum poisoning.

Grain Sorghum Varieties.

The necessity for the use of seed of good quality and a high standard of purity has been stressed in an earlier section. It is important that farmers should know the main varieties available to them and should be able to ask for and obtain seed of specific varieties of proven performance in their districts.

It is very unfortunate that the term "Milo" should have gained such favour amongst farmers and seedsmen throughout the State. This term was applied originally in America to a group of sorghum types each characterised by certain constant features, but differing from each other in a number of minor attributes. A similar term applied to another

group of varieties of common origin was "Kafir." In Queensland, the term Milo is practically meaningless, as no true Milo types are now commercially grown. Wheatland was originally introduced as Wheatland Milo, but this term was really a misnomer, as Wheatland originated from a cross between a Milo and a Kafir and bears certain characteristics of both groups. The term Milo has long been dropped from the original Wheatland Milo, and Wheatland is now its accepted name both in the United States and in this country. Day Milo was another early introduction which is in many respects a true dwarf Milo type; this variety has, however, practically disappeared from cultivation in Queensland. There is therefore no excuse for the retention of the term Milo in Queensland sorghum culture, particularly as its use only leads to misunderstanding and confusion. Farmers and seedsmen are urged to discontinue the use of this word, and to know and ask for grain sorghum varieties by their correct names.

The following brief descriptions refer to three of the varieties originally introduced into Queensland in 1932-33, in addition to four varieties developed locally and three more recent introductions from the United States of America which are at present undergoing test. It should be realised in reading these descriptions that they are intended to give an average picture of each of the varieties dealt with. Unfortunately, most sorghum varieties vary considerably from one site to another and one season to another, making it impossible to provide descriptions that will fit all situations. Thus a variety which normally has straw-coloured glumes or hulls may under certain conditions develop black or blotched glumes; a variety which is normally of medium height may under differing conditions reach a height of 5 to 6 feet; or again one variety may be earlier maturing than another in one district while in a different district the reverse may be true. A good example of the last effect is afforded by a comparison of Wheatland and Kalo. In Central Queensland Wheatland has almost always proved earlier than Kalo by at least a few days, whereas on the Darling Downs Kalo is considered to be unquestionably earlier than Wheatland. Such variations will be referred to where they are known to occur.

Wheatland (Plates 72 and 77).

This is one of the original dwarf varieties introduced into Queensland, and has been a standard variety up to the present day. It is a true double-dwarf, ranging in height from 2 ft. 6 in. to 3 ft. 3 in. It normally heads within 50 to 70 days of planting and matures in approximately four months (generally later on the Darling Downs). The variety tillers quite freely, and may produce frequent stem-branches following late rains. Foliage is rather stiff and harsh; the leaves are crowded at the base of the plant and are typically erect and somewhat twisted, giving a characteristic appearance to the variety; the midrib is cloudy to white. Heads are normally broad and irregularly cylindrical, and are of medium density. The variety is awnless. Glumes are typically black, sometimes blotched. The grain is usually large, varying to medium size under drier conditions, pale yellow in colour and well rounded in outline. Main advantages of this variety are its low height (for ease of heading), its stocky habit (enabling it to stand up well under most conditions) and its general reliability. Main disadvantages are its unevenness of heading height in seasons of irregular rainfall and the poor quality of the crop residues after heading. There

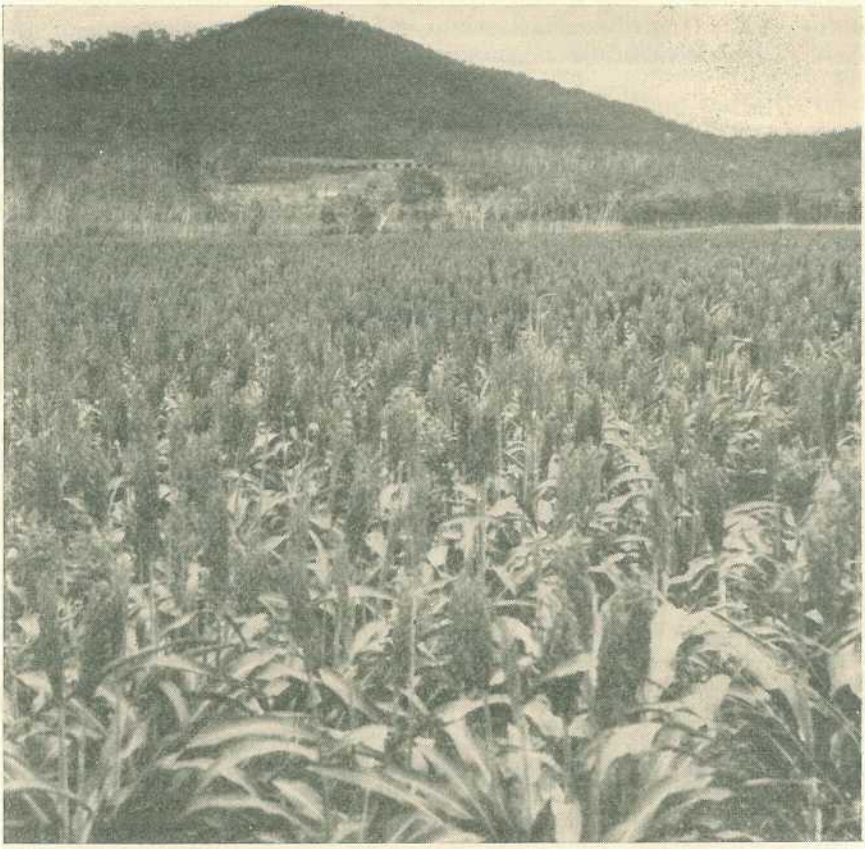


Plate 72.
Wheatland.—A crop in coastal Central Queensland.

is also a tendency for the heads of this variety to "blast" when flowering occurs in hot dry weather, resulting in much sterility and grain loss; this condition has been noted several times in Central Queensland. Wheatland is the most popular variety in the South Burnett and is also extensively grown throughout the Upper Burnett and Central Queensland. It has lost popularity on the Darling Downs, where it has been largely displaced by Kalo. Certified seed of Wheatland is now being produced in considerable quantity.

Kalo (Plates 73 and 78).

This is another of the original dwarf varieties introduced from the United States of America. It is not a double-dwarf variety, and is frequently somewhat tall for header harvesting. Its height ranges from 3 ft. 6 in. to 5 feet, but on black soil it seldom exceeds 4 feet. It heads normally in 55 to 75 days from planting and matures in approximately four months. Kalo carries good foliage which is well spaced up the stems and is typically turned over towards the tips and not held erect as in Wheatland. The midrib is cloudy, indicating juiciness of the leaf and stem. Heads are typically long and club-shaped, and of medium density. The variety is prominently awned, the awns being

Plate 73.
KALO.—A heavy crop on black soil at Hermitage Regional Experiment Station.

angled and approximately ¼ inch in total length. Glumes are small and straw coloured, often edged with brown. The grain is medium-small, though well grown samples may reach medium size; the grain is plump and rounded and is normally reddish gold in colour. This variety is a prolific producer under good conditions, and it possesses excellent powers of recovery. During dry seasons it can hold out for long periods, and still produce a useful crop from late tillers and stem-branches when rains finally occur. Its stubble is more abundant and more palatable than that of Wheatland, making it popular for grazing subsequent to harvesting. Its main disadvantages are its height, which is sometimes excessive, and its tendency to lodge prior to full maturity. These characteristics seem to be accentuated on scrub soils and on some of the lighter textured alluvials, but are not often of serious account on heavier clay alluvials and the black soils of the Downs. This variety has attained its greatest popularity on the Darling Downs, where it has been grown with great success. It has also been widely distributed throughout central and sub-central Queensland, where it has largely yielded place to Wheatland, and more recently to Early Kalo.

Hegari (Plate 79).

This variety, which is a native of North Africa, is the most variable of our varieties in response to seasonal conditions, sites and planting dates. In the United States it is also described as being especially sensitive to seasonal conditions and varying widely in time of heading,

maturity, height, and yield. In Queensland it is typically tall, ranging from 4 ft. to 5 ft., or even higher under certain conditions. Hegari ranges in maturity from early to late; on the Darling Downs and in the Burnett it is sometimes earlier in its heading (45 days) than either Kalo and Wheatland, while in the Callide Valley it is usually classified as late, heading in 60 to 85 days and maturing in 4½ to 5 months. Under long-season conditions it normally tillers very freely, giving the plants a spreading habit, while under short-season conditions stooling may be greatly suppressed. Foliage is generally quite abundant, drooping, and with midribs mainly cloudy. Heads are irregularly oval in shape and fairly dense, the tight clustering of the grains on short branches providing a "bunch of grapes" effect. Awns are present in this variety but are so minute that the heads normally have a distinctly awnless appearance. Glumes are conspicuously black, and the kernels, which are well exposed, are well rounded, of medium size, and chalky white in colour. This variety, though less popular than Wheatland and Kalo, has given excellent individual yields at scattered centres throughout the grain sorghum belt of Queensland. Its main virtues are its ability (like Kalo) to recover well following rains late in the season and the bulk of feed it provides for grazing. Its main disadvantages are its unpredictable behaviour and its lodging propensities following good growing conditions on fertile scrub soils. Its grain, being relatively soft, is very susceptible to weevil attack and does not normally store as well as that of the coloured varieties.

Early Kalo (Plates 74 and 78).

This variety originated in the United States as a selection from Kalo. The material received in Australia, however, showed definite variability in grain colour and plant habit. Selections were therefore made within

Plate 74.

End View of Four of the Plots in a Grain Sorghum Varietal Trial, Hermitage Regional Experiment Station, 1949.—Plots from left to right are Early Kalo, Alpha (Wheatland 11s), Caprock, Kalo.

the variety at Biloela in 1942. These were purified and tested over a four-year period, when the best selection was increased and made available for field testing. This variety is clearly a Kalo type, which under some conditions is very difficult to distinguish from standard Kalo until maturity is reached. Normally it is distinctly shorter than Kalo, particularly in Central Queensland, its height ranging from 3 ft to 4 ft. The variety heads in from 40 to 60 days of planting and reaches maturity in 3 to 3½ months. Its foliage is somewhat sparse compared with Kalo, but is otherwise similar, the midrib being cloudy. The variety tillers quite freely when space permits. Stem-branching may be altogether absent or quite pronounced, depending upon the season, but the secondary heads do not vary greatly in height from the primary heads. Heads are similar to those of Kalo, but tend to be somewhat more open and less club-shaped. Awns are present but are generally less than ¼ inch long and are often deciduous at maturity. Glumes are small and straw-coloured and the grain is well rounded, medium-small to medium size, and a rich reddish gold or full red in colour. When grown alongside standard Kalo this variety is readily distinguishable from it at maturity on account of the richer colour of its grain. Early Kalo's main advantages lie in its earliness and its powers of recovery after a check. In good seasons it cannot be expected to compete in yield with Kalo or other later varieties, though it has on occasions produced 60 to 80 bushels per acre. Its earliness makes it a useful variety for drier districts, particularly for early planting (where a quick crop is required) or for late planting (where it is desired to escape frost damage). Though liberated widely only in the Callide Valley, it has also given good results in trials as far south as Warwick.

Alpha (Plates 75 and 77).

This variety, previously known as Wheatland selection 11s, arose from a single plant selection made on the farm of Mr. C. Skinner in the Biloela district in 1944. The resultant row from the seed of this plant was at once impressive, being more prolific and uniform than any of the other Wheatland selections. The strain was purified by pedigree selection, and was first put into yield trials in 1946-47, when it outyielded all standard varieties at the Biloela Regional Experiment Station. In addition it has topped the yields in two successive trials at the Hermitage Regional Experiment Station (near Warwick) and has been given good general field reports. Although this selection is very similar to Wheatland in many respects, it is sufficiently distinct to merit a new name. In height it is very similar to standard Wheatland, but appears less subject to variation; in all tests so far conducted it has been very close to 3 feet tall. Its foliage is very similar to that of Wheatland but is somewhat finer and less harsh; the midrib is cloudy, indicating juiciness in the leaf and stalk. The variety tillers very freely but branches sparsely. In Central Queensland it differs very little from Wheatland in its periods of heading and maturity, but on the Darling Downs it has so far proved some days earlier. The heads are similar in overall shape to those of Wheatland but are more regular and more level on top. Awns are absent, as in Wheatland, and the glumes are normally black to purple-brown. The major difference from Wheatland is in the grain, which is distinctly smaller in size and slightly richer in colour. One of the great advantages of this variety is the regularity of its heading height, in which respect it is much superior to Wheatland. In three years of trial it has proved to possess good

drought resistance and to be easily handled by harvesting machinery. It is offered mainly as a substitute for Wheatland as a midseason variety, particularly in Central Queensland and the Darling Downs.

Plate 75.

ALPHA.—A new Queensland variety, originating as a selection from Wheatland. Alpha has yielded well in trials, and produces its heads at a very uniform level.

Capricorn (Plates 76 and 79).

This is another new variety developed in Queensland, and has resulted from selection within Early Kalo. Known for some seasons as Ex Early Kalo, EK. 7, it has also been subjected to limited testing from Central Queensland to the Darling Downs. It is in the same height range as standard Kalo, ranging from 3 ft. 6 in. to 4 ft. 6 in. In Central Queensland it has normally headed within 60 to 70 days and matured its crop quite uniformly in approximately four months. In the Central Burnett it has been recorded as distinctly early maturing, but in three trials on the Darling Downs during 1948-49 it proved to be later than any of the standard varieties and required a full five months for its maturity. This variety carries a heavy and attractive foliage, which, coupled with its free stooling habit suggests definite possibilities as a dual purpose variety. It is reported that dairy cattle showed marked preference for this variety over all others in a varietal

Plate 76.

Capricorn.—A Queensland-bred grain sorghum, originating as a selection from Early Kalo; planted in rows three feet apart on a Central Queensland farm.

