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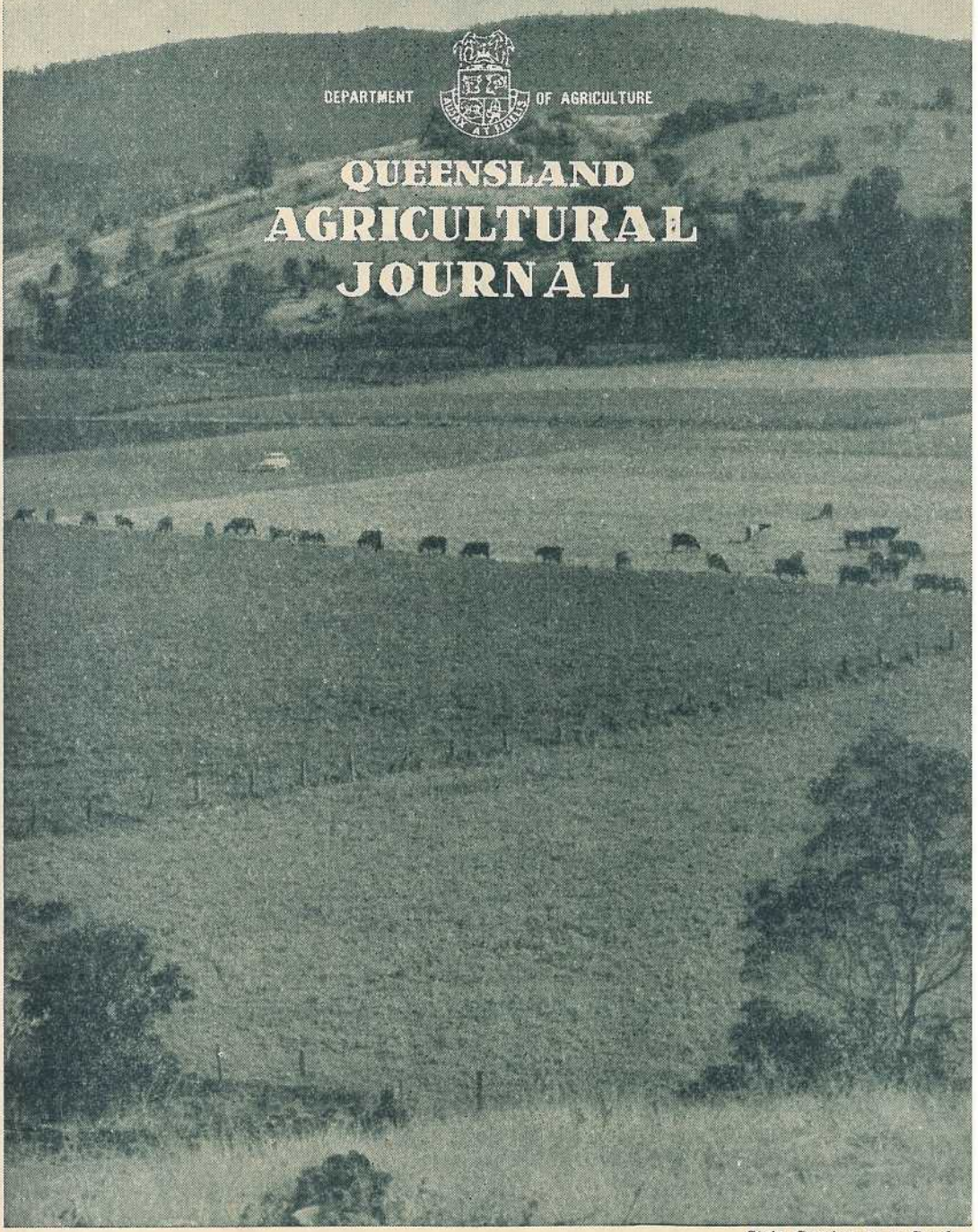
DEPARTMENT OF AGRICULTURE

QUEENSLAND AGRICULTURAL JOURNAL



Strip Grazing on a South Coast Dairy Farm.

LEADING FEATURES

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Queensland AGRICULTURAL JOURNAL

Contents

Cotton Growing in the Burdekin District.

By N. H. ADAMS, Senior Adviser in Agriculture.

The climate of the Burdekin district is characterised by a short rainy season extending from January to March with relatively arid conditions for the remainder of the year. Winter temperatures are normally mild, and with the aid of irrigation cotton may be grown with varying degrees of success throughout the entire year. A suitable combination of climate, soils and water exists in the Burdekin area, offering considerable scope for the production of cotton.

Experiments conducted in the district have demonstrated that yields exceeding 2,000 lb. of seed cotton per acre can be obtained with the aid of irrigation. Whilst the use of irrigation adds materially to the cost of production, the extra costs are more than compensated for by the heavier yields obtained.

Seasonal Influences.

Although the winter months are comparatively mild, the temperatures are usually sufficiently low during June and July to check plant growth appreciably. This check may be beneficial to a crop approaching maturity, but it is deterimental to a young crop. Crops planted in early spring grow very satisfactorily, but mature during the rainy season and the harvest may be lost under excessively wet conditions.

Experience gained over recent years clearly indicates that crops established before the end of March are the most productive. Every effort should therefore be made to plant during the period from late January to mid-March. Such crops will be well advanced at the onset of the cool weather, when a retardation of the growth rate does not appear to have any detrimental effect.

The actual planting date will depend mainly on the summer rains. The heavier soils which dry out slowly present some problems and frequently planting has to be delayed until after the cessation of the rainy period. Adequate preparation of the land cannot be carried out until the soil moisture is at a suitable level.

Crop Rotation.

The ideal plant for mechanical harvesting is an erect open type, with short fruiting branches, and maturing at approximately three feet in height. Such plants are characterised by light-green foliage and a minimum of vegetative growth.

Experience has shown that this type of plant can be produced immediately following virgin grassland or the grass phase in a rotation. A similar plant type can be produced when cotton follows one of the cultivated crops of the grass family, such as maize, sorghum or sugar-cane. In the Burdekin district, some excellent cotton crops have been produced following sugar-cane on the Delta soils.

Preparation of the Seedbed.

The ideal seedbed for cotton is one which has been brought to a fine tilth and which is moist near the surface and firm and moist underneath. If these conditions prevail there should be little difficulty in establishing a good stand of plants.

Plate 1.

A Young Cotton Crop at Home Hill. This crop of Miller 43-9-0 occupied 30 acres. The condition of the plants and the appearance of the soil give evidence of good cultural treatment.

Soils.

Cotton can be grown successfully on a wide range of soils, but in general, clay loams overlying a clay subsoil at approximately two feet can be considered ideal, provided the nitrate level is sufficiently low during the growing season. Unfortunately, the wet season rains frequently result in plantings being late on these soils because of the delay in land preparation.

The light, well-drained sandy loams with permeable subsoil are more easily handled during the January-March period, and have the distinct advantage of providing ample opportunity for establishing and cultivating early plantings.

In order to improve the chances of early planting, land preparation should be commenced before the onset of the wet season rains. If the preliminary ploughing operations have been completed, only light cultivations (such as discing and harrowing) will be required to bring the soil into good tilth should a break in the weather present an opportunity for planting. It is considered undesirable, however, to work the land into a fine tilth prior

to the rainy season, as heavy rains will then pack the soil and possibly cause erosion.

Cotton does not require deep ploughings and a depth of approximately six inches is satisfactory. The number of ploughings is dependent on the condition of the land, but usually two ploughings are sufficient. The land should be turned over during the early summer, when storm rains frequently provide the opportunity to work soil that has been in a very hard dry condition. The second ploughing should usually be completed before the end of December, but in dry years it might be advisable to delay the operation until the first break in the weather after the commencement of the rainy season.

Varieties.

Further work needs to be carried out in the Lower Burdekin before varietal recommendations can be made with confidence. Sufficient information, however, is available to indicate that Miller 43-9-0 is a useful commercial variety for the area.

Varieties under test which have shown promise are Coker 100, D. and P.L. 14, Empire and Locket. An important consideration is the development of strains which have plant characteristics suitable for mechanical harvesting. It is also essential that such strains should yield lint of a quality suitable for absorption by the Australian market. Selection work to develop strains with these desirable characteristics is in progress.

Sowing.

Cotton grown for mechanical harvesting should be planted in rows 3 ft. 6 in. apart, as this distance is required for the successful operation of the picking machine. The planting rate will vary from 12 lb. to 20 lb. of delinted seed per acre, depending on the type of planter in use. Double-row machines that drop as a steady stream, or in hills 9-12 in. apart, are favoured by most growers. However, whatever machine is selected for the work, care should be taken to ensure that the plates or other planting units are suitable for sowing delinted cotton seed.

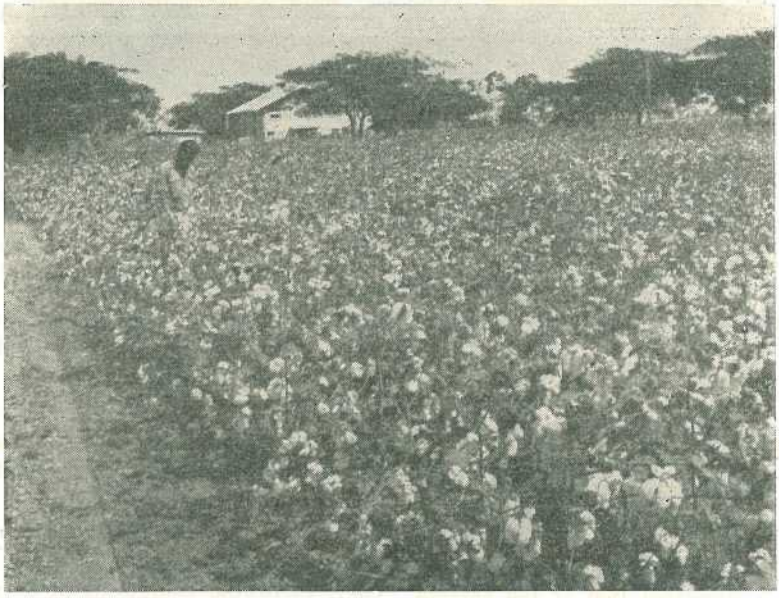


Plate 2.

An Excellent Crop of Cotton ready for Harvest at the Ayr Regional Experiment Station. The picture, taken in September, shows portion of a time-of-planting trial; this particular section was planted in early March and gave the highest yields.

The planting depth is particularly important and largely determines the success or failure of the strike. The seed should be planted in moist soil at a depth of 1½-2 in. Land preparation after the cessation of the summer rains dries out the surface soil, and unless the moisture is replenished by planter or tractor for the purpose of removing the dry surface soil from the line of the row. This in effect means that the seed is planted at the usual depth of 1½-2 in. in moist soil under the base of a shallow furrow, thus obviating the necessity of applying a pre-planting irrigation.

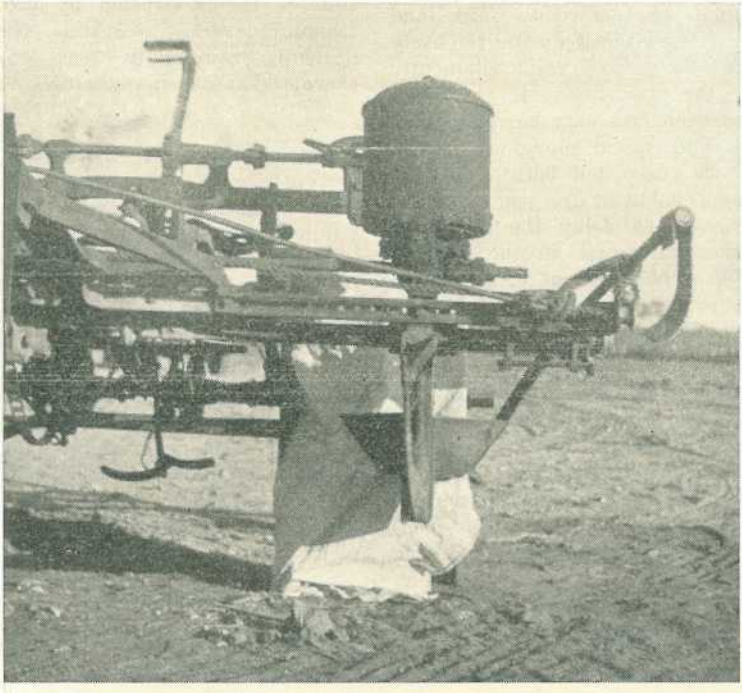


Plate 3.

The Attachment of "Moisture-seeking" Equipment to a Cotton Planter. The illustration shows the two plates or wings attached to a planting boot about 2 in. above its base. These wings remove the dry surface soil from the line of the planting row, and enable the seed to be planted at the correct depth below the base of the furrow thus made.

rain or irrigation, difficulty will be experienced in obtaining a satisfactory strike. Insufficient moisture in the surface soil and deep sowing are two major factors that have been responsible for strike failures in the Lower Burdekin district in past years. At the commencement of planting it is advisable to uncover a few seeds to ensure that they are being placed at the required depth.

It is suggested that if the surface soil is dry while good moisture exists below the 2 in.-5 in. levels, moisture-seeking equipment be attached to the planters in common use in the Burdekin district can be equipped quite easily with plates or wings bolted or riveted to the planting boot for the purpose of pushing the dry soil surface aside. If the bases of the plates are placed 1½-2 in. above the bottom of the boot the correct cover will be obtained irrespective of the depth at which the planter is set. In an emergency, furrowing equipment of a type that will provide small shallow furrows may be attached to the tractor directly in front of the planter wheels.

Thinning.

A plant spacing of 9-12 in. is regarded as a suitable average stand for crops grown under irrigation. In plantings of only a few acres in extent, hoe-thinning at a height of approximately nine inches enables the elimination of a high percentage of insect-damaged and undesirable plant types. In large areas where hand-thinning is impracticable, the stand may be thinned by cross cultivation with tines spaced appropriately.

Some growers have successfully regulated their planters to drop at approximately the required distance in order to avoid thinning. This method does not allow for errors, in that the planting machine must be functioning perfectly and the seed, seedbed and moisture must be uniformly good.

Cultivation.

