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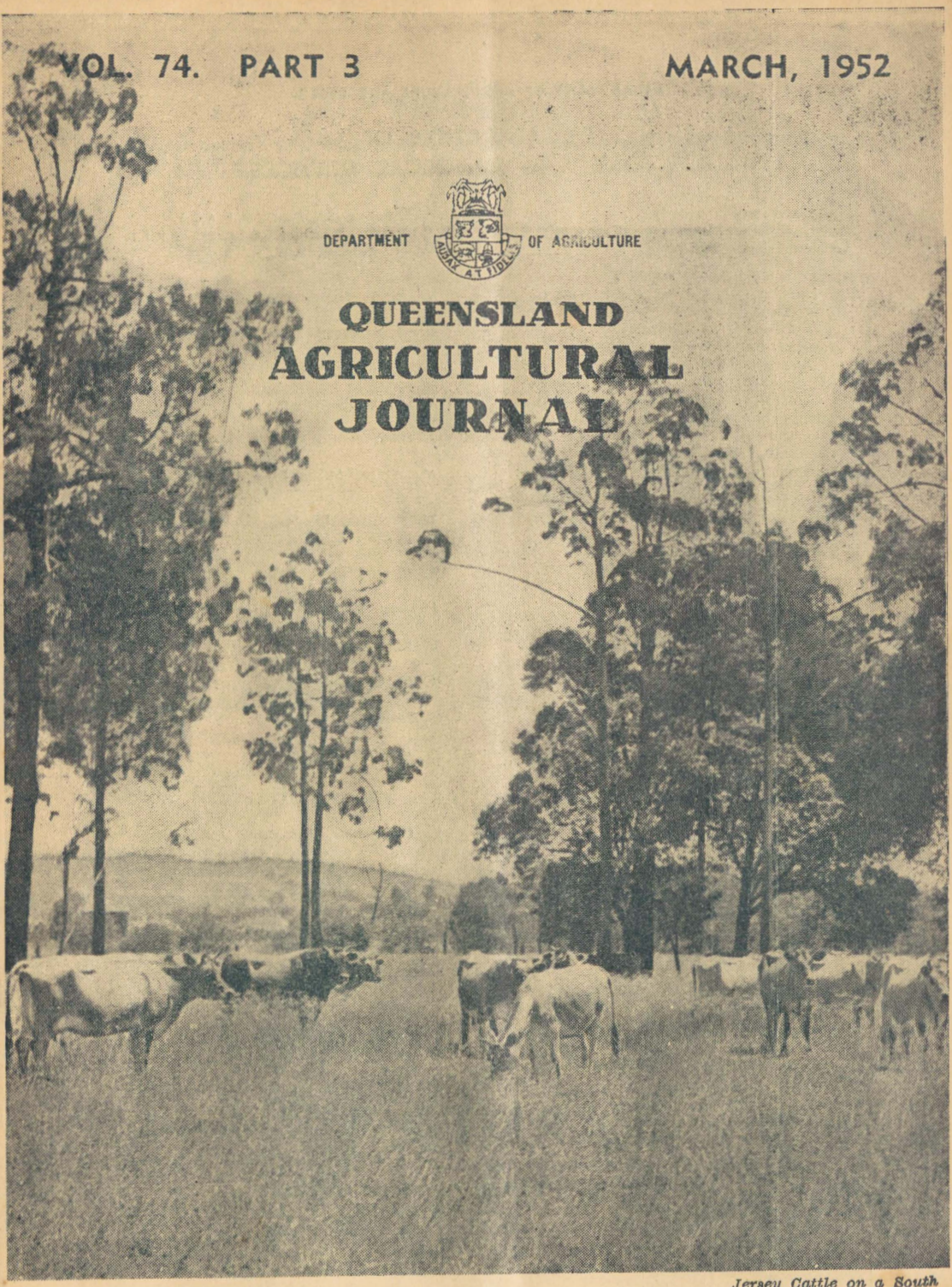

Jersey Cattle on a South Burnett Farm.

LEADING FEATURES

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Edited by
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Contents

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ROMA STREET . . . . BRISBANE

Pumpkins, Squashes and Marrows, and Grammas.

PREPARED BY OFFICERS OF THE AGRICULTURE BRANCH.

[*Continued from page* 121 *of the February Issue.*]

CLIMATIC AND SOIL REQUIREMENTS.

The climatic and soil requirements of these crops are very similar to those of maize. For best results it is necessary that growth should be maintained without repeated or undue checks. This requires an adequate rainfall (or supplementary irrigation) coupled with warm summer day and night temperatures. The cucurbits are tolerant of quite high temperatures, provided they are not accompanied by a shortage of soil moisture. Plants of this group are very susceptible to frost, and winter or early spring crops can only be grown with safety in normally frost-free areas. Such conditions are satisfied in many North Queensland districts and in a few restricted, sheltered locations near the coast in central and southern districts.

A fertile, well drained soil with a loamy structure is the ideal soil for these crops, and this is the dominant soil type on which they are grown in the main producing districts. The better class agricultural soils of the Lockyer, Beaudesert, Darling Downs, Burnett and Mary Valley districts are all very well suited for the growing of cucurbits. In some of the less favoured districts their culture is restricted to the better alluvials, as is also largely true of the previously listed Lockyer, Beaudesert and Mary Valley districts.

Less suitable soil types may be improved sufficiently with intelligent cultivation and adequate manuring to permit the successful growth of this group of crops, particularly where irrigation facilities are available. Generally speaking, sandy or light-textured soils are most responsive to such treatment, but some stiff clays, provided drainage is adequate, are also capable of being made highly productive. Examples of such red and grey clayey soils in a satisfactory state of production can frequently be met with around the metropolitan area of Brisbane. A poorly drained, badly aerated, sour soil should be avoided at all costs as these crops will not tolerate such conditions.

CROP ROTATION AND GREEN MANURING.

The rapidly developing and extensive root system of the cucurbit crops makes necessary a high degree of soil tilth for the achievement of optimum yields. Without such tilth, plant foods, whether already

existing in the soil or added as fertilizers, cannot be utilized to full advantage. Improvement in tilth can be brought about by judicious cultivation allied to a well-planned system of crop rotation. Improvement, other than that achieved by cultivation, can be most effectively brought about in both light and heavy soils by the addition of farmyard manure or the ploughing under of a green manure crop. To most farmers growing the crop on a considerable acreage, the latter alternative is the only practicable one. The introduction into the crop rotation of a periodic leguminous crop for turning under is therefore highly advisable if pumpkins or other cucurbits are to be a feature of the cropping programme.

Some very sound crop rotations are being evolved for the irrigation farms of the Lockyer Valley. While the details of such rotations would vary from farm to farm, a good general basis might be along the following lines: lucerne for four years (or longer profitable life), followed by potatoes (spring crop), cowpeas (summer crop ploughed under), potatoes (spring crop), pumpkins (late summer), fallow, and return to lucerne. Alternatively, the second potato crop could be followed by a late summer green manure crop, then a spring crop of pumpkins and finally lucerne. Such rotations provide for only one crop of pumpkins in some six or more years, but they certainly do give this crop every opportunity for effective development, and enable it to play a useful part in the cropping programme.

Where lucerne is not grown as a major crop, a simple rotation is potatoes (autumn), pumpkins (spring-summer), potatoes (autumn), pumpkins (spring-summer) followed by a green manure crop. Where crops are being grown for stock food and grazing as well as for sale, such a rotation could be modified to include maize, winter cereals, field peas, or even a pasture phase. Wherever a pasture or lucerne phase is not introduced, however, opportunity should be taken to provide a green manure crop at least once every two years. Whatever regular or irregular rotation is finally adopted, it should not include the growing of pumpkins or grammas on the one area for two or more years in succession.

LIMING, FERTILIZING AND MANURING.

Liming is not generally adopted in the districts in which these crops are grown on a field scale. In some of the heavier rainfall coastal districts, however, where soils tend towards an acid reaction, lime would prove of considerable benefit. Where it is suspected that lime might be required, a soil test should be made to determine the rate at which the lime should be applied. Applications of as low as 3 cwt. per acre of air-slaked lime have given increased yields, but much heavier dressings might be required according to the nature of the soil. Lime should be applied a few weeks before sowing, and should be thoroughly incorporated into the soil.

The beneficial effects of farmyard manure have been referred to in the previous section, but its use is generally restricted in this country to small plantings on a market-garden scale. Periodic dressings of five tons or more per acre will benefit almost all types of soil and will prove to be a major factor in maintaining structure and fertility.

The direct use of artificial fertilizers on these crops is not widespread in Queensland. In the inland agricultural districts most of the better cultivated soils are well supplied with the plant foods required, and fertilizing is not therefore warranted if good rotation practices are followed. In the smaller mixed farming and vegetable crop districts, pumpkins, marrows, squashes, etc., are generally grown following a heavily fertilized crop such as potatoes, tomatoes or beans, and their requirements are largely satisfied by the residual effects of the earlier applications. Where the cucurbits are grown in coastal districts and do not follow a heavily fertilized crop, it may then be advisable to apply a few hundredweights per acre of a complete fertilizer just prior to planting, and possibly to side-dress the young plants with a nitrogen-rich fertilizer. On the small-crop farms surrounding Brisbane, for example, it is customary to use dressings of up to 8 or 10 cwt. per acre of a complete mixture approximating to 5:13:5 composition before planting, and to topdress with 2 oz. per vine of 10:8:7·5 mixture when the plants have run to 12 or 18 inches.

PREPARATION OF THE SEED-BED.

As previously mentioned, these crops have a large and quickly developing root system. This is concentrated mainly in the uppermost 6-12 inches of the soil. Consequently the surface foot of soil should be loose and moist, and due regard should be paid to this requirement when preparing the land for sowing.

The first essential is a deep and thorough ploughing, which should be carried out early in the season and preferably before the June rains. Subsequent requirements in the preparation of the seed-bed will be determined by weather conditions and the farmer's individual experience of what is necessary to bring his particular soil to a high state of tilth. If practicable, the ground should remain open and in a rough condition for a long period through the winter. This will allow frost and other climatic influences to hasten the weathering of the soil, thus rendering large lumps friable. Then, when sufficient rain has fallen to supply adequate subsoil moisture, harrowing should effectively reduce the surface soil to a fairly fine physical condition.

A shallower cross-ploughing, followed by the necessary surface harrowings to break all lumps, should then create the desired tilth. Such a tilth is obtained when the top 1–2 inches of soil is loose and finely divided, and the soil immediately below is moist and firm, but granular and not stiffly compacted. To obtain the desired condition, heavy soils require longer preparation than loams, while sandy soils may need the use of rollers rather than cultivators or harrows in the final stage of preparation.

SOWING.

Sowing periods for the cucurbit crops in Queensland range almost throughout the year, depending largely upon temperature and rainfall conditions in the various producing districts. These plants are all susceptible to frost and must therefore be grown in normally frost-free seasons if they are to be given a reasonable chance of success. Moreover, it has been shown that a minimum soil temperature of approximately 52 deg. F. (or slightly higher than that for maize) is required for seed germination, while the optimum temperature for such germination is around 90 deg. F.

In southern Queensland, planting is generally carried out between August and January. The earlier planting periods are often favoured by farmers as it gives them a chance to get their crops on to a favourable early market. However, for the reasons given above, planting must be delayed until all reasonable danger of frost is over. On certain well protected areas near the coast the frost damage is very slight, enabling these crops to be planted earlier without serious risk.

In most of the coastal districts of North Queensland frost is generally of no significance, with the result that cucurbits can be grown throughout most of the year. In the wetter districts it is important to avoid the heaviest wet-season period, and plantings are generally delayed until April or May. These months are also a favoured planting period for the irrigation districts such as are found in association with the Don, Burdekin and other northern rivers.

It is usual to allow for a sowing rate of about 2 lb. per acre for pumpkins and grammas, and a somewhat heavier rate for the closer spaced marrows and squashes. Table pumpkins are usually sown in drills 10-12 feet apart, seed being dropped singly at distances of 2-4 feet apart, or in hills of 2–3 seeds every 6–8 feet. On some of the more fertile loams the row spacing is increased to 15 feet or more, while on poorer or lighter soils it may be decreased to 7–9 feet. With cattle pumpkins and mammoth types of gramma on good soils, rows are often made 15–20 or more feet apart with 6–12 feet between hills in the row. Squashes and marrows (that is, the table varieties) normally require a row spacing of only 4–5 feet, with two feet between plants in the drill.

Seed is usually dropped by hand into open furrows, and covered to a depth of approximately two inches by scuffler or similar means. In hill sowing, 2–4 seeds may be dropped into a hole made with a hoe, dibble stick or walking-stick planter; if this method is adopted, an ultimate stand of 2–3 plants per hill should be aimed at. In some districts where early seedling losses through insect attack or disease are anticipated, it is customary to plant at much higher rates than those described, and to thin out the seedlings by hoe when the risk of serious mortality has passed.

In districts in which single-row maize planters are available, these may be used with complete satisfaction provided care is taken in selecting the right plate for the seed used. Planting by this means does away with the necessity for exposing open drills to the drying action of sun and wind, and also saves a considerable amount of hand-work. Where large areas are to be planted, or where single-row planters are not available, two-row or four-row planters can easily be used for the job if a little thought is given to the problem. For example, a two-row planter may be used to plant at a row spacing of eight feet, if the machine is set for 4-feet intervals and only one seed hopper is used; such an arrangement would require a 4-feet marker on the side of the empty hopper and a 12-feet marker on the side of the planting hopper. With a four-row planter, a row spacing of 12 feet could easily be obtained by using the two outside hoppers only. Either the press-wheel or the cultivator type of planter would do an excellent job in well prepared seed-beds.

Where machine-planting is adopted, check-row planting has much to recommend it, as it enables subsequent cultivation to be done in two directions at right-angles. Where machines are not equipped for

hill or check-row planting, they should be geared to give a continuous seed drop at a closer spacing than is ultimately required. At a suitable time following germination, the excess seedlings can then be removed by cross-cultivation or hand-hoeing.

In districts of favourable soil and rainfall, pumpkins and grammas are sometimes grown in conjunction with maize. Pumpkin or gramma seed may be substituted for maize in every fourth planting row, or, as is sometimes preferred, a light seeding of the secondary crop is broadcast in amongst the maize just prior to the final inter-row cultivation.

CULTIVATION OF THE CROP.

The main purposes of cultivation are to remove weeds which would compete with the crop for moisture and plant foods, and to keep the surface soil in a condition receptive to further rains. Where the crop is planted in hills on a check-row basis, cultivation can be carried out as required in two directions, thus enabling weeds to be most effectively controlled.

Under favourable conditions the lateral root growth of these crops is quite rapid, and the aim of cultivation should be to keep the surface soil well stirred just ahead of the roots without injuring the latter in any way. Inter-row cultivation may be continued, in successively decreasing bands, until the growth of the vines prevents the further use of implements.

Diamond harrows may be used in the early stages for breaking the surface and destroying young weeds following rain. Where rows are too closely spaced to allow the use of this implement, or where the cultivation space has been decreased by spread of the vines, spring-tine or rigid-tine cultivators are most effectively used. Where weeds have got out of hand during a prolonged wet spell, disc implements may have to be employed, and hand-hoeing near the base of the plants may also be necessary. The ordinary single-row scuffler will probably be the most effective implement for the final cultivations of the crop.

IRRIGATION.

While a considerable proportion of the Lockyer Valley's pumpkin crop is irrigated, the pumpkins and grammas are not generally irrigated elsewhere in the agricultural districts of southern Queensland. Supplementary irrigation is sometimes applied, particularly to early planted crops, on some of the alluvial soils of the Boonah, Gympie and Beaudesert districts, and could profitably be used to a much greater extent. Plantings made in July or August to catch the early market will almost certainly require irrigation to bring them through to maturity. Such crops may be planted in moist soil which has been given a good pre-planting irrigation, or set in dry soil and watered in. While the latter practice may be less wasteful of water, the pre-planting watering will enable a crop of weeds to germinate and be harrowed out before the cash crop is sown. One to three subsequent waterings may be required to carry the crop to flowering stage, when irrigation normally ceases.

Pumpkins, squashes and marrows grown as market-garden crops in the vicinity of the larger cities are mainly grown under irrigation; this of course applies particularly to crops grown outside the normal summer wet season.

In most districts in which the cucurbits are grown under irrigation, spray systems are used. Ground sprays are normally used in the agricultural districts, and overhead sprays in some of the market-garden areas. In the Bowen delta country, however, flood irrigation is used almost exclusively. Drills are opened up to a depth of five or six inches and the open drills flooded prior to planting. The seed is then dropped in the open furrows and scuffled in lightly. Two or three waterings are applied in the original drills up till the flowering period, and the irrigation is normally completed by one final watering subsequent to flowering.

FLOWERING AND SETTING.

Early flowering depends on the strength and vigour of the young plants, and if growth is rapid, flowering is early, thus enhancing the prospects of a good yield. Flowering may extend over a period of several weeks, both male and female flowers being produced on the same vine. The male flowers are the first to appear; they are borne on long, slender flower stalks not far from the crown of the plant, and are readily visible above the foliage. The female flowers are carried on short, stout stems toward the ends of the runners, and are easily recognised by the ovary or undeveloped fruit which can be seen immediately below the showy portion of the flower.

The flowers are open for 24 hours, and pollination, which is effected by insects, chiefly honey bees, takes place mostly in the early morning, but may occur at any period when the flowers are open. Pollen is carried from the male flowers to the female flowers, and fertilization is thus effected.

It is generally claimed that a better setting of fruit is obtained when cross-pollination occurs. Setting may vary with the variety and to some extent with the strain within the variety, and may be adversely affected by disease incidence or unfavourable weather. Only a small proportion of the female flowers set fruit, even though all may be fertilized. The shedding of fruiting flowers is a natural phenomenon and cannot be corrected except by the selection of better strains and varieties in which the phenomenon is less marked than in others. The nipping or cutting-back of vines is not calculated to increase the yield. It can only very slightly increase the size of the fruit set, and as all female flowers are borne towards the terminals of the plant, it removes potential fruiting portions of the crop.

SEED SELECTION.

With the cucurbit crops, as with maize and other cross-pollinating crops, seed selection is of vital importance if varieties are to be maintained at a reasonable standard of purity. A notable example of the variability which can occur through uncontrolled pollination is the Queensland Blue variety of pumpkin. Almost any field of this variety shows considerable variability in the type and quality of the fruit. Moreover, the fruit type regarded as true to the variety in one district or on one farm may be altogether different from that in another district or even upon a neighbouring farm. Careful seed selection is essential if type and uniformity are to be improved in a mixed variety, or maintained in a variety which is already of high standard.

It has also been pointed out that selected varieties or strains may be capable of setting a greater number of fruit per vine than material which has not been selected for this characteristic. Thus selection may be the means of increasing yield as well as quality and uniformity.

The barn selection of individual fruit for seed requirements is unwise, since the fruit selected may be from low-yielding vines or may be exceptional individuals from a vine of otherwise poor quality fruit. It is therefore necessary for seed selection to be carried out in the field. This is not as difficult as may at first appear, since, after the leaves have fallen, individual vines are fairly distinctively traced. Only well-shaped fruit, true to type and from vines of high yielding capacity, should be selected. Precautions must also be taken against possible crossing with other varieties, as has been outlined in a previous section.

Ten pounds of pumpkin will provide approximately one pound of seed; consequently selections need not be extensive. Contrary to popular opinion, the age of the seed, provided germination is not impaired, has no influence upon the yield of the subsequent crop. New season's seed has by experiment been shown to bear just as heavily as seed of older origin.

HARVESTING.

Squashes and marrows are usually harvested for market before they reach maturity—that is, before the rind or shell commences to harden. A simple test can be applied by pressing the rind with the thumb-nail, which, if the fruit is at the correct stage, should penetrate the rind under only light pressure. If such fruit are allowed to mature fully, the flesh becomes coarse and fibrous.

The scallop type of bush squash (or custard squash) is in excellent condition for table use when only two to three inches in diameter, and, when grown for home consumption, is often picked at that stage. It is normally harvested at a considerably later stage, however, when required for market.

Pumpkins and grammas are harvested when fully mature, usually after the vines have been frosted or have otherwise died off. Pumpkins harvested in an immature condition may be satisfactory for immediate home use but are unsuitable for market or storage. Such fruit are very susceptible to bruising, and losses through rotting may be very heavy. When the stage of full maturity has been reached in the field, the fruit should be harvested and put under cover before excessive sunburning can occur.