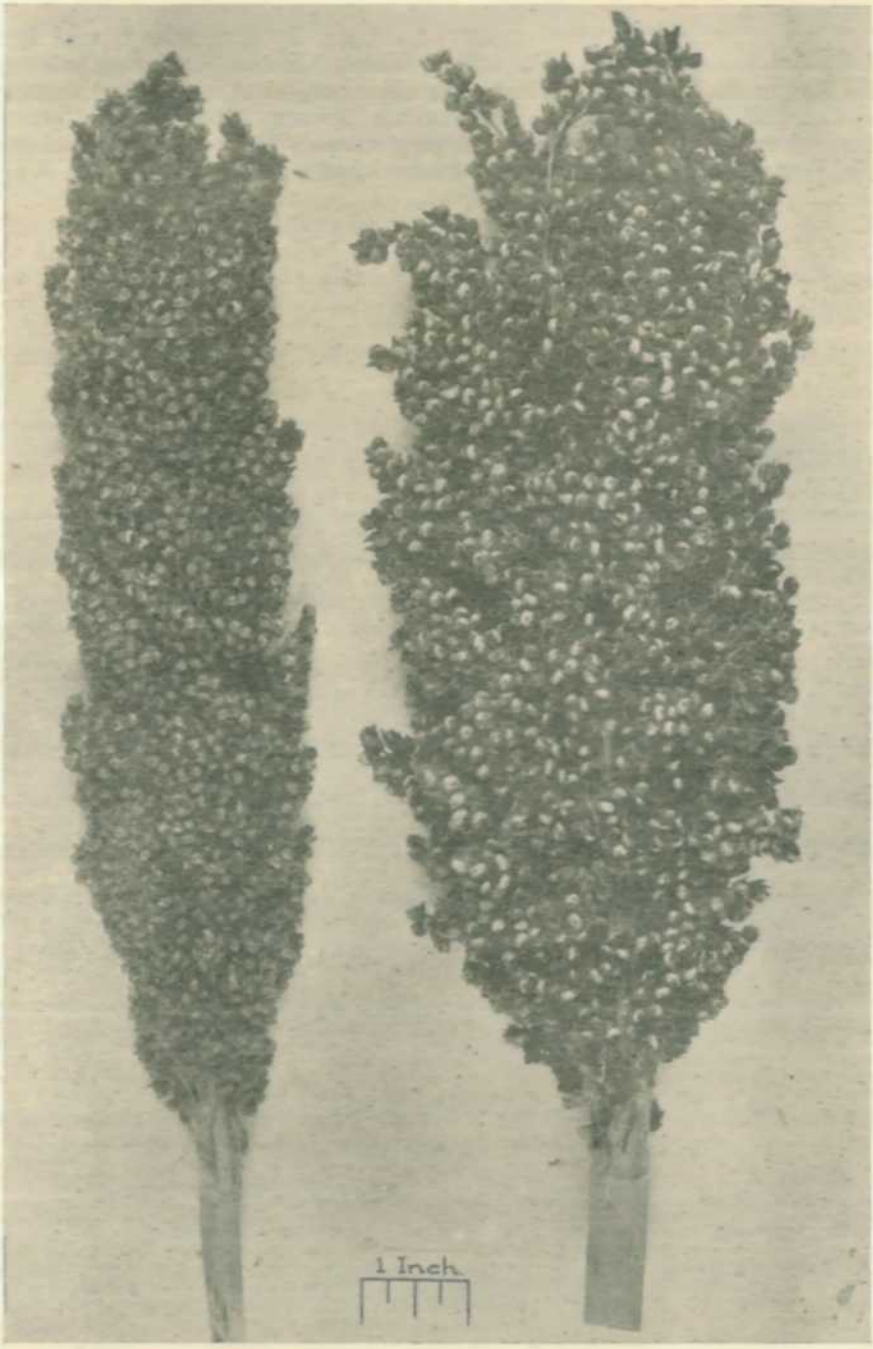


Plate 77.

Heads of Grain Sorghum Varieties.—Alpha on left; Wheatland on right.

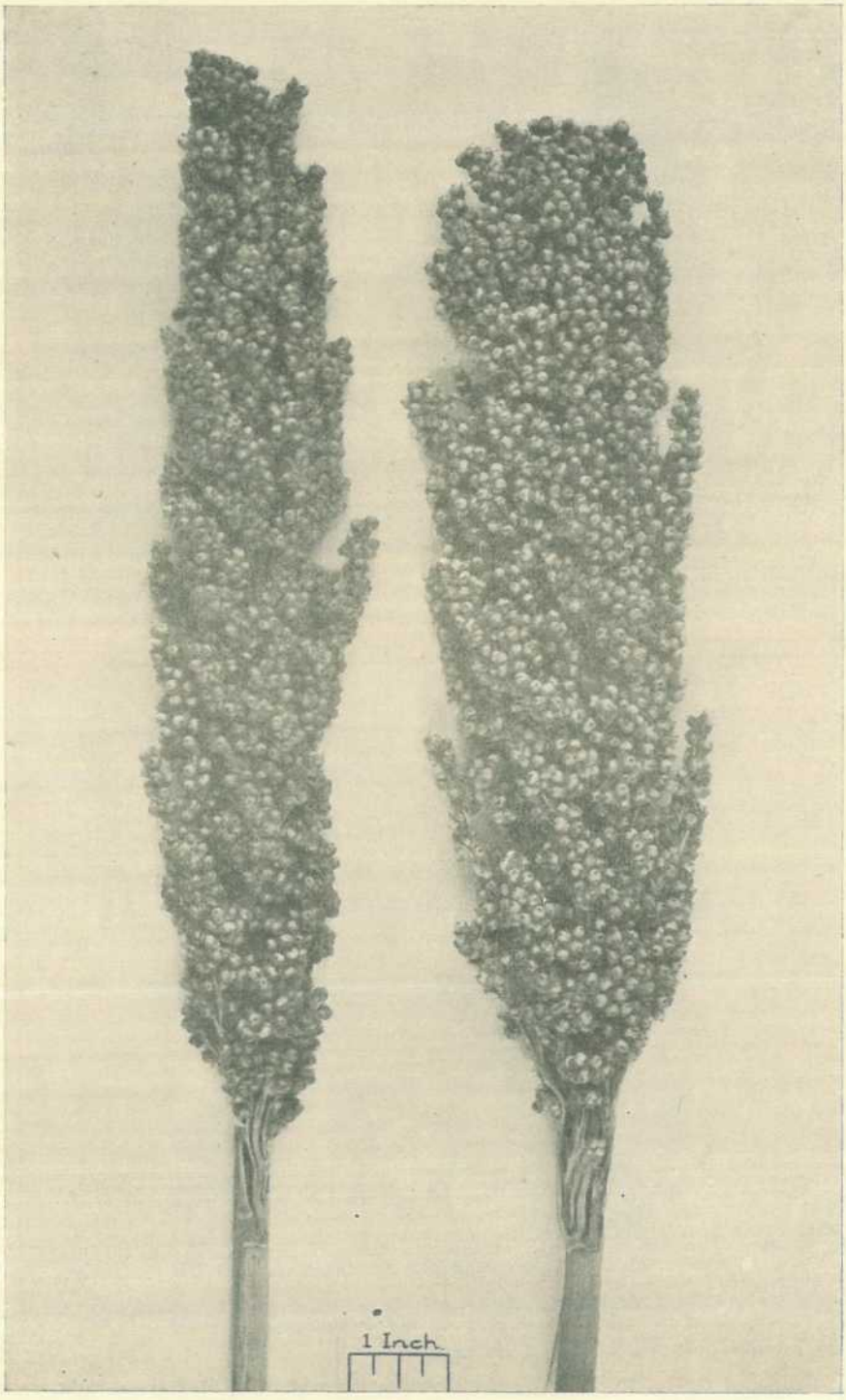


Plate 78.

Heads of Grain Sorghum Varieties.—Early Kalo on left; Kalo on right.

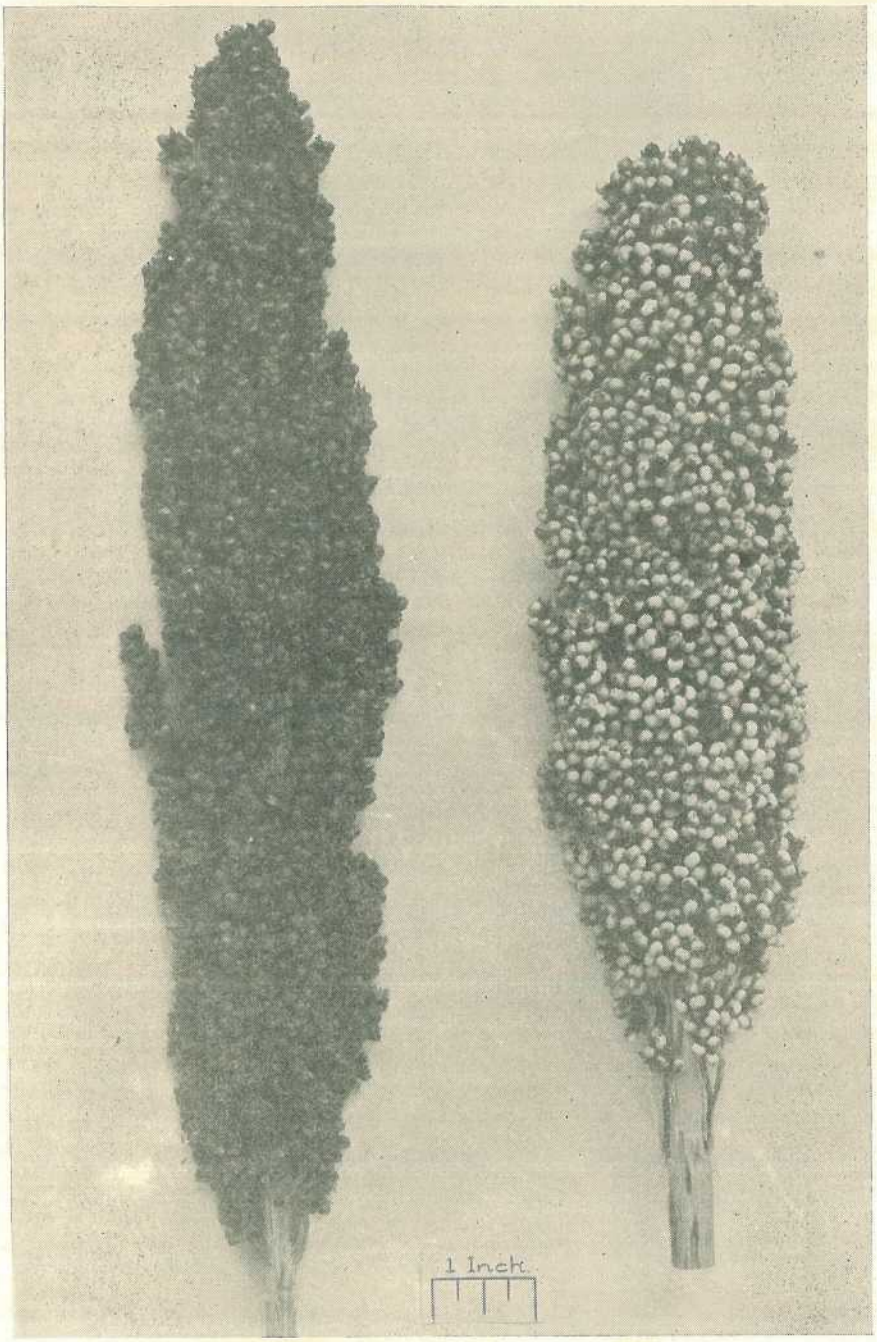


Plate 79.

Heads of Grain Sorghum Varieties.—Capricorn on left; Hegari on right.

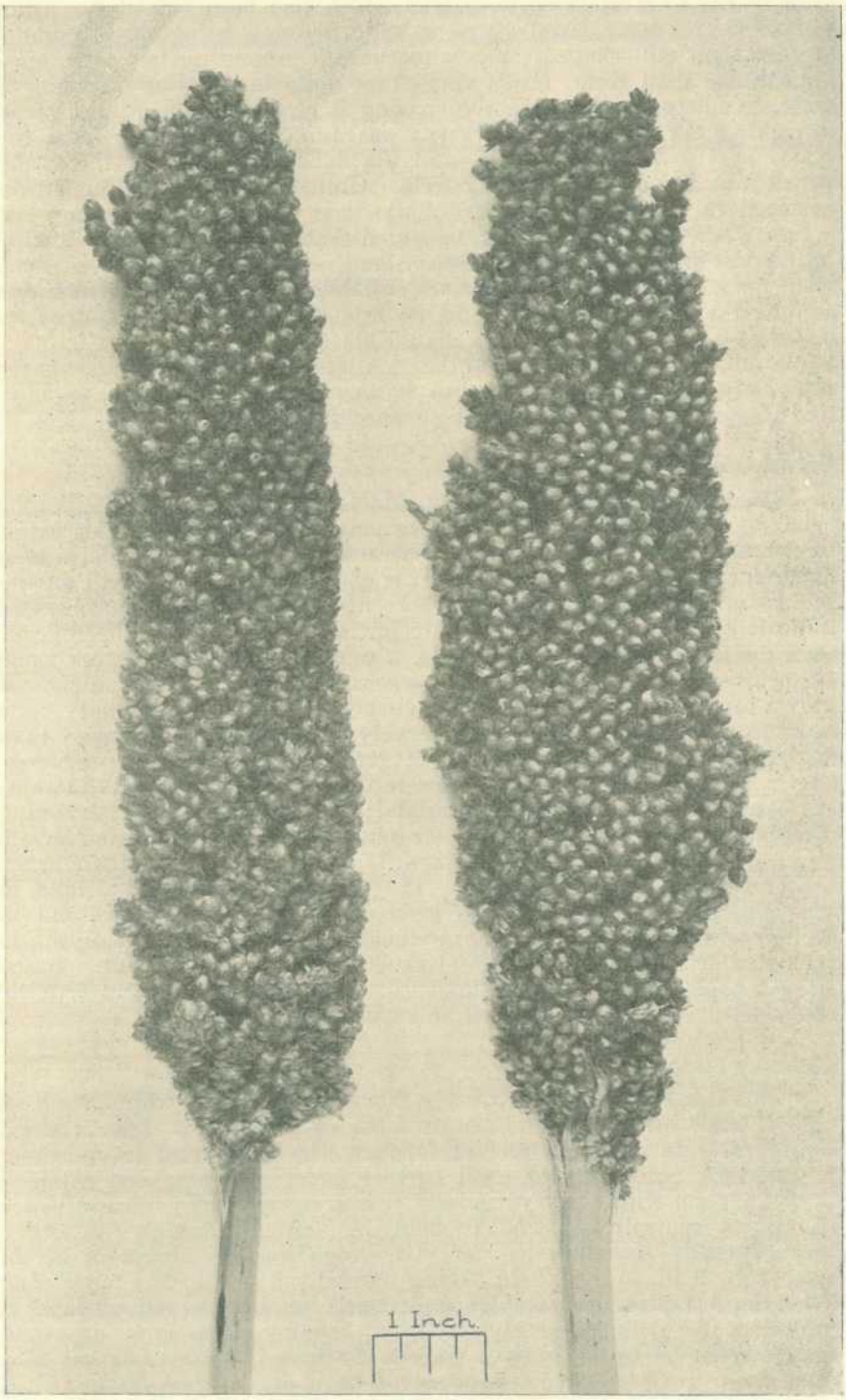


Plate 80.