The cultivation of cotton is similar to that of other row crops in that it is necessary to eliminate competition from weeds, particularly in the early stages of growth. For machine-harvested cotton it is also essential to keep weed growth to a minimum during the later stages of the crop, in order to facilitate the operation of the picking machine.

The first cultivation should take place as soon as it is possible to work close to the plants without smothering them. If guards are fitted, this may be achieved when plants are 2-3 in. tall. Tines are used in this operation in preference to discs.

The number of subsequent cultivations will depend largely on weed growth, rain or irrigation applications,

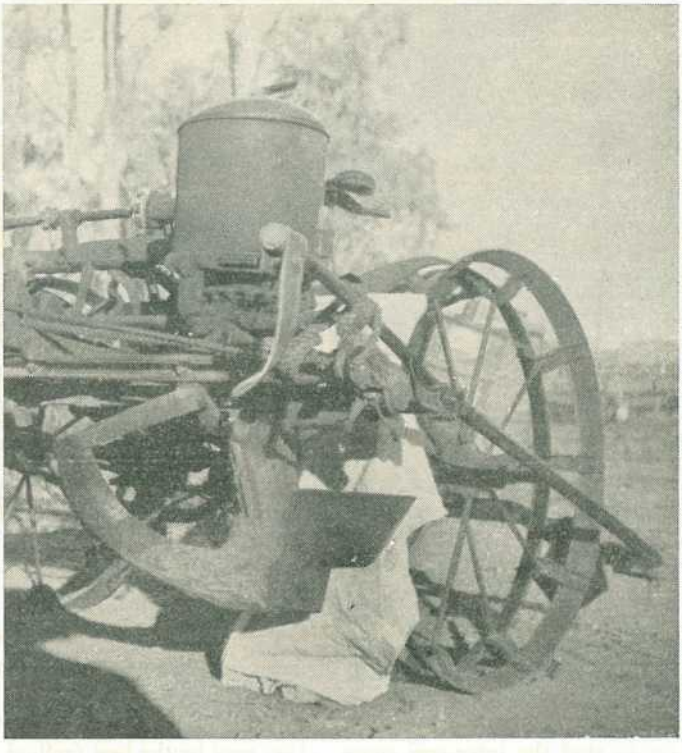


Plate 4.

A Side View of a Two-Row Cotton Planter modified as in Plate 3. This view shows the "moisture-seeking" equipment, which is attached to both planting boots, also one of the "press-wheels" of the planter, which compact the soil round the seed without forming a hard crust on top.

and may continue until the plants are too large to straddle with the machinery. If excessive rains follow an early planting, thus promoting vigorous weed growth, it will be found that discs, first cutting away and then hilling towards the plants, will give best results.

When hilling towards the plants in preparation for irrigation, the hills should be as small as practicable and if possible not higher than six inches. High ridges of a type which are frequently seen in cane crops make mechanical harvesting extremely difficult. Single discs may be used for the operation, but boards or sweeps are preferable so that the inter-row space is left flat, thereby providing an easy passage for the harvesting machine. For highly efficient machine-harvesting, it is imperative that in addition to checking weed growth, sticks, tree roots, and other obstructions be removed from the field.

Irrigation.

The frequency of irrigation depends on both soil type and weather conditions, and for this reason pre-determined watering schedules are of little value. Sandy well-drained soils will require water more frequently than those with a clay subsoil.

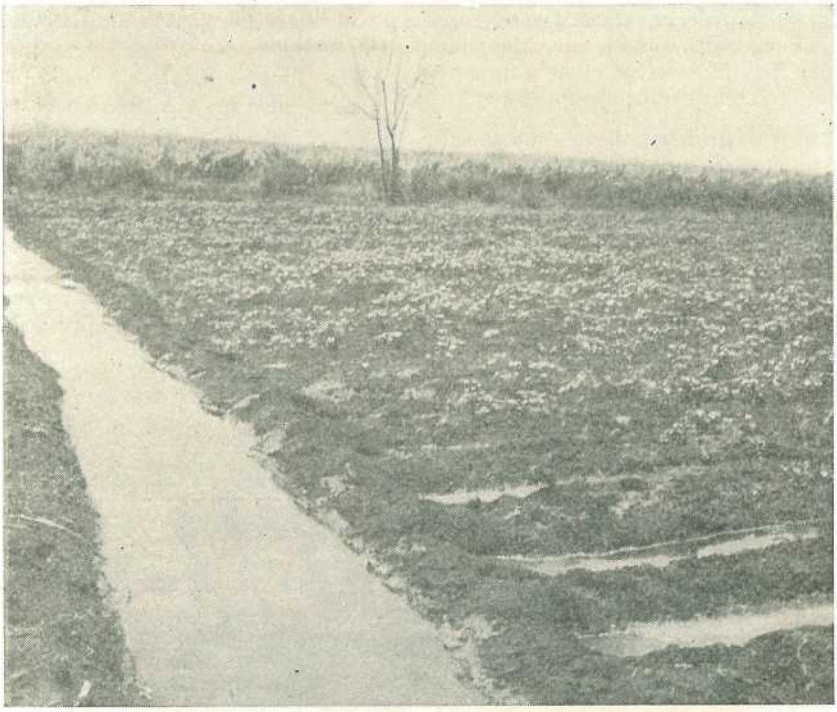


Plate 5.

Furrow Irrigation of Young Cotton in the Burdekin District. In this instance, galvanised iron outlets were used to feed water from the head-ditch to the inter-row furrows.

Both spray and furrow methods of irrigation have been used successfully in producing cotton crops. Where the topography is suitable, furrow irrigation may be the best method for applying water. It is cheaper and avoids the inconvenience of shifting pipes, particularly in the later stages of the crop's growth. Moreover, there is less

risk of using inadequate amounts of water than there is with the spray system.

Usually it will be found that crops planted in the January-March period can be established without the aid of irrigation, either shortly after rain, or alternatively by the removal of dry surface soil along the line of the rows as previously described. If good summer rains are received, the reserve of soil moisture should be sufficient to promote satisfactory growth until the commencement of flowering, without recourse to irrigation.

It is most important that crop development should not be checked because of an inadequate supply of moisture, particularly after the early bolls begin to set. Cotton grown under suitable conditions is a deep-rooting plant and is not suited to light applications of water even if applied frequently.

The January-March planted crops will set fruit during the autumn and early winter months, and, with the approach of cooler weather, 3 in. irrigation applications on most soils can be expected to provide adequate moisture for a period of at least three weeks. Three irrigations, each of three inches, applied on a three-weekly basis, and commencing at the beginning of flowering, should provide sufficient moisture for normal crop requirements.

Harvesting.

Cotton crops planted during the January-March period will mature in the winter and spring months, when most of the seasonal labour is absorbed by the sugar industry. While the hand-picking of cotton generally produces a cleaner and better grade, labour for this work is very limited, and for this reason the cotton industry in the Burdekin is based almost

Plate 6.

A Cotton Field at Home Hill, in Which Harvesting has Commenced. The portion of the field in the left middle-distance has already been picked once.

entirely on mechanical harvesting. During recent years the Cotton Marketing Board has made mechanical harvesters available and it is expected that this practice will be continued, provided the district cotton acreage is sufficient to justify their operation.

Heavy shedding of the early fruiting forms due to insect damage or insufficient moisture at critical stages may lengthen the duration of the crop. Under normal circumstances, however, there are usually enough bolls fully opened between the fifth and sixth months to warrant a first harvesting, and a final pick is then required at approximately seven months.

Heavy crops yielding in the vicinity of 2,000 lb. per acre usually have a well-developed top crop, and frequently justify three distinct picks. The harvesting of light crops not exceeding 500 lb. per acre may well be delayed in order that the whole harvest may be handled in one operation. The bolls should be well opened and the lint dry before harvesting, but after this point is reached there is a gradual deterioration in quality from exposure.

Seed cotton is baled in once-used wool packs, and these may be obtained from the Cotton Marketing Board. They are returned to the grower promptly and are serviceable for a number of years.

Baling is usually done on the headlands and a portable baling frame or press is most convenient for setting up at the various dumping points. Cotton is tramped into the bales, and well-filled bales usually average about 400 lb. in weight. If picking has to be carried out while the fibres are damp from dew or rain, the cotton

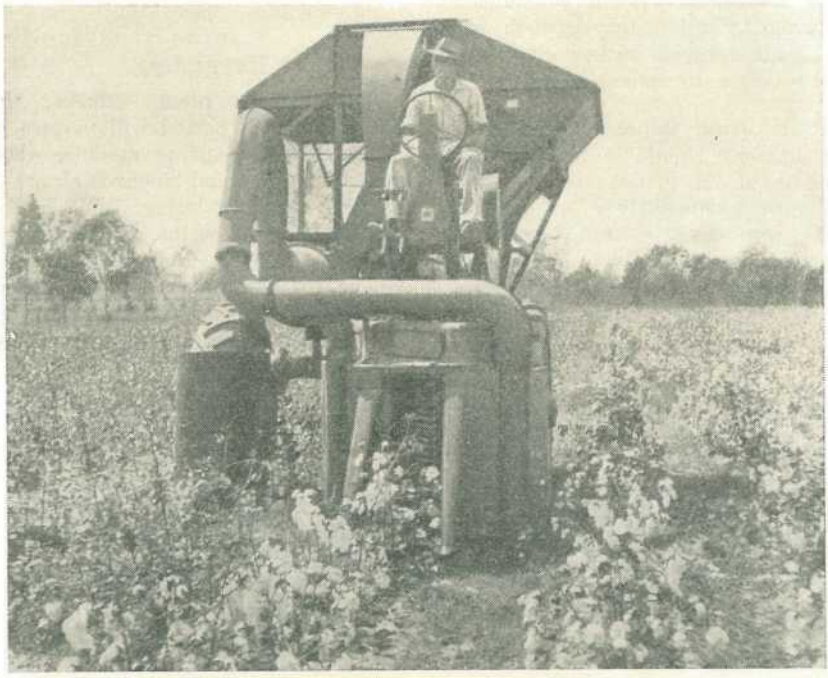


Plate 7.

Mechanical Harvesting of Cotton in the Burdekin District. This dwarf crop was in excellent condition for machine-harvesting, as can be seen by comparison of the picked rows on the left with the unpicked rows.

should be spread out to dry before baling. First picks with the mechanical harvester frequently contain a small percentage of "green" fibre and it is therefore advisable to allow the cotton to air in the sun for a few hours before commencing to bale.

Cotton is marketed through the Queensland Cotton Marketing Board, and in the northern districts it is consigned to the Glenmore Ginnery, Rockhampton. Full details of marketing arrangements and payment to growers may be obtained from the Queensland Cotton Marketing Board, Whinstanes, Brisbane.

Destruction of Plants after Harvesting.

Cotton bushes should be destroyed as soon as possible after the completion of harvesting, as the practice of ratooning or allowing them to stand over is particularly undesirable. Such crops provide a breeding ground for insect pests. Disc ploughing is the usual method of destroying bushes in this district, and if the operation is completed prior to the summer rainy season, satisfactory decomposition will result.

The Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) addressing farmers at a Field Day in the Coomera District.

SAFETY IN THE DAIRY.

(Issued by the National Safety Council of Australia.)

Owing to the number of accidents, some fatal and most of them involving young children, occurring around milking machinery on dairy farms, the National Safety Council of Australia feels that a good purpose will be served by advising dairy farmers of some of the mechanical hazards that exist in the dairy, and by suggesting methods of prevention.

It is fully realised, of course, that the best method of protection is to keep the machine room locked at all times when machinery is in use, but unfortunately this is not always done.

The greatest hazard of all is the exposed shaft ends of pumps and engines, the majority of which are close to ground level. Two fatal accidents have occurred to small children on dairy farms near Brisbane during the last 12 months through the children's clothing being caught on the exposed shaft of the milk pump. The danger can very easily be overcome by covering the shaft with an upturned packing case and securing the case to the floor in some manner. This protection would also remove the danger from shaft key heads, etc.

Exposed flat or vee belts from the engine or motor to the pump also require guarding. The guard can be made very easily from scrap timber, and if close to ground level attached to the packing case used to protect the shaft end and so make one complete unit. Suitable and cheap guarding can also be made from fine wire netting and piping.

The danger that exists even in polished shafting such as counter shafting installed at a low level is not generally realised. Farmers are advised to enclose this in a suitable manner.

Owing to the increased use of electricity on the land, farmers are reminded that all electrical installations are required by law to be installed by a qualified electrician. The use of long leads is to be avoided wherever possible, and extreme care must be taken when using portable equipment during wet weather or under damp conditions.

In conclusion, farmers are advised that the Department of Agriculture and Stock, through its field officers in the Division of Dairying, has agreed to assist in every way possible to ensure safety in the dairy, and your co-operation with these officers will be appreciated.

ATLAS OF AUSTRALIAN RESOURCES.

An atlas of Australian resources, comprising 32 loose maps with commentaries, is being issued in sections by Angus and Robertson Ltd., Sydney, as publishers for the Department of National Development.

The 10 maps already issued cover Mineral Deposits, Rainfall, Temperature, Underground Water, Soils, Agricultural Production, Population Density and Distribution, Major Developmental Projects, State and Local Government Areas, and Climatic Regions.

The maps are available in loose or folded sheets, with commentaries, for 10s. 6d. each. Box containers to hold 10 folded maps and commentaries may be bought for 10s. 6d. each.

QUEENSLAND BUSH BOOK CLUB.

The Queensland Bush Book Club feels that there are still many country people who do not know of the service the Club gives to those living beyond the reach of town libraries.

For a fee of 3s. 6d. a year, subscribers may receive parcels of 10 books as well as magazines and illustrated papers. The Queensland Railway Department carries the parcels free to the nearest railway station, but members must make their own arrangements for delivery from the station.

Each parcel contains about three months' reading, but exchanges may be made more often if desired. Write to the Secretary, Bush Book Club, Victory Chambers, 249 Adelaide street, Brisbane, enclosing 3s. 6d. and you will be enrolled as a member.

Para Grass.

BY OFFICERS OF THE AGRICULTURE BRANCH.

Para grass (*Brachiaria mutica* Stapf), which is popularly known in Queensland as *Panicum muticum* or giant couch, is a native of northern Africa and Brazil, and is now used extensively in practically all tropical and subtropical countries for grazing and fodder purposes.