Where pumpkins and grammas are broken off clean from the fruit stalk, the scar left at the point of junction represents a weak spot for the entrance of fruit-rotting organisms. A short length of stalk should therefore be left attached to the fruit when it is picked; this is especially important if the crop is intended for distant market or for storage. Care must also be taken in handling the harvested fruit, as any unnecessary bruising or skin-cracking will react seriously against their keeping quality.

STORAGE.

Storage of pumpkins and grammas applies mainly to the late summer and autumn crops, which are normally harvested in the early winter period. Spring crops are not so well suited to storage,

because the warm humid weather of summer encourages fairly rapid deterioration. The main purposes of storage are twofold:— (1) to provide the farmer with stock food over the winter months, and (2) to enable him to market his produce outside the glut period.

All fruit to be stored must be mature and free from cuts and bruises. For long storage it is essential that the fruit be kept dry and as cool as practicable, with free access of air throughout. On many farms pumpkins and grammas are thrown carelessly into a heap in the corner of a yard or up against a barn, with the result that almost total losses may occur through bruising, sweating, and eventual decay. Storage therefore should always be in single layers in a cool and well aerated space.

Frequently a large hayshed or barn may provide the necessary floor space for storage of the crop under such conditions. If sufficient floor space is not available, wooden racks should be constructed to accommodate the fruit in single layers.

Where pumpkins and grammas are stored for farm use, and where indoor storage is not available, it will pay the farmer to select a clean, dry, well-drained area of land and to store the fruit in a single layer on this site. A covering of dry grass or straw will protect the crop from the sun and to some extent from rain. Inspections should, however, be made from time to time so that partially decaying fruit can be removed and either utilised or destroyed.

Smaller quantities of fruit for culinary use can often be kept for long periods on benches underneath the house or in other cool, well-aerated places round the farm house or buildings.

YIELDS.

While statistics show the State's average yield of pumpkins to be just in excess of 2½ tons per acre, this figure is of course a low one for good farming practice. On good fertile soils in south-eastern Queensland, particularly where irrigation can be applied, yields of more than five tons per acre should be easily attainable. Many well-tended crops of table pumpkins have yielded five to eight tons per acre, while yields of 10-12 tons per acre have been claimed for the mammoth types of cattle pumpkin. On poorer soils and under dry-farmed conditions, yields generally range from 30 cwt. to four tons per acre. In northern districts, under natural rainfall conditions, yields of 4-5 tons per acre are common, while irrigated crops in the Bowen district often exceed eight tons per acre.

Squashes and marrows grown under market garden conditions should yield more heavily than pumpkins because of the bush habit of most varieties and the closer plant spacings used. Yields of 8-12 tons per acre should easily be attainable where water is available and sound manuring practices applied.

With the large stock types of gramma, yields are very similar to those obtained with cattle pumpkins.

VARIETIES.

Pumpkins (Cucurbita maxima).

Queensland Blue or *Beaudesert*.—This variety, developed in the Beaudesert district of Queensland, has gained popularity in other Australian States and is by far the most widely grown variety of

table pumpkin in Queensland. The variety's origin is somewhat uncertain, but one of its parents is certainly the old Ironbark variety and a second parent is probably Crown. When the variety first became popular it was not fully fixed, and as a result many different strains exist today. The fruit type regarded as true "Beaudesert" may differ very markedly from district to district and even from farm to farm in the one district. Furthermore, in some districts it has been customary to give the name "Beaudesert" to one general type of fruit and "Queensland Blue" to a different fruit type altogether; in other districts again, the name "Beaudesert Blue" is applied to the whole varietal complex. There is, however, no definite evidence to suggest that the two names Queensland Blue and Beaudesert are not synonymous.

The typical fruit of this variety as represented in the Beaudesert district is a compact, medium table pumpkin with a steely blue-grey skin. In shape, it is quite deep in relation to its width and is fairly deeply and regularly ribbed; its sides have a pronounced taper from top to bottom, this taper being sometimes almost straight and at other times with a pronounced constriction near the middle (see Plate 74). The skin is hard and relatively thick, and the flesh should be of good thickness, hard but uniform in texture, and of a rich yellow or orange colour. The mature flesh when cooked should be dry and of excellent flavour. The variety is normally a good yielder and the fruits store well under favourable conditions.

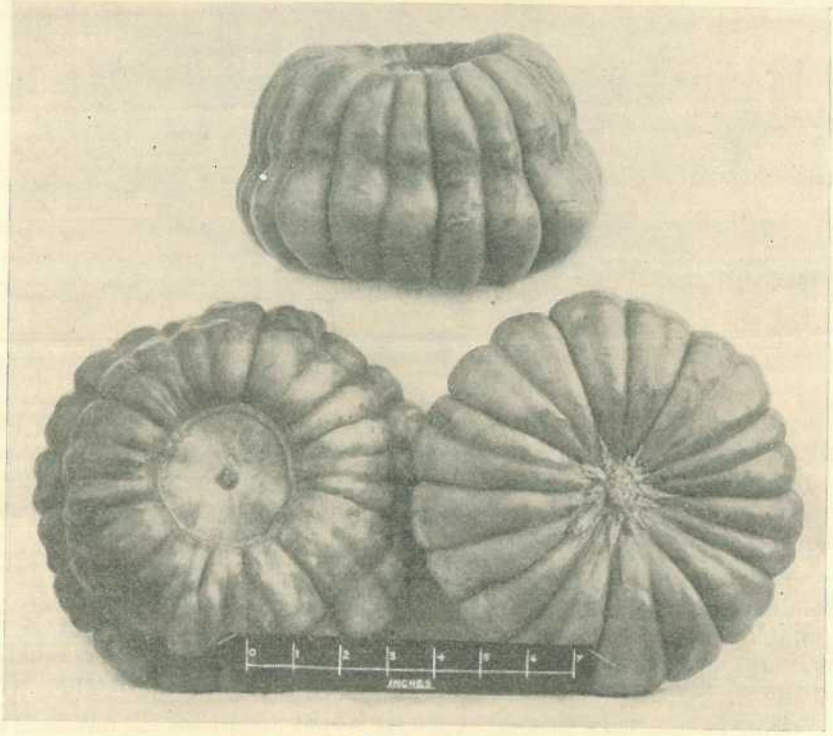

Plate 74.

Pumpkins—Beaudesert or Queensland Blue. This sample shows a less pronounced taper and a broader disc at the blossom end than other strains of the variety.

Triamble or *Triangle.*—This variety (Plate 75) is characterised by the convoluted hexagonal shape of the fruit when viewed from either stem end or blossom end. It is grey to grey-green in colour and has a deep golden-coloured flesh of firm texture. The variety is of difficult shape for packing but is a good home or farm type since it yields well and has good keeping qualities.

Ironbark.—This variety was once a very popular table type but has for many years been largely replaced by Queensland Blue. It is characterised by its very hard skin and very corrugated ribbing.

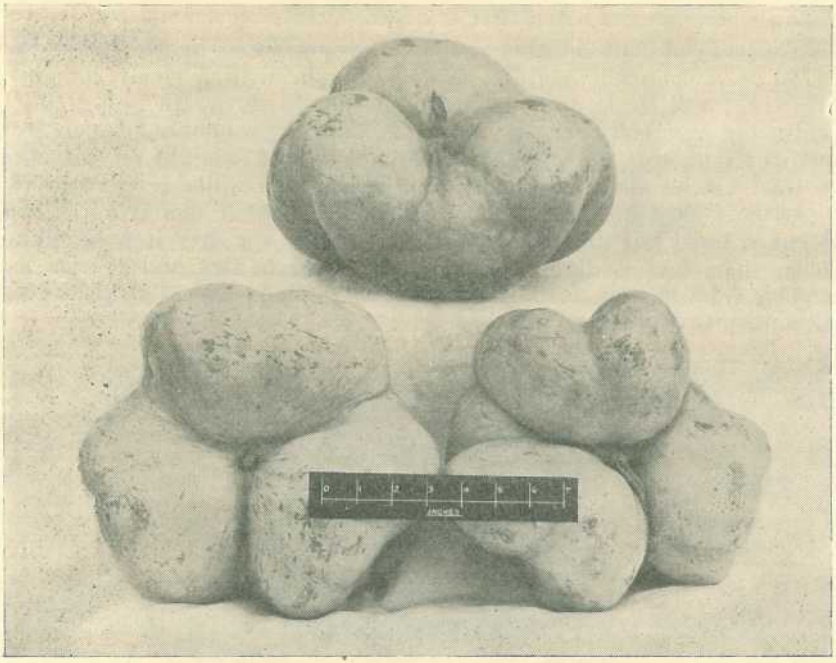

Plate 75.
Pumpkins—Triamble Variety.

Crown.—While still grown to some extent, Crown (Plate 76) has also been largely displaced by Queensland Blue. It is an evenly ribbed, medium-large pumpkin with a slate-coloured skin and a yellow flesh of good cooking quality. Its name is derived from the prominent crown or protrusion at the blossom end of the fruit.

Turk's Head or *Turban.*—In this variety the crown is far more prominent than in the preceding variety, giving the appearance of a "pumpkin within a pumpkin" (Plate 77). Some strains of this variety are very striking in appearance as the crown or turban is usually variegated and the dominant colour may be either red or green.

Hubbards.—This general varietal type comprises a number of strains such as Green Hubbard, Golden Hubbard and Warted Hubbard. The fruit is broadly pear-shaped, but tapers to a blunt point at both stem and blossom ends. The Hubbards are good table types which

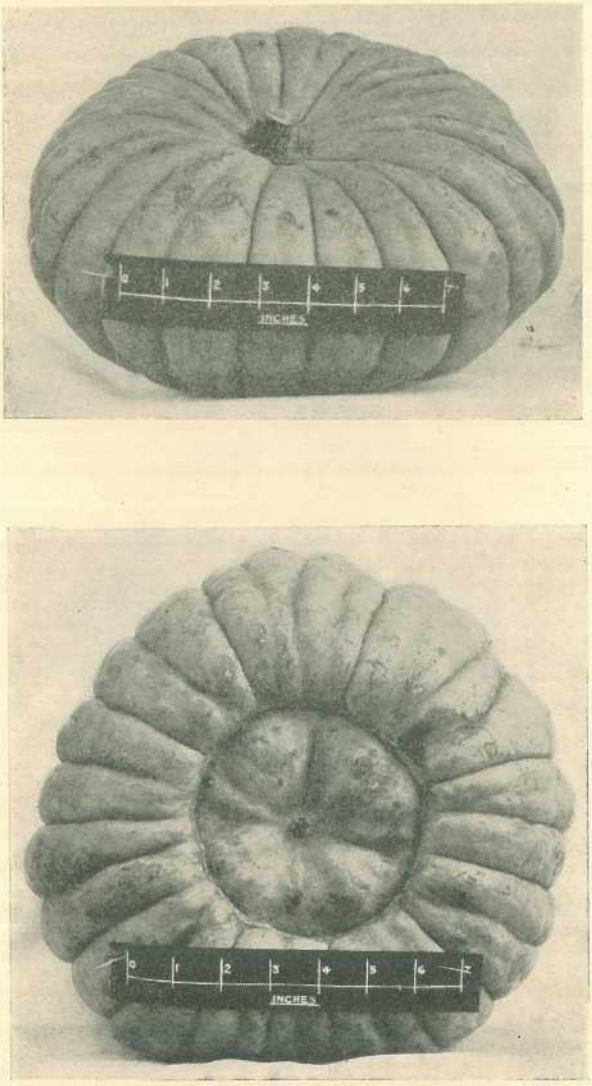

Plate 76.
Pumpkins—Crown Variety.

mature early and store well. They are not commonly encountered in Australia, but represent one of the most popular cucurbit varieties in the northern United States.

Banana.—The Banana pumpkin is somewhat similar to the Hubbard but is more elongated, and has a softer rind. The variety is normally greyish-green in colour and is reputed to be well flavoured.

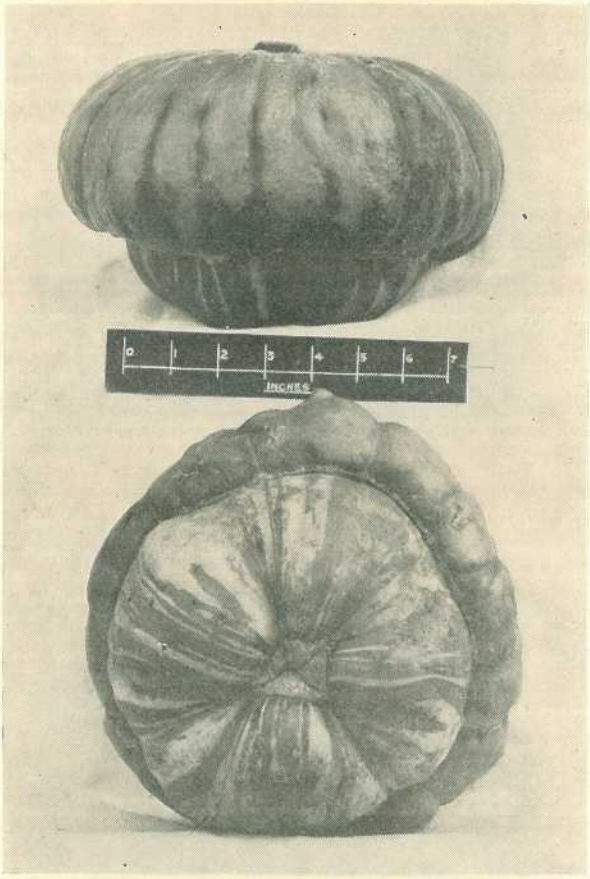

Plate 77.
Pumpkins—Turk's Head or Turban Variety.

Cattle Pumpkins.—(Plate 78). Though a number of distinct varieties of cattle pumpkin, such as Mammoth Cattle, Mammoth Yellow and Mammoth Chili, are recognised in various countries, seed is frequently sold here in mixed lots. Though minor differences may be observable between some of these varieties, all are large in size (frequently weighing between 100 and 200 lb.) with large seed cavities. The flesh is usually coarse, pale and soft, and the rind is softer than that of many of our table pumpkins; as a result they do not normally store well. The type is really misnamed in this country as they are grown mainly for pig-feeding, and few crops, if any, find their way into cattle food.

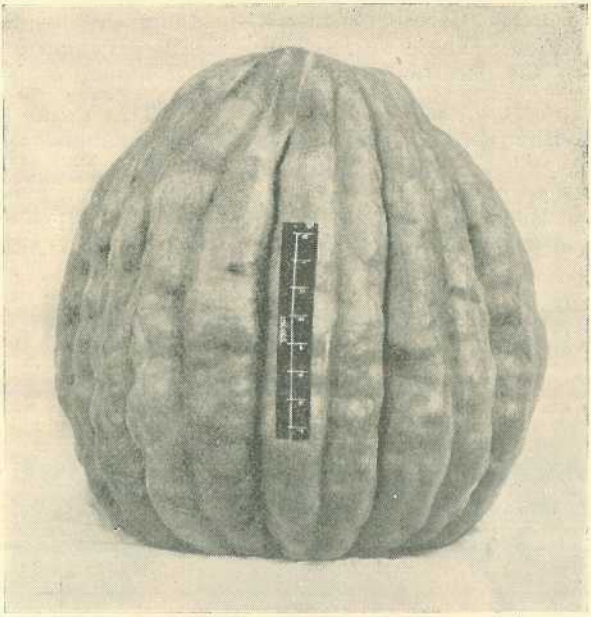

Plate 78.

Pumpkins—Mammoth Cattle Variety. This specimen weighed 120 lb. and is regarded in the Beaudesert district as of ideal size and type.

Marrows and Squashes (Cucurbita pepo).

Vegetable Marrows.—The fruits of the vegetable marrows are normally elongated and cylindrical, or slightly swollen at the blossom end (Plate 79). The skin is smooth and the flesh white. Both bush and runner varieties exist but the bush type is most popular in this country. The Long White Bush marrow is probably the commonest

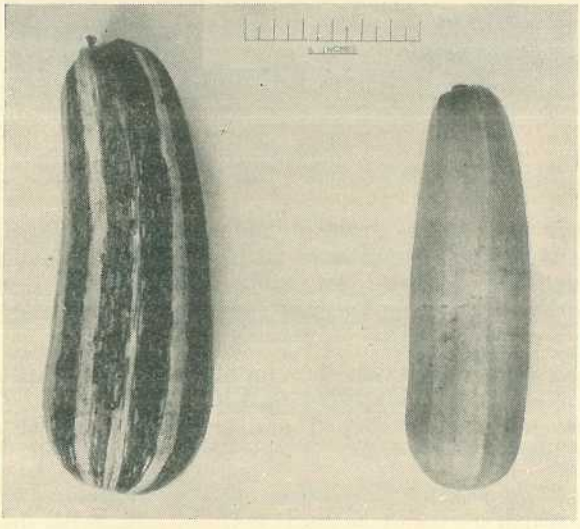

Plate 79.

Marrows—Yellow Striped and Long Cream Bush Varieties.

variety, but the Long Green Bush and the Long Creamy marrows are also in cultivation. These varieties are easily distinguishable by the skin colours of the mature fruit.

Scallops, Patty Pans, Custard Squashes.—This group of varieties is distinguished by the disc-shaped fruit with its symmetrically scalloped outline (Plate 80). Early White is probably the most popular variety; it has white skin and flesh and is a rapid and prolific bearer. Early Golden Bush and Golden Custard are two other varieties of scallop, but neither of them bears as freely as the Early White variety.

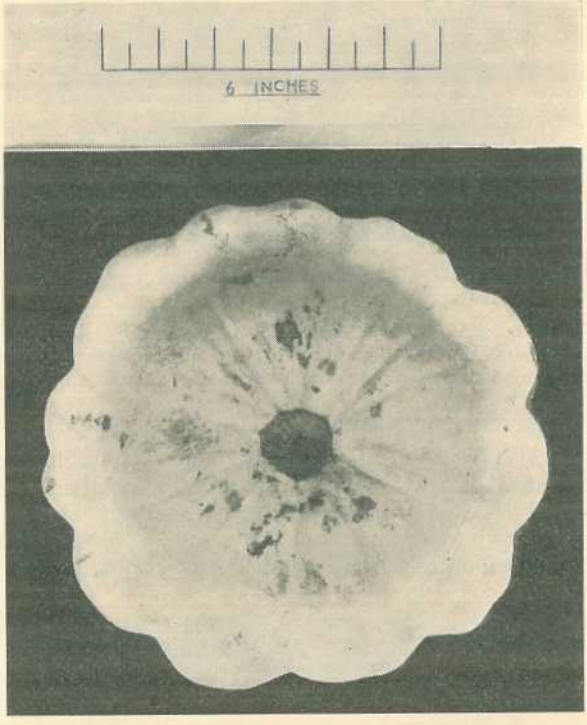

Plate 80.
Scallop or Custard Squash—Early White Bush Variety.

Sugar Squashes.—This group includes both small and large fruited types which are of no importance in Australia. Two large running varieties which are unsuited for table use and would popularly be classed with the cattle pumpkins are Mammoth Tours and Connecticut Field.

Fordhook Squashes.—This is another minor group of squashes including small fruited table types such as Table Queen. This variety is small, dark green, acorn-shaped, and grooved, with rich orange flesh of good flavour.

Crookneck Squashes.—This group derives its name from the shape of the fruit, which must not be confused, however, with the Bugle type of gramma. Yellow Crookneck has a bright yellow, warted skin and yellow flesh, and is reputed to be a prolific yielder.

Grammas (Cucurbita moschata).

Bugle.—This variety (Plate 81), often erroneously known as the Bugle "pumpkin," is one of the most widely known grammas. It produces a large crookneck fruit with a slightly swollen stem end and a much swollen blossom end. The skin is a brownish buff colour when mature, and the flesh is orange-coloured and sweet. This is the most popular cucurbit variety for the making of jams and pies. In common with other grammas, it has good keeping qualities, and makes a useful stock food.