Heads of Grain Sorghum Varieties.—Caprock on left; Martin on right.

trial in the Central Burnett district which had been ruined for grain purposes by frost. Head shape is very distinct, being more spindle-shaped than club-shaped, and with heads presenting a more open appearance than Kalo; heads vary from quite large, where spacing is wide, to fairly small, where the spacing is close or tillering and stem-branching are heavy. This variety is also distinguishable from the Kalos by the absence of awns, and the dark red colour of the grain, which is darker even than Early Kalo. Glume colour varies from straw-coloured to blotchy and black. While it is still too early to forecast a future for this variety, it can be stated that it has yielded well during indifferent seasons in Central Queensland, and on account of its somewhat open head it may prove more suitable for coastal areas than our standard varieties. Moreover, in its trials at Biloela it produced its heads at a more uniform level than Kalo or Wheatland. Preliminary trials indicate that it may be rather too late on the Darling Downs for use solely as a grain variety, but it may eventually replace varieties like Hegari as a grazing or dual purpose variety.

Coastland.

Though this variety is not available for general distribution, a brief note on its main characteristics may be of interest at this stage. Growers of grain sorghum on the central coast of Queensland have long experienced serious trouble from larvae of the yellow peach moth during the heading stages of the crop. As entomological investigations had indicated that these caterpillars were far less prone to attack open heads than dense or tightly packed heads, a number of selections were made of open-headed types. Some of these selections from Wheatland showed very open heads with drooping branches, which in preliminary tests near Rockhampton showed considerably less caterpillar damage than did standard Wheatland, Kalo or Hegari. These selections previously known as Open Wheatland are now termed Coastland. Twelve strains are being tested in Central Queensland with the object of determining the best and multiplying this up for general use. These strains have a plant structure similar to Wheatland, but normally project their heads higher from the top leaf sheath. They also differ from Wheatland in the possession of the very open head type referred to above, and in the existence of strong awns approximately $\frac{3}{8}$ inch long. The grain is very similar to that of Wheatland in shape, size and colouring. Based on past experience this type cannot be recommended for inland districts where hard conditions may well be experienced.

Martin (Plate 80).

This is a relatively new variety from Texas U.S.A., which has been under trial in Queensland since 1945-46. While it has attained considerable favour with certain farmers who have tried it, it cannot be generally recommended until further experience has been obtained in comparison with other varieties. It is a fairly sturdy variety which tillers very sparsely and could probably be planted at a higher rate than that generally recommended for other varieties. It ranges in height from 2 ft. 9 in. to 3 ft. 9 in., being normally a few inches taller than Wheatland under comparable conditions. In Central Queensland it appears to be definitely early maturing, heading in 40 to 50 days and maturing in $3\frac{1}{2}$ to 4 months. On the Darling Downs it behaves as a mid-season variety, but it appears to be about a week earlier than Wheatland throughout. The head is erect, long and somewhat slender,

and is awnless. Glumes are black in colour and enclose the grain rather fully. The grain is large, rounded in shape and reddish brown in colour; it is very similar to Wheatland except for the darker colour. The variety has shown itself capable of good yields under a variety of conditions. In addition, it gives promise of being stronger at the base of the stalk than Kalo, and therefore less susceptible to lodging, and may prove more regular in heading height than Wheatland.

Caprock (Plate 80).

This is another recent introduction from Texas, which was officially tested for the first time in Queensland in 1948-49. It appears typically a late maturing variety of a strong stocky habit of growth and with heavy broad foliage. In height it has ranged from 3 ft. to 3 ft. 9 in., but is not so regular as Alpha, Capricorn or even Kalo in this respect. Heads are fairly dense in texture and are heavily awned. The grain is medium-large to large and is a rich reddish-gold or red, being distinctly brighter in colour than Martin or Kalo and comparable in this respect with Early Kalo. This variety has, during one season's testing, given evidence of its ability to yield well under reasonably good growing conditions. Its habit of growth and its relatively late maturity, however, suggest that it may be better adapted to good soils and good rainfalls than to poorer or drier conditions.

Plainsman.

This variety, like Caprock and Martin, is a recent introduction to Australia from Texas. An American report describes it as a double-dwarf variety which bears a thick stout stalk and tillers slightly. The heads are fairly long, cylindrical, and dense, and are prominently awned. Grain colour is a rich red, like that of Caprock, but the glumes are blackish rather than straw-coloured. Under Texas conditions the variety matures 10 days later than Martin and five days earlier than Caprock. Plainsman and Caprock both originated from the same cross, and are very similar in their general appearance; the main difference between them lies apparently in their periods of heading and maturity.

[TO BE CONTINUED.]

DAIRY BULL FREIGHT REBATES.

The Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) has announced that an Interstate Sire Subsidy Scheme has been approved as one of the projects to be financed from the grant made available by the Commonwealth Government for improving efficiency in the dairying industry.

The position therefore is that, in addition to the rebate on rail freight within the State which has been granted for some years under the State Dairy Cattle Improvement Rebate Scheme, rail freight incurred in other States may now be refunded up to a maximum of £15 per bull on a limited number of bulls railed from these States to Queensland.

To be eligible for this rail freight rebate, a bull must be the progeny of a cow which has qualified for entry into the Advanced Register of a Dairy Cattle Herd Book Society. Application forms are available from the Department of Agriculture and Stock, Brisbane.

The conditions governing the new scheme are similar to those relating to the existing State scheme.

Hybrid Maize—A Progress Report.

W. W. BRYAN, Queensland Agricultural High School and College, Lawes.*

LAST year certified hybrid maize seed was on sale in Queensland for the first time, but only approximately 300 bushels were available and this quantity was sold immediately certification was completed. This year it is expected that at least four times this quantity of seed will be available and it is in the interests of intending buyers that they should clearly understand both the advantages and shortcomings of this material.

The aims in breeding hybrid maize for south-eastern Queensland were higher yield of sound grain and a good plant type that would be fairly resistant to insects, diseases, heat and wind. In general, these aims have been achieved and in addition the type of hybrid produced shows remarkable uniformity in plant type and in ears and grain. While no selection for show type has been made in the breeding programme, hybrids have been successful in winning championships at a number of shows, including Toowoomba, during the last 12 months. On the average yield of 26 bushels per acre for south-eastern Queensland, an increase of approximately four bushels per acre has been gained, and this percentage increase is maintained in better seasons when yields are higher, e.g., on a 78-bushel crop nearly 12 bushels per acre extra grain can be expected.

Seed Certification.

A brief review of the composition of hybrid maize may not be amiss. Hybrid maize is a combination of four different inbred lines. These lines are first combined in pairs to form single crosses or "Foundation Hybrids," this work being done at the Queensland Agricultural College, Lawes. A pair of single crosses is then combined, and this part of the work is carried out by private growers under very strict supervision. The resultant seed for use by ordinary maize growers is sold only if it has met all the requirements of hybrid maize seed certification.

In brief, the certification programme of the Queensland Department of Agriculture and Stock requires the following:—

(a) The area on which the seed crop is to be grown must be registered. The site must be approved by a seed certification officer as being suitable for the crop, as not having grown a maize crop during the previous season, thus disposing of the danger of volunteer plants, and as being likely to be sufficiently isolated at flowering time.

(*b*) At flowering there must be no other maize within a quarter of a mile which is shedding pollen while receptive silks are present on the female or ear parent of the cross.

(*c*) The single cross chosen as the ear parent must be thoroughly detasselled at flowering time, all tassels from these plants being removed before they have shed any pollen.

(*d*) The harvesting of the crossed seed, its shelling and bagging must be done under the close supervision of a seed certification officer, who seals the bags as they come from the sheller. When an official seed test for physical purity and germination has been passed, the bags are labelled with official labels and the seed is available for sale by the seed producer.

* In collaboration with C. C. F. Bourne, E. U. A. McCarthy and L. T. Petersen.

All seed is sold in officially sealed and labelled bags and no seed can be offered for sale in Queensland as hybrid maize seed unless it is officially certified.

Each Hybrid is Individual.

Many different inbred lines have been bred and many different combinations of four inbreds are therefore possible. Each hybrid is thus strictly individual. The importance of this cannot be over-emphasised. A good illustration is supplied by the two hybrids Q462

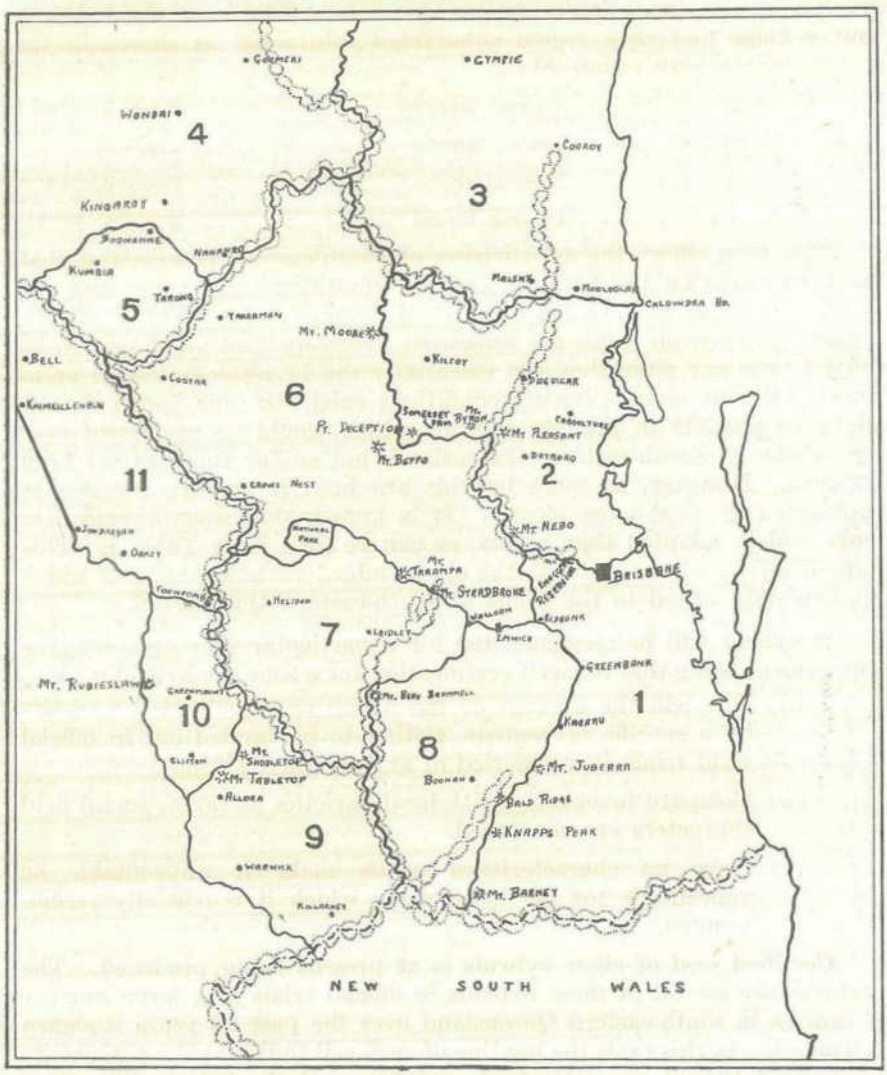


Plate 81.

Sketch Map of South-eastern Queensland Sowing Zones in which Different Maize-growing Conditions are Experienced.

and Q629, which differ in only one inbred line; thus if Q462 is composed of the inbreds A, B, C, D, Q629 would consist of A, B, C, Y. In Zone 1, Q629 is 2.5 per cent. *better* than Q462, while in Zone 7 Q629 is 14.7 per cent. *worse* than Q462. Such findings are not uncommon. Each hybrid must therefore be tested for performance in different districts to determine its suitability.

Testing of Hybrids.

For the protection of maize growers, before any Queensland hybrid can be certified it is thoroughly tested in the various regions of south-eastern Queensland which have been determined as providing different growing conditions. South-eastern Queensland has been divided into four regions and each region subdivided into zones as shown in the accompanying map (Plate 81).

Region I.	..	Coastal Moreton	Zones 1, 2, 3.
Region II.	..	South Burnett	Zones 4, 5.
Region III.	..	West Moreton	Zones 6, 7, 8.
Region IV.	..	Darling Downs	Zones 9, 10, 11.

This map shows the sub-division of south-eastern Queensland that has been made on the basis of growing conditions, soil types and the reaction of various maize strains in different areas. Some of the boundaries between zones are somewhat arbitrary and are likely to be subject to minor alteration, but essentially the 11 zones represent areas where different maize growing conditions exist. It was hoped that it might be possible to produce hybrids which would be successful over the whole of south-eastern Queensland, but so far this has not been achieved. However, as more hybrids are bred it may be possible to approach this ideal more closely. It is known that some hybrids are more widely adapted than others, as can be seen from Table 1. This state of affairs also exists with the old standard varieties, none of which is completely suited to the whole of south-eastern Queensland.

A hybrid will be recommended for a particular zone or zones, the requirement being that to merit certification for a zone the hybrid must—

(*a*) Outyield the average of the better open-pollinated varieties by a specific percentage, testing to be carried out in official yield trials over a period of at least three seasons.

(*b*) Compare favourably with local varieties as far as sound field characters are concerned.

(*c*) Have no characteristics which make it unprofitable or undesirable for the locality for which it is officially recommended.

Certified seed of eight hybrids is at present being produced. The performance record of these hybrids in official trials at a large number of centres in south-eastern Queensland over the past 10 years is shown in Table 1. In this table the top line of each cell indicates the percentage increase of hybrid over standard varieties, and the bottom line gives the number of seasons over which the hybrid has been tested in each zone. The number of actual trials is generally greater than the number of seasons, as in most zones more than one trial site is used annually.

TABLE I.

PRODUCTION RECORDS OF MAIZE HYBRIDS.

Hybrid.	Zones.								
	1	3	4	5	7	8	9	10	11
				$5\frac{1}{2}$ to 6 months maturity.					
Q23 ..	16·9% * 3	−4·7% 1	21·4% * 7	13·6% * 2	24·7% * 3	−11·2% 1	.. ..	7·0% 1	.. ..
Q431 ..	14·3% 2	8·3% 1	18·8% * 5	.. ..	21·4% * 3	.. ..	.. ..	.. ..	.. ..
Q499 ..	29·5% 1	18·0% 1	12·5% 4	6·9% 3	16·6% * 7	.. ..	.. ..	.. ..	.. ..
Q629 ..	17·8% * 5	−6·2% 1	16·2% * 8	18·4% * 3	8·3% 4	12·1 2	.. ..	.. ..	.. ..
Q692 ..	7·1% 2	.. ..	20·4% * 6	11·2% 3	−9·2% 1	.. ..	.. ..	.. ..	.. ..
				5 months maturity.					
Q716 ..	.. ..	.. ..	16·9% * 3	−7·4% 1	25·8% * 6	15·7% * 5	18·7% * 2	10·1% 5	8·8% 4
Q717 ..	.. ..	.. ..	1·6% 3	8·8% 2	29·0% * 3	11·3% 5	.. ..	12·4% 1	11·5% 2
Q739 ..	.. ..	.. ..	25·2% * 3	−6·3% 2	14·4% 4	1·1% 3	15·9% * 3	8·3% 1	17·4% * 4

An asterisk (*) in any cell of this table indicates that the particular hybrid is officially recommended for that zone.