It was introduced into Queensland about 1880 and has since been widely planted along the eastern coastal plain from Cooktown to the southern border, particularly in those areas which receive high rainfall and have few heavy frosts. Many coastal areas are known to be suitable for the growing of para grass, particularly where the land is too damp for normal cultivation. Increasing use is being made of this grass by both pastoralists and dairymen who have this type of country.

The palatability of para grass is beyond question, but because good seed is rarely available, planting has to be carried out by stem or root cuttings. This is a slow method of establishment and has no doubt limited the use of the grass.

Description.

Para grass is a rapidly growing perennial with broad hairy leaves up to 12 in. in length. Young plants first produce stout runners which grow along the surface of the ground and form a shallow root system at each joint. Under favourable growing conditions runners may reach a length of 12-14 ft. in one summer season.

Later, upright shoots are developed at the joints and the creeping stems themselves turn upwards. The latter spread very quickly and the area occupied by the grass rapidly increases both in extent and in density of cover. The grass may reach a height of several feet under favourable growing conditions, and usually the stand is so dense that few other plants are able to grow in competition with it.

Though the grass flowers in southern Queensland, it is only in the tropics that flowerheads are produced in profusion. The inflorescence is produced on erect stalks and consists of alternate branches spaced about half an inch to one inch apart and varying in length from one to two inches. The flowerhead is yellowish green, turning brown as the seed ripens. Seed of low germination has been harvested and sold commercially in North Queensland, but at present no commercial seed stocks are available.

Climatic Requirements.

This grass requires warm moist growing conditions normally associated with tropical and subtropical lowlands, and in Queensland the main distribution of para grass is a reflection of its climatic requirements.

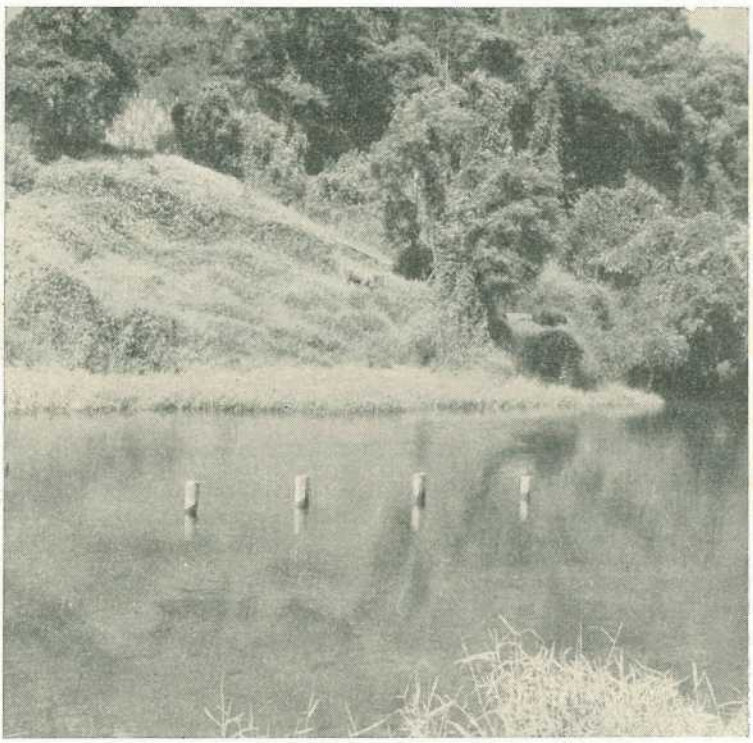


Plate 1.

Para Grass Mixed with Puero (a Tropical Legume) on the Bank of the South Johnstone River in North Queensland. Para grass thrives under these conditions.

In areas subject to frosting para grass suffers defoliation and cutting back, but will normally make satisfactory regrowth in spring. On the coast it thrives during the wet season and will survive the relatively cold dry conditions which are often experienced in late winter and spring months.

On the Daintree River, where it thrives on the river flats, this grass has proved invaluable for dairying and the fattening of beef cattle. Para grass is also proving highly productive under irrigation in the Burdekin area, where it is growing in association with the legume centro.

Of recent years limited use of para grass has been made in the Burnett and Darling Downs areas for gully stabilisation work, and it seems likely to produce satisfactory soil cover despite the heavy winter frosting period. Recovery during spring and early summer months is rapid enough to give gully cover before storm scouring occurs. It will not stand heavy stocking in these marginal regions where the rainfall is relatively low and the winters are severe.

In general, para grass is unlikely to thrive under average rainfall conditions outside a narrow belt of coastal lowland less than 50 miles wide, except north of Townsville, where the species is known to make good growth in moist situations in locations more than 100 miles from the coast.

Soils.

Para grass shows a preference for locations which remain moist, as in waterlogged and lowlying areas. It will make rapid growth on creek banks and margins of waterholes and this

Plate 2.

Para Grass Established in a Scrub Clearing at Utchee Creek, in the Innisfail District of North Queensland. The background slope in this picture is under molasses grass.

feature is particularly noticeable along North Queensland streams. Where irrigated pastures are used on alluvial soils in southern Queensland, para grass is recommended particularly for planting tail drains and outfalls.

Para grass has also been successfully established under comparatively dry conditions on freshly cleared or newly burnt scrub areas where competition does not hinder the development of runners.

Experiments carried out recently in lowlying wallum country in south-eastern Queensland have shown that para grass can be a useful pioneer grass once soil drainage has been undertaken and suitable fertilizer applied.

Once established in a suitable environment, para grass can make rapid dense growth to the extent that legume establishment and maintenance becomes difficult.

In general, it can be accepted that, other things being equal, para grass will thrive on any soil type where soil moisture is consistently high.

Planting.

Unless it is harvested very carefully, seed of para grass is likely to be of extremely poor quality and unsuitable for sowing purposes. However, sowings of well-filled seed made at the rate of 2-4 lb. per acre have in the past produced good stands.

The usual method of propagation is by vegetative material consisting of either stem cuttings or root sections. Each cutting should have two or three joints or nodes where primary rooting occurs, and at least one node should be buried in moist soil. Rooting takes place at the buried nodes and if the cuttings are planted by hoe or mattock up to 6 ft. apart each way, a good ground cover of runners is quickly obtained on clean land.

When planting material is plentiful and the grass is being established on arable land, the cuttings should be planted in furrows during ploughing. Each row of cuttings is then covered by the succeeding furrow slice. Spacing of the cuttings along the furrows and the distance between the planted furrows will be governed by the amount of planting material which is available.

In some areas broadcasting of chaffed stems over the surface of the ground, followed by disc harrowing and/or rolling, has led to success.

Competition from weeds may hinder the early establishment of this grass, and plantings should be made, if possible, on clean, well-prepared ground.

While the methods previously outlined are highly successful in establishing para grass, they are expensive and time-consuming, particularly when applied to big areas. A new method now being tested in North Queensland shows considerable promise for the rapid planting of large tracts of open country without incurring the expense of normal land preparation.

The method requires the use of a bulldozer, in which the blade is replaced by a large wooden platform. This platform is capable of holding two men, in addition to a ton of grass runners. In front of each dozer track there is a hole in the platform through which the runners can be fed onto the ground. As the bulldozer is driven across the paddock the two assistants feed the planting material through the holes in front of the advancing tracks of the tractor.

If the operation is carried out while the soil is thoroughly wet, the tussocky native grasses are considerably disturbed by the cleats on the dozer

Plate 3.

An Irrigated Pasture of Para Grass and Centro at the Ayr Regional Experiment Station, on the Burdekin. Such pastures have an excellent carrying capacity.

Plate 4.

Para Grass in the Vicinity of Brisbane, Showing the Excellent Growth obtained under Favourable Conditions in the Subtropics.

tracks, and the para grass runners are thoroughly compressed into moist soil.

The best time to plant, whether by mechanical methods or by hand, is during the spring or summer, but it is entirely dependent on the moisture in the soil and the prospects of seasonal rains. Swamp areas or tea-tree flats may be sown immediately after winter so that establishment may be obtained prior to flooding or inundation during the wet season.

In Queensland, para grass as usually planted quickly establishes itself as a pure stand and effectively suppresses other pasture species, including most legumes. However, at Gatton Irrigation Research Station an excellent pasture comprising para grass and strawberry clover has been grown successfully for some years. Work at the Bureau of Tropical Agriculture at South Johnstone has demonstrated the value of a mixed pasture consisting of para grass and centro. At the Ayr Regional Experiment Station the same mixture has shown much promise under irrigation.

Management.

Under normal conditions para grass will not stand heavy or continuous grazing, and careful stocking management is necessary. With new plantings care should be taken to see that the vigorous runners secure a firm foothold before the stand is grazed. Early grazing of a new pasture results in destruction and pulling out of runners. With a new stand it is desirable to allow 12 months to elapse before grazing is undertaken. This is advocated so that the area can be disced or lightly ploughed after the first spring and with the breaking up of the runners a very thick stand will result in the second summer.

A point to remember is that para grass must be regarded as a *browse* grass. Cattle when placed in a mature stand primarily eat or browse the leaf and side-shoots, and leave the coarse main stems. However, if concentrated stocking is carried out, stems are destroyed to the crown or rootstocks and very slow recovery results.

On farms where only small patches of the grass exist in mixtures, the usual practice is to cut the grass with a hook or scythe, and feed it to cattle in a green or chaffed state. This method of feeding is extremely useful where labour is available for such cutting and handling.

Paddock management and grazing routines as recommended for all pasture grasses can be undertaken with advantage on any para grass pasture. Grazings or cuttings should be regulated in such a way that the feed is used before it becomes too coarse and stemmy.

Pastures of para grass can withstand heavy grazing while soil moisture remains high. For that reason it is possible to stock swampy areas planted with the grass more heavily than otherwise.

On the well-drained, red volcanic soils which do not retain moisture well, prolific growth may occur during the summer wet season and a high rate of stocking can be adopted. However, in the late winter, spring and early summer months, growth is much slower and the pasture has to be grazed at a much lighter rate if it is not to be badly damaged. Overgrazing at this time may lead to heavy invasion by other grasses or weeds in the following summer season. Continuance of such poor management will eliminate the para grass.

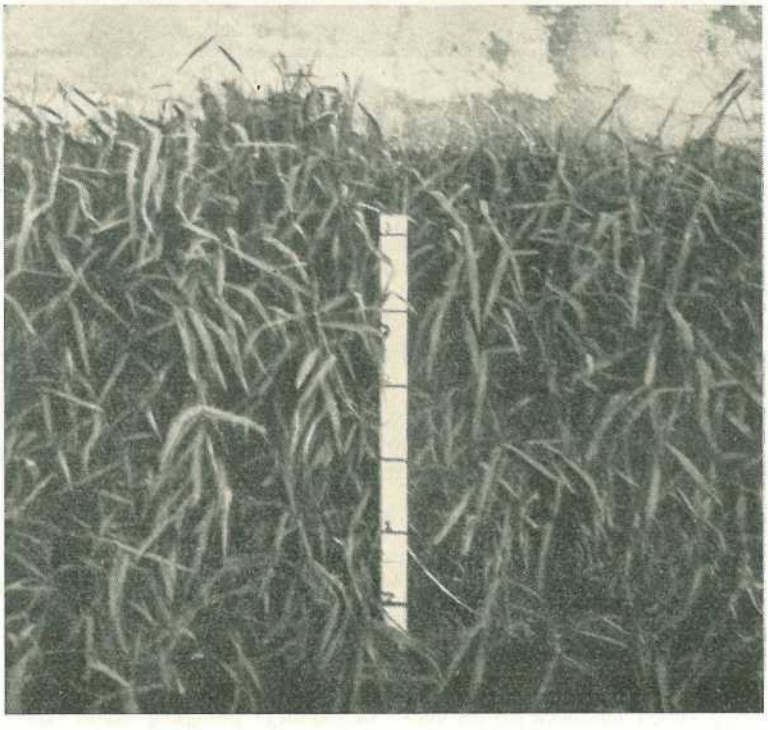


Plate 5.

Para Grass near Brisbane. Such young, leafy growth makes a highly nutritious pasture.

Plate 6.
Stock Grazing on Para Grass near Rockhampton.

In the early years of establishment on a scrub burn in North Queensland, para grass can be comfortably stocked at a beast to two acres. Later on, a stocking rate of a beast to three or four acres should not be exceeded.

At the Bureau of Tropical Agriculture, a stocking rate of one beast to an acre and a quarter has been maintained on lowland country for several years. On hillsides, however, where soil moisture is held less easily, it is possible that about one beast to two acres or even three acres is the maximum stocking rate even in a high rainfall area such as the Innisfail district represents.

Under irrigation a stocking rate of at least one beast per acre can be confidently anticipated.

Conservation.

Para grass should be quite suitable for ensilage purposes but there has been little experience of this in Queensland. It will also make an excellent hay of high palatability suitable for chaffing. Some difficulty is experienced in drying out the rather thick stems during the wet season period. If required for hay the drier autumn months of April-May should be selected for cutting and curing. If the windrows are thick, frequent turning may be necessary to prevent moulding.

Feeding Value.

The palatability of the young growth of para grass to all classes of stock is high, and its feeding value is good. The older growth is dry and woody with a corresponding reduction in feeding value.

A study of the seasonal changes in the chemical composition of para grass and other tropical grasses has been carried out at the Bureau of Tropical Agriculture at South Johnstone in

TABLE 1.

CHEMICAL COMPOSITION OF TROPICAL PASTURE SPECIES EXPRESSED AS A PERCENTAGE OF WATER-FREE MATERIAL.

Species.	Season.	Crude Protein.	Crude Fat.	Carbo-hydrate.	Crude Fibre.	Ash.	CaO.	P_2O_5.
		%	%	%	%	%	%	%
Para grass	Wet	18·6	2·0	49·6	33·0	18·8	1·488	·917
	Pre-wet	9·9	1·4	40·5	28·2	6·8	0·341	·388
Molasses grass	Wet	14·9	2·6	52·5	35·1	10·1	0·513	·940
	Pre-wet	8·4	1·3	45·4	29·3	6·2	0·315	·415
Guinea grass	Wet	16·2	1·7	46·9	36·4	15·6	1·000	·644
	Pre-wet	6·8	1·0	41·7	32·0	7·4	0·413	·276

North Queensland, and the following conclusions were reached:

"Para grass pasture may be regarded as having an adequate protein content throughout the year. Similarly, molasses grass, which has a crude protein content of 10-11% throughout the year, may be accepted as satisfactory as a supplier of protein. In both cases the protein levels are highest during the late wet season (February-March) and lowest during the pre-wet season (December-January). Moreover the fibre content of these two grasses is not high, so that provided the stock always have access to succulent leaf, the intake of the growth and energy producing constituents should be adequate." (See Table 1.)