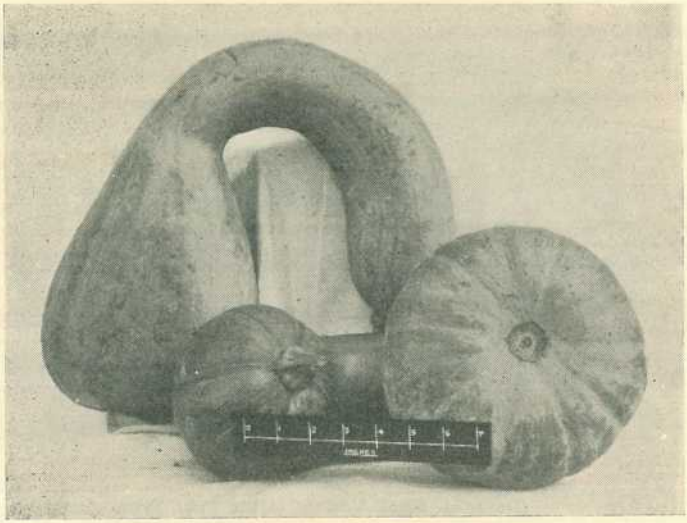

Plate 81.
Gramma—Bugle Variety.

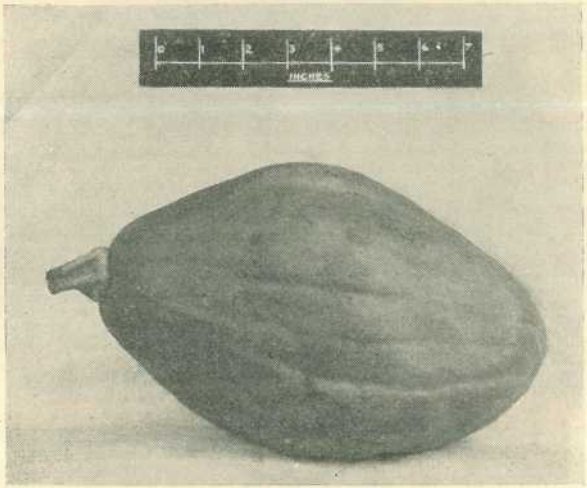

Plate 82.
Gramma—Papaw Variety.

Papaw.—The Papaw gramma (Plate 82), which is also misnamed Papaw "pumpkin," is a small gramma with a papaw-shaped fruit. This variety is probably the best of all the grammas for home gardens and for table use. The fruit are of good size for family requirements, and the variety merits far wider popularity than it at present enjoys.

Stock Grammas.—Other stock grammas include such varieties as Mammoth Round, Giant Long, Pear (Plate 83) and Large Cheese (Plate 84). These varieties are seldom seen in pure stand, however, but may occasionally be found in paddocks of so-called mixed "pumpkins."

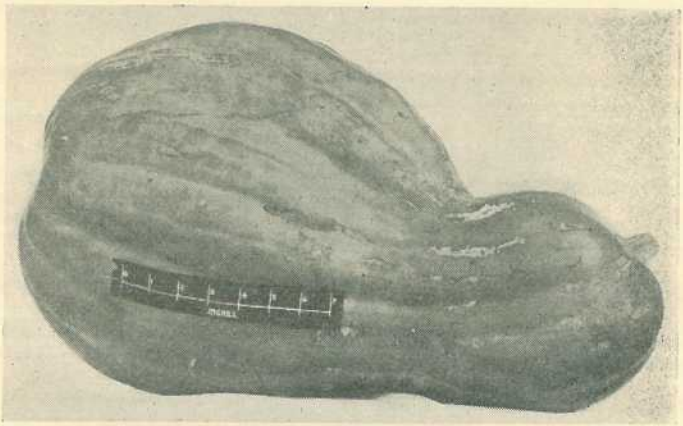

Plate 83.
Gramma—Stock Variety of the Pear Type.

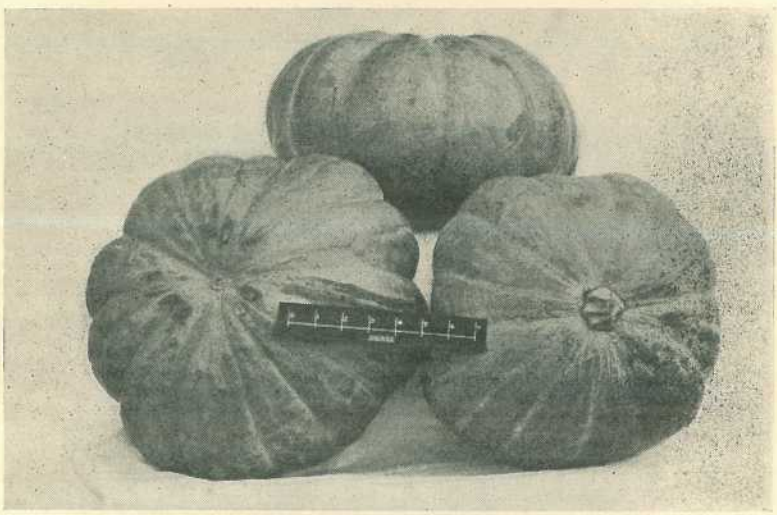

Plate 84.
Gramma—Stock Variety of the Large Cheese Type.

PESTS AND DISEASES.

The major pests of the cucurbit crops dealt with in this article are the pumpkin beetles and the leaf-eating ladybird. Both types of beetle are almost universally present on these crops and may in certain

instances do considerable damage if not checked. The recommended treatment for these pests is a dust containing 25 per cent. of arsenate of lead in a hydrated lime or kaolin carrier. The dust should be applied thoroughly when the air is still, preferably in the early morning when the dew is present on the plants. If the treatment is carefully applied at intervals during the earlier stages of growth, a vigorous crop should not require treatment in the fruiting stages when there would be a risk of accumulating poisonous residues on the maturing fruit.

Other insect pests which may occasionally menace the successful growth of these crops include aphids, thrips, red spider, caterpillars, stem borers and shield bugs, all of which are dealt with fully in the Division of Plant Industry's Pamphlet No. 101, entitled "Pests of Cucurbit Crops."

The most common disease of the cucurbit family is powdery mildew, which is easily recognised by the white floury patches found on both sides of the leaves. If vines are vigorously growing the disease usually causes little loss, but when plant growth is checked the fungus may become destructive. The recommended control measure is a dusting with sulphur or a mixture of equal parts of sulphur and hydrated lime. Both surfaces of the leaves should be covered, and applications should be repeated as the disease reappears.

Details of combined insecticidal and fungicidal treatments may be found in Pamphlet No. 101. For further information relating to pests and diseases of these crops, reference should be made to the Science Branch of the Department of Agriculture and Stock.

BONE IN PUMPKINS.

A frequent occurrence in pumpkins is the formation of "bone" or "woodiness" in the flesh. This "bone" comprises hard woody tissue which may vary in size and distribution from small granules to large irregular lumps. In extreme cases, almost the whole of the flesh of the fruit may be "bone." The phenomenon is not restricted to any one variety, and has been observed in soft mushy fruit as well as in fruit of otherwise excellent flavour and texture.

The presence of "bone" can generally be detected in the uncooked flesh of the pumpkin, either by variation in the resistance to cutting or by the mottled appearance of the flesh. When present only in small degree, this condition considerably reduces the palatability of the vegetable, while in extreme cases it may render the material completely inedible.

While many theories have been advanced to explain the occurrence of "bone," no entirely satisfactory explanation has yet been offered. The trouble has been variously ascribed to drought, to excessive water, to insect punctures during early growth, and to planting seed from affected pumpkins. Whatever the cause may finally prove to be, there is no definite evidence that the characteristic is inherited. Such being the case, there seems little point in recommending the selection of "bone"-less fruits for seed production.

The probability is that the condition is a physiological one, which might well be tied up with irregularity of water supply to the developing fruits. Should this be true, little could be done under rain-grown conditions to alleviate the trouble. Where irrigation is available, the object should be to keep the plants moving without check, and to avoid if possible either excessively wet or dry conditions.

TUBERCULOSIS-FREE CATTLE HERDS.
(AS AT 15th FEBRUARY, 1952.)

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

A SPECIAL RADIO SERVICE FOR FARMERS

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The COUNTRY HOUR, a special service for farmers, is broadcast DAILY through the National and Regional Stations from 12 to 1.

Planting Tables for Vegetable Crops.

Prepared by Officers of the Horticulture Branch.

THE State of Queensland occupies the north-eastern corner of the Australian continent and lies between latitudes 28 degrees south and 12 degrees south. It covers an area of 670,500 square miles. The climate is far from uniform, and as climate largely determines what crops can be grown and the period of the year in which they may be planted, a single crop planting table for the whole State could be very misleading. For practical purposes, therefore, the State is conveniently divided into southern, central and northern Divisions. These are merely geographical units, and within each some zoning in terms of altitude and distance from the coast is useful when grouping horticultural districts. Altitude can bring the mild temperatures and the short cropping seasons of temperate areas into subtropical and tropical latitudes. Thus the Granite Belt in southern Queensland and the Atherton Tableland in the far north can grow some crops during the summer months when production on the adjacent coastal areas would be quite impracticable. Similarly, the climate of the inland is distinctive, for temperatures there are less equable than they are nearer the coast where the influence of coastal winds is apparent. Inland areas are, therefore, characterised by hot summers, cold winters and a daily temperature range which is fairly wide.

All crop planting tables must be interpreted in terms of local conditions. In these tables, the southern Division is subdivided into coastal, tableland, and inland districts, but in the central and northern Divisions, the tableland and inland districts are merged into one. This is due primarily to the fact that, climatically, the tableland and inland areas of central and northern Queensland have a great deal in common. In each of the subdivisions, current practices in a key centre have been used in compiling the data. Hence, when the table is consulted, practices in the nearest key centre should indicate the procedure to be followed on any particular property. Adjustments can, of course, be made to suit individual cases. The key centres are as follows:—

Division.	Coastal.	Tableland.	Inland.
Southern ..	Brisbane	Stanthorpe	Charleville
Central ..	Rockhampton ..		Emerald
			Barcaldine
Northern ..	Cairns		Atherton
	Bowen		Charters Towers

Divisions.

The southern Division extends from the Queensland-New South Wales border to Miriam Vale and west from the coast. The rainfall near the coast varies from 40 to 75 inches and drops sharply with the distance of the locality from the coast. About 60 per cent. of the total annual rain falls between October and March. During the autumn, winter, and spring months, volume production of vegetables is concentrated within 100 miles of Brisbane, the capital city. Stanthorpe is the main producing area during the summer months. Fairly substantial quantities of most crops are, however, grown for local consumption near important country towns such as Toowoomba, Maryborough, and Bundaberg.

The central Division extends from Miriam Vale to slightly north of Mackay and includes all areas west of the coastline between these towns. Although heavier rains occur in the Mackay area, the annual coastal rainfall is usually about 40 inches and the amount tapers off rapidly further inland. About 65 per cent. of the annual rain falls during the October-March period, but the rain is rather unreliable, particularly between April and December, as most of this Division lies within a relatively dry region close to the Tropic of Capricorn. Sometimes both summer and winter rain influences are favourable and good seasonal conditions operate; sometimes both are unfavourable and droughts occur. Vegetable production in the Central Division is more concerned with local rather than the large southern markets, but in some years substantial quantities of tomatoes are exported from areas near the coast.

The northern Division takes in that part of Queensland north of a line running west from the coast at Bloomsbury. The Division is characterised by a summer rainfall which is high (88 inches at Cairns) in the far north but relatively light (40 inches at Bowen) in the southern and western areas. The main vegetable producing district is Bowen, which specialises in the production of winter tomatoes for the southern markets. Substantial quantities of this and other staple vegetables are also grown at Charters Towers, Townsville, Cairns and on some parts of the Cairns hinterland, for local consumption. Crops are usually planted after the summer rains have ended and irrigation is essential for consistently high production.

Times of Planting.

Temperature normally determines the period of the year during which a crop can be grown, for each crop has its own particular requirements.

Some vegetables, such as turnips, cabbages and carrots, are more or less tolerant to the relatively mild frosts which occur in coastal areas. Others, such as beans and tomatoes, are on the other hand severely damaged by frost, and even cool temperatures without any actual frost are often sufficient to either inhibit fruiting or cause growth abnormalities which reduce yields or lessen the quality of the product. Frost-susceptible crops must, therefore, be planted when the frost risk is negligible during the growing period. On many coastal farms the topography is uneven, and frost risks are often kept to a minimum by siting each crop according to the period of the year. The upper slopes are usually less subject to frost than lower reaches of the foothills and this fact determines the placing of successive plantings in crops such as beans and tomatoes.

Spacing.

Crop management practices vary a great deal from district to district. For example, the tomato may be grown on the ground, or on cradles, trellises, or stakes according to grower preference, the variety and the time of the year. The plant spacings suggested in the tables should prove satisfactory under most conditions when the plant type is near the average for the group to which it belongs. If the plant spread is below average, as in the cluster tomatoes, closer spacing should be practicable. Conversely, if the plant spread is above average, as in some varieties of cabbage, wider spacing will be necessary. Normally, alterations in the planting distances should be made in the row; unless special considerations operate, the distance between rows is determined by the implements used for inter-row cultivation and should not be changed.

Rate of Sowing.

The rates of sowing given in the tables are those generally used when the ground is in good order and the viability of the seed is known to be good. If, for any reason, the ground has not been worked to a fine tilth before planting or the soil moisture at the time of planting is not particularly good, sowing rates may be increased by 20 per cent., unless, of course, germination can be assured by the use of irrigation. A similar increase in the sowing rate is also desirable when old seed of doubtful quality is being used for the crop.

Depth of Sowing.

The depth at which vegetable seeds are sown depends largely on the condition of the ground. Both upper and lower limits are supplied for each crop in the tables. Where the ground has been worked to a fine tilth, and this should normally be the case, shallow sowing is permissible. Where, however, thorough preparation of the land has not been practicable through unfavourable weather or lack of the right implements, deep planting is preferred, as conditions are more favourable for a good even germination when the seed is surrounded by fine particles of moist soil.

The depth of sowing is largely governed by the size of the seed, the amount of reserve food contained in it and the ability of the seedling to push its way through any crust which might form on the surface of the soil. Thorough soaking of the soil after planting and the application of a surface mulch are helpful in seed-beds, but frequent irrigation is desirable in field grown crops.

Period to Maturity.

The period from planting to the commencement of harvesting in any crop depends on the variety, its cultural treatment during the growing period, and the period of the year in which it is grown. A crop planted and grown under optimum temperature and moisture conditions bears fruit more quickly than the same crop grown under harsh conditions. In most of the more important vegetables, too, a wide range of varietal types is available. Some of these are early maturing and others are late maturing types, and both are useful to ensure continuity of production during the season.

SOUTHERN DIVISION.

SOWING AND PLANTING TABLE FOR MARKET GARDEN CROPS.

(The data in this Table may require modification for particular areas).

Crop.	When to Sow or Plant.			How Sown or Planted.				Period of Growth to Harvesting.	Remarks.
	Coastal Districts.	Tableland Districts.	Inland Districts.	Distance Rows Apart.	Distance between Plants.	Quantity Seed per Acre if Drilled.	Depth to Sow.		
				Ft. In.	Ft. In.		In.	Months.	
Asparagus	Aug. and Sept.	September ..	..	4 0	1 6	7,260 crowns	5–6	30	May also be propagated from seed, the seedlings being transplanted when large enough, usually 1 year old
Bean (Broad) ..	Mar. to Apr.	Mar. to May	Mar. to May	2 6	0 8	2 bus. ..	1–2	4½–5	..
Bean (French) ..	Feb. to Sept.	Oct. to Jan...	Sept. and Mar.	2 6	0 5	40 lb. ..	1–2	2–3½	Sowings may be earlier or later according to the district's susceptibility to frost
Beetroot	Feb. to Oct.	Sept. to Feb.	Sept. to Feb.	2 6	0 5	5 lb. ..	¾	2½–4	When hilled, planted in double rows 10 in. apart, with 3 ft. centres
Beet (Silver) ..	Jan. to Sept.	Sept. to Mar.	Sept. to Mar.	2 6	1 0	4 lb. ..	¾	2½–4	..
Cabbage	Dec. to July	July to Dec.	July to Dec.	3 0	2 0	6 oz. ..	½–¾	3–5	Seed is planted in prepared beds and transplanted to the field when large enough to handle
Carrot	Feb. to Aug.	July to Jan...	July to Feb.	2 6	0 3	4 lb. ..	½–¾	3½–5	May be planted in double rows 10–12 in. apart, with 3 ft. centres
Cauliflower	Jan. to Apr...	Dec. to Feb.	Aug. to Dec.	3 6	2 9	4 oz. ..	½–¾	3½–5½	Seed is planted in prepared beds and transplanted to the field when large enough to handle
Celery	Feb. to May..	Aug. to Dec.	Aug. to Dec.	3 0	0 7	3 oz. ..	¼	4–5	Usually planted in double rows 12 in. apart, with 3 ft. centres
Choko	Aug. to Oct.	..	Oct. and Nov.	Trellis ..	12 0	Choko fruit	Shoot 3 in. below ground	5–6	..
Cucumber	July to Mar.	Oct. to Dec...	Feb., Mar., Sept.	4 0	2 0	2 lb. ..	2	3–3½	Earlier or later plantings depend on frost risk
Egg Plant	Feb. to Aug.	..	Aug. to Dec.	4 0	3 0	1 oz. per 1,000 plants	..	4–5½	Earlier or later plantings depend on frost risk
Herbs—Mint	July and Aug.	Aug. and Sept.	Aug. and Sept.	2 6	1 3	..	..	2	Propagated by rootlets only

Marjoram	July and Aug.	Aug. and Sept.	Aug. and Sept	2 6	1 3	..	..	3	Can also be propagated by plant division
Parsley	Nearly all seasons	Nearly all seasons	Aug. and Sept.	2 6	1 3	..	..	3	Can also be propagated by plant division
Sage	Aug. and Sept.	Aug. and Sept.	Aug. and Sept.	2 6	1 3	..	..	3	Can also be propagated by plant division
Thyme	Aug. and Sept.	Aug. and Sept.	Aug. and Sept.	2 6	1 3	..	..	3	Can also be propagated by plant division
Kohl Rabi	Feb. to June	Aug. to June	Aug. to Mar.	2 6	0 9	2 lb. ..	½–¾	3–4	..
Lettuce	All seasons ..	Aug. to Mar.	Aug. to May	1 6	0 9	1½ lb. ...	½	2–3	..
Marrow (Vegetable)	May to Feb.	Sept. to Dec.	Sept. to Jan.	4 0	2 6	2 lb. ..	1	3–4	..
Melon (Rock) ..	Aug. to Jan.	Oct. to Dec.	Sept. to Dec.	4 6	2 0	2 lb. ..	1	3	..
Melon (Water) ..	Aug. to Oct.	Oct. to Dec.	Sept. to Dec.	8 0	7 0	2 lb. ..	1	3–4	..
Parsnip	Feb. to May	July to Dec.	July to Dec.	2 6	0 4	2 lb. ..	½	5–6	May be planted in double rows 12 in. apart, with 3 ft. centres
Peas	Mar. to July	June to Oct.	Mar. to July	2 6	0 3	1 bus. ..	1–1½	3–5	Period of maturity depends on variety, time of year and district
Pumpkin	June to Jan.	Sept. to Jan.	Sept. to Jan.	9 0	3 6	2 lb. ..	1–1½	4½–6	Distance apart and time of maturity vary with the variety
Radish	All seasons ..	Nearly all seasons	Nearly all seasons	0 9	0 1½	10 lb. ..	¼–½	1–1½	..
Rhubarb	Jan. to Apr...	Aug. to Mar.	Mar. and Apr.	3 3	2 0	2 lb. ..	¾	4–5	Plants raised in seed-beds and transplanted to field
Rosella	Aug. to Nov.	Sept. and Oct.	Sept. and Oct.	5 0	3 6	2½ lb. ..	¾	4–4½	Sown in beds and transplanted
Shallot	Feb. to Sept.	All seasons ..	Mar. to Aug.	1 6	0 6	..	..	3	Propagated by division of the bulbs
Squash		As for Marrow	..	..	..	..	..	..	..
Strawberry	Mid-Mar. ..	March ..	March ..	Single Rows. 2 6	1 3	14,000 runners	4	..	..
				Double Rows 3 ft. 6 in. Centre. 1 3	1 3	20,000 runners			
Tomato	Jan. to Aug.	Aug. to Nov.	Aug. to Jan.	Ground Crop. 5 6	3 6	1 oz. seed per 2,000 plants	½	3½–5	Grown in prepared seed-beds and transplanted. Planting distance depends on variety and district
				Trellised. 4 6	1 6				
Turnip	Mar. to June	Feb. to Aug.	Mar. to July	2 6	0 5	2 lb. ..	½	2–3	..