No trials have yet been finalised in zones 2 and 6.

Production of Hybrid Maize Seed.

Producers of hybrid maize seed are divided into two groups:—

(*a*) Home producers—those growers who intend to produce seed wholly for their own use and do not intend to offer their crop for sale. This seed is not certified.

(*b*) Commercial growers—those growers whose intention is to offer their seed crop for sale as certified hybrid maize seed.

All intending producers of hybrid maize seed must serve a probationary period of one growing season before they are allowed to produce seed commercially. There are two reasons for this—one, to allow the grower to learn the job of hybrid maize seed production, and the other, to satisfy the certification authorities that he has the knowledge and equipment to carry out the programme efficiently.

During the 1945-46 season the first probationary crossing plot was successfully completed. This was the only plot grown during the season.

The 1946-47 season saw an increase in probationary plots to three, one of which was condemned. No commercial or home producer plots were planted. For the next season (1947-48) the number of probationary growers who planted increased to 10, three of whom lost their plots due to seasonal conditions and one of whom had his plot condemned. Two commercial growers planted a total area of 13 acres with a yield of 306½ bushels of seed. The hybrids produced were Q23, Q431, Q629, and Q716.

Last season (1948-49) nine probationary plots were planted, one being lost due to bad conditions and one condemned. These plots have not yet been finalised. There were two home producers and seven commercial producers. A total area of 54 acres was planted for commercial seed production, this being an increase of 41 acres over the previous season.

Next season it is anticipated that 17 growers will undertake probationary plots and that certified seed will be produced by 15 growers planting a total area of 165 acres, three times that of the previous season.

Seed Sources.

1948-49 Commercial Growers are listed hereunder:—

Nane and Address of Grower.	Hybrid.	Period of Maturity.	Recommended Zones.
David Young and Sons, Seed Merchants, .. Box 53, P.O., Kingaroy	Q23 Q431 Q739	Late .. Late .. Mid-season	1, 4, 5, 7 4, 7 4, 9, 11
A. W. Bachmann, Roadside, Mulgowie ..	Q716	Mid-season	4, 7, 8, 9
W. A. Bateman, Flagstone Creek, *via* Helidon	Q717	Mid-season	7
D. E. Poulsen, Roadside Box 460, Cooroy ..	Q499	Late ..	7
H. T. Tommerup, Central Kerry, *via* Beaudesert	Q629	Late ..	1, 4, 5
R. C. Andrews, Booie road, *via* Nanango ..	Q692	Late ..	4

Any maize grower interested in purchasing hybrid maize seed should contact a seed producer direct. Seed will be available in ½, 1 and 3 bushel lots, the price being £3 per bushel. Seed stocks of some of the hybrids may soon be exhausted.

Generally speaking, these hybrids should be suitable for the following regions:—

Region.	Suitable Hybrid.
Coastal Moreton ..	Q23, Q431, Q629 (late maturing)
South Burnett ..	Q23, Q431, Q629, Q692 (late maturing), Q716 (mid-season)
West Moreton ..	Q23, Q431, Q499 (late maturing), Q716, Q717 (mid-season)
Darling Downs ..	Q716, Q739 (mid-season)

Buyers are warned that the Regulations under the Seeds Acts provide the following:—

NO PERSON SHALL SELL ANY MAIZE SEED FOR SOWING AS HYBRID MAIZE SEED UNLESS SUCH SEED IS CERTIFIED AS HYBRID MAIZE SEED.

APPLIED BOTANY

Weir Vine—A Declared Noxious Plant.

C. T. WHITE, Government Botanist.

WEIR vine (*Ipomaea calobra*) has been declared a noxious weed throughout the area of every Local Authority in Queensland and the following description and illustrations are offered to aid in the recognition of the plant.

Description.

Weir vine is a vigorous, summer-growing, creeping plant sending out long leafy runners over the ground from a large central crown. It produces large, underground, sweet-potato-like tubers. The leaves are on long stalks, somewhat heart-shaped and fairly large (up to 4 inches across). The flowers are of a typical convolvulus or morning glory type and are borne in clusters on stalks about as long as the leaves. They are about 3 inches long and change from pinkish-red to blue. The seed capsules are of a roundish egg-shape, ¾-1 inch across, and bear several blackish angular seeds.

Distribution.

The vine is confined to Queensland and finds its greatest development on the hard red soils carrying mulga and ironbark in the Maranoa district.

Local Names.

According to its discoverer, Walter Hill, first Director of the Brisbane Botanic Gardens, it was known to the natives on the Barcoo as Calobra. "Weir" or "Gueeah" seems to have been the name in the Maranoa country and weir vine has held as the popular name to the present day.

Properties.

The green plant is poisonous to stock, especially sheep. In feeding tests, initial symptoms were produced within 30 days. The animals lost condition and carried their heads unusually high, with the ears well back; their backs were arched and there was some inco-ordination of gait. From a study of advanced field cases it seems there are a number of functional disturbances of some of the finer adjustment centres of the brain. The animal urinates copiously and frequently. It staggers badly when walking, the hind legs being straddled, apparently in an effort to maintain balance, and the sheep seems no longer able to judge the kind of obstacle it encounters when walking through yards or timbered country. It is not uncommon to see affected sheep pushing against rails, trees or fences and making little effort to go around them. When this stage is reached, the animal usually dies fairly soon, either from accident or apparently as a result of the weir vine poisoning. No poisonous principle has yet been isolated.

Plate 82.

Uses.

The large, watery, underground tubers were reputed to be eaten by the aborigines. An "arrowroot" flour has been made from them by local residents and the plant has been thought of as a source of commercial mucilage for industrial purposes, but the tubers are low in starch content and their collection and treatment is hardly likely to be practicable.

Eradication.

The Biological Section of the Lands Department has carried out investigations into the eradication of this plant and has reported that hormone-type weedkillers can be used successfully against this plant in concentrations of 0.1 per cent. 2, 4-D. The solution is best applied by spraying the vines when they are growing vigorously and about half-grown. A kill of 95 per cent. of plants averaging 646 to the acre has been achieved, using an average of 36 gallons of solution to the acre.

By chopping off the top growth just below ground-level with a mattock and pouring a small quantity of arsenic pentoxide solution mixed at 1 lb. to 1 gallon of water on the exposed damaged crown, a complete kill is obtained. This operation is simply and quickly carried out but is considerably more costly than spraying with the hormone weedkillers.

DESCRIPTION OF PLATE 82.

Weir Vine.

A, Base of corolla laid open to show stamens. B, Capsule. C, Seeds.

Pests and Diseases.—The main features of the Science Branch display at the Brisbane Show were the control of potato diseases, the use of hormone-type weedicides, and life-history cases of important insect pests.

The Origin of the Ellendale Mandarin and Its Relatives.

A. A. ROSS, Horticulturist.

THE origin of citrus varieties is not always easy to trace. Some mandarins have been propagated in Queensland from seedling trees with desirable characteristics. Two of these, the Ellendale and the Solid Scarlet, are grown fairly extensively and the following information is based on data supplied by Mr. Randal Burgess, formerly of Ellendale Orchard and now living in retirement at Traveston on the Burrum River.

Some time prior to 1870, a penal settlement was established at Baffle Creek, approximately 25 miles north of Bundaberg. Captain Walker, who traded with the schooner "Iona" between Baffle Creek and the ports of Bundaberg and Maryborough, owned a piece of land on the banks of the Burrum River in the vicinity of the present railway bridge. Mandarin and orange trees were grown at Baffle Creek by convicts to produce fruit for the settlement, and somewhere about the year 1878 Captain Walker obtained seed from fruit grown there and planted it at Burrum. Mr. E. A. Burgess purchased several of the resultant seedlings and established them on his property lower down the Burrum River. One of these seedlings produced a good quality, large, late mandarin (Plate 83), which was named "Ellendale" after the property. Mr. A. H. Benson, a former Director of Fruit Culture in Queensland, recognised the potentialities of this new variety and made arrangements for its propagation on the Blackall Range.

The original Ellendale tree continued to grow vigorously and showed no signs of disease until 1936, when it was cut out to permit the replanting of the orchard. The tree possessed two disadvantages shown by the majority of its progeny. These are, first, a tendency to split at a fork when the tree carries a heavy crop of fruit (Plate 84), and second, a tendency to skin cracking across the base of the fruit at all stages of development. In spite of these defects, the Ellendale mandarin is grown extensively in Queensland, and it is the main late-season variety

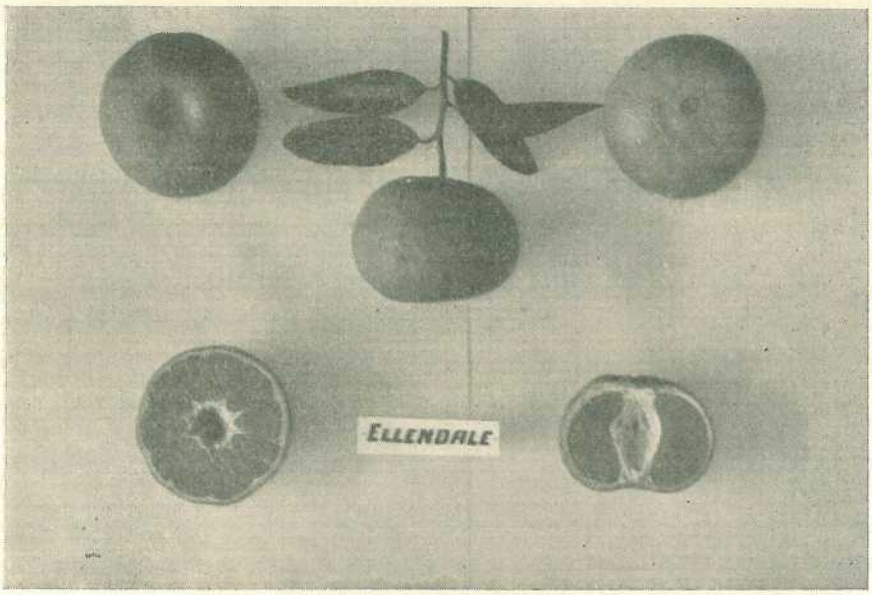


Plate 83.

Ellendale Mandarin.—Note navel development on stylar end. Approximately equal numbers of navel and plain fruits are carried on the same tree.

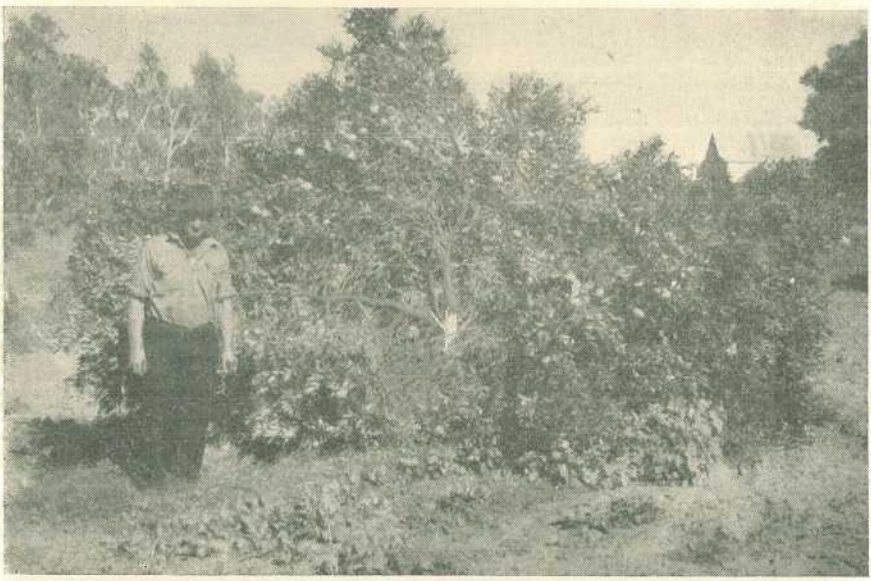


Plate 84.

Ellendale Mandarin Tree.—Showing splitting of the main trunk at the crotch.

in the Gayndah district, where it develops a large, extremely firm, full-flavoured and attractive looking fruit. The crop matures early in July and will hang on the tree under normal conditions until August. The Ellendale mandarin sells particularly well in the southern markets and may be of value for the export trade.

About 1908, Mr. Randal Burgess, a son of Mr. E. A. Burgess, raised a number of open-pollinated seedlings from the Ellendale mandarin and produced a wide range of types, most of which showed no prospect of being worthwhile commercial varieties. However, two of the best seedlings were selected and became known as Pride of Ellendale and Burgess Scarlet. The latter was later renamed Solid Scarlet.

Fruit of both varieties is inferior to the original Ellendale mandarin. The Solid Scarlet, however, thrives better than the parent Ellendale in the Howard-Burrum district, where it crops consistently and produces fairly large fruit of good quality which hang well on the tree. It matures slightly later than the more widely grown Emperor and so enables the mandarin harvesting season in the Howard-Burrum district to be extended. The use of the name Solid Scarlet is unfortunate, as it suggests a relationship between this mandarin and the somewhat raggy, puffy variety called Scarlet. In view of the history and derivation of the Solid Scarlet mandarin, a more appropriate name would be Burgess.

PINEAPPLE FARMING.—The principles of good pineapple farming—selection of the best planting material; correct fertilizing; efficient soil management; careful handling of fruit for market—were illustrated by the Horticulture Branch in its exhibit at the Brisbane Show.

American Foul Brood of Bees.

C. R. R. ROFF, Apiaries Inspector, Science Branch.

FOR the first time since 1931 American foul brood was found in two Queensland apiaries in 1949. This disease is the most serious of those affecting bees, and is responsible for losses in the beekeeping industry in many parts of the world. Economic management of bees is not possible in an infected apiary; however, the chances of serious losses are considerably reduced if beekeepers are familiar with the symptoms and with the correct procedure for dealing with an outbreak of the disease.

The causal organism of American foul brood is a bacterium (*Bacillus larvae*) which, under suitable conditions, multiplies very rapidly. It is able to form resting bodies or spores which may remain viable and infective for long periods and are resistant to moderate heat and disinfection. The most common methods of spreading these spores is the utilisation of infected honey by nurse bees and by the transfer of infected brood combs. The disease may also be transmitted by contaminated beekeeping equipment and the drifting of bees from diseased to healthy hives.