Topdressing and Fertilizer Requirements.

In the past, most para grass paddocks were established in moist tropical areas where soil fertility conditions were satisfactory. With the establishment of para grass on low swampy or tea-tree areas it has now become advisable to use complete fertilizers incorporating nitrogen, phosphorus and potash. Para is a heavy feeder on soil nitrates, and unless suitable legumes can be incorporated in the stand, regular applications of nitrogenous fertilizers will be necessary to maintain colour and growth. Being a surface feeder, its response to sulphate of ammonia is rapid and of reasonable duration.

Undesirable Features.

Along irrigation or drainage channels, para grass may become troublesome by impeding the flow of water, but this feature has been of little importance to date in Queensland.

Some trouble has been experienced on rich alluvial cultivations from infestation with para grass. With high soil fertility and good soil moisture, para grass will spread quickly, and many headlands in sugar-cane growing areas, especially in North Queensland, soon become a tangled mass of this grass. The position is aggravated in high rainfall areas where badly drained patches become infested with the grass. In these circumstances it is difficult to cultivate in order to control the grass and the patches remain as sources of reinfestation.

The use of weedicides such as sodium chlorate and diesel fuel may be necessary to help control such growth, as it may be impracticable to employ heavy stocking or grazing techniques.

Pests and Diseases.

Para grass is comparatively free of serious pests and diseases, though of recent years this grass, along with other summer pasture species, has been attacked by pasture caterpillars.

Coccid bug attack associated with sooty mould has been recorded as being responsible for damage to the young leafy shoots.

PLANT PROTECTION

Peanut Diseases.

By R. B. MORWOOD (formerly Senior Pathologist, Science Branch).

The spectacular rise in the peanut industry in 1925-1930 was followed by a period in which disease threatened its existence. The adoption of seed treatment as a routine measure since 1937 and attention to seed selection, while not eliminating disease, have controlled it to the extent that the industry has continued to expand. The diseases and their control are discussed in the following notes.

CROWN ROT AND PRE-EMERGENCE ROT.

The most serious disease in Queensland is crown rot (Plate 1). It is usually first noticed as a wilting of young plants but it may affect plants at any stage of maturity. Affected plants have the main stalk rotted at or just below ground level. The rotted tissues are usually dry and shredded but this depends on weather conditions

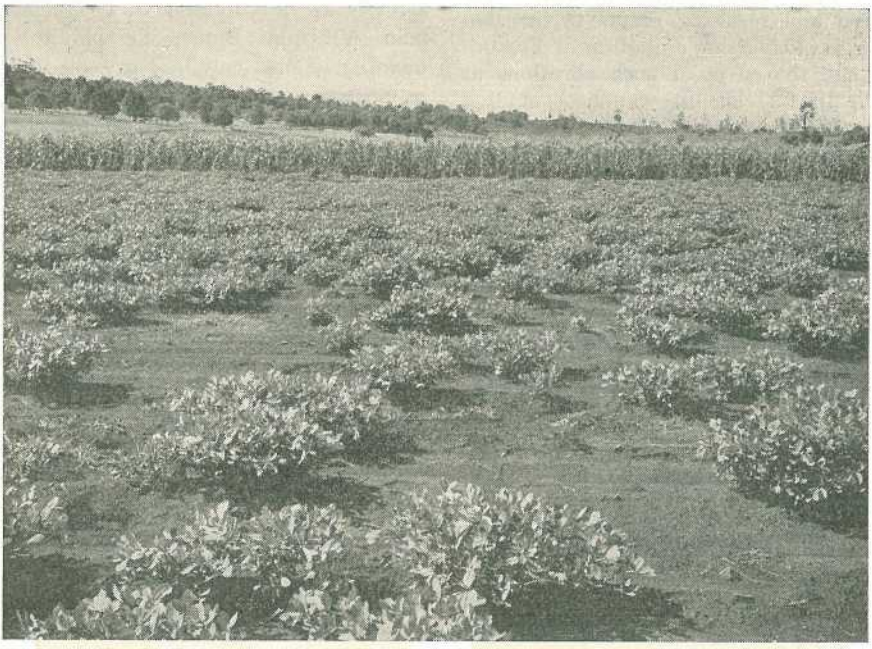


Plate 1.

Crown Rot. A peanut crop in which the stand has been thinned out by the disease.

and secondary organisms. Dark masses of the spores of the fungus (*Aspergillus niger*) causing the disease can be seen on the surface of the affected portions. Invasion is frequently from the seed-leaves, and the region of attachment of these leaves is the commonest site of stem infection. Plants affected in the later stages may maintain a precarious existence by the development of adventitious roots and under good conditions may even produce some crop, but usually affected plants soon succumb to the disease.

Rotting of peanut seed in the ground is associated with crown rot and may be caused by the same organism. In addition, other fungi are involved and the commonest cause of pre-emergence rot is now believed to be a common mould (*Rhizopus arrhizus*).

The conditions which favour the development of pre-emergence rot and crown rot are the same. One of the factors is injury to the seed coat such as normally occurs during machine shelling. Such injuries predispose the seed and resulting plants to invasion by the damaging organisms. Fortunately, the effect of such abrasions at the time of shelling can be countered by the use of a fungicidal dust at a fraction of the cost of alternatives such as hand shelling or the use of whole nuts for seed. The latter practice is viewed with disfavour also because it possesses certain undesirable agronomic features.

The conditions under which the crop is sown have a marked effect on the development of this trouble. Thus, when the same seed is used the disease is much more serious in old cultivations than in land which has been just broken up from grass.

Control.

The same control measures are used for both crown rot and pre-emergence rot.

Excessive injury in shelling should be avoided and the kernels should be treated with an organic mercury dust as a further protection against infection (Plate 2). Both Ceresan and Agrosan applied at the rate of 1 oz. to 20 lb. of seed have given good results on the Virginia Bunch variety, but on Red Spanish kernels—which actually are less in need of treatment than Virginia Bunch kernels—this quantity of dust may lead to some loss in germination, and the rate of application accordingly should be reduced to 1 oz. to 40 lb. of seed.

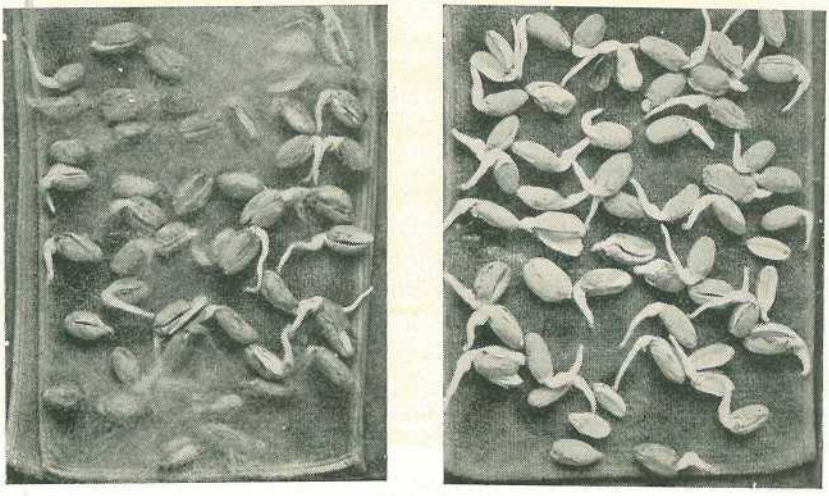


Plate 2.

Effect of a Mercurial Dust on Peanut Germination. Treated seed on right.

In Queensland, both the shelling and the treatment of the seed for planting are carried out by the Peanut Marketing Board and the principal direct control measure is therefore applied without effort on the part of the grower.

The grower, however, is responsible for sowing the kernels and he should see that they are planted on new cultivation or on land which has not grown peanuts for some years. It should hardly be necessary to add that a rotation of crops is a highly desirable practice quite apart from its influence on disease control.

WILT.

Mature peanut crops usually contain a small, but variable, percentage of wilted plants, the wilting of the foliage being due to one or other of a number of causes. For example, it may be a symptom of a definite wilt disease affecting the water-conducting tissue of the stem; but crown rot, as mentioned above, can cause wilting, as also can insect injury to the roots.

The wilt disease proper can be identified by pulling up and examining a typically affected plant. The underground portions of such a plant appear sound externally, but on cutting the stem it will be found to contain a number of brown streaks. These streaks are due to the presence of a fungus (*Fusarium* sp. or *Verticillium* sp.) which has entered the roots of the plant and penetrated the water-conducting tissues of both the roots and the stem.

Wilt seldom reaches serious proportions and can usually be held in check by adequate attention to the rotation of crops.

LEAF SPOT.

Peanut crops invariably are affected by a leaf spot characterised by the presence of somewhat circular brown spots on the older leaves of affected plants. The spots carry the spores of the causal fungi (*Cercospora personata* and *C. arachidicola*), but these are so small as to be indistinguishable by the eye.

Leaf spot generally affects the crop when it is ripening off, at which stage it is not considered to have any appreciable adverse influence on the productiveness of the plants or on the quality of the nuts. The presence of the fungus may even be advantageous in that it assists in the drying off and subsequent curing of the crop. Adverse effects may occur when the disease appears somewhat earlier than usual, but this is only likely to occur when conditions are specially suited to the development of the fungus.

If control measures are necessary, 3-5 applications of a copper-sulphur dust at intervals of 7-10 days, commencing at flowering, should give adequate protection.

VIRUS DISEASES.

The most serious virus disease of peanuts (rosette) has not been recorded in Queensland. However, several other diseases which are present in this State are considered, because of their general behaviour, to be virus diseases and are known respectively as chlorosis, bunchy plant, and leaf curl.

Rosette-affected plants either bear tufts of small curled leaves at the ends of the branches, or the whole plant may be reduced to a tuft of such leaves; a yellow discolouration also develops either uniformly over the leaves or on irregular areas, and thus imparts a mosaic-like pattern to the foliage.

In the case of chlorosis, the leaflets are puckered and yellowing occurs in irregular blotches or concentric rings; there is also a considerable withering of the yellow areas in the later stages of this disease and an affected plant is decidedly dwarfed in stature. The symptoms suggest that the virus concerned is tomato spotted wilt.

The chief symptoms of bunchy plant are a reduction in the size of the leaves, a shortening of the internodes, and an extensive development of axillary buds. The floral parts of plants affected by this disease are green and proliferated, and though there is no mottling the whole plant may be a somewhat lighter green than is normal. This behaviour is typical of the big bud virus.

Plants affected by leaf curl have their leaflets thickened, brittle, fleshy and curled backward, and elongated light-green streaks appear on the foliage.

No definite information is available regarding the nature and behaviour of these three diseases. Chlorosis and bunchy plant are widespread in their incidence but they do not affect any large proportion of a crop. No specific control measures have been developed.

GENERAL CONSIDERATIONS.

To grow peanuts reasonably free from disease, crop rotation is a prime necessity. Selected seed properly stored and correctly treated is also highly important. After planting, high cultural standards are very desirable, but nothing further is usually warranted for the specific control of disease.

Fertilizing Citrus Trees.

By A. A. ROSS, Horticulturist.

Fertilizers are used to supplement plant food reserves in the soil and are needed, therefore, when these reserves are insufficient for normal plant growth.

In permanent crops, such as citrus, the fertilizer requirement varies according to the season and the age of the trees. During early spring, for example, a plentiful supply of available nitrogen is necessary. Further, the usual summer fruit drop which occurs in Queensland citrus orchards in November and December is greatest in a nitrogen deficient soil. Vigorous, healthy trees, well supplied with nutrients, set relatively large crops and the fruit develops better even under adverse conditions than on trees supplied with adequate amounts.

Organic Matter.

Bulky organic materials such as green manure crops, farmyard manure or mulch, when applied to a soil, produce a temporary reduction in available nitrates, a phenomenon which is associated with the normal process of decomposition.

As decomposition proceeds, the complex forms of nitrogen contained in such material are converted through the action of soil microorganisms into nitrates, the only form in which nitrogen can be absorbed by citrus trees. Thus, the best time to apply organic materials is in late autumn or early winter when the soil is still sufficiently warm for decomposition to proceed fairly rapidly and the nitrate requirement of the tree is low.

Major Elements.

Major elements which play an important part in plant nutrition are nitrogen, phosphorus and potassium, and the better known fertilizers usually contain salts of these elements in various proportions. In Queensland, the formula of a mixed fertilizer indicates the percentages of nitrogen, phosphoric acid and potash in it and these are always expressed in that order. Thus a 10:8:7 mixture contains 10% nitrogen, 8% phosphoric acid and 7% potash.

Nitrogen in the form of nitrate moves through the soil comparatively freely and the best time for the application of soluble nitrogenous fertilizers varies according to soil type and rainfall.

In the sandy soils which are commonly used for citrus culture, nitrates are readily leached below the root zone

of the trees and it is therefore necessary to make several applications of nitrogenous fertilizer during the year. One such dressing should always follow the normal wet season. However, in heavy soils such as clay loams, no advantage is gained by splitting the annual nitrogen ration and a single dressing is usually effective.

In Queensland citrus orchards, the last application of fertilizer for the season, or the single annual dressing, as the case may be, should also be timed with respect to the variety. Early-maturing varieties require their final application earlier than late varieties if it is to have its full effect on the developing crop. This means that in the early varieties, such as Washington Navel oranges, the late-summer dressing is applied before the end of February, whereas in Valencia Late and other late varieties it is delayed until early April.

Phosphate and potash are not readily leached through even sandy soils, and in clay loams difficulty is sometimes experienced in getting phosphates down into the root zone. In many orchards, it is preferable to apply fertilizers containing these nutrients in one main dressing and then cultivate or irrigate immediately. Usually phosphate and potash are applied along with nitrogen in a mixed fertilizer.

Fertilizing Programme for Queensland Orchards.