CENTRAL DIVISION.

SOWING AND PLANTING TABLE FOR MARKET GARDEN CROPS.

(The data in this Table may require modification for particular areas).

Crop.	When to Sow or Plant.		How Sown or Planted.				Approximate Period of Growth to Harvesting.	Remarks.
	Coastal Districts.	Tableland and Inland Districts.	Distance Rows Apart.	Distance Between Plants.	Quantity Seed per Acre if Drilled.	Depth to Sow.		
			Ft. In.	Ft. In.		In.	Months.	
Asparagus	Aug.		4 0	1 6	7,260 crowns	5–6	30	Propagated from seed
Bean (Broad)	Mar. and Apr.	Mar. and Apr.	2 6	0 9	2 bus.	1–2	4½–5	..
Bean (French)	Mar. to Aug.	Aug. and Mar.	2 6	0 5	40 lb.	1–2	2–3½	Sowings may be earlier and later according to the district's susceptibility to frost
Beetroot	Feb. to Aug.	Mar. to Aug.	2 6	0 5	5 lb.	¾	2½–4	When hilled planted in double rows 10 in. apart, with 3 ft. centres
Beet (Silver)	Feb. to Aug.	Mar. to Aug.	2 6	1 0	4 lb.	¾	2½–4	..
Cabbage	Feb. to Sept.	Feb. to Sept.	3 0	2 0	6 oz.	½–¾	3–5	Seed is planted in prepared beds and transplanted to the field when large enough to handle
Carrot	Feb. to Aug.	Mar. to June	2 6	0 3	4 lb.	½–¾	3½–5	May be planted in double rows 10–12 in. apart, with 3 ft. centres
Cauliflower	Feb. to May	Feb. to May	3 6	2 9	4 oz.	½–¾	3½–5½	Seed is planted in prepared beds and transplanted to the field when large enough to handle
Celery	Feb. to Apr.	Feb. to Apr.	3 0	0 7	3 oz.	¼	4–5	Usually planted in double rows 12 in. apart, with 3 ft. centres
Choko	July to Oct.	Sept. and Oct.	Trellis	12 0	Choko fruit	Shoots 3in. below ground	5–6	..
Cucumber	May to Aug.	Aug. and Feb.	4 6	2 0	2 lb.	2	3–3½	..
Egg Plant	Feb. to Aug.	July to Sept. and Jan. to Feb.	4 0	3 0	1 oz. per 1,000 plants	..	4–5½	..
Herbs—								
Marjoram	Aug.	Aug. and Sept.	2 6	1 3	..	..	3	Can also be propagated by plant division
Mint	Aug.	Aug. and Sept.	2 6	1 3	..	..	2	Propagated by rootlets only
Parsley	Nearly all seasons	Aug. and Sept.	2 6	1 3	..	..	3	Can also be propagated by plant division

Sage	Aug. and Sept.	Aug. and Sept.	2 6	1 3	..	..	3	Can also be propagated by plant division
Thyme	Aug. and Sept.	Aug. and Sept.	2 6	1 3	..	..	3	Can also be propagated by plant division
Kohl Rabi	Mar. to June	Mar. to July	2 6	0 9	2 lb.	½–¾	3–4	..
Lettuce	Feb. to Oct.	Feb. to Sept.	1 6	0 9	1½ lb.	½	2–3	..
Marrow (Vegetable)	Feb. to Sept.	Feb., Aug., Sept.,	4 0	3 0	2 lb.	1	3–4	..
Melon (Rock)	July to Nov.	Aug. to Oct.	4 6	2 0	2 lb.	1	3	..
Melon (Water)	July to Oct.	Sept. and Oct.	8 0	7 0	2 lb.	1	3–4	..
Parsnip	Mar. to May	Mar. to May	2 6	0 4	2 lb.	½	5–6	May be planted in double rows 12 in. apart, with 3 ft. centres
Pea	Mar. to June	Mar. to June	2 6	0 3	1¼ bus.	1–1½	3–5	Period of maturity depends on variety, time of year and district
Pumpkin	Feb. to June	Aug. and Jan.	9 0	3 6	2 lb.	1–1½	4½–6	..
Radish	All seasons	All seasons	0 9	0 1½	10 lb.	¼–½	1–1½	..
Rhubarb	Feb. to Apr.	Mar. to May	3 3	2 0	2 lb.	¾	4–5	Plants raised in seed-beds and transplanted to field
Rosella	Aug. to Feb.	..	5 0	3 6	2½ oz.	¾	4–4½	Sown in beds and transplanted
Shallot	Feb. to Aug.	Feb. to Aug.	1 6	0 6	..	..	3	Propagated by division of bulbs
Squash	..	..	As for Marrow					
Strawberry	Mar.	Mar.	2 6	1 3	Single Row. 14,000 plants	..	4	..
..	..	..	1 3	1 3	Double Row. 3 ft. 6 in. centres. 20,000 plants	..	..	..
Tomato	Feb. to Aug.	Feb., Aug.	6 to 10 feet	3 to 10 feet	Ground Crop. 1 oz. seed per 2,000 plants	½	3½–5	Grown in prepared seed-beds and transplanted Planting distance depends on variety and district
			5 0	1 6	Trellised.			
Turnip	Mar. to June	Mar. to July	2 6	0 5	2 lb.	½	2–3	..

NORTHERN DIVISION.

SOWING AND PLANTING TABLE FOR MARKET GARDEN CROPS.

(The data in this Table may require modification for particular areas).

Crop.	When to Sow or Plant.		How Sown or Planted.				Approximate Period of Growth to Harvesting.	Remarks.
	Coastal Districts.	Tableland and Inland Districts.	Distance Rows Apart.	Distance Between Plants.	Quantity Seed per Acre if Drilled.	Depth to Sow.		
			Ft. In.	Ft. In.		In.	Months.	
Asparagus	..	Sept.	4 0	1 6	7,260 crowns	5–6	30	May be grown only in the tablelands and comparatively cooler districts
Bean (French)	Mar. to Sept.	Aug. to Apr.	2 0	0 5	40 lb.	1–2	2–3	Sowings may be made earlier or later according to the district's susceptibility to frost
Beetroot	Mar. to Aug.	Feb. to Sept.	2 6	0 9	4 lb.	..	2–3½	..
Beet (Silver)	Mar. to Aug.	Feb. to Sept.	2 6	1 0	4½ lb.	¾	2½–4	..
Cabbage	Feb. to June	Jan. to July	3 0	2 0	6 oz.	½–¾	2½–3½	Seed is planted in prepared beds and transplanted to the field when large enough to handle
Carrot	Feb. to July	Feb. to Sept.	2 6	0 3	4 lb.	½–¾	3½–4½	May be planted in double rows 12 in. apart, with 2½ ft. centres
Cauliflower	Feb. to Apr.	Feb. to May	3 6	2 9	4 oz.	½–¾	3–5	Seed is planted in prepared beds and transplanted to the field when large enough to handle
Celery	..	Feb. to Apr.	4 0	0 6	3 oz.	¼	4–5	..
Choko	Apr. to July	Aug. to Nov.	Trellis	6 0	Choko fruit	Shoot 3 in. below ground	3½–5	..
Cucumber	June to Apr.	July to Mar.	5 0	2 0	1½ lb.	2	2–3	..
Egg Plant	Mar. to July	Nov. to Feb.	3 6	3 0	1 oz. per 1,000 plants	..	3½–5	..
Herbs—								
Marjoram	..	Aug. and Sept.	2 6	1 3	..	..	4–6	Can also be propagated by plant division
Mint	Mar. to Aug.	Aug. and Sept.	2 6	1 3	..	..	4–6	Propagated by rootlets only
Parsley	Mar. to Aug.	Aug. and Sept.	2 6	1 3	..	..	4–6	Can also be propagated by plant division
Sage	..	Aug. and Sept.	2 6	1 3	..	..	4–6	Can also be propagated by plant division
Thyme	..	Aug. and Sept.	2 6	1 3	..	..	4–6	Can also be propagated by plant division

Kohl Rabi	Mar. to May	Mar. to June	2 6	1 6	2 lb.	½–¾	3–3½	..
Lettuce	Mar. to Sept.	Feb. to Oct...	2 0	0 9	1½ lb.	½–¾	2–3	..
Marrow (Vegetable)	Apr. to Oct...	Aug. to Feb.	6 0	3 0	2 lb.	1	2½–4	Distance apart and time of maturity depend on variety
Melon (Rock)	July to Oct...	Aug. to Feb.	5 0	2 0	2 lb.	1	2½–3½	Distance apart and time of maturity depend on variety
Melon (Water)	July to Oct...	Aug. to Nov.	8 0	7 0	2 lb.	1	3–4	..
Parsnip	Mar. and Apr.	Feb. to May..	2 6	0 6	2 lb.	½	6–7	..
Pea	Mar. to May	Feb. to June	2 6	0 3	1 bus.	1–1½	3–5	Period to maturity depends on variety
Pumpkin	Mar. to July	Aug. to Feb.	9 0	3 6	2 lb.	1–1½	4–6	Distance apart and period to maturity vary with the variety
Radish	Nearly all seasons		1 0	0 1½	10 lb.	¼–½	1–1½	..
Rhubarb	Mar. to May	Mar. to June	3 6	3 0	2 lb.	¾	4–5	When propagated from roots, quicker returns may be expected
Rosella	Aug. to Feb.	Sept. to Jan.	5 6	3 9	2½ lb.	¾	3½–4½	..
Shallot	Mar. to Aug.	Mar. to Aug.	1 6	0 6	..	..	2½–3½	Propagated by division of bulbs
Squash	As for Marrow							
Strawberry	..	Mar.	Single Rows. 2 6	1 3	14,000 plants	..	..	..
			Double Rows. 3 ft. 6 in. Centres					
..	..	..	1 3	1 3	20, 000 plants	..	..	..
Tomato	Mar. to July	Aug. to Feb.	6 to 10 ft.	4 to 10 ft.	1 oz. seed per 2 000 plants	½	2½–3½	Grown in prepared-seed beds and transplanted. Plant spacing depends on variety and district
Turnip	Apr. to June	Mar. to June	2 6	0 6	2 lb.	½	1½–2½	..

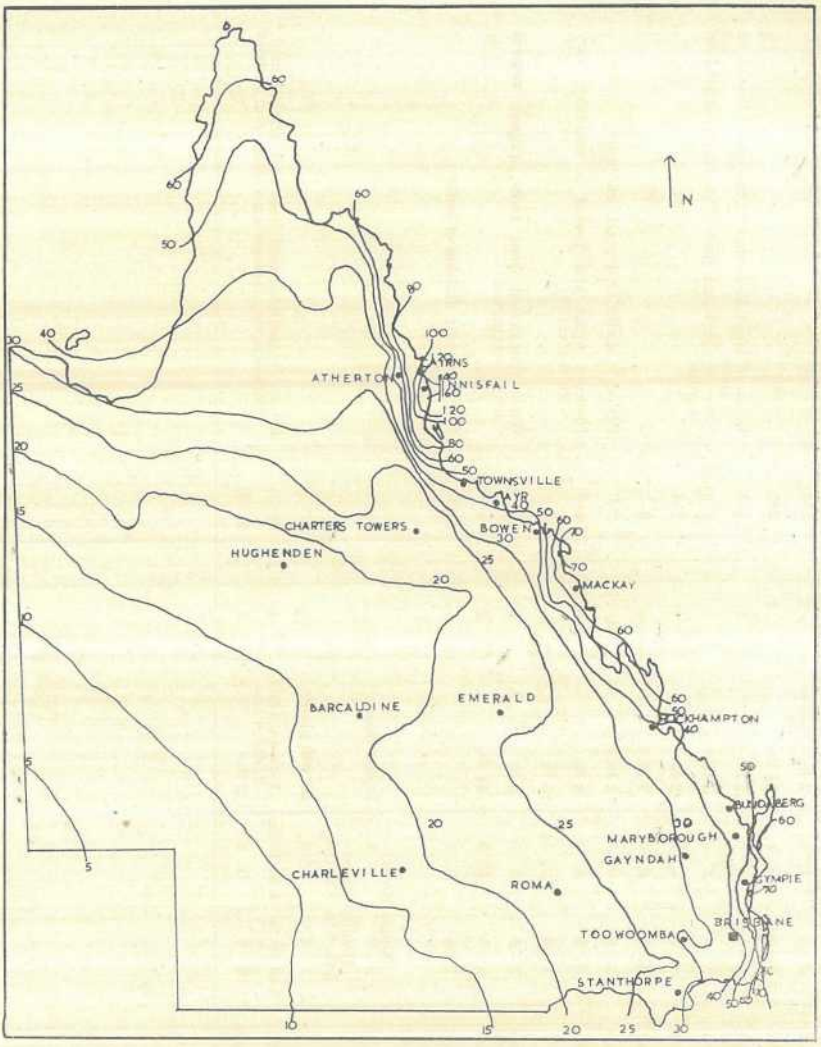


Plate 85.

Sketch Map Showing Average Annual Rainfall. Each line connects districts with the same annual rainfall.

CHANGE OF ADDRESS.

Journal subscribers notifying change of address should state their full Christian names and surname as well as their full former and new addresses.

Address all communications to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Seed Testing Explained.

F. B. COLEMAN (Standards Officer) and
A. C. PEEL (Technical Advisory Officer), Standards Branch.

THE Seeds Acts and regulations prescribe standards for purity and germination for agricultural and vegetable seeds offered for sale in Queensland. Any seed that does not comply with the appropriate standard is liable to seizure and destruction without compensation to the seller.

There is a penalty of £50 for an offence against the Acts.

The germination standard for certain selected seeds, and also lists of common prohibited and restricted weed seeds, are included in this article.

Many sellers of seeds, in an endeavour to ensure that the seeds which they are selling comply with the standards, submit samples to the seed testing section of the Standards Branch, Department of Agriculture and Stock, for examination and report.

It is undesirable for growers to buy and sow seed which will not germinate, and it is uneconomical as well as vexatious to sow seed which contains excessive amounts of weed seeds. Furthermore, death of stock can result from the eating of poisonous plants emanating from weed seeds sown with other seeds.

These and other facts relative to the quality of the seed available are worth knowing beforehand by the seller and the farmer. The facilities of the Brisbane Seed Testing Station are available for testing samples of seed. A fee of 2s. 6d. is charged for each sample tested if the bulk to which the sample refers is for sale, but, should a farmer desire to use the seed for his own sowing, no charge is made for the test.

The methods used in the Government Seed Testing Stations in Australia are those laid down by the "International Rules for Seed Testing" modified for Australian conditions. In some cases a period of three weeks may be necessary before it can be said with certainty whether a sample of seed will or will not grow.

For the information of those who desire to interest themselves in testing seeds, the following is supplied. Such tests would not be supported by authority in the case of a dispute, but valuable preliminary information can be obtained with a minimum of delay and used as a guide to possible future action.

One of the objects in testing seeds is to express on paper sufficient information about the sample examined to enable a value to be placed upon it or to compare it with other samples. The information should be clearly expressed to indicate the desirable, as well as the undesirable, features of the sample. This necessitates ascertaining the quantity

of prohibited seeds, weed seeds, other seeds and inert matter present, the presence of insects or injury due to insects and diseases, and lastly but by no means the least important, the ability of the seed to produce a healthy root and stem growth indicated in terms of germination in a given number of days.

Sampling the Bulk.

Unless the samples of seed submitted for testing truly represent the bulk to which they relate, subsequent work is of little value. Details of drawing samples are set out in a pamphlet entitled "Sale of Seeds" issued by this Department.

Upon receipt of a sample for testing, the marking on the sample and details as to its origin should be recorded in a book or on a card, and given a sequence number.

Working Sample.

The sample is placed upon a sheet of glass or stiff paper. Mix the seed thoroughly by means of a spatula, plasterer's knife or large knife blade, taking care the blade is inserted into the heap close to the glass, thereby lifting any small seeds, etc., before turning the blade over to form another heap. This should be continued until all the seed has been turned over at least three times. Avoid mixing with the fingers, as this allows small seeds and fine material to collect at the bottom of the heap. This fine material must be lifted up on the blade and mixed through the sample.

After mixing, spread out thinly and then, by the aid of the spatula or knife, lift several portions from different parts of the paper until a sufficient quantity is obtained, as indicated in the following:—

200 grammes beans and similar large seeds.
100 grammes cowpeas, cotton, pumpkin, wheat, etc.
30 grammes millets.
10 grammes grass seeds.
5 grammes Rhodes grass.
1 gramme paspalum.
(28.3495 grammes = 1 oz. Avoir.)

Analysis for Purity.

The analytical purity should be first ascertained in order that the germination may be carried out on the pure seed. Where the word "Purity" is used in seed testing, it relates to analytical purity—not purity of strain.

The weighed portion is spread out on a sheet of glass say 2 feet by 15 inches (see Plate 86)—stiff paper with a smooth surface will do—and, with the aid of a counter (a spatula-like instrument such as the blade of a table knife with one end pointed) it is divided into parts, as follows. Each of these parts should be weighed and calculations made on a percentage basis.

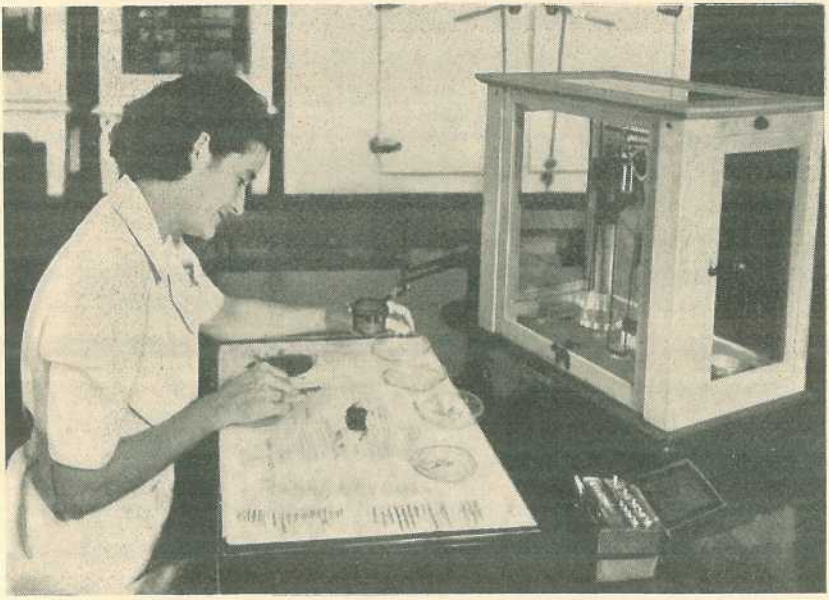


Plate 86.
Purity Test in Progress.

(*a*) *Pure seed—that is, the seed under consideration.*

All seeds of the kind under consideration, whether shrivelled, cracked or otherwise injured, and, in the case of broken seeds, any fragment larger than one-half, should be considered as pure seed. Pieces of seed that are one-half or less, and seeds of legumes (lucerne, cowpeas, clovers, peas, beans, &c.) with the seed coat absent, should be considered as inert matter.

Grass seeds which consist of a caryopsis enclosed in glumes, or naked caryopses (hulled seeds), should be considered as "pure seed". The presence or absence of a caryopsis within the glumes may be determined by testing each grain very carefully with a pair of forceps or by means of the fingernail, without injuring the germ, or by stroking the seed with a thin-bladed scalpel or sharpened spatula of horn or similar material. Care must be taken not to injure the caryopsis by undue pressure.

When in samples of grass seeds with many-flowered spikelets several individual seeds adhere together, these should be separated, and all parts of the spikelet which normally do not belong to the seed in question should be removed and treated as "inert matter". However, with some grasses (for example, Rhodes grass, *Chloris gayana*), where the separation of the sterile glumes would involve an excessive amount of work, this procedure may be omitted.