Features of the Disease.

(1) Larvae of all three castes are susceptible, and infection takes place only during the larval feeding period. Death occurs invariably after the capping of cells, when the insects are still in the late larval or early pupal stages.

(2) Larvae are susceptible to infection in all seasons, and an outbreak of the disease may appear irrespective of the quantity of food available.

(3) All races of honey bees are equally susceptible to American foul brood.

(4) Infected honey is not injurious to humans.

Symptoms.

(1) The colony is noticeably weak.

(2) The brood comb has an irregular appearance. In healthy brood the cappings are slightly convex, but where death has occurred they become concave or sunken and may be perforated. In addition, capped cells are somewhat scattered, giving what is often termed a pepper-box appearance (Plates 85 and 86).

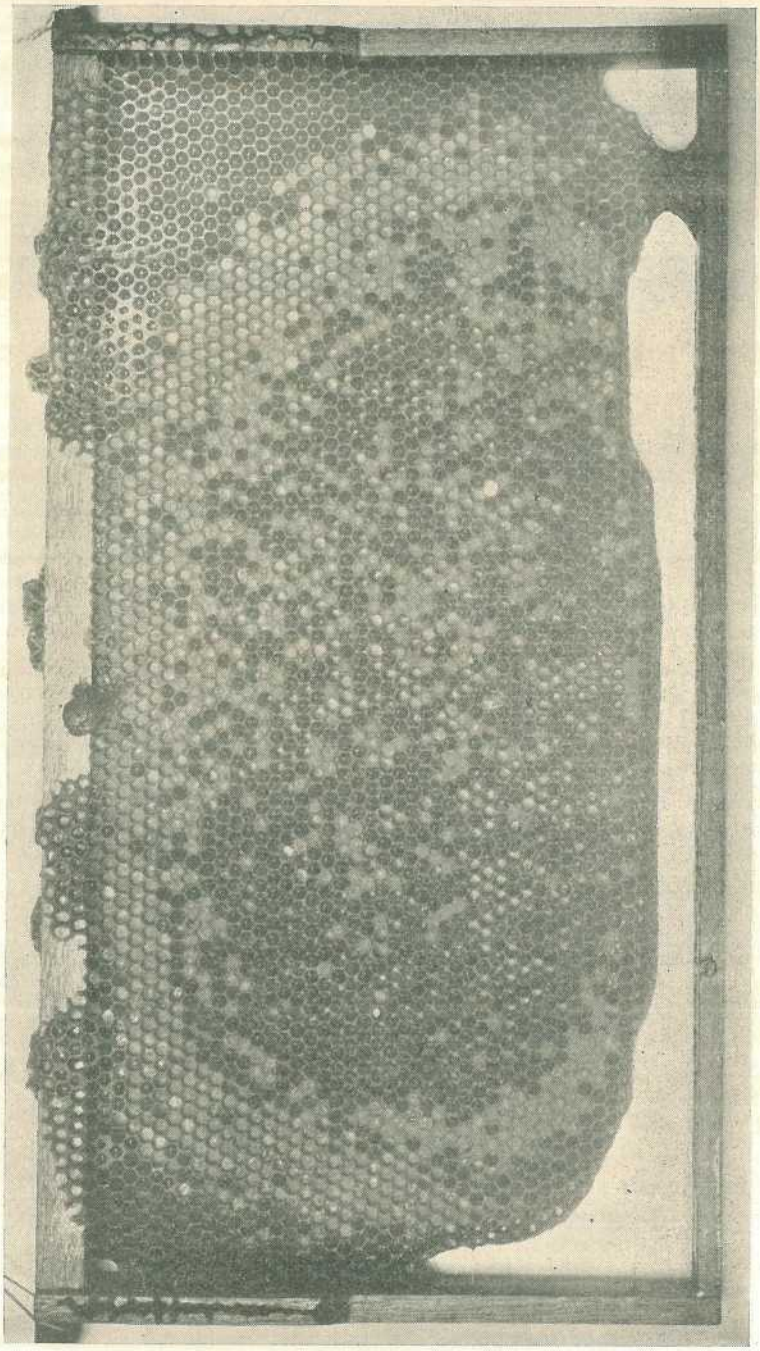


Plate 85.

Brood comb infected with American foul brood, showing the irregular distribution of capped cells.

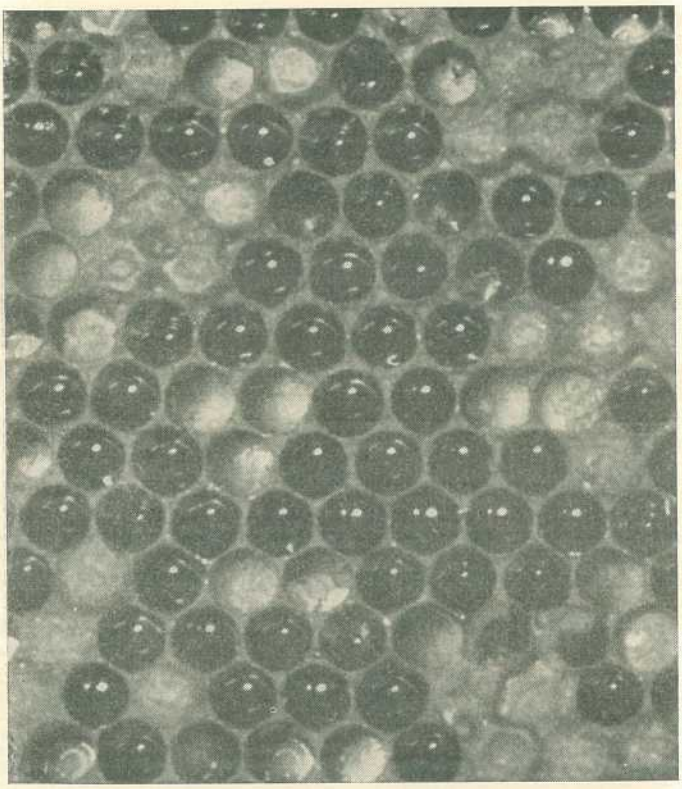


Plate 86.

Portion of infected brood comb, slightly enlarged, showing sunken and perforated cappings.

(3) Diseased larvae or prepupae are at first slightly yellowish in colour, but as decomposition advances they gradually change to brown. The dead larvae are usually extended lengthwise in the cells.

(4) The decaying contents of a cell may, before drying, be drawn out with a wooden match or a splinter of wood into fine, gluelike, ropy threads. In drying a tough dark-brown or coffee-coloured scale is formed which the bees cannot remove. This may be seen extended along the lower side walls when the comb is held so that sunlight falls on the side and lower walls of the cell.

(5) Where death has occurred after pupation a partly developed "tongue" may protrude as a fine thread upwards and backwards from the scale, sometimes adhering to the upper wall of the cell.

(6) The odour in an infected hive may become heavy and foetid, and has been likened to that of stale glue.

Preventive Measures.

The following measures for preventing the appearance and spread of American foul brood are recognised as sound:—

(1) The interchange of brood combs between hives and apiaries should be reduced to a minimum.

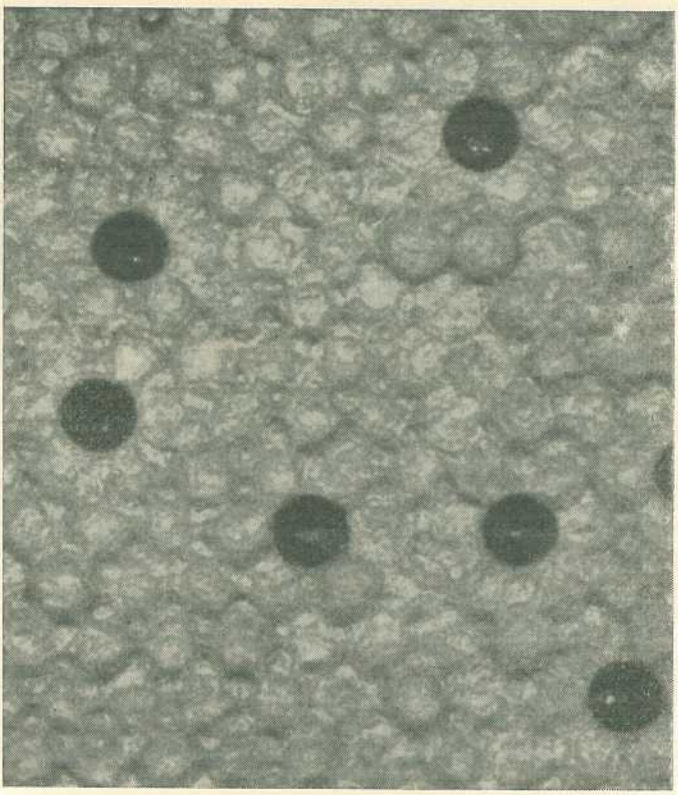


Plate 87.

Portion of healthy brood comb, slightly enlarged, showing compact and normal convex cappings.

(2) Any manipulations or activities which induce robbing should be avoided.

(3) Second-hand bee equipment should not be bought.

(4) Honey from an unknown source should never be fed to bees.

(5) If second-hand honey tins are used great care should be exercised to ensure that the bees do not have access to them.

Treatment of Infected Colonies.

All contents of diseased hives should be burnt and the hives themselves decontaminated according to the following method, which is the safest and most economical:—

(*a*) The destruction of diseased colonies should take place in the evening when all bees are in the hives.

(*b*) Dig a pit of a size suitable for the number of colonies to be destroyed.

(*c*) Kill all bees in the diseased hives with calcium cyanide; about two teaspoonfuls of the poisonous powder should be put through the entrance of each hive before closing it. *Extreme care should be taken*

to avoid inhaling the poisonous gas given off by the cyanide. If calcium cyanide is not readily available the hive entrance should be closed, a pint of petrol sprinkled over the top frames, and the top cover replaced.

(*d*) Build a fire in the pit and, as soon as it is burning well, add the dead bees and combs. The only parts of the hives not to be burnt are the bottom boards, the hive bodies of the brood nests, the bodies of the extracting supers, and the top covers.

(*e*) Scrape the inside surfaces of the unburnt parts of the hives and burn the debris.

(*f*) After all diseased material has been burnt spade the ground down, refill the pit, and pack well.

(*g*) Sterilize the undestroyed, contaminated hives and hive parts by either boiling for half an hour in 1 per cent. caustic soda solution or scorching to a dark-brown colour with a blow torch all the inner surfaces and edges.

Legislative Requirement.

Under "*The Apiaries Act of* 1947" it is provided that any beekeeper in whose apiary any disease appears shall immediately notify, in writing, the Under Secretary, Department of Agriculture and Stock, Brisbane.

Irrespective of the legal requirements, any beekeeper who notices unusual brood symptoms in his apiary should, for his own sake, communicate promptly with the Department in order that assistance may be rendered in treating the infection.

THE COMMITTEE OF DIRECTION OF FRUIT MARKETING.

The following representatives elected by the various Sectional Group Committees, together with Mr. H. S. Hunter, Director of Marketing, have been appointed by the Minister for Agriculture and Stock (Hon. H. H. Collins) to be members of The Committee of Direction of Fruit Marketing for the period until 31st August, 1952:—

Banana Group: W. J. Branch (Russell Island) and E. J. Coghlan (Burleigh Heads).

Pineapple Group: H. S. Franks (Wamuran) and J. R. Stocks (Dundowran, via Nikenbah).

Citrus Group: J. A. Kidd (North Tamborine) and J. R. Perkins (Flaxton).

Other Fruits Group: J. H. Kidd (Redland Bay) and P. J. Savage (Brookfield).

Deciduous Group: N. A. Collins (Glen Aplin) and H. E. Phillips (Thulimbah).

Vegetable Group: W. J. Beattie (Lagoon Pocket) and A. E. Newman (Rockhampton).

Queensland Cheese Production, 1948-1949.

Compiled by Officers of the Division of Dairying.

AS was predicted last year, production of cheese in Queensland has shown a further decline. The factors tending to bring about this decline, however, were countered to some extent by the favourable seasonal conditions experienced during the greater part of the year. The actual production was 21,033,063 lb. (green weight), compared with 21,595,525 lb. last year.

The following table shows how production has varied over the last 10 years:—

	Tons.		Tons.
1939-1940	6,179	1944-1945	10,017
1940-1941	5,237	1945-1946	12,028
1941-1942	7,292	1946-1947 (Dry Year) ..	7,720
1942-1943	12,730	1947-1948	9,641
1943-1944	10,733	1948-1949	9,390

Grading.

A total of 13,485,996 lb. of cheese was graded during the year. After allowing for shrinkage, this represents approximately 67 per cent. of the quantity manufactured, though, of course, some of the cheese graded would have been made during the latter part of the previous year. The official gradings, though they represent only a proportion of the cheese made, nevertheless indicate the trend in quality.

It is pleasing to note that the figures show a substantial improvement as compared with last year's figures, even though they fall somewhat short of the figures for 1946-1947. Grading figures for the past four years are as follows:—

Year.	Choice and First.	Second.	Third.
	Per cent.	Per cent.	Per cent.
1945–1946	70·27	28·28	1·45
1946–1947	72·19	25·88	1·93
1947–1948	63·00	34·40	2·44
1948–1949	71·47	27·61	·92

The proportion of cheese which was classified as Third Grade is probably the lowest ever recorded.

The quality of Queensland cheese compares very favourably with that produced in other States, but a note of warning against complacency must be sounded. Although markets appear very secure for some time, it is inevitable that sooner or later the position will arise when buyers will be able to discriminate. When they do, the good article will outsell its competitors. Many factories are doing excellent work. Seven factories had over 95 per cent. of all cheese graded classified as Choice or First Grade and several others over 90 per cent. These figures show what can be done, and other factories are urged to emulate the high standard which these have obtained. In this connection a word to suppliers would not be out of place. No factory can produce good cheese from inferior milk, and if suppliers could develop a sense of pride in their factory's product the factory's task would be easier.

Detailed statistics showing the production and gradings of individual factories are set out in tables at the end of this article. No details of cheese condemned or prohibited from export have been included, as much cheese which cannot be exported is suitable for local trade or for processing, while in some instances where a large consignment has been prohibited some of the lines included in the consignment may be quite suitable for export and may subsequently have been exported. Reference must be made, however, to the fact that several factories produced quantities of cheese which was prohibited from export because the fat content was below the standard prescribed. Factory managers are warned that a serious view will be taken of the production of cheese below standard in the future.

In reading the grading results for individual factories, care should be taken to observe the proportion of output which was graded. The figures cannot be accepted as a reliable guide to quality where the proportion was small.

Summary of Cheese Production and Gradings for the Year 1948-1949.