The following fertilizing programme is suitable for most citrus orchards in Queensland:—

Late Winter (July).—An 8:10:8 or similar mixture at the rate of 1 lb. per tree per year of age with a maximum of 10 lb. (that is, a six-year-old tree would receive 6 lb. and a 15-year-old tree 10 lb.).

Early Summer.—Sulphate of ammonia or other straight nitrogen fertilizer containing about 15-20% nitrogen at the rate of ½ lb. per tree per year of age with a maximum of 5 lb.

Late Summer (following heavy rains.—A 10:8:7 or similar mixture at the rate of ½ lb. per tree per year of age with a maximum of 5 lb.

In sandy soils, especially during seasons of unusually frequent rainfall, it is an advantage to split the early summer dressing, applying one part in November and the other in December.

Liming.

Materials such as agricultural lime (calcium carbonate) or dolomite (a compound of calcium and magnesium carbonates) are not normally classed as fertilizers. Their main use is to neutralise soil acidity. They are plant foods nevertheless and the time of their application should be co-ordinated with the fertilizing programme.

The regular use of certain types of fertilizers such as sulphate of ammonia tends to acidify the soil and this induced acidity frequently has to be corrected by the use of liming materials. Soil acidity is determined by chemical analysis and is indicated by reference to what is known as the pH scale. Readings below 7 on this scale register acidity while readings above 7 indicate alkaline conditions; a pH of 7 is therefore the neutral point.

Citrus trees thrive best in a soil with a pH between 6.0 and 6.5, which is slightly acid in reaction. Chemical tests indicate the necessity or otherwise for treatment as well as the quantity and type of material required. In the case of trees exhibiting the typical leaf symptoms of magnesium deficiency, or where soil analysis reveals a shortage of magnesium, dolomite is the most suitable material to use.

Since the acidifying effect of fertilizer does not extend laterally in the soil, liming materials should be placed in the same area as are the fertilizers used in the orchard. In young orchards, where fertilizers are applied only a short distance from the trunk, most of the liming material is broadcast within a few feet of the tree.

Fertilizers containing ammonium salts cannot be mixed with, or placed close to, lime or dolomite without some loss of nitrogen. They should therefore be cultivated into the soil at least one month before ammonium sulphate is applied either alone or in a mixed fertilizer. A September application of lime therefore fits in well with the normal fertilizing programme.

Methods of Application.

Fertilizer should be applied only to soil containing functioning roots, and the zone of application therefore extends outwards from the trunk as the tree becomes older. In mature orchards, the roots of the trees occupy the whole available space and the fertilizer is evenly distributed between the trees. For this purpose, a mechanical spreader is desirable. In younger orchards the roots extend well beyond the "drip" of the tree, and as a general rule fertilizer is spread over an area extending from about a foot from the trunk out to a distance equivalent to twice the "drip."

Mechanical spreaders save a great deal of time, and when properly adjusted give a more even distribution of the fertilizer than is possible by hand. In a large orchard, they are essential. There are two general types available—direct drop and spinning; each has its particular advantages and the type used will depend on the requirements of the individual orchard.

The fertilizer should be evenly distributed. A concentration of fertilizer (for example, in a narrow band near the roots) may be injurious and can in extreme cases kill the tree.

In furrow-irrigated orchards, the fertilizer should be placed in the bottom of the furrow so that it will be dissolved by the irrigation water and carried into the soil. If it is placed on the ridges between the furrows, absorption is, at best, slow.

Some types of nitrogenous fertilizer (for example, calcium cyanamide) if left on the surface of the soil for long periods lose an appreciable quantity of nitrogen. Fertilizing should therefore be followed by cultivation or irrigation, both of which incorporate the fertilizer into the soil.

Non-Tillage Systems.

In some citrus orchards where non-tillage is practised, frequent mowings are essential to keep the moisture content of the soil within the limits required by the trees. Even so, additional fertilizer is needed, more particularly during the first few years after the introduction of this method of soil management.

Usually a 25% increase in the standard rates of application for citrus will be sufficient. Since the fertilizer cannot be incorporated in the soil, it must be all water-soluble so that rain or irrigation will carry it down to the roots of the trees.

Foliage Application of Plant Nutrients.

Trace elements have been applied to citrus trees for some years in foliage sprays to correct deficiency symptoms. Another foliage spray, urea, has been introduced recently on to the Queensland market. It is an organic compound containing 46% nitrogen which can be applied in a spray at concentrations up to 10 lb. per 100 gallons without causing injury to healthy trees. At present, this material is mainly of experimental interest and details of its use in citrus orchards have yet to be determined.

The Olive.

By A. M. RICHARDSON (Adviser in Horticulture) and A. A. ROSS (Horticulturist).

The olive (*Olea europaea* fam. *Oleaceae*) is native to Asia Minor and Northern Africa. The plant is a tall, densely foliaged evergreen tree (Plate 1) which is well adapted for use in windbreaks around orchard and vegetable crops. It is not grown commercially in Queensland for oil extraction but the fruit of some varieties is pickled for home use.

The olive thrives in a wide range of climates but crops best in areas which are free from extremes of heat and cold. Satisfactory yields have been obtained on the sub-coastal tablelands and in areas west of the Dividing Range.

The plant requires a well-drained loam or sandy loam of reasonable depth. Sandy soils are less suitable than loams or sandy loams because of their limited water-holding capacity, while heavier soils are frequently poorly drained and conducive to root rots. The olive has a relatively high lime requirement and therefore should not be planted on very acid soils.

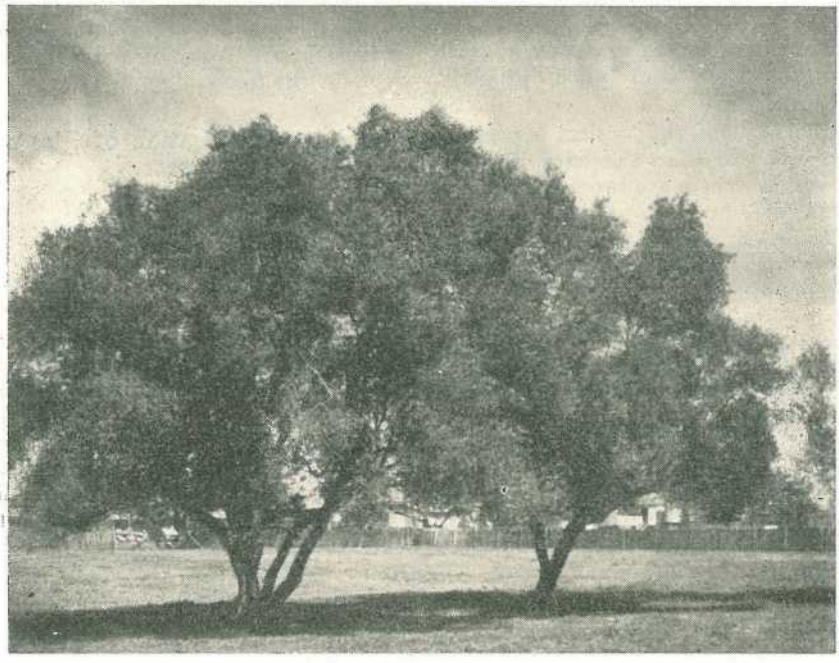


Plate 1.
Olive Trees.

VARIETIES.

In Queensland, the most attractive variety is Hardy's Mammoth, a vigorous tree which bears excellent crops of good pickling olives on the Darling Downs. Others of local interest are Corregiolla, Mission, Nevadillo Blanco, Manzanilla and Sevillano.

TREE MANAGEMENT.

Olives may be propagated from seeds, cuttings, suckers, root cuttings, stool beds and layers.

Where the trees are to be grown primarily for the fruit, they should be propagated by budding or grafting on seedling stocks raised from selected mother trees of known performance. The grove will then be characterised by reasonable uniformity in tree type, early bearing habits and vigour.

If only a limited number of trees are to be established and these are required for ornamental or windbreak purposes, it may be simpler to propagate the trees from truncheons or cuttings. Truncheons—1-1½ ft. lengths of mature wood about two inches thick—are set out in winter or early spring, the beds being well watered. Rooting takes place at the nodes of the truncheon, and in about 12 months they can be cut into sections each with its own root system. These sections are planted out in the permanent tree positions.

Cuttings are taken from healthy shoots and should be 3-5 in. long. After removing all but the tip leaves, they are planted in sand boxes and allowed to root. They are then transferred to nursery beds for a year or so before being set out in the field.

The usual methods of land preparation and tree planting are adopted, care being taken to keep the roots continuously moist when transplanting, as they are extremely susceptible to drying. When planted in blocks, a 25–30 ft. spacing between the trees should be provided, but in windbreaks the spacing may be reduced to 15 ft. so that the trees touch each other and form a more or less continuous wall.

Early training should aim at developing an open-centred tree with a minimum number of leaders, well furnished with laterals. Pruning of mature trees is limited to the removal of dead wood.

SOIL MANAGEMENT.

Orchard management will involve cultivation to control weeds and conserve soil moisture.

Fertilizing is only necessary when the trees lack vigour or show a yellowish discoloration of the leaves. An application of a complete mixture with an 8 : 10 : 8 or similar formula may then be used at the rate of 1 lb. per tree per year of age with a maximum of 10 lb.

The olive is well adapted to withstand drought conditions, but nevertheless fruit development may be affected by a shortage of soil moisture, particularly in the top three feet of soil. In addition to the summer irrigations, olives should be watered in spring and again in autumn, whenever practicable.

HARVESTING.

The fruit may be required for pickling or oil extraction and the method of harvesting depends on the outlets available.

Fruit for pickling is picked by hand into shallow containers with a padded base to minimise the risk of bruising, taken to the packing shed and carefully packed into paper-lined cases for shipment to the treatment plant. There, they will be subjected to brining and fermentation treatments and packed in an acid brine for distribution. Olives are harvested for pickling when the mature-green colour shows a tinge of yellow.

Fruit for oil extraction is harvested when fully coloured and is dislodged from the tree with a light pole or rake and collected on hessian or canvas sheets. Waste matter is then removed by winnowing before the olives are forwarded to the extraction plant.

YIELDS.

The trees come into full bearing at from eight to 10 years of age and will produce 2,500 lb. or more of olives per acre under favourable conditions.

Stock-piling Water on the Darling Downs.

By A. E. FISHER, Information Branch.

The spectacular results already achieved from irrigated pastures in Queensland have given a stimulus to the system of stock-piling water from low-capacity bores and wells and using it as a source of supply to irrigate small, but highly productive, areas of pasture.

Stock-piling water is now assuming a vital role in altering the whole farming pattern on sections of the Darling Downs by providing an insurance against drought for livestock production, which must go hand in hand with any stable farm economy.

Since it was first settled, the Darling Downs has been essentially a dry farming area with a large measure of dependence on crops. However, it is now becoming increasingly evident that, to stabilise agriculture in this region, livestock production will have to be incorporated in the farming system. Livestock effect the stabilisation of agriculture by acting as a medium for the better economic disposal of crops and by maintaining soil fertility.

Though the utilisation of crops can often be best accomplished by feeding the surplus to stock, pasture is still the basis of successful livestock production, and irrigated pasture is a leader in the field of fodder production.

Besides providing security against the inevitable drought by supplying nutritious fodder all through the year, irrigated pastures, in common with dry-land pastures, are an effective buffer against soil erosion. The legume component, too, by building up the soil's nitrogen content, gradually but surely raises the level of fertility.

Although the Darling Downs is a dry-farming area, there are, at the same time, many places where underground water is available, though often in relatively small quantities.

A flow of 30,000 gallons an hour is considered to be a big supply and adequate for large-scale irrigation. However, where the water is in short supply or there is a slow delivery (down to 1,000 or even 750 gallons an hour) irrigation is still practicable, but it now becomes necessary to stock-pile the water before any really efficient use can be made of it.

Stock-piling is the term used to describe storing water as it is yielded by low-capacity bores or wells in reservoirs of 10,000 to 100,000 gallons capacity. Storage is effected by pumping almost continuously from the source of supply, and when a useful quantity is stock-piled, a small booster pump delivers it through the spray lines on to the patch of irrigated pasture.

Earth tanks and turkey nests, well-known and widely used for watering stock, are now being found to make effective reservoirs, though sometimes they need treatment to ensure that they will hold. Galvanised iron or concrete tanks, though more expensive to install, are often employed.

It is seldom practicable for the individual farmer to store sufficient water to irrigate a large acreage, but areas ranging from seven to 10 acres are well within the scope of a large number and are becoming increasingly common on the Darling Downs. These relatively small plots make a valuable and economically worthwhile contribution to the farm's fodder production.

Enterprising Darling Downs farmers are showing that even though the restrictions imposed by the shortage of water limit the irrigable area

to about 10 acres, these irrigated pastures will carry the stock through a lean period and maintain both the farm's carrying capacity and its production.

By sowing a carefully determined blend of summer- and winter-growing species, fodder may be produced all through the year from irrigated pastures, and when dry-land pastures on the remainder of the farm can carry the stock comfortably during a flush season, the irrigated land provides a valuable source of hay or silage as an additional standby.

In any stocking programme, the possibility of using at least portion of a crop such as wheat, oats and barley for grazing must not be overlooked. This will apply also to some of the grain, especially if markets are short or depressed and the price of grain falls too low.

Farmers will thus balance their agriculture and at the same time take advantage of that balance of agriculture to protect their farm economy.

Work already carried out by the Department of Agriculture and Stock has shown that the establishment of suitable irrigated pastures offers no great difficulty. Species already established satisfactorily in trial plots under irrigation are prairie grass, phalaris, ryegrass and cocksfoot. For legumes, lucerne, which can be used either in pure stands or as a component of a mixed sward, offers the greatest possibilities, but red and white clovers and subterranean clovers all have their place according to the locality.

Dry-land pastures can be established on most farms on land which is not being cropped. Trials by the Department of Agriculture and Stock have revealed the great potentialities offered by green panic, buffel grass and Rhodes grass, with the medics as the legume component, in the establishment of dry-land pastures. Where a shortage of water limits the area under irrigation, dry-land pastures are an invaluable source of supplementary feed.

Water Harvesting.

Even where there is no underground irrigation water available, production of irrigated pastures need not be ruled out entirely, for quite useful supplies of water can be obtained by using a method of water collection known as water harvesting. This system is based on impounding the water from wet-season rains in depressions along the farm's main drainage line.