(*b*) *Seeds of other crop plants.*

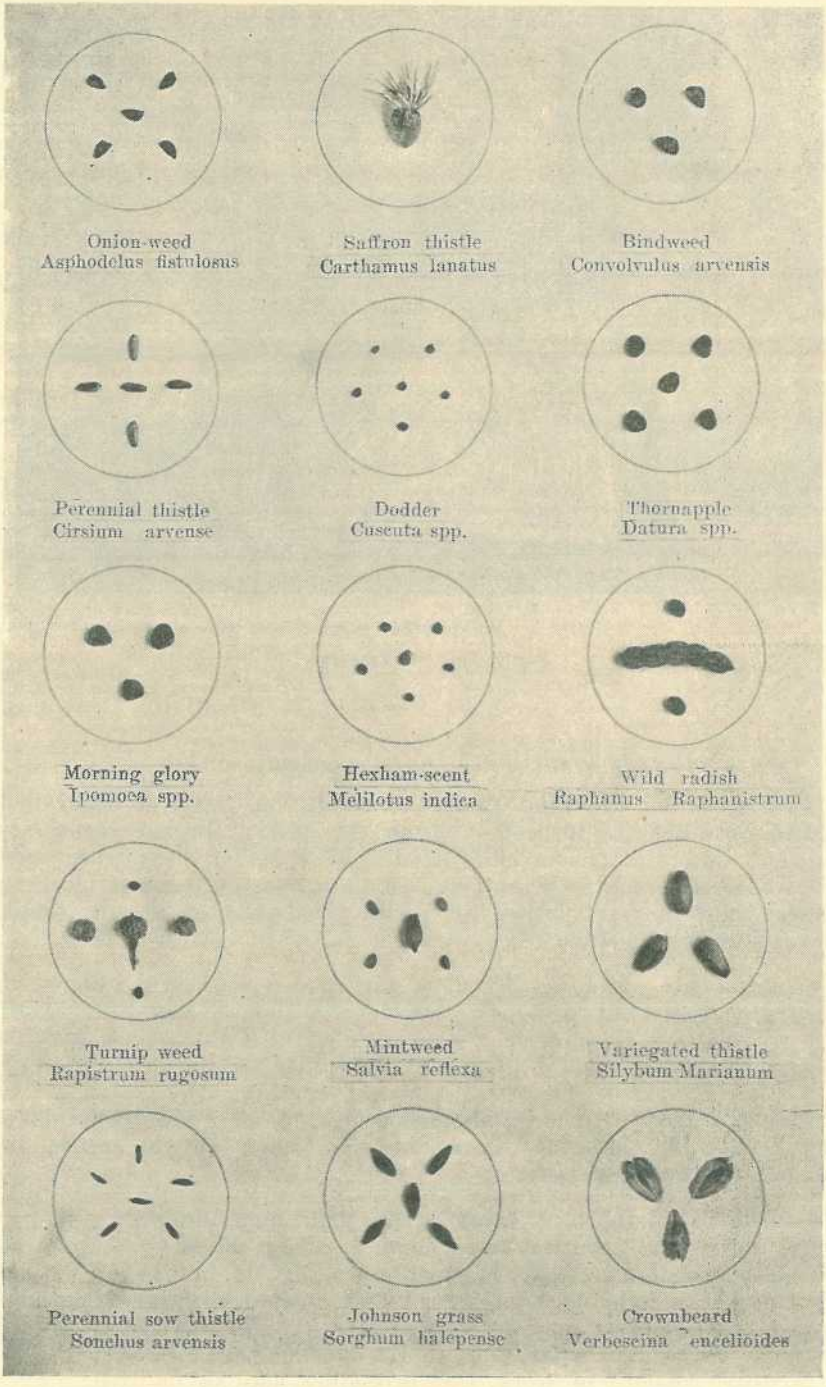


Plate 87.

Prohibited Seeds.

(*c*) *Prohibited seeds.*

The principal totally prohibited seeds commonly found in Queensland include the following and are shown in Plate 87:—

Asphodelus fistulosus	Onion weed
Carthamus lanatus	Saffron thistle
Convolvulus arvensis	Bindweed
Cirsium arvense: Syn. *Cnicus arvensis*, Syn. *Carduus arvensis*	Creeping Californian thistle or Perennial thistle
Cuscuta spp.	Dodder
Datura spp.	Thornapple, Datura
Ipomoea spp.	Morning glory, Bell vine
Melilotus indica	King Island Melilot, Hexham scent
Raphanus raphanistrum	Wild radish, Jointed charlock
Rapistrum rugosum	Turnip weed
Salvia reflexa	Mintweed
Silybum marianum: Syn. *Carduus marianus*	Variegated thistle
Sonchus arvensis	Perennial sow thistle
Sorghum halepense	Johnson grass
Verbescina encelioides	Crownbeard

Seeds infested with live insect pests in any stage of development and diseased seeds are also prohibited.

All recognised cultivated varieties of the above-mentioned species used for the purpose of cultivation are exempt from this list.

(*d*) *Weed seeds.*

After recording the total weight of all weed seeds, they are identified and divided into two groups called, respectively, restricted and others.

In the case of barley, beans, cowpeas, maize, oats, peas, rye, tares, wheat and seeds of similar or larger size, the number of restricted weed seeds hereunder mentioned present in 1 lb. should be determined. In the case of other seeds, the number of restricted seeds per ounce should be ascertained.

The restricted weed seeds (Plate 88) which occur most frequently in Queensland are:—

	No. of seeds in oz. or lb.
Alternanthera repens—Khaki weed	20
Argemone mexicana—Mexican poppy	10
Brassica spp.—All weed species	20
Cirsium lanceolatum—Spear thistle	10
Echium spp.—Bugloss	20
Lithospermum arvense—Corn gromwell or Ironweed	20
Marrubium vulgare—Horehound	10
Polygonum spp.—Wireweed	20
Sisymbrium spp.—Mustard weed, Wild mustard	20

(*e*) *Inert matter—that is, any matter that is not a seed as indicated above.*

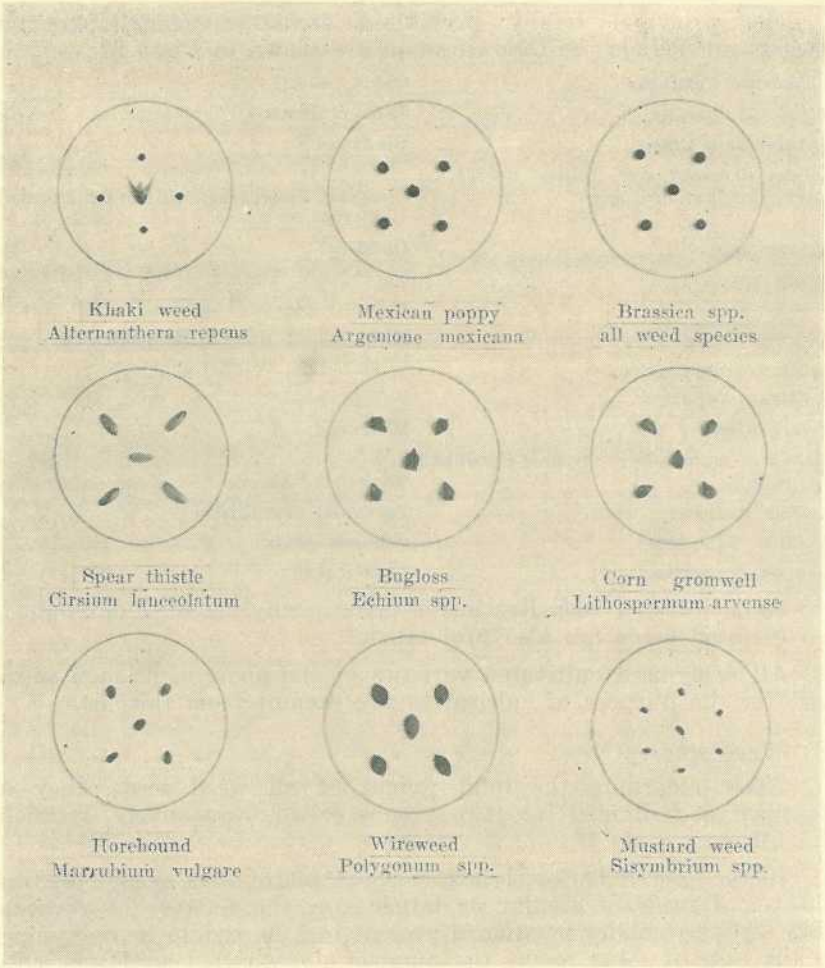


Plate 88.
Restricted Seeds.

Seeds of half or less than half in size are considered as inert matter. Inert matter includes all empty or sterile glumes—that is, glumes without caryopses, except in the case of—

Rhodes grass,

Molasses grass,

Guinea grass,

Green panic grass,

Panicum muticum,

in which case all of the so-called commercial seeds, with or without caryopses, should be included in the "pure seeds".

Germination.

The pure seed is placed out to germinate as follows:—

Take three lots of 100 seeds (that is, pure seed) and space evenly onto three thicknesses of moist flannelette or onto a bed of sand of not less than half an inch in depth which has been first placed on a clean plate or tin tray, and keep moist. Excessive amounts of water are detrimental in particular for marrow, pumpkin and rockmelon. Sand used for this purpose should be clean and obtained from a source not contaminated with salt or brackish water. It should be boiled before use so as to reduce contamination. In the case of small seed such as lettuce, cabbage, carrot, &c., squares of filter paper, marked in 100 sections, can be placed on the moist flannelette or sand, one seed being placed in each section. For reference purposes, the test should bear the sample number and each hundred seeds should receive the letters A, B, and C respectively. It is best to keep a sheet of glass or other material on top of the plate or tray so as to prevent excessive evaporation. Large seeds such as peas, beans, cowpeas, marrow and pumpkin require to be covered with flannelette. Care should be taken to place the trays in a position suitable for the germination of the seeds concerned. For instance, winter grasses, winter-growing crops, &c., should be placed in as cool a position as possible during warm or hot weather, while summer grasses and summer-growing crops should be placed in a warmer position.

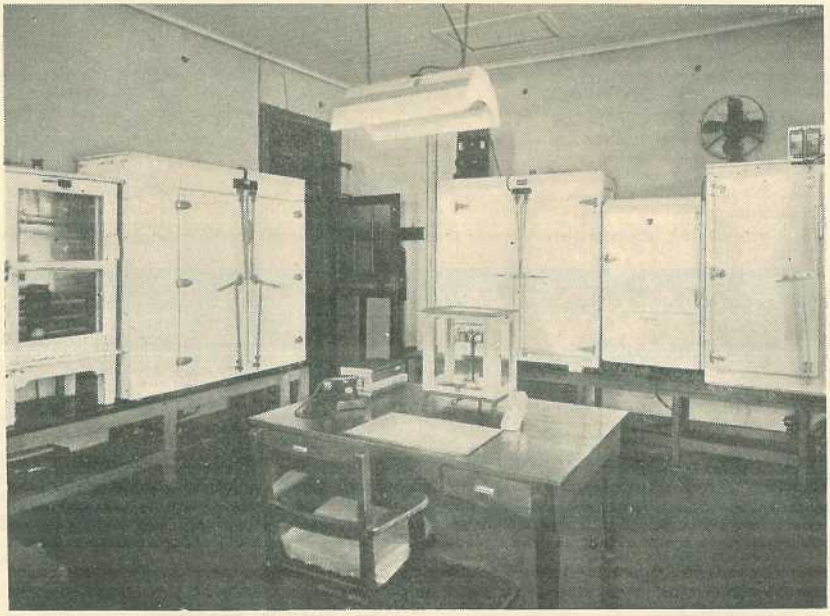


Plate 89.

Seed Germinators run at Different Temperatures and a Refrigerator used for Pre-chilling Seed.

In actual practice, germinators operating at controlled temperatures such as 68°F., 78°F., 86°F., 90°F., and 99°F., and for pre-drying at a temperature of 104°F., are used (Plate 89). For some seeds alternating temperatures are required. Obviously these conditions are only available in properly equipped seed-testing stations.

The following table sets out temperatures most suited for the germination of some of the more common seeds:—

Kind of Seed.	Temperature.	Minimum Germination.
	°F.	%
Barley	68	80
Beans (French)	78	75
Beet	78	55*
Cabbage	68	65
Canary seed	68	65
Carrot	78	50
Couch grass	68 and 99 (*a*)	60
Cowpeas	90	70
French millet	78	75
Japanese millet	78	75
Lucerne	68	80
Maize	78	80
Mauritius beans	90	70
Millets	78	75
Molasses grass	68 and 99 (*a*)	30
Oats	68	80
Onion	68	50
Panicum	78	75
Parsnip	68	40
Paspalum	68 and 99 (*a*)	60
Peanuts	78	80
Peas	68	75
Phalaris tuberosa	68	60
Prairie grass	68	65
Radish	78	75
Rhodes grass	90	30
Rye corn	68	75
Sorghum	90	70
Sudan grass	90	65
Tomatoes	78	70
Wheat	68	80
White panicum	90	75

* Clusters.

(*a*) Alternating temperature—lower temperature at night, higher temperature by day.

Plate 90.

Germination Count in Operation. A seed analyst is counting while the other analyst records results.

Note the number of seeds that germinate from day to day and record results (see Plate 90). Take careful note that only those seeds are counted that produce strong, healthy development.

When counting legume seeds such as lucerne, cowpeas, clovers and Mauritius beans, a number of sound seeds may be found that have not germinated; these are known as hard seeds. They may germinate at a later date, but if the seed coat is scratched, permitting the entrance of moisture, germination will commence immediately.

In the case of maize, wheat, oats, barley, all grasses and other seeds of the order *Gramineae* (grass family), only those producing root and stem growth are counted as germinating. Sowing some of the larger seeds in the soil will act as a check for the results obtained in the above manner. All germinated seeds should be removed from the tray or plate when counted and the number entered on a sheet of paper ruled as follows:—

Sample No. .....

Date Started.	No. of Seeds.	Germination in Days.									Total Germination %
			1	2	3	4	5				
		A									
		B									
		C									

From these records, particulars regarding speed and uniformity of germination, in addition to total germination percentages, may be obtained.

The percentage of pure germinating seed—which is a true indication of the value of a seed sample—is based on purity and germination and is obtained by the following formula:—

$$\frac{\text{Pure Seed \% x Germination \%}}{100} = \text{\% Pure germinating seed.}$$

Little difficulty is likely to be encountered with seeds such as wheat, maize and beans, provided they are fully matured, but with a number of seeds such as Rhodes grass, paspalum, &c., owing to the experience and technique necessary, and also the special apparatus and equipment required, it is not possible to obtain accurate results without such facilities.

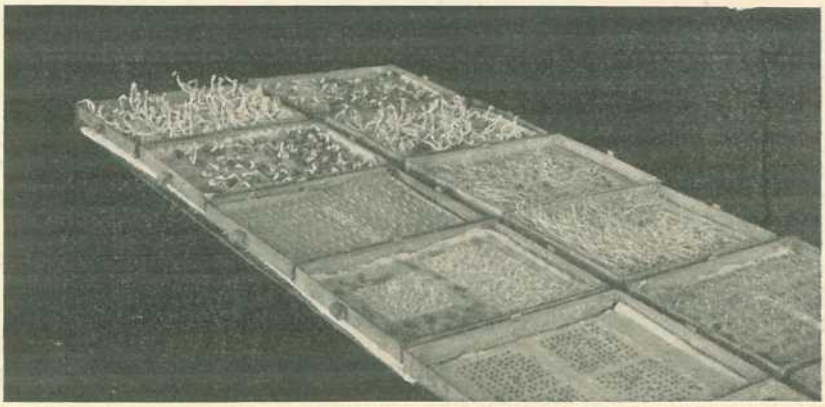


Plate 91.

Seeds Germinating on Trays. The glass covers have been removed in readiness for counting.

Plate 91 shows a series of seeds on the germinating trays; some of them have not yet commenced to germinate, while others are well advanced, as can be seen by the profuse root and stem growth.

Seed Testing Equipment.

Some of the equipment required is as follows:—

1 sheet of glass, galvanised iron or thick paper—24 inches x 14 inches.

1 plasterer's spatula with 11-inch blade.

1 metal seed counter.

1 pair medium-ended forceps.

1 lens, magnification x 5.

4 Petri dishes or round glass dishes with lids.

1 small scoop.

1 balance.

1 set weights, gramme preferred.

Germination trays of galvanised iron, aluminium or other suitable metal—10½ inches x 8 inches.

Glass sheets for covering germination trays.

Flannelette or supply of clean sand for making seed-bed.

1 squeegee for rolling out flannelette for removal of air pockets and excess moisture.

Filter paper squares marked with 100 small squares.

Filter paper strips for marking sample number.

1 waterproof pencil.

1 scribbling block for calculations.

1 black lead pencil.

Seed envelopes—2 sizes.

Book or cards for recording findings.

ANIMAL HEALTH

Bracken Fern Poisoning of Cattle.

K. D. SKERMAN (Government Veterinary Officer) and L. G. NEWTON
(Officer-in-Charge, Animal Health Station, Oonoonba, Townsville).

FOR many years sporadic deaths of cattle showing the characteristic effects of bracken fern poisoning have been recognised in this State, but it has often been difficult to convince owners that the plant can be harmful to stock.

As early as 1893 it was believed in other parts of the world that an acute, fatal sickness of cattle could be caused by their eating bracken; soon after that time feeding tests with chopped plant showed that a similar condition could be reproduced experimentally. Since then, tests have been done on numerous occasions by different investigators; some of their results are tabulated:—

Animal.	Age.	Bracken Consumed.	Period.	Result.
		Lb.	Days.	
Calf	3½ months	112	30	Died
Calf	8 months ..	260	26	Died
Heifer	18 months ..	915	74	Died
Heifer	18 months ..	678	78	Lived
Heifer	3 years ..	578	262	Lived

In a recent trial in the Atherton district, two 14-months old steers were fed bracken fern. One of the animals died suddenly with typical bracken poisoning after 69 days, having eaten 214 lb. of the plant. The other showed signs of illness but recovered, bracken feeding being discontinued when symptoms appeared.

While feeding tests have not always caused death, they show conclusively that bracken is poisonous.

Description of the Plant.

Bracken (*Pteridium aquilinum*) is widely distributed in temperate and tropical regions of the world. Many varieties have been described. During the course of feeding tests at Atherton, two varieties—common bracken and hairy bracken (var. *lanuginosum*)—were identified.

Common bracken is a coarse robust fern with creeping underground stems often covering extensive areas of country. Fronds (Plate 92) are erect, mostly 2-3 feet high and 1-2 feet across but varying considerably in size according to the situation and locality. Spores are borne on the undersurface of the fern in long narrow lines close to the margins of the lobes of the frond.

Plate 92.
A Mature Frond of Bracken Fern.

Hairy bracken, which appears to be restricted to tropical areas, reaches a height of up to six feet. It has hairy stems and retains a soft growing point at the top of the mature stem.

Bracken can become a serious pest of pasture lands and thrives well where paddocks are overstocked and overgrazed. It is under these conditions that mortalities are most likely to occur.

Stock Affected.

Deaths occur most frequently in calves about yearling age, though adult animals may also be affected and in certain instances losses have been confined almost entirely to the older cattle (for example, breeding cows).

On some farms losses occur every year but as a rule they tend to be sporadic. In North Queensland, deaths occur most frequently in spring and autumn.

Horses are affected with "bracken staggers" in other countries but the disease has not been seen in this State. Recent reports from overseas also indicate that sheep may die of bracken poisoning, but it is unlikely that similar mortalities will occur here as sheep are not usually kept in coastal areas where bracken is prevalent.

Course of the Disease.

Bracken poisoning is essentially a slow process, and large amounts of the plant must be eaten to produce toxic effects. An important feature is that deaths often continue for some weeks after animals have been removed from bracken infested areas. The duration of illness is usually short, about three days, and once symptoms are manifest death is the usual result. Should recovery occur, the animal may remain dull and in low condition for some months.

Symptoms.

In many cases death occurs suddenly without symptoms being shown. The usual manifestations include dullness, lack of appetite, and a high temperature. The coat is harsh and staring and condition falls away rapidly. Dark, hard, foul smelling dung which often contains clots of blood is passed; in the later stages it may consist almost entirely of blood.

A common feature is bleeding from natural openings (nostrils, anus, vagina and the eyes), and not uncommonly through the skin, though there is no sign of injury or bruising. At times blood accumulates in and about the loose tissues of the throat, causing difficulty in breathing. In these cases the head is held low and in the later stages the mouth is opened to assist breathing. This form of the disease is sometimes referred to as the "laryngeal" type. Dark-brown urine is seen in some cases. Struggling and bellowing often precede death.