	Lb.		
* Milk received	204,092,535	Yield of cheese per 100 lb. milk	10·30
* Cheese made	21,018,093	Yield per pound of butterfat ..	2·7
* Butterfat paid for ..	7,791,841	Average butterfat test of milk ..	3·82

* Figures for the Queensland Farmers' Co-operative Association Ltd. factory for Booval have not been included in these calculations, as data for milk and butterfat are incomplete.

Gradings.

Total Submitted.	Choice.	First.	Second.	Third.
Lb.	Lb.	Lb.	Lb.	Lb.
13,485,996	38,109	9,600,970	3,722,762	124,155
	·28%	71·19%	27·61%	·92%

MANUFACTURE AND GRADINGS OF QUEENSLAND CHEESE FACTORIES FOR THE YEAR ENDED 30TH JUNE, 1949.

Factory.	Milk Received.	Production and Yield.					Official Gradings.				
		Cheese Green Weight.	Butterfat.	Cheese Yield.		Average Test.	Total Lb. Submitted and Per Cent. of Manufacture.	Choice.	First.	Second.	Third.
				Per 100 Lb. Milk.	Per Lb. Butterfat.						
	Lb.	Lb.	Lb.	Lb.	Lb.	Per cent.					
Biddeston	6,899,803	739,403	259,368	10·72	2·85	3·76	399,185 55%	.. ..	347,417 87·03%	51,768 12·97%	.. ..
Coalstoun Lakes	1,657,341	168,957	62,441	10·19	2·71	3·77	26,721 15·8%	.. ..	.. ..	19,403 72·61%	7,318 27·39%
Daredale	2,335,507	224,096	88,142	9·6	2·54	3·77	217,328 97%	.. ..	131,412 60·47%	83,508 38·42%	2,408 1·11%
Woodleigh	1,709,020	166,977	65,509	9·77	2·55	3·83	164,101 98·3%	.. ..	111,743 68·09%	52,358 31·91%	.. ..
Boodua	2,787,734	296,662	118,078	10·64	2·51	4·24	334,283 100%	.. ..	208,429 62·35%	123,090 36·82%	2,764 ·83%
Toowoomba	23,123,617	2,496,447	891,552	10·80	2·80	3·86	2,114,434 84·7%	.. ..	808,525 38·24%	1,282,376 60·65%	23,533 1·11%
Dundarrah	1,186,997	116,021	44,798	9·77	2·59	3·77	28,587 24·6%	.. ..	1,932 6·76%	22,047 77·12%	4,608 16·12%
Felton	4,875,443	509,461	185,749	10·45	2·74	3·81	409,246 80·3%	.. ..	344,570 84·20%	64,676 15·8%	.. ..
Greenmount	3,238,666	343,459	122,151	10·6	2·81	3·77	131,200 38·2%	.. ..	.. ..	130,510 99·47%	690 ·53%
Highgrove	1,295,514	132,796	49,645	10·25	2·67	3·83	126,144 97·2%	.. ..	23,503 18·2%	100,762 78·02%	4,879 3·78%
Irongate	3,672,116	368,059	135,179	10·02	2·72	3·68	290,314 78·9%	16,909 5·82%	247,879 85·38%	25,526 8·80%	.. ..
Kooroongarra	4,225,570	427,523	154,836	10·12	2·76	3·66	409,826 95·9%	.. ..	337,198 82·28%	72,628 17·72%	.. ..
Kraft Walker Cheese Co. Pty. Ltd., Quinalow	9,529,910	980,410	359,432	10·29	2·73	3·77	176,690 18·0%	.. ..	40,374 22·85%	123,749 76·26%	1,567 ·89%
Malling	6,562,946	646,730	251,878	9·85	2·57	3·84	292,486 45·2%	.. ..	91,638 31·33%	191,138 65·35%	9,710 3·32%
Maclagan Valley, Maclagan ..	8,440,087	844,925	316 613	10·01	2·67	3·75	456,680 54%	.. ..	285,900 62·60%	158,288 34·66%	12,492 2·74%

Maclagan Valley, Kulpi ..	8,276,174	826,936	309,103	9·99	2·68	3·73	839,814 100%	.. ..	600,731 71·53%	235,649 28·06%	3,434 ·41%
Maryborough, Tansey	6,072,283	622,201	256,902	10·25	2·42	4·23	191,097 30·7%	810 ·42%	180,837 94·63%	9,450 4·95%	.. ..
Maxam, Cooranga North ..	7,109,935	753,701	293,434	10·6	2·57	4·13	637,655 84·6%	.. ..	575,289 90·22%	58,601 9·19%	3,765 ·59%
Maxam, Lilyvale	2,558,774	278,964	99,500	10·9	2·8	3·89	267,035 95·7%	.. ..	247,221 92·58%	19,814 7·42%	.. ..
Moola	4,598,670	456,792	169,150	9·93	2·70	3·68	353,181 77·3%	.. ..	324,300 91·82%	25,876 7·33%	3,005 ·85%
Mount Sibley	2,978,197	313,859	115,017	10·54	2·73	3·86	268,990 85·7%	.. ..	285,189 99·37%	1,801 ·63%	.. ..
Mount Tyson	5,867,963	607,067	219,252	10·35	2·77	3·74	29,653 48·8%	.. ..	29,653 100%	.. ..	.. ..
Oakey, Kelvinhaugh	..	Ceased Production, 30–6–48			..		13,081 ..	.. ..	12,765 97·58%	316 2·42%	.. ..
Pittsworth, Pittsworth ..	5,344,237	557,566	217,105	10·43	2·57	4·06	251,851 45·2%	4,444 1·76%	214,230 85·06%	30,924 12·28%	2,253 ·90%
Pittsworth, Linthorpe	2,038,128	213,396	76,283	10·47	2·80	3·74	168,487 79%	.. ..	147,196 87·36%	20,644 12·25%	647 ·39%
Pittsworth, Scrubby Mt. ..	2,352,074	252,483	89,670	10·73	2·82	3·81	174,343 69·1%	.. ..	141,226 81·00%	32,959 18·91%	158 ·09%
Pittsworth, Springside	2,229,116	243,799	85,399	10·94	2·85	3·83	145,532 59·7%	5,879 4·04%	136,697 93·93%	2,956 2·03%	.. ..
Pittsworth, Yarranlea	5,592,851	579,651	212,102	10·36	2·73	3·79	334,861 57·8%	.. ..	264,142 78·88%	69,476 20·75%	1,243 ·37%
Port Curtis, Bracewell	3,853,017	395,839	141,186	10·27	2·80	3·66	398,433 100%	.. ..	362,000 90·86%	35,807 8·99%	626 ·15%
Port Curtis, Theodore	3,266,139	339,375	124,114	10·39	2·73	3·8	95,874 28·3%	.. ..	84,266 87·89%	11,608 12·11%	.. ..
Q.A.H.S. and College, Lawes ..	34,390	3,786	1,484	11·01	2·55	4·32	..	No Gradings	..	..	..
Queensland Farmers, Booval *	..	14,970	..	..	..	..	..	No Gradings	..	..	..
	* Data incomplete.										
Ramsay	1,989,100	204,550	76,972	10·28	2·66	3·87	187,151 91·5%	.. ..	121,970 65·17%	65,181 34·83%	.. ..

MANUFACTURE AND GRADINGS OF QUEENSLAND CHEESE FACTORIES FOR THE YEAR ENDED 30TH JUNE, 1949—*continued.*

Factory.	Milk Received.	Production and Yield.					Official Gradings.				
		Cheese Green Weight.	Butterfat.	Cheese Yield.		Average Test.	Total Lb. Submitted and Per Cent. of Manufacture.	Choice.	First.	Second.	Third.
				Per 100 Lb. Milk.	Per Lb. Butterfat.						
	Lb.	Lb.	Lb.	Lb.	Lb.	Per cent.					
Rockview	2,721,028	283,339	105,133	10·41	2·70	3·86	226,058 79·8%	.. ..	218,207 96·53%	7,851 3·47%	.. ..
Rocky Creek	2,927,975	301,517	105,755	10·3	2·85	3·61	284,153 94·2%	.. ..	173,476 61·05%	92,983 32·72%	17,694 6·23%
Rosemount	..	Ceased Production 30–6–48 ..		..		..	6,384 ..	.. ..	6,384 100%	.. ..	.. ..
Southbrook	6,739,800	689,422	247,830	10·23	2·78	3·68	278,984 40·5%	490 ·16%	219,493 78·69%	58,760 21·06%	241 ·09%
South Burnett, Goomeri ..	5,088,118	518,282	201,982	10·19	2·57	3·97	430,353 83%	.. ..	342,677 79·63%	78,479 18·24%	9,197 2·13%
South Burnett, Murgon ..	4,980,979	474,892	194,322	9·53	2·44	3·9	312,340 65·8%	6,092 1·95%	301,710 96·6%	4,538 1·45%	.. ..
Sugarloaf	1,949,270	195,768	79,496	10·04	2·46	4·08	102,170 52·2%	.. ..	51,663 50·57%	50,507 49·43%	.. ..
Sunnyvale	1,672,673	184,053	66,998	11·00	2·75	4·01	49,064 26·7%	.. ..	30,407 61·97%	18,657 38·03%	.. ..
Warwick, Greymare	2,381,080	245,589	87,899	10·31	2·79	3·69	133,404 54·3%	.. ..	64,148 48·09%	67,656 50·71%	1,600 1·20%
Warwick, Talgai	1,105,128	111,802	42,562	9·01	2·63	3·43	30,010 26·8%	.. ..	5,605 18·68%	24,247 80·8%	158 ·52%
Warwick, Victoria Hill ..	657,360	67,633	23,958	11·31	2·79	4·05	21,149 31·3%	.. ..	.. ..	10,984 51·94%	10,165 48·06%
Warwick, Mill Hill	21,731,470	2,177,413	804,630	10·02	2·71	3·70	1,211,095 55·6%	3,485 ·29%	1,151,207 95·06%	56,403 4·65%	.. ..
Yamsion	3,076,544	314,835	113,183	10·23	2·78	3·68	297,500 94·5%	.. ..	204,848 68·86%	92,652 31·14%	.. ..
Yargullen	3,359,791	341,657	126,049	10·17	2·71	3·75	148,069 43·3%	.. ..	122,913 83·01%	25,156 16·99%	.. ..
Totals	204,092,535	21,033,063	7,791,841	..	..	..	13,485,996	38,109	9,600,970	3,722,762	124,155

Lambing Losses.

G. R. MOULE, Officer-in-Charge, and M. N. S. JACKSON, Senior Adviser, Sheep and Wool Branch.

THE Australian Merino is often described as a breed of sheep which is not particularly fertile, and percentages of lambs marked to ewes mated are quoted to substantiate this statement.

Actually, the percentage of lambs marked is really a measure of the reproductive rate of the flock and it is influenced by the losses of lambs between birth and marking as well as the number of lambs which are born.

Recent investigations have focused attention on the serious proportions that losses between birth and marking may reach. In addition, it is well known that very often the ewe as well as the lamb is lost at lambing time and for this reason many properties write off 10 per cent. of their breeding ewes each year to cover what might be regarded as expected losses.

Losses of lambs are regarded as inevitable, but by careful management their incidence can be reduced considerably. The purpose of this paper is to acquaint sheep raisers with some of the factors influencing the survival of lambs and ewes at lambing time.

HOW SERIOUS ARE LAMBING LOSSES?

In a survey conducted recently the opinion of sheep men was sought about the extent and nature of losses of lambs between birth and marking. Most men considered their losses varied in the average year between 5 per cent. and 12 per cent. of the lambs born. One property owner was able to quote reliable figures to indicate that the losses of his stud lambs before marking had averaged about 12½ per cent. a year, but agreed that they were sometimes higher. Many men quoted disastrous results which had been obtained during drought years, or when lambing took place during extremely hot weather, or when dingoes attacked the lambing ewes. In one stud flock only eight lambs, from 200 known to have been born, survived to marking time, and on another occasion 600 lambs from a flock of about 800 perished on a water-hole during a heat wave. While such losses as these are spectacular and serious, the lesser but more constant losses which occur each year are probably more important. A trial conducted recently in north-western Queensland revealed that, even under favourable

conditions, 22 per cent. of the lambs could be lost within the first few days of birth. Needless to say, losses such as these can retard the rate at which flocks increase or can restrict culling percentages.

The causes of mortalities in very young lambs can be classified broadly as those affecting the ewe and the lamb and those which affect only the lamb, and they are described under their respective headings.

CAUSES OF MORTALITIES OF THE EWE AND/OR THE LAMB.

Ewes Unable to Lamb.

It is well known that ewes in Queensland may experience difficulty in lambing, but the factors predisposing them to trouble of this nature are not well understood. Being overfat can be an important contributing cause amongst crossbred ewes in the fat lamb areas, but on the other hand, extreme poverty may cause heavy mortalities amongst Merino ewes in the drier pastoral country.

Turning back of one or both front legs, or of the head, are the "bearing troubles" most commonly encountered, and while they are often difficult to detect and handle amongst flock sheep valuable stud animals can be saved by timely and carefully applied assistance. In cases such as these the lamb is most commonly strangled during birth.

Pregnancy Toxaemia.

Pregnancy toxaemia is fairly common amongst breeding ewes in Queensland and it can be a serious cause of loss, as it is difficult to treat affected sheep. It usually occurs when ewes which are in advanced pregnancy are subjected to a period of starvation, such as occurs during a rail journey, or to rather sudden variations in their plane of nutrition.

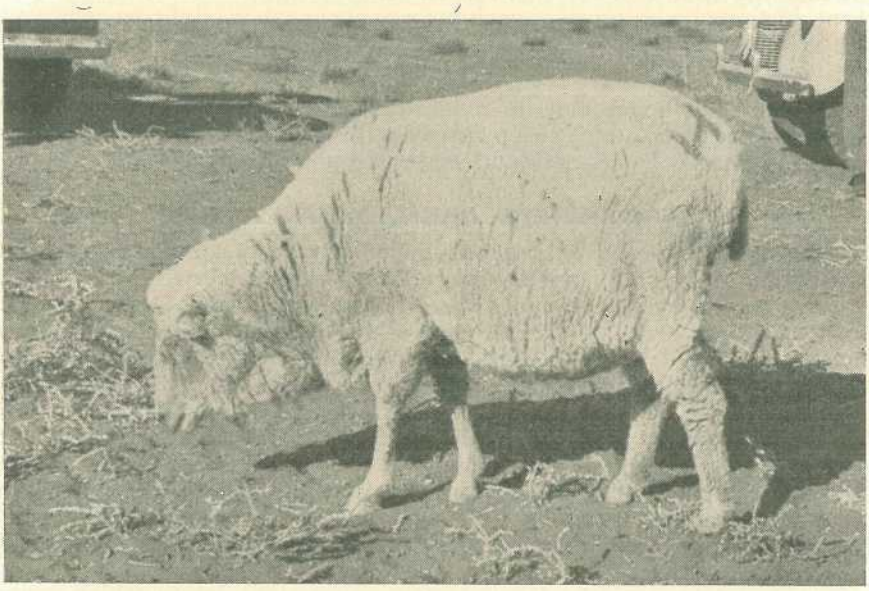


Plate 88.
EWE SHOWING TYPICAL SIGNS OF PREGNANCY TOXAEMIA.