Maximum use is made of runoff water from heavy rains by trapping them behind a series of small inexpensive earth weirs along the main drainage line. As the topmost weir overflows it fills the next one farther down the slope, and so on until all the dams are full. This series of dams is now frequently termed a "staircase" system.

The system serves two purposes—the collection of runoff water for re-use when the weather is dry, and the prevention of soil erosion and flooding.

When required, the water impounded in the weirs can be pumped onto the irrigated pasture plots with a mobile pump unit and pipelines.

The carrying capacity of irrigated pasture can safely be taken as one to 1½ cattle or 10–12 sheep per acre, but where abundant water supplies permit perennial irrigation to be practised the carrying capacity is higher. Dairying on irrigated pasture, butter production returns approximately £200 per acre per year and milk production approximately £250.

However, for most farmers the main advantage is not the year-round carrying capacity of their pastures but the extensive stocking they will stand up to during times of stress such as occur in frequent short dry spells. It is these short droughts which commonly seriously affect both stock and pastures. A few acres under irrigation can make a tremendous difference—one out of all proportion to the area watered in comparison with the total farm size.

The ability of irrigated pasture to withstand heavy stocking for a short period was demonstrated on a Darling Downs farm during the dry spring of 1953. Here a 1½-acre irrigated pasture plot, strip-grazed with the aid of an electric fence, carried 12 milking cows for 22 days before it was eaten out.

Last year, a Toowoomba district farmer, irrigating pasture from a well yielding only 500 gallons an hour, carried a dairy cow to the acre on a year-round basis, and he almost trebled his returns from dry-land farming with some cultivation.

Where ample water is available, either directly or indirectly through stock-piling or water harvesting, flood irrigation is perfectly satisfactory and is the cheapest method. With spray irrigation, however, strictest economy can be exercised in the use of water and this system may be preferable. On steep slopes, flood irrigation, except by a specialised system, is impracticable because the water runs off quickly before there is any satisfactory penetration. Here, too, a spray system may give better results.

On sandy soils, sprays ensure even water distribution, whereas water flooded onto such soils may be absorbed at the top of the border and the lower portion may receive little or none at all.

Darling Downs farmers have the choice of three types of animal production—beef, dairying and sheep (both fat lambs and wool-growing)—for incorporation in any improved system of land usage hinged on stock-piling water or water harvesting.

The actual type of animal production in a particular area will depend on the individual farm—its area, proximity to processing centres and transport all influencing the farmer's decision. But whatever type of stock is selected, the judicious use of irrigation water may well be the foundation on which a new era of farm prosperity will be built on quite large sections of the Darling Downs.

MARKETING

The Changing Market for Maize.

By E. O. BURNS, Division of Marketing.

Queensland, which produces about 60% of the Australian crop, has a vital interest in the Australian maize market.

The structure of this market has changed radically since the mid-thirties. Livestock have always been by far the largest consumers of maize as grain but now much less is being consumed in this way than in pre-war years. This is partly because other grains, principally wheat, are being fed in larger proportions, and partly because of the replacement of horses by tractors and motor vehicles. The last decade has also seen a decline in the quantities of maize used in manufacturing processes and particularly cereal foods.

On the other hand, Australia has since the war emerged as an exporter of maize, and the overseas market has partially offset the diminishing home market.

The change in market structure is illustrated by the graph in Fig. 1, which compares average distribution for the periods 1936-37/1938-39 and 1949-50/1951-52.

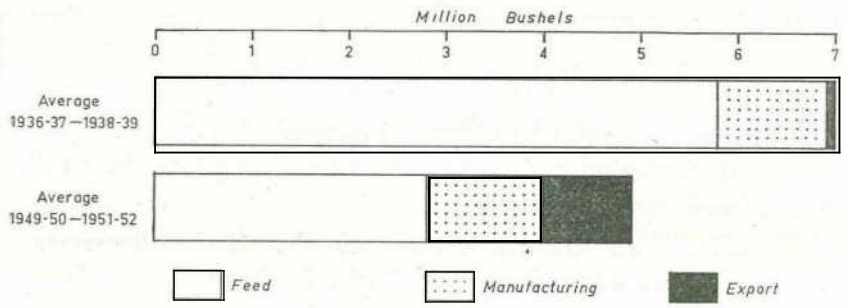


Fig. 1.

Distribution Pattern of Australian Maize, 1936/37-1938/39 and 1949/50-1951/52.

Estimated annual consumption of maize in Australia since 1936-37 is shown in Table 1.

TABLE 1.

LOCAL CONSUMPTION OF MAIZE—AUSTRALIA.

('000 bushels)

Year.	Stock Feeding (*a*).	Manufacturing.	Seed (*a*).	Total.
1936–37	6,115	1,058	80	7,253
1937–38	5,672	1,115	77	6,864
1938–39	5,623	1,077	75	6,775
1939–40	5,350	1,205	75	6,630
1940–41	7,756	1,362	74	9,192
1941–42	5,887	1,474	73	7,434
1942–43	5,254	1,567	72	6,893
1943–44	5,763	1,598	68	7,429
1944–45	5,135	1,261	62	6,458
1945–46	4,738	925	66	5,729
1946–47	4,640	1,111	56	5,807
1947–48	4,148	1,424	48	5,620
1948–49	3,762	1,252	48	5,062
1949–50	3,403	1,350*a*	42	4,795
1950–51	2,197	1,300*a*	44	3,541
1951–52	2,740	1,050*a*	40	3,830

a Estimated.

MAIZE USED FOR FEEDING STOCK.

The main usage of maize in Australia is for stock feeding as grain. The amount consumed annually in this manner cannot be exactly ascertained, but the figures shown in Table 1 have been calculated by deducting from each year's production the quantities reported to be used in manufacturing, adjusting for exports and imports and making an allowance for seed requirements.

The table reveals the striking fact that less than half the quantity of maize which was fed annually to livestock in Australia in the mid- and late-thirties is now being used for this purpose.

Pigs, poultry and horses constitute the main groups of maize feeders under Australian conditions. Pig and poultry populations have not altered very much over this period. Pig numbers are slightly less, but there are certainly more poultry, although statistics are not available. Over this period feeding habits in respect of pigs and poultry have changed to some extent. Wheat has been gradually replacing maize as the principal grain.

It is estimated that in Queensland, wheat used for stock feeding has increased from 1,039,000 bushels in 1940-41 to 4,250,000 bushels in 1952-53. Increases of similar proportions, although the quantities are smaller, have also occurred in respect of oats, barley and grain sorghum. Over the same period, it is estimated, maize consumption has fallen from 3,704,000 bushels to 1,000,000 bushels.

Very important is the decreased demand for maize for horse feeding. This was one of the principal uses of the grain in the past. Motor power has been gradually replacing the horse since immediately after the first World War. The horse population decreased from 2.5 million in 1919 to 1.8 million in 1930, but remained fairly constant during the first half of the thirties. This was a result of the economic

depression which retarded capital investment in tractors and motor transport. The trend was resumed in the mid-thirties. The number of tractors increased fourfold, from under 40,000 in 1936-37 to over 150,000 in 1952-53, and motor vehicles increased from 713,000 to 1,660,000. During this same period the horse population halved from 1,763,000 in 1936-37 to 895,000 in 1952-53. The demand for maize for horse feeding has probably declined to a greater extent than the comparative horse population figures indicate, as urban horses, which are now virtually non-existent, would have consumed more grain per head than farm horses, which depend on grazing for an important part of their feed requirements.

MAIZE USED IN MANUFACTURING PROCESSES.

It is difficult to ascertain the complete extent to which maize is used in manufacturing processes in Australia. From 1936-37 to 1948-49 inclusive, the Commonwealth Government Statistician published the figures shown in the second column of Table 1 under the heading "Grain Milling (including Cereal Foods and Starch)". Since 1949-50 only maize used in the manufacture of Cereal Foods and Starch has been shown. The last three figures in this column have accordingly been estimated.

Table 2 shows such details as are available relating to articles produced from maize in the period 1936-37 to 1948-49. These figures are not complete, as where there are less than three manufacturers of similar articles in any State the information supplied is treated as confidential.

TABLE 2.

ARTICLES MANUFACTURED FROM MAIZE—AUSTRALIA.

(Source : Commonwealth Government Statistician)

	Bran.	Breakfast Foods.	Cornflour.	Meal.
	short tons	cwt.	cwt.	cwt.
1936–37	5,139	*a*	93,341	44,677
1937–38	4,719	409,835	117,667	56,185
1938–39	4,059	*a*	112,414	50,768
1939–40	*a*	*a*	263,156	56,253
1940–41	*a*	*a*	127,600	64,696
1941–42	*a*	*a*	167,258	89,840
1942–43	*a*	*a*	156,449	65,549
1943–44	*a*	*a*	229,076	70,897
1944–45	5,607	*a*	168,462	74,747
1945–46	3,854	*a*	210,044	47,679
1946–47	3,745	*a*	254,622	178,895
1947–48	*a*	*a*	132,150	*b*
1948–49	*a*	*a*	121,046	*b*

a Not available for publication.

b Not available.

It is unfortunate that comparative statistics are not available in respect of breakfast foods. As indicated in Table 1, maize used in manufacturing showed an increasing tendency up to the mid-war years, from which position it receded to a level somewhat higher than that of the mid-thirties. As far as can be gathered from the figures, maize

bran production remained constant, whilst that of cornflour and maize meal increased to some extent. It can perhaps be deduced that breakfast foods absorbed increasingly more maize up to 1943-44 and that there has been a sharp downward trend since then.

This conjecture is supported by the only figures available since 1948-49. These indicate that the usage of maize in the manufacture of cereal foods and starch has dropped steadily, as follows:—

1949-50	1,203,918 bus.
1950-51	1,160,407 bus.
1951-52	904,302 bus.

MAIZE EXPORT.

Reference to Table 3 reveals the emergence of a new factor in the structure of the Australian maize industry—that is, entry into the international market. A fairly substantial quantity was exported in 1938-39, but this was an isolated instance. After the war, the shortage of grains on world markets resulted in overseas prices considerably in excess of local prices, which were subject to price regulation. The Commonwealth Government at first exercised control over export but this was subsequently relaxed.

TABLE 3.

AUSTRALIAN OVERSEAS TRADE IN MAIZE.

(Source : Overseas Trade Bulletins.)

Year.	Imports.	Exports.
	bus.	bus.
1936–37	7,934	1,130
1937–38	47,441	54
1938–39	54	282,017
1939–40	75,123	5,012
1940–41	61	779
1941–42	80	1,623
1942–43	9,305	1,418
1943–44	612	5,166
1944–45	4	4,682
1945–46	14	411
1946–47	389	1,468
1947–48	312	547,531
1948–49	602	126,685
1949–50	59	1,201,023
1950–51	120	1,188,960
1951–52	..	187,600

There is no longer any shortage of grains on world markets and the gap between overseas and local prices has closed. It seems probable that the export market will still be used to drain off surplus supplies from the local market, whilst more strenuous attempts will probably be made to sell maize locally. All grains are, to some extent at least, substitutes, and the margin between prices at which maize and alternative grains have been offered locally has tended to discourage local consumption of maize. This margin, which was possible only because there was an alternative more attractive market available overseas, has now been lost and there is already evidence of greater local interest in maize.

THE RECENT PRODUCTION TREND.

Whilst the market for Australian maize has been declining, so naturally has production. Table 4 shows in respect of the period since 1936-37 particulars of sowings for grain and green fodder, production of grain and average yields per acre. Particulars of sowings for green fodder are only available since 1941-42. Figures shown for prior years for green fodder and total plantings are therefore only estimates.

TABLE 4.

AREA, PRODUCTION AND YIELDS PER ACRE OF MAIZE—AUSTRALIA.

(Source : Commonwealth Government Statistician.)

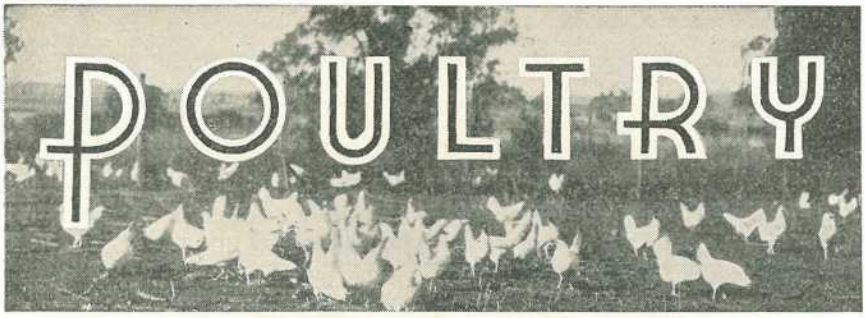
—	Area.			Production.	Yield per Acre.
	Grain.	Green Fodder.	Total.		
	acres.	acres.	acres.	bus.	bus.
1936–37 ..	317,710	82,000(*a*)	400,000(*a*)	7,246,383	22·81
1937–38 ..	320,207	65,000(*a*)	385,000(*a*)	6,816,612	21·29
1938–39 ..	324,146	50,000(*a*)	374,000(*a*)	7,056,642	21·77
1939–40 ..	311,812	65,000(*a*)	377,000(*a*)	6,560,065	21·04
1940–41 ..	362,871	40,000(*a*)	403,000(*a*)	9,192,744	25·33
1941–42 ..	301,360	69,602	370,962	7,436,174	24·67
1942–43 ..	284,592	79,390	363,982	6,884,953	24·19
1943–44 ..	282,681	74,975	357,656	7,432,618	26·29
1944–45 ..	256,955	83,435	340,390	6,462,987	25·15
1945–46 ..	235,729	75,058	310,787	5,729,252	24·30
1946–47 ..	259,738	72,342	332,080	5,807,632	22·36
1947–48 ..	222,748	57,061	279,809	6,168,342	27·69
1948–49 ..	181,958	56,592	238,550	5,187,625	28·51
1949–50 ..	193,591	48,053	241,644	5,995,753	30·97
1950–51 ..	169,339	42,013	211,352	4,728,820	27·93
1951–52 ..	169,540	49,736	219,276	4,017,868	23·70

a Estimated by Division of Marketing.