Post-mortem Findings.

The most spectacular and characteristic changes are seen after death. The most pronounced abnormality is haemorrhage (bleeding) into and about the tissues of any part of the body. When the skin is removed, haemorrhages varying in size from a pin head to broad sheets several inches in diameter may be seen; clots of blood may be present where the skin is loose, such as the brisket, the throat and behind the shoulder.

On opening the abdomen, large haemorrhagic areas varying from an inch to a foot across are frequently seen on the outer surface of the paunch and intestines. The interiors of the first three stomachs (honeycomb, paunch and bible) are usually normal but in the fourth or true stomach, two types of change occur: in some cases the folds of the lining membrane are greatly swollen and distended with fluid (oedema) while in others they are of normal size but punctured with numerous shallow ulcers.

Free blood or bloodstained food material may be found in any part of the intestine, and the walls are intensely reddened; large clots of blood are especially likely at the lower end of the small bowel and caecum (blind gut). Brownish or red striping of the internal lining of the caecum, referred to as "zebra marking," is often seen.

Changes in the liver vary, there being little departure from normal in many cases while in others there are greyish patches scattered throughout its substance or a brownish-yellow discoloration over the whole organ.

Haemorrhages are constantly present in the heart. They frequently form a pattern with numerous pin-head sized spots in the fatty tissue and along the grooves, but in other cases "splashes" of blood extend over most of the heart muscle and clots are found inside the organ.

Bleeding takes place into the lung tissue, giving localised areas of congestion or large clots which lead to the development of pneumonia.

Plate 93.
Stomach of Calf Showing Lining Membrane with Thickened Folds Typical of Bracken Poisoning.

Diagnosis.

The diagnosis of bracken poisoning is based on the following:—

(1) Bleeding from the nostrils, anus, or through the skin.
(2) The passage of hard, black dung containing blood.
(3) High temperature—up to 107 deg.
(4) Shallow ulcers inside the lips and in the nostrils (sometimes red haemorrhagic spots are seen in the nostrils).
(5) Haemorrhages throughout the tissues.
(6) Oedema or ulceration of the folds of the fourth stomach (abomasum).
(7) Blood or bloodstained material in the bowel.

Toxic Effects and How They Are Produced.

Much of the confusion regarding the toxicity of bracken has arisen because it was not understood how the plant produced its toxic effects.

The harmful results of poisonous plants are usually due to the presence of a toxic principle—for example, prussic acid (in some sorghums) alkaloids (in ironwood), and nitrates (in wild mint). These substances interfere *directly* with one or more of the normal functions of the body. Bracken, on the other hand, is believed to act *indirectly* by destroying vitamin B, so the animal actually suffers from a vitamin deficiency disease.

American workers first showed that when rats were fed on a diet containing bracken fern they developed symptoms identical with vitamin B1 (thiamin) deficiency. Furthermore, the rats recovered quickly when treated with this vitamin. Soon afterwards, in Wales, it was found that horses with "bracken staggers" responded equally well to treatment with thiamin. Finally, it was demonstrated by test tube experiments that certain "extracts" of bracken leaves have the power to destroy vitamin B1.

With cattle the position is still not entirely clear. Though these animals, when affected with bracken poisoning, show a deficiency of vitamin B1, as determined by chemical tests, they do not respond to treatment with this vitamin. Recent reports from England, however indicate that another member of the vitamin B group (nicotinic acid) is effective in treating the disease. As the various members of the vitamin B group act in conjunction, further information is required to determine exactly how the toxic effects of the plant are produced in cattle.

Treatment and Control.

Treatment has been of little value up to the present but vitamin B therapy appears promising. However, death often occurs so suddenly that treatment, no matter how efficacious, cannot be used. Every effort should therefore be directed towards preventing bracken being eaten in sufficient quantities to be harmful. The following procedures are recommended:—

(1) Avoid overstocking and depleting the pasture—these conditions favour the growth of bracken, and the amount of bracken eaten will also be greater.

(2) Calves about yearling age and breeding cows are most prone to be affected. Feeding bonemeal mixtures will help to prevent deficiency of minerals which may lead to depraved appetite and hence eating larger quantities of bracken than usual.

(3) As the disease has a seasonal incidence, ensure that calves are supplied with the best possible feed during the most dangerous periods (spring and autumn).

(4) Reduce bracken undergrowth by rotation and pasture management.

(5) If the eradication of bracken is considered, consult agricultural officers of the Department of Agriculture and Stock before undertaking the work, as incorrect methods may lead to increased growth rather than successful control of the plant.

Graphs and the Woolgrower.

R. E. CHAPMAN, Wool Technologist, Sheep and Wool Branch.

IN his excellent book, *Mathematician's Delight*, W. W. Sawyer points out that people often regard mathematics, or anything verging on mathematics, as something to be feared and dreaded. But why, he asks, should there be such fear? Does it lie in the nature of the subject itself?

Quite certainly the cause does not lie in the nature of the subject. The most convincing proof of this is the fact that people in their everyday occupations (when they are making something) do reason along lines which are essentially the same as those used in mathematics. However, they are unconscious of this fact, and would be appalled if anyone suggested that they should interest themselves in mathematics for everyday use.

The fear of this subject is a tradition handed down from days when the majority of teachers knew little about human nature, and nothing at all about the nature of mathematics itself. What they taught was an imitation.

Nearly every subject has an imitation, but as such it is merely parrot-learning. It is this which produces the schoolboy "howlers" in examination papers, because the words do not convey any picture and there is a lack of realistic thinking. Real education makes "howlers" impossible, but more important is the saving of unnecessary strain, and the achievement of security and confidence of mind. It is far easier to learn the real subject properly than to learn the imitation badly.

To understand anything requires effort; but it does not necessarily require unpleasant effort or drudgery. The main task is to see the practical applications of the subject.

While text-books are needed to master any special department of mathematics, most of them contain vast masses of information, the object of which is not always obvious. It would be useless to burden one's memory with all this purposeless information when merely trying to understand a subject. Mathematics is like a chest of tools: before studying the tools in detail a good workman should know the object of each, when it is used, how it is used, and for what purpose it is used.

Graphs—or Thinking in Pictures.

One problem in the presentation of facts is to make them obvious. A bald statement is soon forgotten, whereas vivid images remain in the memory. In this respect graphs are a valuable aid in presenting data.

What is a graph? In its simplest form a graph is a pictorial representation of the relation that exists between two variable quantities, and shows the manner in which one changes as the other alters in value. For instance, the weight of a sheep depends, among other things, on its age, in which case age is termed the independent variable and weight the dependent variable. In drawing a graph, intervals of age (the independent quantity) are marked off along a horizontal scale, and intervals of weight (the dependent variable) along a vertical scale. The actual line or graph is obtained by joining the points which represent the weights at various ages. To mark these points, indicated by crosses in Figure 1, vertical lines are drawn from the various ages on the horizontal scale to meet horizontal lines through the corresponding weights on the vertical scale. These are shown by the dotted lines in the figure. The graph is then drawn through the points of intersection of these vertical and horizontal lines. A somewhat similar procedure is followed when the weight at a certain age is being read from the graph. A vertical line is drawn at the required age until it cuts the graph, from which point a horizontal line is drawn to the left-hand scale, from which the weight is read.

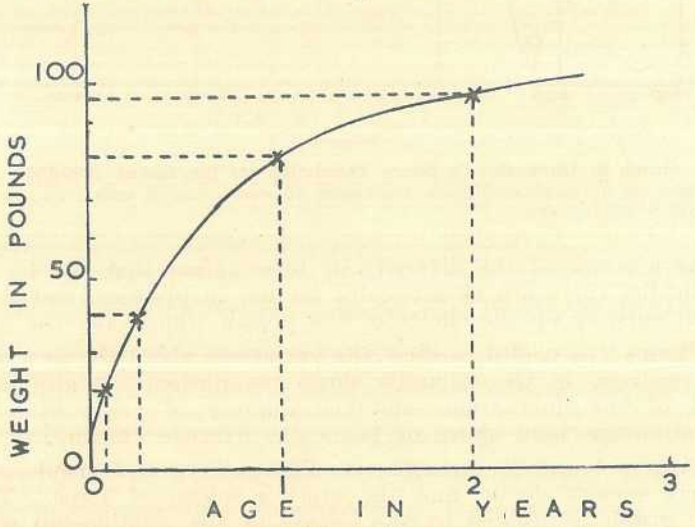


Figure 1.

Graph Showing the Increase in Liveweight of a Sheep with Age. The vertical scale shows the liveweight of the sheep in pounds and the horizontal scale its age in years. The sheep concerned weighed 20 lb. at the age of 1 month, 40 lb. at 3 months, 80 lb. at 1 year and 98 lb. at 2 years. The broken lines are not part of the graph: they have been drawn to show how the points of the graph are marked.

This brings up the question of scales. Generally, the horizontal and vertical lines are marked off in intervals which represent a certain quantity. For example, in Figure 1, one inch on the horizontal line represents one year of age, and one inch on the vertical line is

equivalent to 50 lb. of liveweight. The intervals used depend on the nature of the relationship, the magnitude of the quantities involved, and the size of the graph required.

In the case of a graph of the sheep population of Queensland over the last 60 years, the quantities are of considerable magnitude, the sheep population being in millions. If years are marked along the horizontal scale and sheep numbers along the vertical scale, then less than one inch on the vertical scale will have to represent several millions of sheep, as shown in Figure 2.

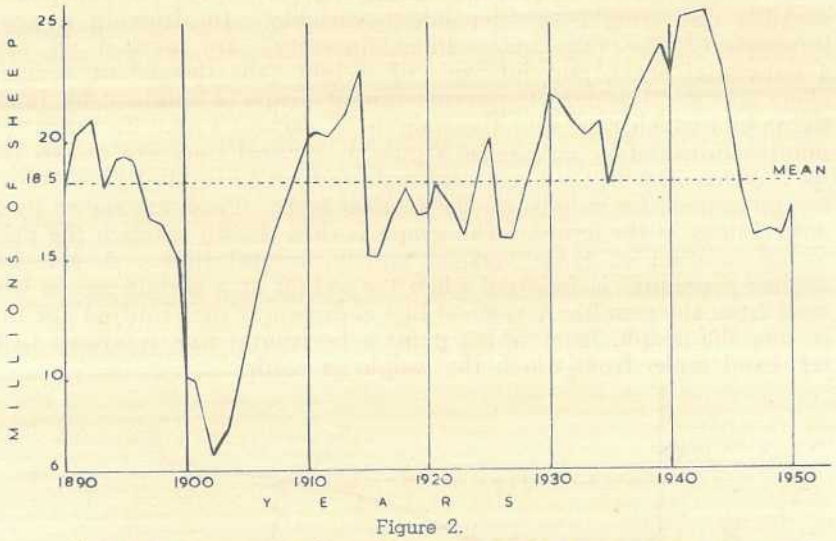


Figure 2.

Graph of Queensland's Sheep Population for the Period 1890-1950. Here $\frac{5}{8}$ inch on the horizontal scale represents 10 years, and $\frac{5}{8}$ inch on the vertical scale 5 million sheep.

As a result of the diversity of information that can be recorded graphically, there are no set scales for use in practice, and those used depend entirely on the choice of the person who draws the graph.

Figure 2 is useful to show the variations about the average which have occurred in Queensland's sheep population. It also shows the extent of the fluctuations and the number of years in which the population has been above or below the average (mean).

Figures 1 and 2 represent two different types of graph, one being a fairly smooth curve, and the other a series of steps. The form of the graph is decided by the nature of the relationship which the graph is intended to illustrate.

One important point that must be kept in mind when reading graphs is the necessity of noting the scales that are used, otherwise a somewhat misleading idea may be obtained. For instance, a casual glance at the top graph in Figure 3, which shows the changes in greasy cut per head for different age groups of wet ewes, would suggest an alarming fall in greasy fleece weight after the sheep is 3 years old. However, on closer examination it is seen that each vertical interval represents only half a pound change in cut per head, and had a smaller distance been used to represent this, the graph would have appeared much flatter, as in the lower graph.

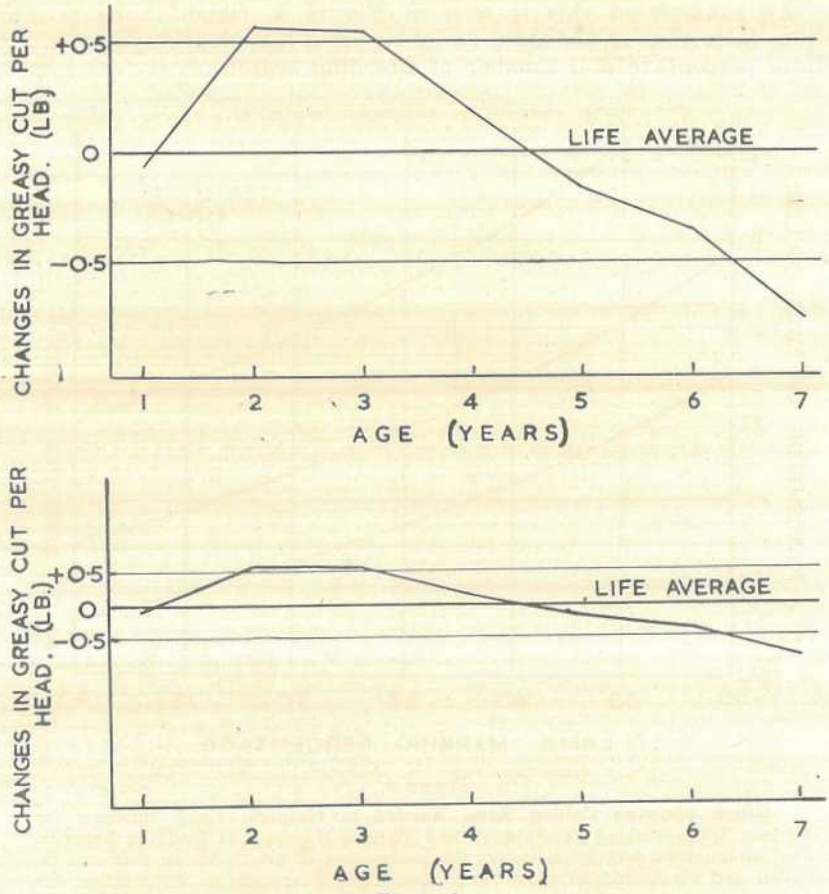


Figure 3.

Graphs Showing Changes in Greasy Cut Per Head with Age. The graphs are prepared from the same set of figures, but a smaller vertical scale is used in the lower graph, making the changes appear smaller. The point 0 on the vertical scale in both cases represents the average cut per head over the lifetime of the sheep; the point —0.5 represents a cut of half a pound below the lifetime average; the point +0.5 represents a cut of half a pound above the lifetime average. The horizontal scale presents the age in years.

The graph shows that the cut is above the lifetime average during the earlier years of life but falls below the average after the sheep reaches 4½ years of age.

By using the large interval, the differences between age groups can be more readily measured from the graph. Quite often where small quantities are involved it is necessary to use an exaggerated scale to show up the differences.

Graphs with Three Variables.

So far the cases considered have involved only two variables, and their relationship has been one line, either continuous or stepped. It is also possible, however, to represent the relation between three variables graphically. The horizontal and vertical scales are used as before for two of the variables, and the third is brought into the picture by using a series of lines instead of only one.

An example of this is seen in Figure 4, which shows possible culling rates of ewes, the three variables being lamb-marking percentage, culling percentage and number of breeding seasons.

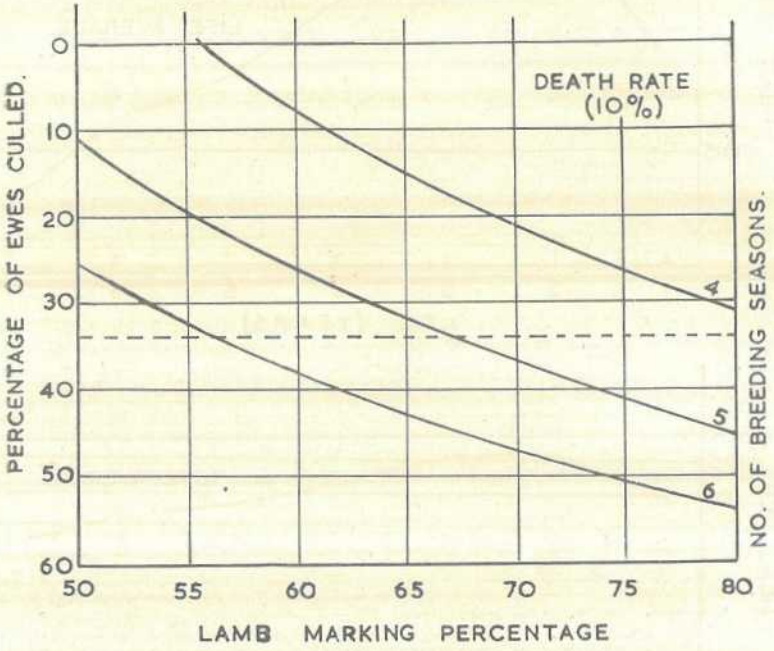


Figure 4.

Graph Showing Culling Rates Needed to Maintain Flock Numbers for Various Lamb-marking Percentages and Various Numbers of Breeding Seasons. The left-hand vertical scale shows the percentage of young sheep that can be culled and the horizontal scale the lamb-marking percentages. In practice, the proportion of young sheep which can be culled depends on (1) the lamb-marking percentage, (2) the losses the flock experiences, and (3) the number of times the ewes are mated. The graph has been drawn for an average annual loss of 10% and the number of times the ewes are bred is shown by the curved lines marked 4, 5 and 6 on the right-hand vertical scale.

The dotted line represents a culling rate of 34%, at which flock strength will be maintained if (1) the ewes are bred 6 times and the average lamb-marking percentage is 57, (2) if the ewes are bred 5 times in a flock which has an average lamb-marking percentage of 67, or (3) if the ewes are bred four seasons, when the average lamb-marking percentage would need to be about 82.

As the number of breeding seasons is changed there is a new curve for the relation between the percentage of ewes culled and percentage of lambs marked, but for convenience these are all drawn on the one graph.

Histograms.

Graphs, whether as continuous curves or as a series of steps, are by no means the only method of pictorial presentation of data. A near-relation of the graph is what is called a histogram, examples of which are shown in Figures 5 and 6. Rectangles with their heights corresponding with the appropriate number of units on the left-hand vertical line are erected over each division of the horizontal line.

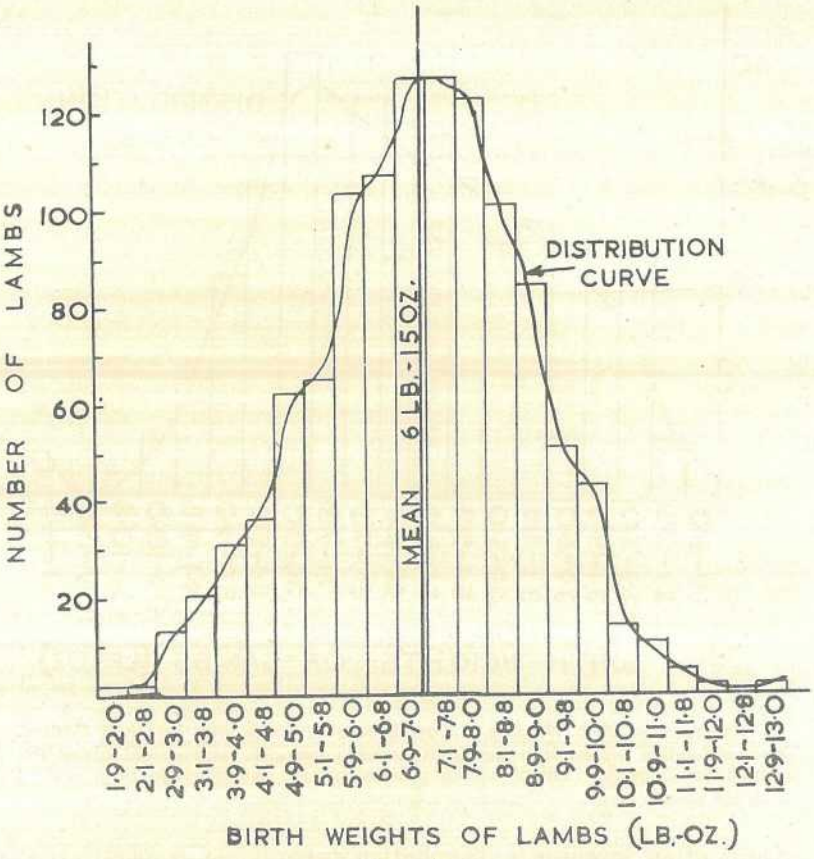


Figure 5.