Plate 89.
Ewe Down With Pregnancy Toxaemia.

Pregnancy toxaemia may reach "outbreak" proportions in a flock and it usually occurs amongst ewes which have not lambed. Affected sheep stand about in a listless fashion, appear to be blind, are disinclined to feed, but may grind their teeth. The course of the disease is protracted and sick ewes (Plates 88 and 89) may linger for seven or eight days before dying. Sometimes affected sheep abort, but the ewes seldom survive. Preventive measures obviously include the careful handling of pregnant ewes and, where necessary, supplementary feeding.

Plate 90.
Ewe Suffering from Milk Fever.

Milk Fever (Hypocalcaemia).

In some ways the history and symptoms of milk fever may resemble those of pregnancy toxaemia, but fortunately it is easy to treat animals suffering from this condition. It is caused by a sudden diminution in the amount of lime (calcium) circulating in the blood and affected animals respond quickly to injections of the drug calcium borogluconate. Milk fever may reach severe proportions when it occurs amongst ewes brought in for pre-lambing crutching or during some other procedure which necessitates their being held in the yards or being exercised. Sometimes cold, windy weather, infestation with internal parasites or the ingestion of certain poison plants may precipitate symptoms. In these circumstances the sheep are often "in hand" when the condition occurs and it can usually be recognised by the quickness of its course and the almost immediate recovery affected sheep will make if they are given subcutaneous injections of from 1½ to 2 ounces of 20 per cent. solution of calcium borogluconate. If the ewes are not treated they usually die and loss of the mother means loss of her lamb as well. Plate 90 shows a ewe down with milk fever.

Mastitis.

Mastitis is the name given to the inflammation of the udder. Although this disease is well known amongst dairy cows it is probably more common than is generally imagined amongst ewes. A few cases have been observed amongst ewes kept under close observation at lambing time and the disease has reached outbreak proportions on some properties. Mastitis may occur in a mild, uncomplicated form or it may be complicated and serious. In the former case the disease is not particularly important. There is a decrease in the amount of milk available for the lamb and the affected half of the udder may become permanently blind.

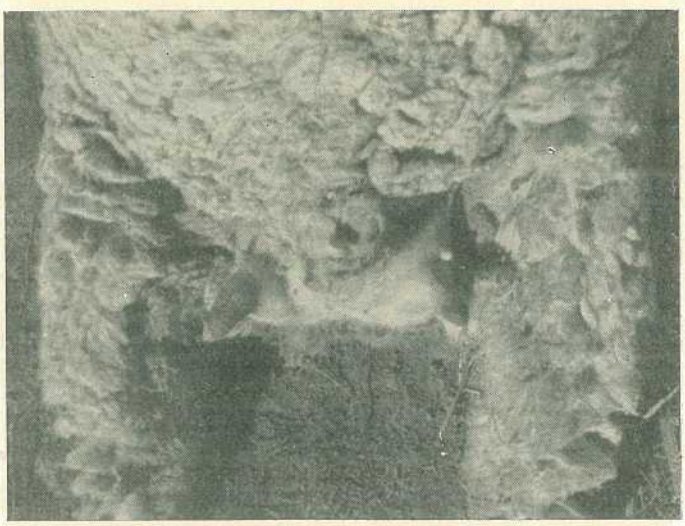


Plate 91.

THE TEATS AND UDDER OF A EWE SUFFERING FROM MASTITIS. NOTE THE BLACKISH INFLAMED TEATS.

In its complicated form mastitis may lead to the death of the ewe. The udder becomes bluish-black in colour (Plate 91) and the affected ewe usually shows evidence of distress, lameness in her hind limbs, an increased respiratory rate and a high temperature. Prompt treatment, which consists of the administration of the drug sulphamezathine at the rate of 1 gram for every 15 lb. live-weight or the infusion of solutions of calcium penicillin into the udder, is necessary in most cases to save affected animals.

Accidents Associated With Lambing.

Most experienced sheep men are familiar with the accidents which may befall ewes at lambing time. They include an eversion of the breeding passage, or of the whole breeding bag, or rupture of the "skirt muscle" which separates the chest cavity from the belly. Although spectacular, the conditions do not usually account for a very large proportion of the ewes which die at lambing time. However, as most of these conditions are fatal the lamb is left as a "poddy" before he is old enough to survive.

Puerpural Sepsis.

Puerpural sepsis is the name given to the acute blood poisoning which sometimes occurs through virulent disease-producing bacteria gaining entrance to the breeding bag at lambing time. This condition is usually fatal within a few days and in most cases treatment is of little avail. Fortunately, it is not very common amongst ewes, but when it occurs it usually kills the ewe before her lamb is old enough to survive without its mother.

THE CAUSES OF ABORTION, OR LAMBS BEING BORN DEAD.

Vitamin A Deficiency.

The most important source of vitamin A to the sheep is green grass and during times of plenty the animal stores this vital substance in its liver. When the pastures become dry, as they do in the winter, the liver stores of vitamin A are used to meet the daily requirements. Vitamin A is essential to the normal utilisation of protein, which is so important for the growth and development of lambs, both before and after birth. Should the ewe receive insufficient vitamin A, small weak lambs may develop and on being born their chances of survival are slender. Alternatively, the ewes may abort before their lambs are fully formed.

Consideration of the conditions in Queensland reveals that a large number of ewes lamb at a time when the pastures are deficient in vitamin A, and although it has not been proved experimentally in this State, there is reason to believe that vitamin A deficiency might be a contributory cause to losses of baby lambs. Making sure the ewes have a vitamin A and protein-rich supplement during the latter stages of pregnancy (if the grass is dry) is helpful in reducing losses due to this cause.

Phenothiazine Drenching.

A few cases of abortion and/or of still-born lambs occurred amongst some flocks in New South Wales following the drenching of the ewes with phenothiazine within a fortnight or so of lambing. Because of this it is usually recommended that ewes should not be drenched with phenothiazine within a month or six weeks of lambing.

Abnormalities in Development.

"Freak" sheep are not commonly seen, because they usually die at, or within a few hours of, birth. However, it is doubtful if abnormalities in development are common enough in most flocks to reduce lamb-marking percentages appreciably.

Disease.

It is as well to remember that there are a number of diseases which may lead to lambs being aborted or born dead. As far as is known, none of these is prevalent in Queensland, but it is advisable to seek the assistance of Departmental officers in investigating such occurrences.

CAUSES OF EARLY DEATH OF LAMBS.

On most properties the greatest losses of lambs occur within three days of birth, and a large number of factors can cause quite heavy mortalities amongst new-born lambs. These are set out below.

Failure of the Lamb to get a Drink.

Some lambs seem to experience difficulty in finding the ewe's teat and for this reason it is advisable to lamb off shears or after crutching. However it should not be concluded that because a new-born lamb finds the teat that he has succeeded in getting a drink. A plug of detritus sometimes forms in the teat canal and it gets wedged so firmly that the lamb is unable to move it and although he suckles does not get any milk. The first milk is essential to a young animal because it contains substances which "move the bowels," and should the lamb not be able to get the first milk it soon becomes "tucked up" and constipated. Unless remedial measures are undertaken death is likely to supervene (Plate 92).

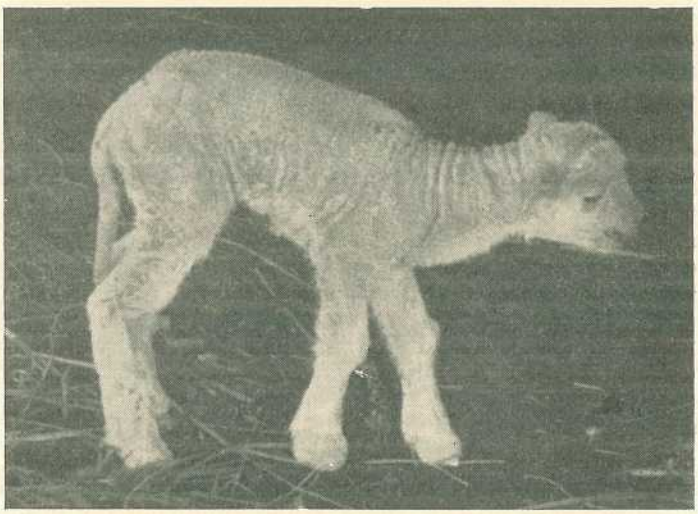


Plate 92.

LAMB, SIX HOURS OLD, WHICH HAS BEEN UNABLE TO GET A DRINK OF MILK OWING TO PLUGS IN ITS MOTHER'S TEATS.

It is difficult to ensure that the teats of flock ewes are "free," but when stud ewes are lambing under close supervision it is relatively easy to ensure that the teat orifice is open and that the lambs get a drink of milk soon after birth.

Extremes of Heat or Cold.

Extremes of heat or cold can cause heavy losses amongst newly born lambs. Cold, dry winds are especially trying at night because the baby lamb must generate enough heat to keep warm, as well as allow for the heat loss due to the evaporation of the moisture in his coat. This can be far too great a task for lambs born during the night and they may freeze to death unless they can find protection from wind.

Navel Infections.

Disease-producing organisms may gain entrance to the lamb's body through the navel, and when this occurs the lamb may become extremely ill. If death does not supervene quickly it is probable that the lamb will develop lameness in one or more limbs. It may not recover.

Copper Deficiency.

Copper is essential to sheep for the normal development of the nerves of the spinal cord, for the formation of red blood cells and for the growth of normal wool. When pregnant ewes do not receive adequate copper there may not be sufficient available to the lamb to ensure the normal development of the nerves of the spinal cord. When this occurs the new-born lambs quickly develop a swaying gait and they may finally become paralysed and die. Preventive measures consist of providing a copper supplement for breeding ewes depastured in areas where sheep are likely to suffer from copper deficiency.

Predators.

The predators most common in Queensland include foxes, crows, eagle hawks and pigs. The severity of attacks by birds and animals is well known to most wool growers, but it is as well to remember that the losses they cause are not the only ones which are likely to reduce lamb marking percentages.

FACTORS WHICH MAKE EWES FORSAKE THEIR LAMBS.

Ewes will sometimes forsake their new-born lambs. While it is commonly considered that maidens are likely to do this through inexperience, older ewes may leave their lambs because of ill-health or poverty, or through faulty management on the part of the owner.

Amongst the conditions of ill-health which are likely to cause ewes to forsake their lambs are pink eye, blowfly strike, crow peck, mastitis and foot rot. Of these there is probably little excuse for losses due to strike, as the following figures illustrate:—

Fertility of Ewes, Struck and Unstruck.

Ewes.	Percentage Wet.	Percentage Lambs.
Not Mules operated, struck	75	79
Mules operated, unstruck	92	100

Effect of Multiple Strikes on Fertility.

—	Number Strikes.	Percentage Ewes Wet.
Mules operated	0	92
Not Mules operated	1	88
Not Mules operated	2	73
Not Mules operated	3	58
Not Mules operated	4	47

Poverty.

It is well known that ewes lambing during a drought may walk away from their lambs immediately they are born. While such a procedure is not conducive to high lamb-marking figures, it probably ensures the greatest chance of survival for the ewes. Naturally, good management aims at lambing at a time which is favourable for the survival of the ewe and her offspring, but this is often difficult to achieve in areas where rainfall is unreliable.

Faulty Management.

Included under this heading are the factors which lead to unnecessary disturbance, such as too much handling, lambing in paddocks through which stock routes pass, and lambing in paddocks which are too large or too small. An important complication resulting from the last practice is that, contrary to popular belief, Merino ewes will adopt lambs to the exclusion of their own offspring (see Plate 93). On the other hand, should the paddocks be too large and inadequately watered young lambs may have difficulty in keeping up with their mothers when they go into water. This can result in heavy loss, especially in hot, dry weather.

THE RELATIVE IMPORTANCE OF THE VARIOUS CAUSES OF LOSS OF LAMBS.

Some of the causes which have been enumerated as being responsible for losses of baby lambs are capable of destroying the whole of a lambing. Such happenings are largely dependent upon seasonal conditions, and it is difficult to assign relative importance to them.

In a trial conducted in the north-west recently, in which ewes were lambed under ideal nutritional conditions and within netting enclosures to exclude foxes and pigs, 22 per cent. of all the lambs born could have been lost had remedial measures not been undertaken. These were successful in reducing the losses to about 12 per cent. A dissection of the causes of potential losses is shown in the following table :—

Cause of Loss.	Percentage of all the Lambs which Died.
Lambs unable to drink because of plugged teats ..	30
Lambs which were weak at birth and/or premature ..	23·3
Extremes of cold	16·6
Forsaken by mother or mother died	13·6
Crow pick	6·6
Strangled at birth through bearing troubles	6·6
Unknown	3·3

In another trial conducted by a grazier in the Longreach area, 34.5 per cent. of the lambs born did not survive until lamb marking. Fifty-six per cent. of these losses were probably due to predators. Apart from predators the greatest variation is likely to occur in the number of lambs which are forsaken at birth or whose mothers die at lambing, in the number which die as the result of extremes of heat or cold and in the number which are weak at birth or which are premature. Fortunately, these are the conditions which are most likely to be offset by correct and careful management.

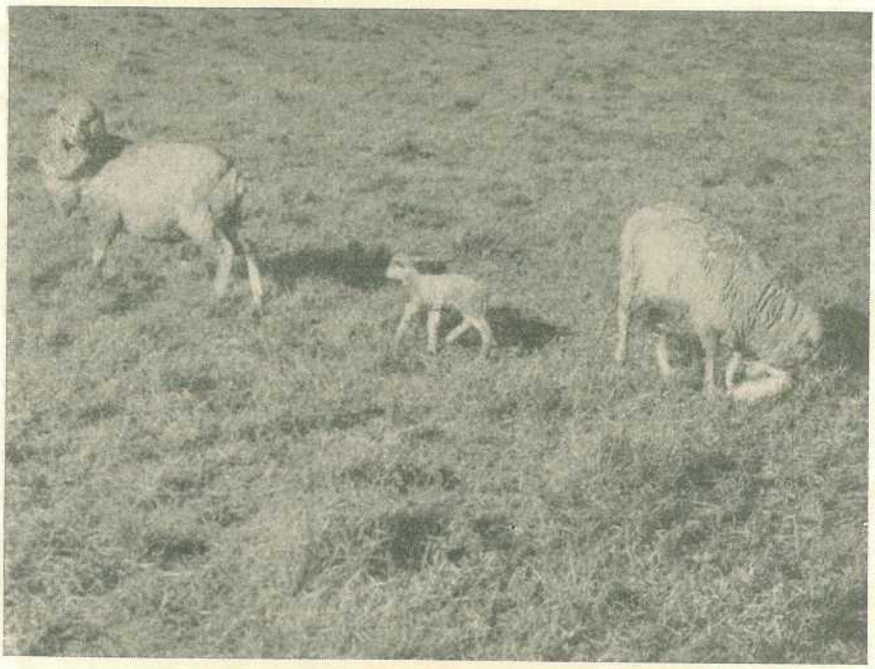


Plate 93.