These figures show a steep downward trend since 1940-41 but it would not be realistic to project this trend too far into the future. Maize is a crop of such diversified economic utility that there is a point below which production and demand are most unlikely to fall. It may be that the decline has been halted. If not, it may be that production and consumption will find a new economic level within the next few seasons, or they may even increase.

One post-war development of economic importance to the maize industry is the increasing popularity of hybrid seed. Hybrid maize was first grown on a commercial scale in the 1948-49 season and since then increasing proportions have been planted each year. Hybrid varieties normally give higher average yields than open-pollinated varieties, given similar soil and growing conditions. Unit costs of production are reduced by increased yields and this is tending to make the position of maize more competitive with other grains.

The purpose of this article has been merely to illustrate the changes which have occurred in the Australian maize market since the mid-thirties. It is difficult to say to what extent reduced consumption has been dictated by a dwindling supply or to what extent the decreased production has followed a smaller demand. A satisfactory explanation could only be forthcoming after a detailed analysis of the "price-cost" structure not only of maize but of alternative grains as well.



"Crazy Chick" Disease.

By P. D. RANBY (Veterinary Officer) and A. H. OUTRIDGE (Poultry Inspector).

"Crazy chick" disease, or encephalomalacia, is a disease of chickens characterised by a severe brain disorder. This results in the production of nervous symptoms; hence the name "crazy chick."

The disease was first discovered in North America in 1931 during experiments with vitamin E deficient diets in chickens. The new disease was called nutritional encephalomalacia, which simply means a nutritional brain lack. A few years later, the disorder was found to occur in the field.

"Crazy chick" disease has been common in Queensland in recent years.

THE BRAIN DISORDER.

On exposing the brain of a "crazy chick," the changes are seen in the cerebellum—the knob at the back of the brain concerned with balance. Here the blood supply is cut off or considerably reduced, resulting in death of the tissue.

Lack of blood to the cerebellum may be demonstrated in a "crazy chick" by injecting dye into the bloodstream (See Plate 1). Soon after the injection, the brain darkens except over the cerebellum. In normal chickens, the brain becomes darkened throughout by the dye.

Under the microscope, the blood capillaries of the cerebellum contain numerous thrombi or clots. These would cut off the blood supply. Why they form is not known.

CAUSE.

The cause of "crazy chick" disease is complex and not fully understood. A number of different factors seem to play a part. Known factors associated with the disease are as follows.

(1) Vitamin E Deficiency.

The underlying cause of "crazy chick" disease is thought to be vitamin E deficiency. Experimental rations low in vitamin E will produce "crazy chicks" but the incidence is not high (for example, up to 5% affected). To obtain a high incidence of "crazy chick" disease on an experimental diet deficient in vitamin E, a certain amount of animal fat such as lard is necessary. Such a diet will produce an incidence of 30-100%. Dosing the chicks with purified vitamin E prevents the disease appearing.

These results tell us that vitamin E deficiency plays a part in the production of the disease in chickens on experimental diets. However, it must be remembered that ordinary rations fed to chickens contain a large proportion of grain products. Grain, cereal products, and wheat germ oil are good sources of vitamin E. Why "crazy chick" disease occurs on such rations is not clear, but probably

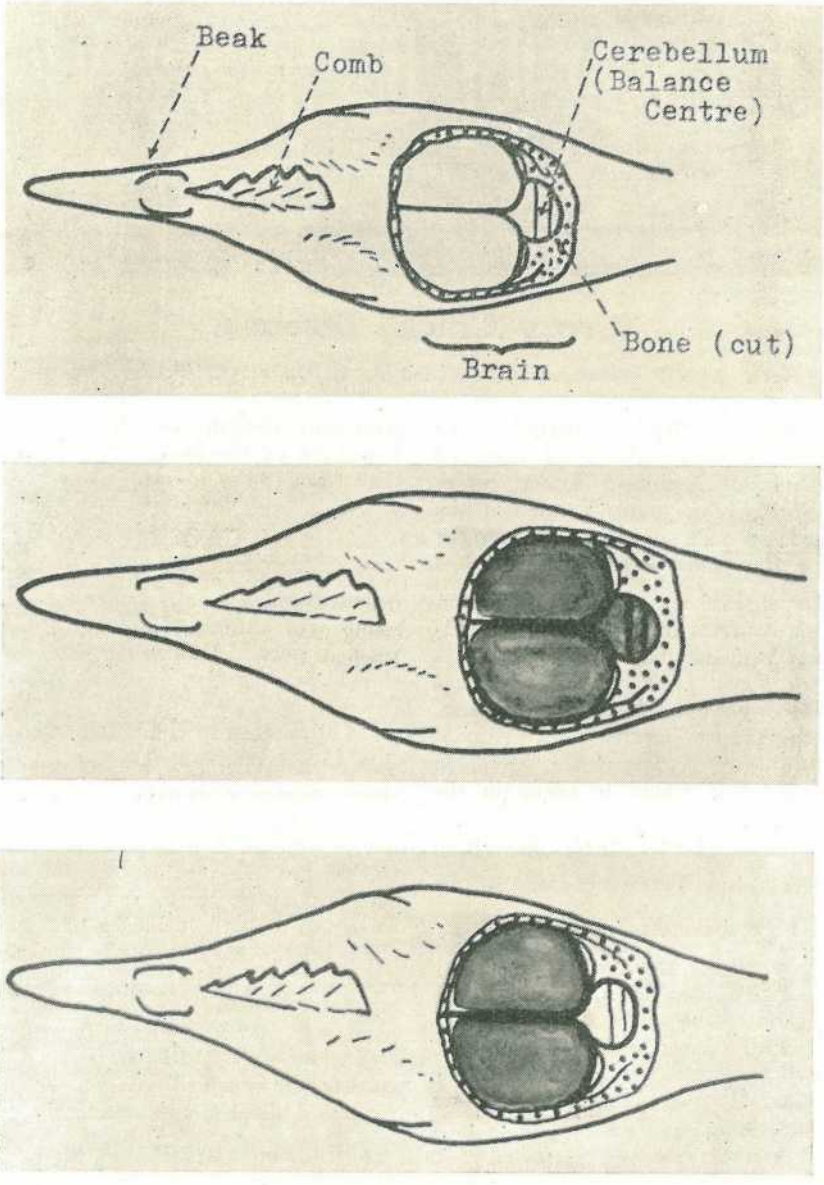


Plate 1.

Comparison of Injected Chick Brains, Showing How the Injected Dye Does Not Stain the Cerebellum of a "Crazy" Chick. Top, normal chick, not injected; middle, normal chick, dye injected; bottom, "crazy" chick, dye injected.

certain substances present in the feed destroy the vitamin E present or hinder the final utilisation of the vitamin by the chick.

(2) Fatty Acids Destroy Vitamin E.

As mentioned before, a certain amount of animal fat is necessary in a vitamin E deficient diet in order to produce a high incidence of "crazy chick" disease.

Fats consist chemically of fatty acid groups, each group linked to the next to form a chain. Such fatty acids undergo chemical changes, becoming rancid and forming substances which will destroy vitamin E.

Ordinary rations contain large amounts of vegetable oils. Rancidity changes are very slow in the fatty acids of these oils due to the presence of natural anti-oxidants. It is difficult, then, to blame the vegetable fatty acids for the trouble, but it is possible that prolonged storage of grain and grain products could be a factor in field encephalomalacia outbreaks.

(3) Do Fish Oils Play a Part?

It must be remembered that the presence of fish oils is not necessary for field outbreaks to occur. "Crazy chick" outbreaks in which no fish oils were fed have been seen in the Brisbane area by the authors. On the other hand, if fish oils are fed at a high level (for example, 5% fish oil) in an experimental diet, it has been found to cause "crazy chick" disease. Hence it has been recommended to reduce or omit fish oils from the chick ration for short periods during an outbreak.

However, fish liver oils should not cause "crazy chick" disease when fed at levels recommended for incorporation in the mash.

(4) Hereditary Influences.

It is likely that hereditary factors play a part in some field cases. The following outbreak may be cited.

A poultry breeder in Brisbane obtained a high incidence of "crazy chick" disease in two out of eight of his sire families in the spring chick season of 1952. Each sire family consisted of one cockerel and about 10 hens, with a dozen chicks being kept per hen. That is, about 120 chicks were produced from each sire. The incidence of the disorder in the two sire families was 23% and 12%, while only one or two cases occurred in the remaining sire families. It is of interest that the dams of these chickens were fed wheat germ meal, which is rich in vitamin E. The chicks themselves were not fed the wheat germ meal.

Breed differences have been found to occur overseas, the White Leghorn appearing to be more resistant to "crazy chick" disease than the heavy breeds. This, of course, has an hereditary basis.

SYMPTOMS IN A FLOCK.

The appearance of "crazy chick" in the field is quite noticeable to the farmer due to the spectacular symptoms present (Plate 2). The incidence of crazy chicks is usually only 1-5%, but occasionally is much higher.

The "crazy chick" first becomes sleepy and tends to stand with its eyes closed. Nervous symptoms then appear, and the gait becomes unsteady as paralysis develops. The chick then becomes prostrated on its side with the legs stuck out and there is a tendency for it to frequently retract its head or weave it about.

Periodic convulsions occur. During the convulsion the chick retracts its head, trembles and stiffly pushes its legs and wings outward. Sometimes the chick will "spin" with its head chasing its tail. Various other postures may be seen during the convulsion, such as the chick on its back with the legs stuck stiffly up in the air.

Death ensues in one to two days. Recovery in an obviously "crazy" chick is rare.

The disease usually affects chickens about five weeks old, the age group being three to nine weeks. This is linked with the fact that the most rapid growth of the chick brain is at this age. Perhaps the more rapidly growing brain has a greater demand for the vitamin and outstrips the supply available.

walking, these had an inco-ordinated or drunken gait. Some chickens suffered short spasms, the legs being stretched out to full extent as they lay on their side with the head weaving about.

An inspection of the flock revealed two new chickens stricken during the next 20 minutes.

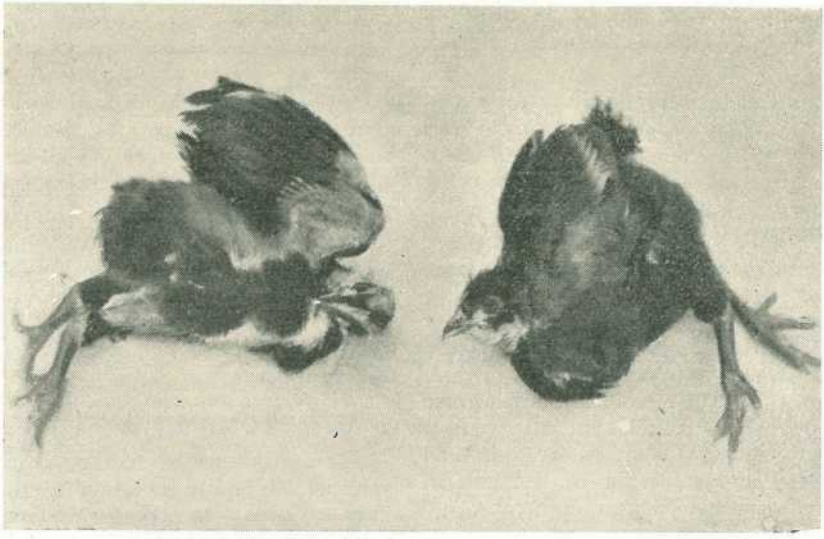


Plate 2.
"Crazy" Chicks. The chick on the left is showing a convulsive seizure.

Farmers reporting the disease claim that mainly the largest and more forward chicks in the flock are affected.

Where cockerel and pullet chicks from the same hatch are kept, "crazy chick" tends to be much more prevalent in the cockerel chicks.

The following outbreak is typical:

In September 1952 an investigation was made of losses in chickens showing nervous symptoms on a poultry farm in the Brisbane area. On this particular farm, some 1,600 Australorp chickens ranging in age from nine days to seven weeks were involved.

The owner had collected 13 chickens that were affected and had isolated them. The majority of these chicks were lying on their sides with their legs sprawled on the ground and heads retracted. A few showed twisted necks. Some were standing and looked dull and sleepy with eyes closed. When

Some chickens died suddenly, while others lingered for 24 hours before succumbing. The farmer had not noticed any recoveries in the chickens affected. Losses had mounted to 50 chickens over a period of five days. Fourteen out of 15 showed haemorrhages in the cerebellum that were visible to the naked eye.

As the younger chicks reached the age of about one month, fresh cases occurred.

SEX DIFFERENCE.

The difference in "crazy chick" incidence between cockerel and pullet chickens from the same hatch can be quite marked—so much so that the difference in growth rates is unlikely to explain it. Two outbreaks of "crazy chick" disease that were investigated in the Brisbane area in 1954 revealed an interesting sex discrimination.

Farm No. 1 reported a disturbance in 1,200 cockerel chickens of mixed breeds ranging from 5 to 8 weeks of age. Typical symptoms of "crazy chick" disease were observed and field post-mortem revealed haemorrhages in the cerebellum visible to the naked eye. The farmer commented on the fact that 1,200 sister chickens of these cockerels in the same age groups showed no signs of the disease. They received the same ration and were penned separately on another portion of the farm. Incidence and loss was 4% up to the time of the visit. The losses in the cockerel flock ceased after 8-10 days and the owner reported that the pullets still showed a "clean sheet" as regards "crazy" chicks.

Farm No. 2 reported a dozen or so chickens among some 850 cockerels aged 4 and 7 weeks as behaving in a "crazy chick" manner. A visit revealed an outbreak of "crazy chick" disease in these two groups of cockerels. A batch of pullet chicks from the same stock 5½ weeks old showed no signs of the disease at the time. They were penned between the two cockerel groups and fed similarly. The outbreak in the cockerel chicks continued for 14 days and mortality was high for this disease (10% deaths). The pullet group lost two birds which, in the opinion of the farmer, exhibited symptoms of "crazy chick" as seen in his cockerel chickens.

Other examples of this marked sex difference are sufficient to convince the authors that such a phenomenon does exist and is not uncommon.

This would suggest the possibility of genetic sex linkage as the cause of the phenomenon within an affected batch rather than difference in growth rate between cockerel and pullet chickens.

POST-MORTEM FINDINGS.