Histogram of Birth Weights of Lambs to Ewes with Sound Udders. This histogram and the one that follows have been drawn from results of studies in losses amongst new-born lambs in Queensland. Altogether over 2,000 lambs were weighed at birth in these observations. The vertical scale in this histogram represents the number of lambs born to ewes with sound udders and the horizontal scale the birth weight of the lambs in pounds and ounces. It is seen that the birth weights range from 1 lb. 9 oz. to 13 lb. and these are divided into groups arranged in half-pound intervals.

Of the lambs born to ewes with sound udders—

2 lambs weighed between 1 lb. 9 oz. and 2 lb.

2 lambs weighed between 2 lb. 1 oz. and 2 lb. 8 oz.;

13 lambs weighed between 2 lb. 9 oz. and 3 lb.;

21 lambs weighed between 3 lb. 1 oz. and 3 lb. 8 oz.;
and so on, up to

2 lambs weighed between 12 lb. 9 oz. and 13 lb. 0 oz.

In drawing Figure 5, rectangles were erected in each age group on the horizontal line with their heights proportional to the number of lambs in each group.

It will be noticed that a line can be drawn through the tops of the rectangles: this is the distribution curve. In Figures 5 and 6 the curves are the distribution curves of the number of lambs plotted against birth weights. The curve in Figure 5 is fairly evenly distributed on each side of the mean and hence is termed a *normal* distribution curve.

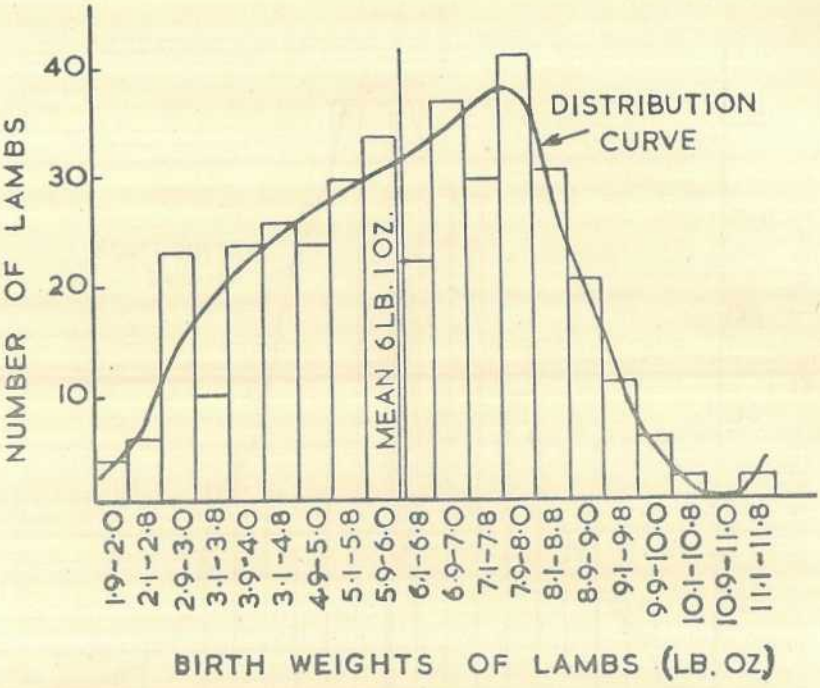


Figure 6.

Histogram of Birth Weights of Lambs Born to Ewes with Unsound Udders. The curved line shows that the birth weights are not symmetrical about the vertical line labelled "mean" which passes through the average birth weight of all the lambs.

Quite often, however, a distribution curve is not symmetrical about the mean or average, in which case it is known as a *skew* distribution. Figure 6 illustrates this type of distribution. It was constructed similarly to the previous one except that the lambs whose birth weights are presented were selected from ewes with unsound udders.

The advantage of the histogram is that it shows the manner in which the measurements (in the cases quoted, the numbers of lambs of different birth weights) are distributed throughout the whole range.

The Uses of Graphs.

Graphs have a great advantage over tables of figures when information has to be examined at a glance. It is quite easy when running an eye down a row of figures to fail to see that one number is much larger than the rest. On a graph such a number would stand out like a mountain peak. A sudden bend in a graph is easily seen whereas a casual glance at the corresponding figures would not as readily reveal its existence. Graphs are particularly useful for busy men who want to know the general outlines of a situation, but do not wish to go into every small detail. In a few seconds one could grasp the general outline of a graph sufficiently well to be able to reproduce it later with fair accuracy, if required, whereas a column of figures would still convey little after much longer study. Further, graphs are a convenient method of summarising data in a condensed form.

Consider, for instance, the number of times that rain sufficient to stimulate plant growth has fallen in each month at Winton, Tambo and Goondiwindi during the years 1893-1948. These are shown in Table 1.

TABLE 1.

SHOWING THE NUMBER OF TIMES IN 55 YEARS THAT RAIN SUFFICIENT TO STIMULATE PLANT GROWTH HAS FALLEN IN EACH MONTH AT WINTON, TAMBO, AND GOONDIWINDI.

Station.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.
Winton ..	3	8	12	26	34	19	5	10	11	14	1	3
Tambo ..	15	21	31	37	37	28	16	17	33	25	12	13
Goondiwindi	26	31	38	37	30	29	25	33	41	43	29	29

It is not easy to obtain a general picture for these three centres by studying this set of figures, whereas the graph in Figure 7 drawn from these figures shows quite clearly the variations at each of these centres.

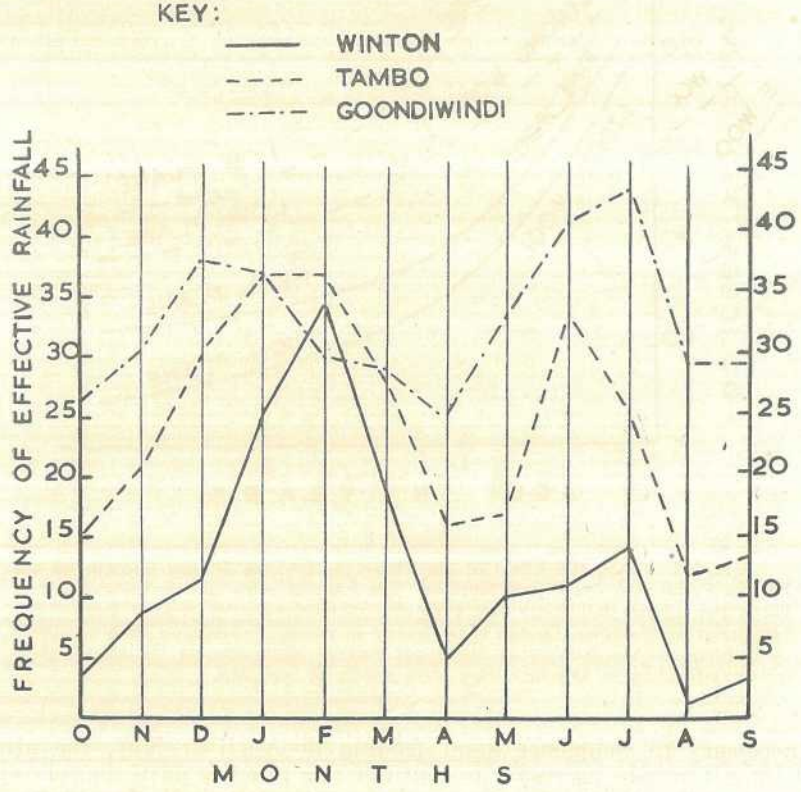


Figure 7.

Graph Showing Frequency of Effective Rainfall in Each Month Over the Period 1893-1948. The number of years (out of 55) in which sufficient rain fell to stimulate grass growth is shown on the vertical scale. Months of the year are shown on the horizontal scale.

It is clear from Figure 7 that:—

(1) Summer rains have occurred more frequently at Winton than winter rains.

(2) Summer rains have occurred more frequently at both Tambo and Goondiwindi than at Winton.

(3) Winter rains have occurred more frequently at Goondiwindi than at either Tambo or Winton.

(4) Winter rains have occurred more frequently at Tambo than at Winton.

This graph shows the usual rainfall pattern for the three districts and can be used in planning drought feeding. It is clear from the graph that if the summer rains fail at Winton, there is a comparatively slender chance of useful rains falling in the winter. Therefore, if it

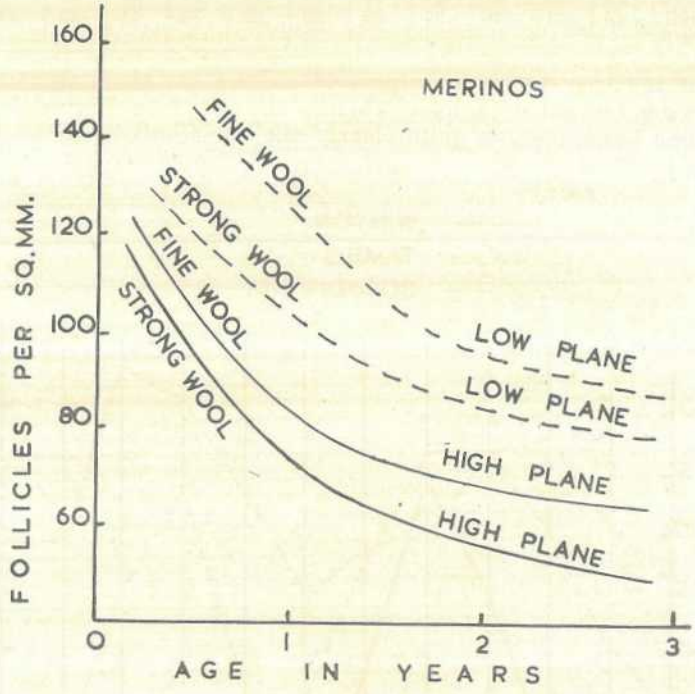


Figure 8.

Graph Showing the Effect of the Plane of Nutrition During Growth on the Follicle Population Density of Merinos. The vertical scale shows the number of fibres per square millimetre (645.2 square millimetres = 1 square inch). The horizontal scale shows the age of the sheep in years. The curved lines represent the change in the number of fibres per square millimetre as the sheep grew older, depending on whether they were poorly or well fed.

is necessary to commence hand feeding in April or May, the graph indicates it may be necessary to continue this practice until the following summer. The graph also shows that at Goondiwindi there is a far greater chance of winter rain, and even if it is necessary to commence hand feeding in April or May, there is a good chance it may not be necessary to continue past June or July.

This is the simplest use of a graph—to convey a general impression. However, graphs can also be used to bring out the connection between more than two sets of circumstances. Such graphs find wide application. Figure 4 is one of this type. A further example is in Figure 8, which

shows the effect of different levels of feeding during growth on follicle population density of Merinos in terms of fibres per square millimetre. This information was obtained by keeping separate groups of fine and strong wool Merino lambs on either a high or a low plane of nutrition and studying the density in terms of fibres per square millimetre as the sheep grew older. This graph actually involves four variables—age, type of sheep, plane of nutrition and follicles per square millimetre.

It is clear from the graph that the fine wool Merinos kept on a low plane of nutrition were denser than comparable sheep which were well fed. This is because the poorly fed sheep did not grow as big as the well fed sheep and consequently they had a smaller total skin area. The strong wool sheep behaved similarly, but the fine wool sheep were always denser than the strong wool sheep which received similar treatment.

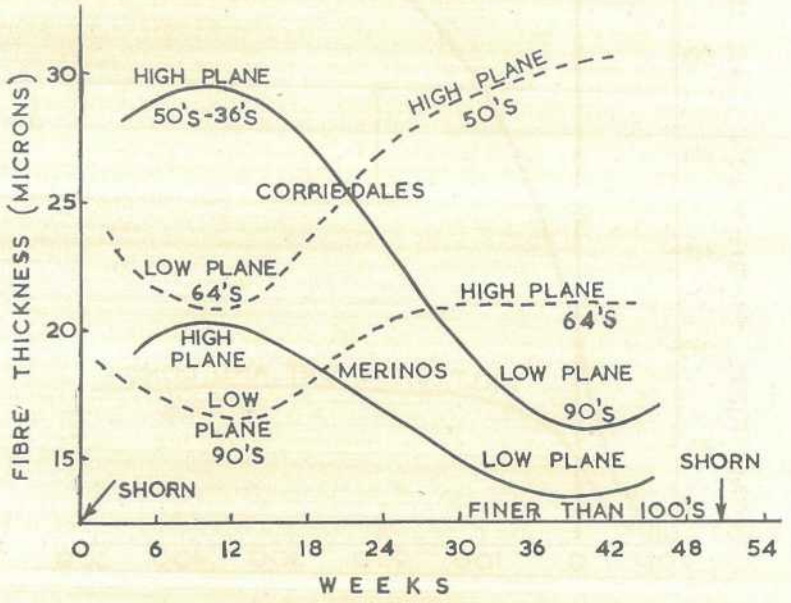


Figure 9.

Graph Showing the Effect of the Plane of Nutrition on Fibre Thickness in Adult Corriedales and Merinos. The fibre thickness is shown in microns (1 micron = 1/10,000 of a centimetre; 1 centimetre = 0.39 inch). The time in weeks is shown on the horizontal scale.

Figure 9, which shows the effect of plane of nutrition on fibre thickness in adult sheep, is also of this type, the four variables here being fibre thickness, time, plane of nutrition and breed.

Corriedale and Merino sheep were used in this experiment and representatives from each breed were subdivided into two groups. One group from each breed was started on a high plane of nutrition, which was reduced to a low plane after the 12th week. The other group from each breed was started on a low plane of nutrition, which was increased to a high plane, after the 12th week.

The continuous lines depict the performance of the sheep moved from the high to the low plane of nutrition and the dotted lines the performance of the sheep moved from the low to the high plane of nutrition.

The curves show that the fibre thickness of wool grown by both Merinos and Corriedales decreases when the sheep are changed from a high to a low plane of nutrition. Conversely, an increase in fibre diameter occurred when the plane of nutrition was raised from low to high.

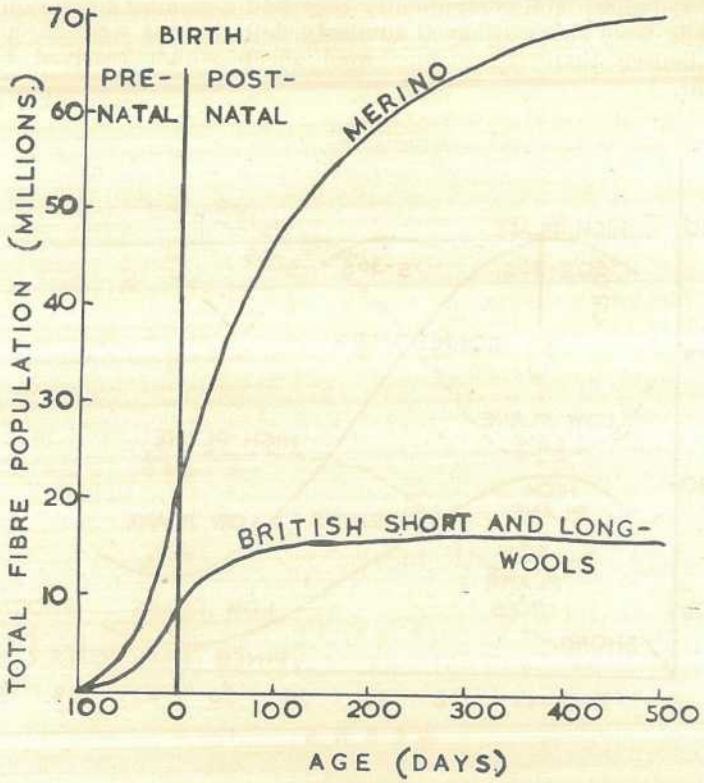


Figure 10.

Graph Showing the Growth of Total Fibre Population with Age. The total number of fibres (in millions) growing on the surface of the skin is shown on the vertical scale and time (in days) on the horizontal scale.

Part of the science of interpreting graphs consists in knowing how a graph looks when something is increasing or decreasing, whether it be at a uniform rate, at an accelerating rate or at a diminishing rate. Figure 10 shows that the rate of increase of the total fibre population in sheep decreases as the sheep grows older.

Merino and British breeds of sheep are compared. It is seen that there is very little increase in the total fibre population of sheep of the British breeds after they attain 100 days of age but that of Merino sheep may continue to increase until the sheep are 400 days old.

While total fibre population increases with age, actual population density, or number of fibres per unit area, decreases with age. This is shown in Figure 11, in which the curved lines represent the changes in the density in terms of the fibre population per square millimetre of Merinos and Lincolns as they grow older. The decrease in density is caused by the skin area increasing at a greater rate than the total fibre population.

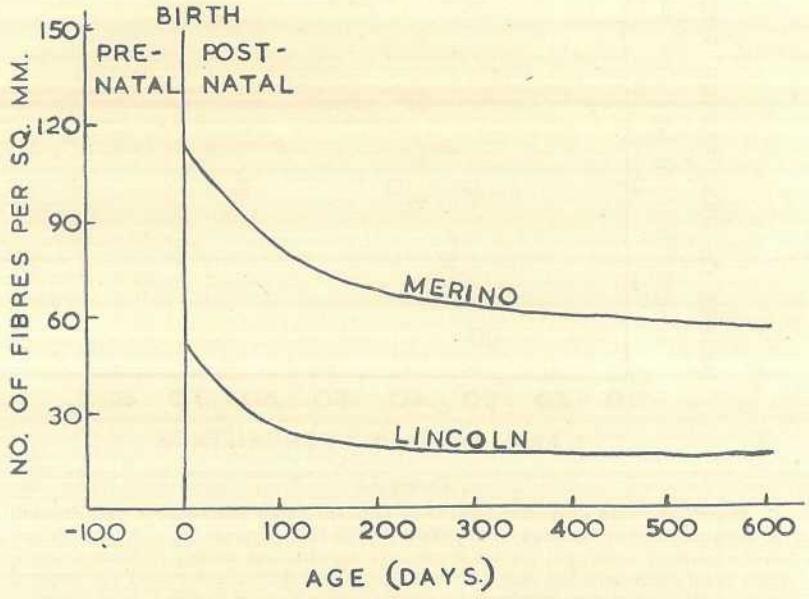


Figure 11.

Graph Showing Change in Fibre Population Density with Age. The fibre population density, as number of fibres per square millimetre, is shown on the vertical scale, and the age (in days) is plotted along the horizontal scale.

So far the conclusions drawn from the graphs have been of a rather general nature, with very little importance being placed on actual values. However, as well as being used to convey a general impression, graphs can be employed by the mathematician for detailed study of many problems. As the result of investigation a mathematical formula may have been found to apply to a particular problem, but the meaning of it may not be readily seen until a graph of the formula is drawn.

In pastoral pursuits it is often desirable to determine if two factors are associated. This can be very difficult, but it is often helpful to present the results of various observations by means of a graph, and from its shape some indication of association can be obtained. In this way graphs may be used to detect correlations between certain physical quantities, as is the case in Figure 12, where the percentage of lambs marked to ewes mated during the years 1896-1930 has been plotted against the inches of rain during the first month of lambing and the month previous to it.

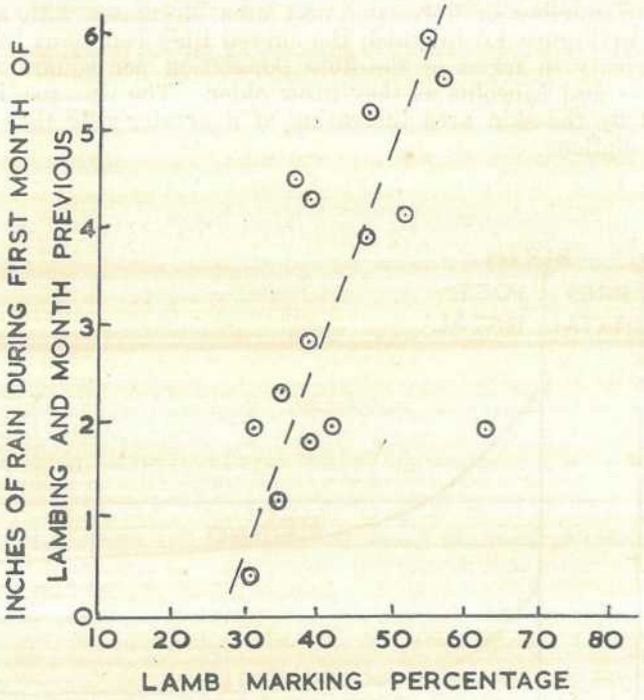


Figure 12.