A Case of Adoption.—The ewe on the right is seen "adopting" the new-born lamb of the ewe on the left, to the exclusion of her own lamb, which is following the "displaced mother," who refused to adopt it as her own.

TUBERCULOSIS-FREE CATTLE HERDS (AS AT 1st SEPTEMBER, 1949).

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas.

ASTRONOMICAL DATA FOR QUEENSLAND.

NOVEMBER.

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

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	4.59	6.05	Cairns	45	12	Longreach	42	28
6	4.55	6.09	Charleville ..	29	25	Quilpie	33	37
11	4.52	6.12	Cloncurry	61	38	Rockhampton ..	17	3
16	4.50	6.16	Cunnamulla ..	28	31	Roma	18	15
21	4.48	6.20	Dirranbandi ..	17	21	Townsville ..	37	12
26	4.47	6.24	Emerald	26	13	Winton	49	31
30	4.46	6.27	Hughenden ..	46	24	Warwick	3	6

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Day.	Rise.	Set.
	p.m.	a.m.
1	2.10	2.27
2	3.02	2.54
3	3.53	3.21
4	4.46	3.47
5	5.39	4.16
6	6.34	4.46
7	7·31	5.20
8	8.29	6.00
9	9.26	6.45
10	10.21	7.37
11	11.11	8.34
12	11.56	9.34
13	..	10.37
	a.m.	
14	12.36	11.41
		p.m.
15	1.13	12.45
16	1.48	1.49
17	2.21	2.54
18	2.56	4.01
19	3.33	5.11
20	4.15	6.23
21	5.04	7.36
22	5·59	8.43
23	7.01	9.44
24	8.05	10.36
25	9.09	11.19
26	10·11	11.56
27	11.08	..
	p.m.	a.m.
28	12.04	12.28
29	12.56	12.56
30	1.48	1.23

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

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

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	22	15	38	31	13	6	43	35
6	12	26	27	42	2	17	30	49
11	9	30	25	45	0	21	26	54
16	16	20	32	36	8	11	36	42
21	29	9	44	24	19	0	52	26
26	27	13	43	28	18	3	50	30
30	19	19	34	35	10	10	39	39

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	35	20	54	44	39	29	29	18
3	26	30	47	50	32	35	22	25
5	16	39	41	57	26	42	14	34
7	7	49	36	63	20	49	7	41
9	2	56	33	67	17	53	3	46
11	3	56	34	67	18	53	4	46
13	12	49	38	63	23	49	11	41
15	18	38	42	56	27	41	16	33
17	29	25	50	47	35	32	25	22
19	42	12	58	38	43	24	35	12
21	52	3	66	32	50	18	43	4
23	56	2	68	32	52	17	46	3
25	52	8	66	36	50	21	43	8
27	43	13	59	39	44	24	36	13
29	32	24	52	46	36	31	26	21
30	27	28	49	49	33	34	23	24

Phases of the Moon.—Full Moon, November 6th, 7.09 a.m.; Last Quarter, November 14th, 1.47 a.m.; New Moon, November 20th, 5.29 p.m.; First Quarter, November 27th, 8.01 p.m.

On November 15th the Sun will rise and set 20 degrees south of true east and true west respectively, and on November 2nd and 17th the Moon will rise and set approximately at true east and true west, respectively.

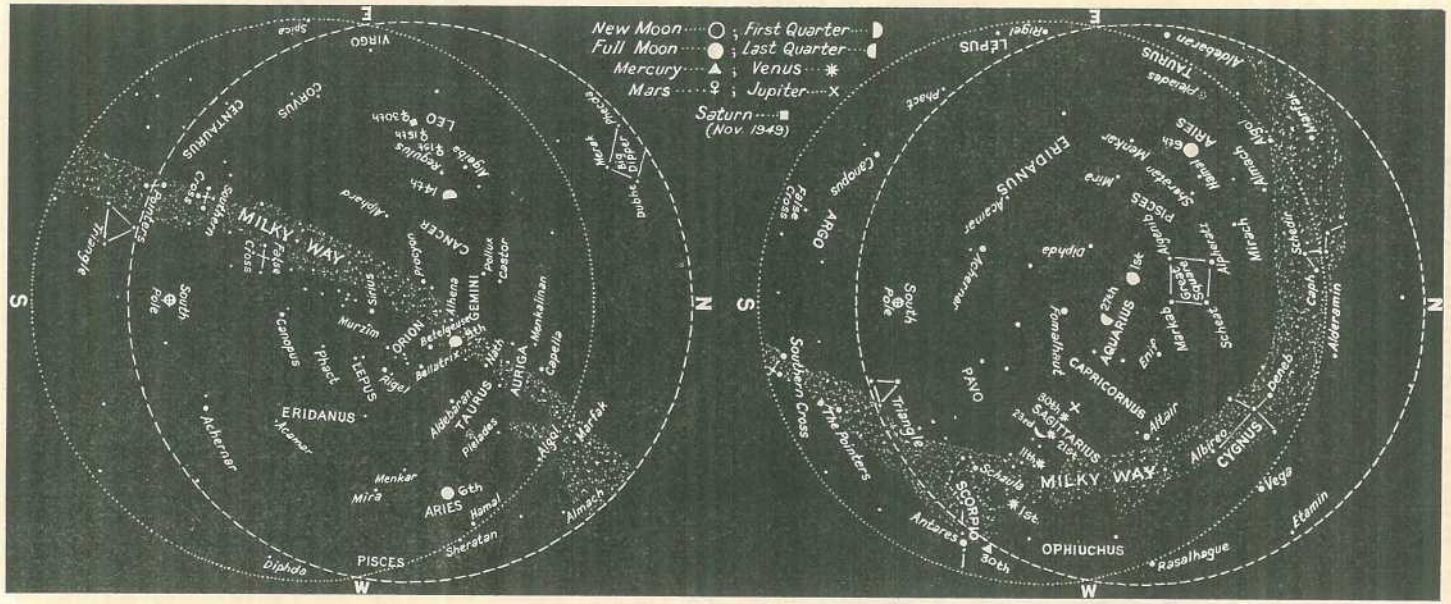
Mercury.—At the beginning of the month, in the constellation of Libra, will rise 35 minutes before the Sun. On the 21st it will be in line with the Sun, after which it will pass into the evening sky and by the end of the month will set 25 minutes after the Sun.

Venus.—Now a most brilliant object in the western evening sky, where on the 1st it will set 3½ hours after the Sun and on the 20th will reach greatest angle from the Sun. By the end of the month it will set 3¾ hours after sunset.

Mars.—In the constellation of Leo, at the beginning of the month will rise between 1.45 a.m. and 3 a.m. and on the 30th will pass less than one degree north of Saturn.

Jupiter.—At the beginning of November will set about midnight and at the end of the month will set between 10 p.m. and 11.15 p.m.

Saturn.—Will rise between 2.15 a.m. and 3.30 a.m. at the beginning of the month and about midnight at the end of the month.



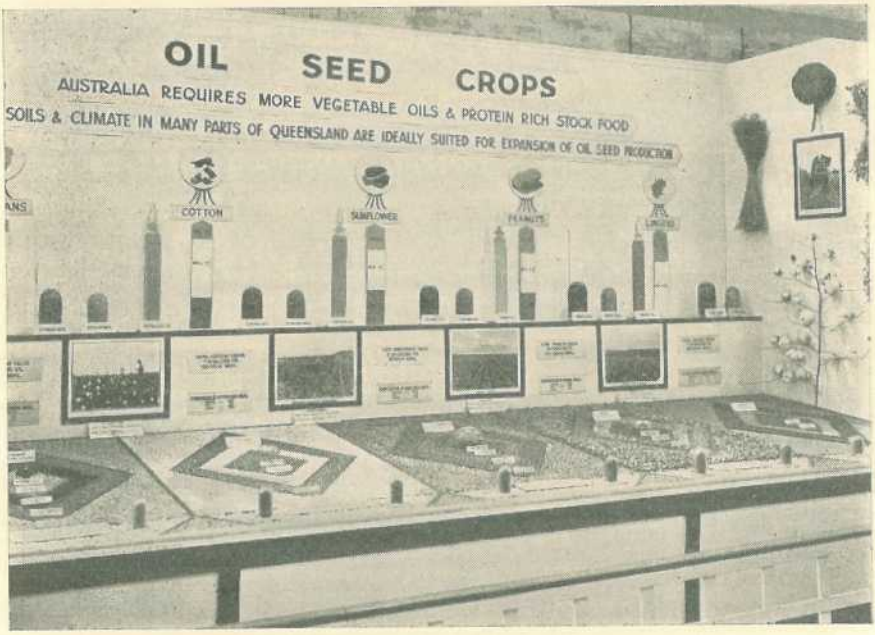
Star Charts.—The chart on the right is for 7.15 p.m. in the south-eastern corner of Queensland to 8.15 p.m. along the Northern Territory border on the 15th November. (For every degree of Longitude we go west the time increases by 4 minutes.) The chart on the left is for 7 hours later. On each chart the dashed circle represents the horizon as viewed from Cape York and the dotted circle is the horizon for places along the New South Wales border. When facing north, hold "N" at the bottom; when facing South hold "S" at the bottom; and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named. The stars, which do not change their relation to one another, moving east to west, arrive at any selected position about 4 minutes earlier each night. Thus, at the beginning of the month the stars will be in the positions shown about 1 hour later than the time stated for the 15th, and at the end of the month about 1 hour earlier than that time. The positions of the moon and planets, which are continually changing in relation to the stars, are shown for certain marked days. When no date is marked the position is for the middle of the month.

The Royal National Show.

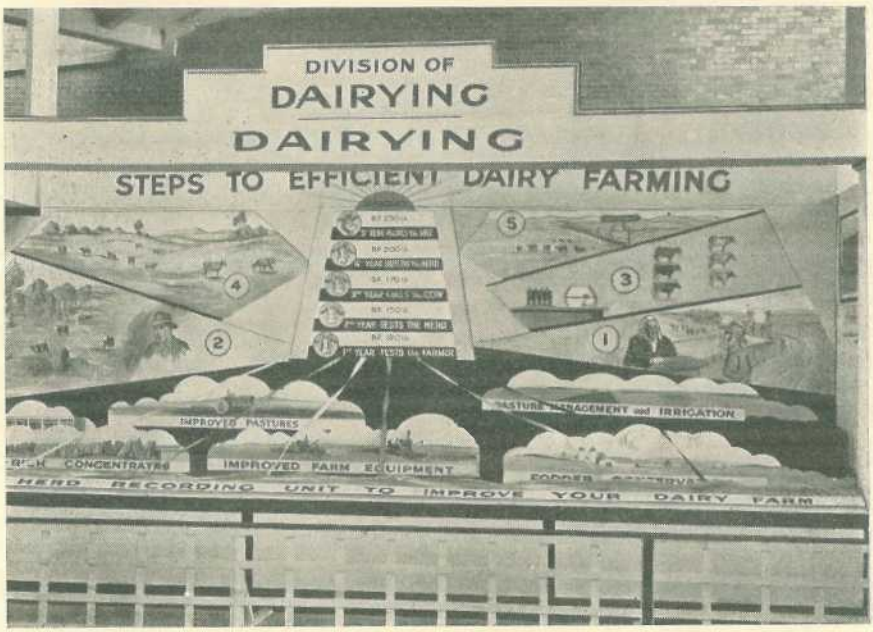
VIEWS OF THE DEPARTMENT'S COURT.

SOIL CONSERVATION.—The ravages of soil erosion and methods for its prevention and control were strikingly illustrated by photograph, diagram and model.

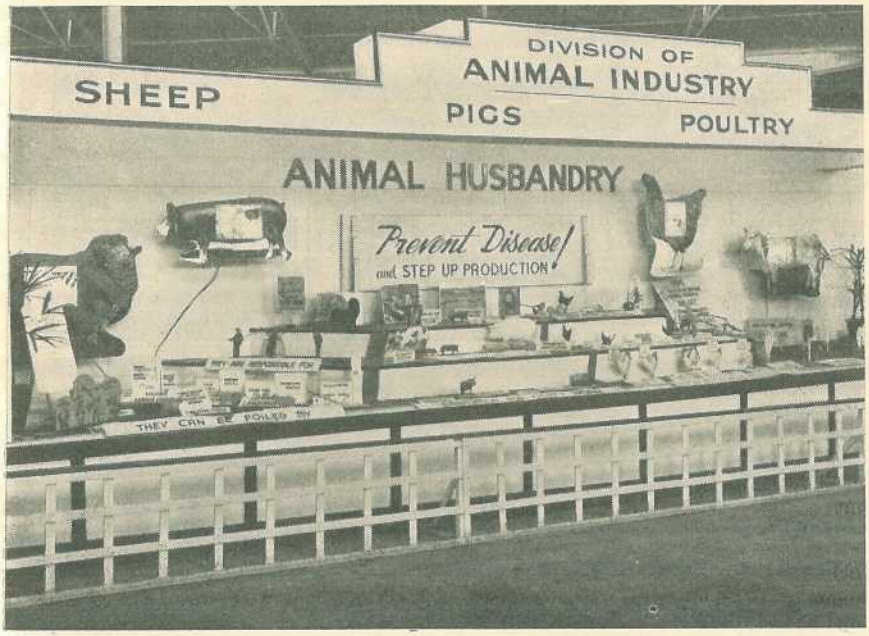
MARKETING AND STANDARDS.—The crop reporting system of the Division of Marketing was explained in an attractive manner. The Standards Branch of the Division brought home to the farmer the requirements of liming materials.



Oil Seed Crops.—The Agriculture Branch in a neat and informative display set out the main features of oil seed crops, the production of which could be expanded in Queensland.



Herd Recording.—In colourful fashion, the Division of Dairying set out the part which herd recording can play in increasing efficiency on the dairy farm.



Disease Prevention.—The theme of the Division of the Animal Industry's section of the Court was the prevention of disease in livestock. A commentary on the exhibit was given by wire recorder at intervans.

Agricultural Chemistry.—The Chemical Laboratory featured the dangers of stock poisoning from the careless use of poisons on the farm, and also showed how fertilizers and other farm requirements are analysed.