Graph Showing Correlation Between Lamb-marking Percentages and Rainfall for August-October Matings of the Years 1896-1930. Inches of rain are shown on the vertical scale and the lamb-marking percentages on the horizontal scale. Each point represents the result for one year. The dotted line shows the general trend of the association between the rainfall prior to and at the time of lambing and the lamb-marking percentages. The general increase in lamb-marking percentage with increase in rain is apparent, but the points to the left of the dotted line in the upper portion of the graph indicate that too much rain in too short a time can decrease lamb-marking percentages.

There are times, however, when data may well be left in the form of a graph, for ease of use, rather than be presented as a complicated formula. Mathematical equations by means of which the amount of culling that can be undertaken in a flock may be found have been developed. These involve the mean number of matings per head, the annual lamb-marking percentage for the flock, the average annual death rate, and the actual number of matings for the flock. As such these equations are rather complicated, and to obtain numerical results from them a large amount of arithmetic is required. However, from the graphs for the corresponding death rate the information can be read directly. These graphs are drawn by plotting the mean number of matings at various lamb-marking percentages, as calculated from the equations. An initial amount of work is entailed in drawing the graphs at various death rates, but then they form a permanent record for future reference. Figure 13 shows the mean number of matings per head and the actual number of matings per group at various lamb-marking percentages and levels of culling for a death rate of 10 per cent.

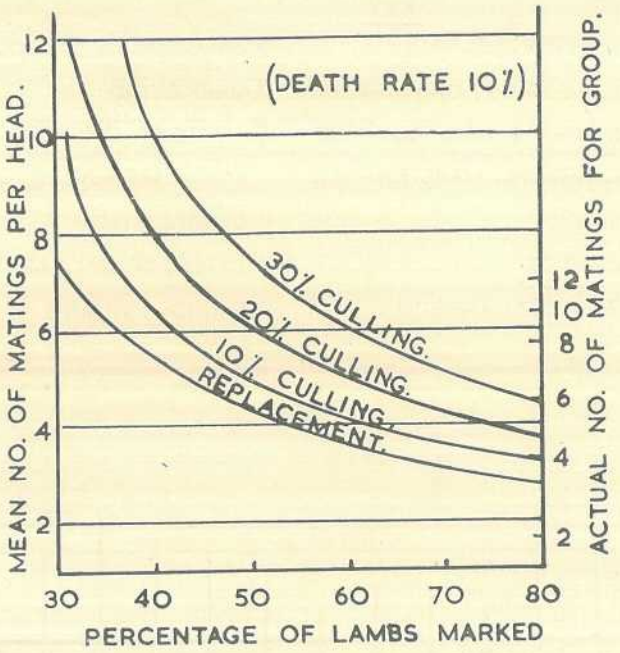


Figure 13.

Curves Showing Number of Matings and Lamb-marking Percentages Required for Various Levels of Culling. The mean number of matings required per head is shown on the vertical scale on the left and the average lamb-marking percentages are on the lower horizontal scale. Different culling rates are shown on the curved lines and the number of years a group of ewes must be mated to achieve the average number of matings per head is shown on the right-hand vertical scale. This has been calculated for an average loss of 10 per cent. per annum.

Suppose a flock maintains an average lamb-marking percentage of 40 and an average of 6 breeding seasons can be secured from the ewe flock. Lines drawn at right angles from the points marked 40 (on the base line and 6 (on the left-hand vertical line) intersect just below the 10 per cent. culling line, indicating that it is possible to cull a few less than 10 per cent. of young ewes. The horizontal line drawn from the point 6 strikes the right-hand vertical line about the point 9, which means that the flock will have to be mated 9 times to allow for the death rate of 10 per cent. on which the graph is based.

In the case of a lamb-marking percentage averaging 75 and an average of 4.5 matings per ewe, the procedure outlined above will show that 30 per cent. of the young ewes may be culled and that the flock must be mated 6 times.

Sometimes cases arise where single quantities only are to be represented, and for these such schemes as shaded areas, lengths of lines, areas of rectangles and so on may be used. An instance of this would be the dissection of production costs per pound of wool into charges for shearing, wages, cartage, repairs, rates, marketing, etc., in which case a series of lines of heights equivalent to cost may be used as in Figure 14.

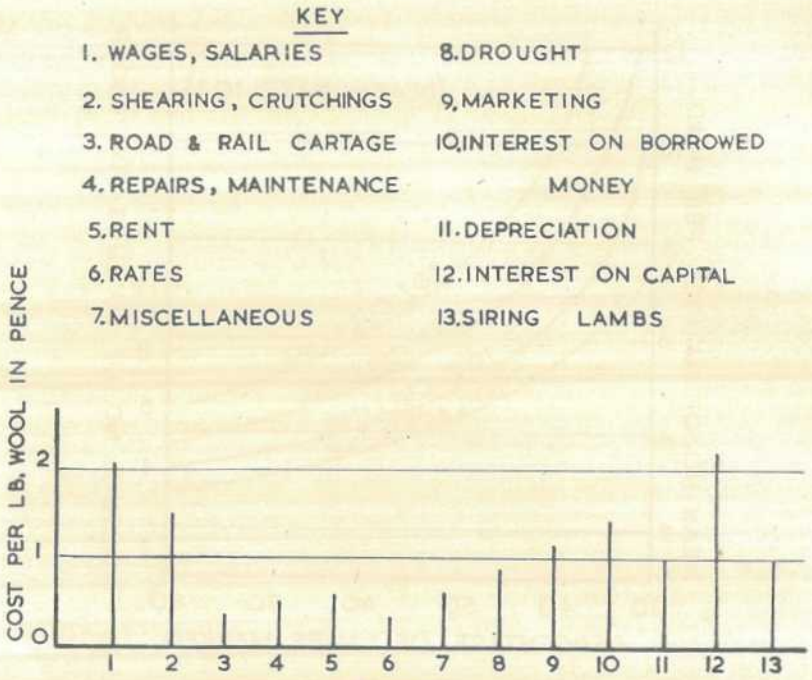


Figure 14.

Graphical Dissection of Average Wool Production Cost in Queensland in 1939. The vertical scale represents the production cost of wool in pence per pound in 1939. The figures on the horizontal scale refer to the various items of expenditure which contribute to production costs and which are listed in the key.

The figures vary from locality to locality and also from year to year; hence such diagrams afford a ready means of comparing the fluctuations. The costs shown in Figure 14 were the average figures for Queensland in 1939 and consequently are far below those of the present day. For their own information, woolgrowers may like to draw graphs of their own production costs for 1951.

Acknowledgments.

Information used in the graphs has been obtained from records of the Sheep and Wool Branch, and from published works by Miss H. Newton Turner, Mr. H. B. Carter and Mr. W. Granger, to whom the author wishes to express his indebtedness.

Advice on Soils and Fertilizers.

Farmers are requested to contact their district Adviser in Agriculture or Adviser in Horticulture if they desire advice on fertilizing or other soil treatments. If a soil analysis is conisdered necessary by the field officer, he will provide directions for the taking of samples.

Brucellosis Testing of Swine.

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

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

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

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.

(AS AT 15th FEBRUARY, 1952.)

Breed.	Owner's Name and Address of Stud.
Berkshire	S. S. Ashton, " Scotia " Stud, Pittsworth
	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	H. V. Littleton, " Wongalea " Stud, Crow's Nest
	O'Brien and Hickey, "Kildurham" Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, "Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H. W. Wyatte, Rocky Creek, Yarraman
	H. M. State Farm, " Palen Creek," Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, " Rosevale " Stud, Beaudesert
	Bowkett and Meacle, " Myola Vale " Stud Piggery, Burra Burri, Jandowae
	D. T. Law, Trouts Road, Aspley
	R. J. McCullough," Maxholm " Berkshire Stud, Gatton
	C. F. W. and B. A. Schellback, " Redvilla " Stud, Kingaroy
	R. H. Crawley, " Rockthorpe " Stud, *via* Pittsworth
	F. R. J. Cook, " Alstonvilla," Wolvi, via Gympie
	D. E. and E. C. Apelt, "Thelmur," Oakey
	Mrs. I. M. James, "Kenmore" Stud, Cambooya
Large White	H. J. Franke and Sons, " Delvue " Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	F. L. Hayward, " Curyo," Jandowae
	J. A. Heading, " Highfields," Murgon
	K. B. Jones, " Cefn " Stud, Pilton
	R. G. Koplick, "Melan Terez " Stud, Rochedale
	R. Postle, " Yaralla " Stud. Pittsworth
	E. C. Smith, "Smithfield" Stud, Coomera
	E. J. Bell, " Dorne " Stud, Chinchilla
	A. G, Fry, "Birubi" Stud, Dalby
	N. E. Myers, Halpine Plantation, Kallangur

TESTED HERDS—continued.

Breed.	Owner's Name and Address of Stud.
Large White—*continued*	L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
	J. H. G. Blakeney, "Talgai" Stud, Clifton
	V. P. McGoldrick, "Fairymeadow" Stud, Cooroy
	N. Woltmann and Sons, Wooroolin
	R. S. Powell, Kybong, via Gympie
	E. B. Horne, "Kalringal," Wooroolin
	S. T. Fowler, "Kenstan" Stud, Pittsworth
	J. A. and J. McNicol, "Camden," Canning Vale, Warwick
Tamworth	S. Kanowski, "Miecho" Stud, Pinelands
	N. R. Potter, "Actonvale" Stud, Wellcamp
	D. F. L. Skerman, "Waverley" Stud, Kaimkillenbun
	A. C. Fletcher, "Myola" Stud, Jimbour
	L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
	Salvation Army Home for Boys, Riverview
	F. Thomas, "Rosevale" Stud, Beaudesert
	A. J. Surman, Noble Road, Goodna
	P. V. McKewin, "Wattleglen" Stud, Goombungee
	Department of Agriculture and Stock, Regional Experiment Station, Kairi
	P. V. Campbell, Lawn Hill, Lamington
	E. C. Phillips, "Sunny View," M.S. 90, Kingaroy
	T. A. Stephen, "Withcott," Helidon
Wessex Saddleback ..	W. S. Douglas, "Greylight" Stud, Goombungee
	K. Day and P. Hunting, "Kazan" Stud, Goodna
	E. Sirrett, "Iona Vale" Stud, Kuraby
	C. R. Smith, "Belton Park" Stud, Nara
	H. H. Sellars, "Tabooba" Stud, Beaudesert
	H. Thomas, "Eurara" Stud, Beaudesert
	D. T. Law, Trouts Road, Aspley
	G. J. Wilson, "Glenbella" Stud, Silverleigh
	G. J. Cooper, "Cedar Glen," Yarraman
	J. B. Dunlop, Acacia Rd., Kuraby

HAVE YOUR SEEDS TESTED FREE

The Department of Agriculture and Stock examines FREE OF CHARGE samples representing seed purchased by farmers for their own sowing.

The sample submitted should be representative of the bulk and a covering letter should be sent advising despatch of the sample.

MARK YOUR SAMPLE

Sample of ..... seed
Drawn from ..... bags
Representing a total of .....
Purchased from .....
Name and Address of Sender
Date.....

SIZE OF SAMPLE

Barley -	8 oz.	Oats -	8 oz.
Beans -	8 oz.	Peas -	8 oz.
Grasses	2 oz.	Sorghum	4 oz.
Lucerne	4 oz.	Sudan -	4 oz.
Millets	4 oz.	Wheat -	8 oz.

Vegetable Seeds - ½ oz.

SEND YOUR SAMPLE TO—**STANDARDS OFFICER, DEPARTMENT OF AGRICULTURE AND STOCK, BRISBANE.**

ASTRONOMICAL DATA FOR QUEENSLAND.

APRIL.

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	5·57	5·47	Cairns ..	20	38	Longreach	31	39
6	6·0	5·41	Charleville ..	26	28	Quilpie	36	34
11	6·02	5·36	Cloncurry	44	56	Rockhampton ..	6	14
16	6·05	5·30	Cunnamulla ..	30	28	Roma	16	18
21	6·08	5·26	Dirranbandi ..	20	18	Townsville ..	18	33
26	6·10	5·21	Emerald	15	23	Winton	35	45
30	6·12	5·18	Hughenden ..	29	41	Warwick	5	3

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Day.	Rise.	Set.
	p.m.	p.m.
1	12·02	10·15
2	12·52	11·10
3	1·35	..
		a.m.
4	2·13	12·06
5	2,47	1·02
6	3·19	1·57
7	3·48	2.51
8	4·16	3·45
9	4·46	4·40
10	5·17	5·37
11	5·52	6·36
12	6·32	7·38
13	7·18	8·43
14	8·12	9·49
15	9·12	10·53
16	10·18	11·52
		p.m.
17	11·26	12·44
18	..	1·30
	a.m.	
19	12·33	2·09
20	1·38	2·45
21	2·42	3·19
22	3·45	3·52
23	4·46	4·25
24	5·48	5·02
25	6·51	5·40
26	7·53	6·24
27	8·54	7·12
28	9·51	8·04
29	10·43	8·59
30	11·29	9·55

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

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

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	9	30	25	45	0	21	26	54
6	14	25	30	41	5	16	34	47
11	25	14	42	29	17	4	49	33
16	30	9	45	24	20	0	53	26
21	21	19	37	34	12	10	43	39
26	11	29	26	44	0	20	28	52
30	10	29	25	44	0	20	27	52

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	2	56	33	67	17	53	3	46
3	6	51	35	64	20	50	6	43
5	14	47	39	62	24	47	13	39
7	23	38	46	56	30	41	20	33
9	34	27	53	48	38	33	28	23
11	44	16	61	41	45	26	37	15
13	53	6	67	34	50	20	44	7
15	56	2	68	32	52	17	46	3
17	51	6	65	34	49	20	42	7
19	45	15	61	41	46	26	37	14
21	34	27	53	48	38	33	28	23
23	21	38	44	57	29	42	18	33
25	11	49	38	63	23	49	10	41
27	3	55	34	67	18	52	4	45
29	3	55	34	67	18	52	4	45
30	5	52	35	65	19	50	5	44

Phases of the Moon.—First Quarter, April 2nd, 6.48 p.m.; Full Moon, April 10th, 6.53 p.m.; Last Quarter, April 17th, 7.07 p.m.; New Moon, April 24th, 5.27 p.m.

On April 15th the sun will rise and set about 10 degrees north of true east and true west respectively, and on the 9th and 21st the moon will rise and set approximately at true east and true west respectively.

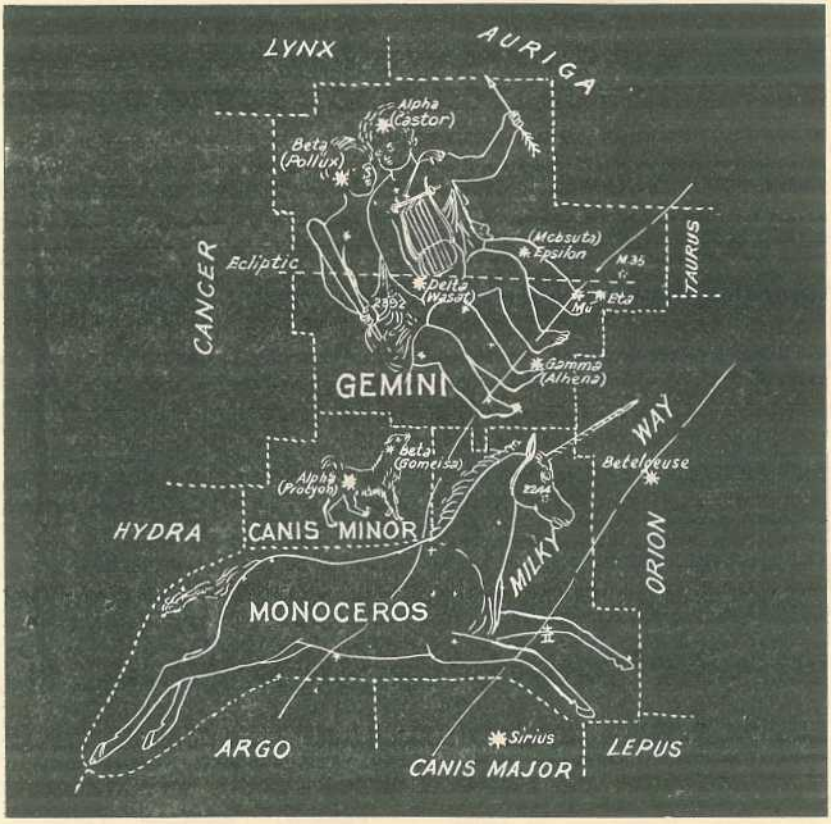
Mercury.—In the constellation of Pisces all this month. On the 1st this planet will set about sunset. On the 17th it will pass to the north of Venus and by the end of the month will rise about 2 hours before the sun.

Venus.—Also in the constellation of Pisces throughout this month. On the 1st rising about 1½ hours before the sun and by the 30th rising only 1 hour 8 minutes before sunrise. The moon will be in the vicinity of Mercury and Venus on the 23rd.

Mars.—Remains in the constellation of Libra all this month, rising between 7.30 p.m. and 8.45 p.m. on the 1st and at sunset on the 30th.

Jupiter.—Now too close in line with the sun for observation.

Saturn.—In the constellation of Virgo, will rise about sunset at the beginning of April and will be well above the eastern horizon at nightfall at the end of the month.



THE CONSTELLATIONS.

GEMINI (THE TWINS).

This is a zodiacal constellation and takes its name from its two principal stars, Castor and Pollux (Alpha and Beta). Castor and Pollux were the twin brothers of Helen of Troy and went with Jason and his Argonauts on the search for the Golden Fleece. During a violent storm, Orpheus, one of the heroes, invoked the aid of Apollo, the God of Light, who caused a star to shine on the head of each of the twins. The constellation shows up as roughly rectangular with the stars Alpha (Castor) and Beta (Pollux) and Gamma at three of the corners and Mu and Eta at the other.

Epsilon and Delta appear along the longer sides of the figure, with Delta, which is almost on the ecliptic, not quite halfway from Beta to Gamma. Eta, at the opposite end of one diagonal of the Gemini rectangle from Pollux, is an orange coloured star and Gamma is a pale blue. Not far to the north-east from Eta is M35, a fine, loose star cluster. About 3 degrees east and one degree south of Delta is N.G.C. 2329, an oval planetary nebula about 25 seconds in diameter with a 9.5 magnitude central star. In this constellation is the radiant point of the meteor shower called the Geminids, which reaches maximum about December 10th, when 20 or more bright, swift moving meteors an hour may be seen.

CANIS MINOR (THE LESSER DOG).

This constellation lies between Canis Major (described in February Journal) and Cancer and is directly south from Castor and Pollux in Gemini. Procyon is the principal star of this group and is a lovely deep yellow star of a binary system which in some ways is like that of Sirius in Canis Major. Procyon B, which was discovered in 1896 by Schaeberle, is only visible in large telescopes, the magnitude being 14 and the separation between the two stars about 44 seconds of arc.

MONOCEROS (THE UNICORN).

A fairly large constellation not conspicuous to the naked eye and lying mainly in the large triangle formed by Sirius, Betelgeuse and Procyon. At about a third of the distance from Betelgeuse to Procyon is one of the most unusual stars yet examined. It is a close binary of total magnitude 6 and is known as "Plaskett's Star" from its discoverer. This binary system has a period of 14¼ days. The components are about 56 million miles apart (about five-eighths the distance of Earth from the sun), the mass of the main star being 76 times that of our sun and the companion 63 times that of our sun with a luminosity about 30,000 times as bright as the sun. These two stars are among the most massive known, for stellar masses approaching even 50 times that of our sun are very rare. The constellation, lying in the Milky Way, abounds with objects of interest for telescope observers, 12 Monocerotis being a giant yellow star.