The tissue changes in "crazy chick"' disease are found in that part of the brain called the cerebellum. The substance of the cerebellum becomes oedematous (watery) and takes on a greyish discoloration due to progressive death of the involved tissue.

In about three out of four cases autopsied in the Brisbane area, small but distinct haemorrhages were seen on the cerebellum and extended throughout the substance of the cerebellum. These haemorrhages are typical of "crazy chick" disease and confirm the identity of the disorder. However, if only a small number of specimens are autopsied from an outbreak, the haemorrhages may not be seen. In such cases, the microscopic changes in the architecture of the tissue are characteristic and always present and will permit a diagnosis to be made. These microscopic changes are different from those seen in the nervous disorder "epidemic tremor."

DIAGNOSIS.

The diagnosis of encephalomalacia or "crazy chick" disease is based on symptoms, age group and post-mortem findings. The disorder must be differentiated from "epidemic tremor," rickets, and curled-toe paralysis.

Epidemic Tremor.

In the field, there may be some confusion between "epidemic tremor" and "crazy chick" disease.

Leg paralysis may be seen in both diseases, but in "epidemic tremor," the prostrated chick tends to rest on its breast and hocks, while in "crazy chick" disease it lies on its side with its legs often stuck out stiffly. This is not clear-cut, however, for different postures are seen. The chick with "epidemic tremor" totters about as if its body were too heavy for its legs and prefers to squat. In an early case of "crazy chick" disease the gait is more a drunken, swaying one.

A proportion of "epidemic tremor" chicks exhibit a peculiar intermittent tremor like a vibrating piano string when disturbed. The tremor may be so fine that it can be felt only when the chick is held in the hand. In "crazy chicks," a tremor may be seen, but it is not fine and is more like a palsy.

In "epidemic tremor" the age group generally affected is one to two weeks old, but sometimes older chickens are

also affected, in which case they may be confused with "crazy" chicks.

A fair proportion of "epidemic tremor" chicks recover. On the other hand, most "crazy chicks" die. On post-mortem examination of the brains of chickens affected with "epidemic tremor," no haemorrhages or other abnormality is seen with the naked eye. Changes in the brain tissues are seen on microscopic examination and identify the disease.

"Epidemic tremor" is caused by a virus which may be passed through the egg to the chick.

Rickets.

Chickens affected with rickets show a leg weakness similar to that in "epidemic tremor"—that is, they totter about and prefer to squat.

The chicks are bright in appearance. Their beaks are soft and "rubbery" and the bones bend easily. If a dead chick is picked up and its leg bent the bone does not snap as in a normal chick.

Rickets is found in chickens that have no access to direct sunlight and at the same time have insufficient vitamin D in the ration. Outbreaks of rickets have resulted from removing fish oils containing vitamin D from the ration in an effort to prevent "crazy chick" disease.

Curled-toe Paralysis.

The toes of chickens affected with curled-toe paralysis turn inwards and the chickens walk on their hocks. The chicks are weak and emaciated and may develop diarrhoea. The disease is due to riboflavin (vitamin B_2) deficiency.

RECOMMENDATIONS.

There is no specific treatment for "crazy chick" disease. Even if purified vitamin E were given, the mortality would be little reduced, for the brain damage is irreparable.

Usually an outbreak of the disease is of short duration in an average flock of chickens (that is, for one or two weeks). Hence, the disappearance of the disease must not be mistakenly attributed to any medicaments given.

Since the cause of "crazy chick" disease is associated with a number of factors, control measures which may appear to be successful in one outbreak may not be successful in another. In any case, there is need for more critical observations to ascertain the value of any one control measure. Where outbreaks are persistent or the incidence high, poultry farmers should contact the Department of Agriculture and Stock.

The following measures have been recommended:

(1) Change the ration by adding fresh bran for a week or obtain fresh mash supplies. The new feed may contain a higher level of vitamin E.

(2) Lower the protein content of the ration for a short period. The idea behind this measure is to slow down growth and hence brain growth during the critical period.

(3) Remove fish oils from the ration for a short period (for example, one week) and substitute succulent green feed as a vitamin A supplement. Where succulent green feed is not available, the fish oil should not be fully withdrawn from the ration or serious effects from vitamin A deficiency and rickets may result.

Where pellets are fed, fish oils are sometimes supplied in the drinking water in case the vitamin A in the pellets has deteriorated. Since the vitamin A in the pellets is supplied by fish oils, the chickens may receive a double dose, and if "crazy chick" disease occurs, fish oil should not be given in addition to the pellets.

Some poultry farmers feed wheat germ meal to chickens as a preventive of "crazy chick" disease, but the value of this is not known.

Fluorosis of Merino Sheep in Queensland.

Part 1. How the Disease is Caused.

By J. M. HARVEY (Senior Biochemist) and G. R. MOULE (Director of Sheep Husbandry).

Without the Great Artesian Basin, Queensland could carry comparatively few Merino sheep. The water it supplies so freely has been the key to the growth of our sheep industry. It has saved sheep in drought time; it has given the water which has unlocked over a hundred million acres of natural grassland.

But in the past we have often thought only in terms of the quantity of water available. In many cases we have not thought about the quality of the water even though it is well known that stock do not like water which is very salty, but often relish water which contains enough salt to be tasted.

During the last 14 years, more careful thought has been given to the quality of the water. Much of the water from artesian and sub-artesian bores contains traces of chemicals which are harmful to sheep. One of the most important of these is sodium fluoride, a salt deceptively like common salt—sodium chloride.

Sodium fluoride occurs in bore waters in such small quantities that it can be neither smelt nor tasted, but even these minute amounts can cause a disorder known as fluorosis in sheep which regularly drink this water. It must be clearly understood that sheep are not the only animals which may develop fluorosis. All domestic animals, and even man, may be affected. The teeth become abnormal. Their colour, size, shape, arrangement and structure all change. They become soft and the front teeth often pit. Sometimes the pits occur in straight lines right across the teeth; sometimes the back teeth wear unevenly. Even the front teeth may wear or chip at the line of the pitting and young sheep may look as though they are "broken mouth."

If the water which stock drink contains a comparatively large amount of sodium fluoride, the animals' bones may become abnormal. The lower jaw bones grow thick and may even be rough from bony outgrowths known as exostoses. If animals are kept on water containing a lot of fluoride their legs may become weak. Sometimes their joints are so thickened that the animals cannot swing their limbs freely.

Fluorosis of sheep was first recognised in Queensland in 1940. It was not noticed before, mainly because the mouths of the sheep were seldom

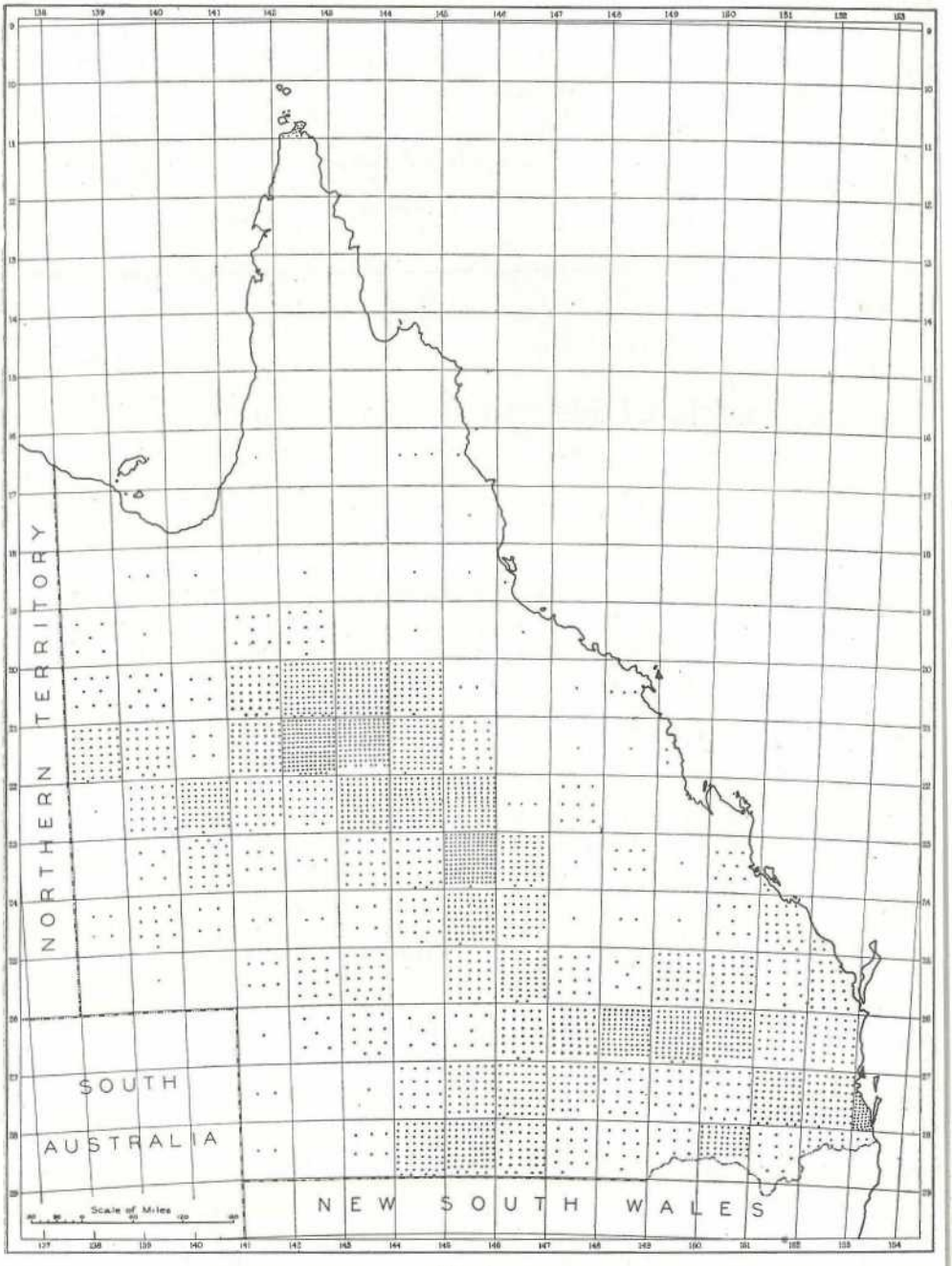


Fig. 1.

Distribution of Waters Analysed and Found to Contain Less Than 1 Part Per Million of Fluoride.

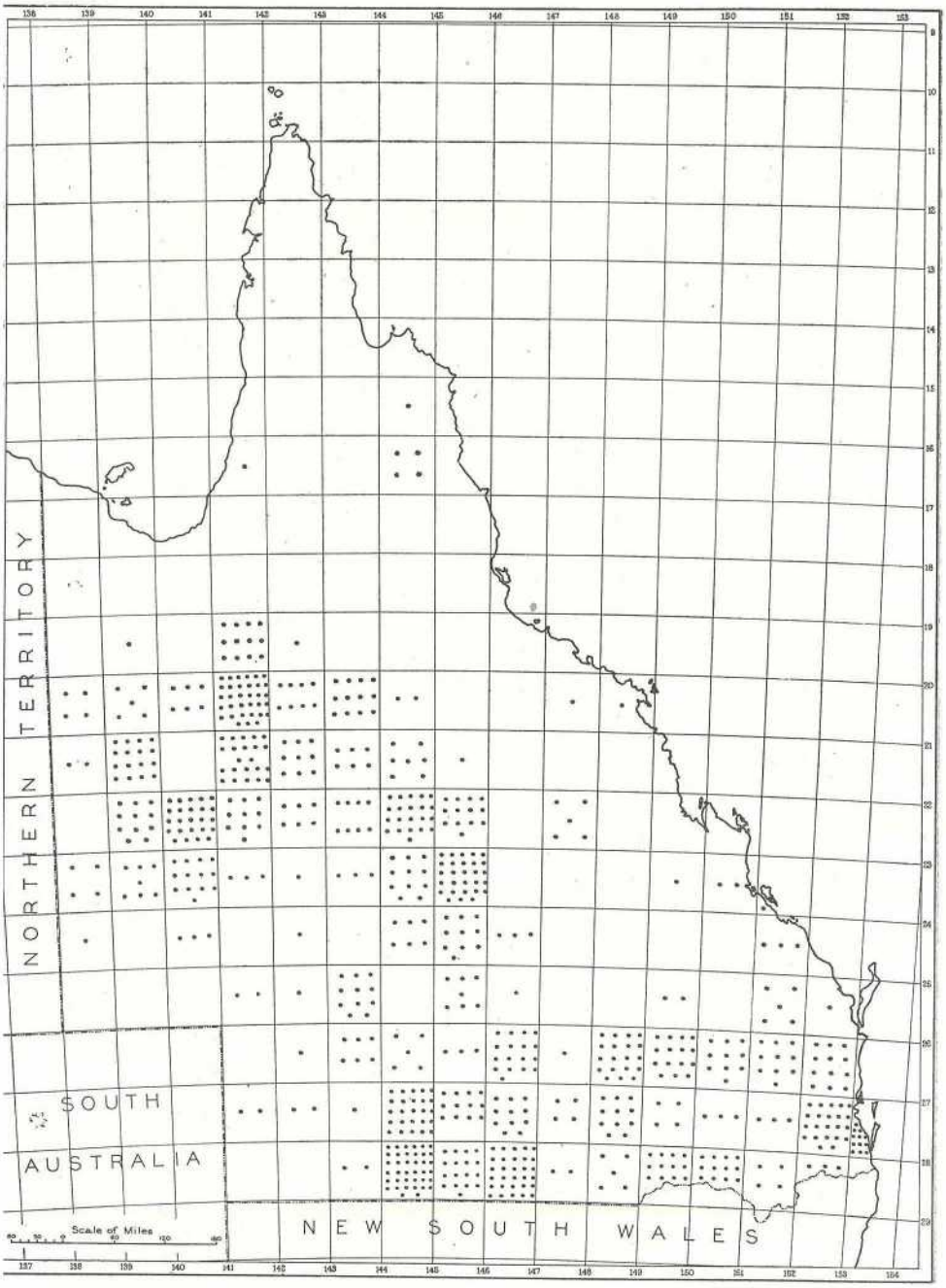


Fig. 2.

Distribution of Waters Analysed and Found to Contain 1-2 Parts Per Million of Fluoride.

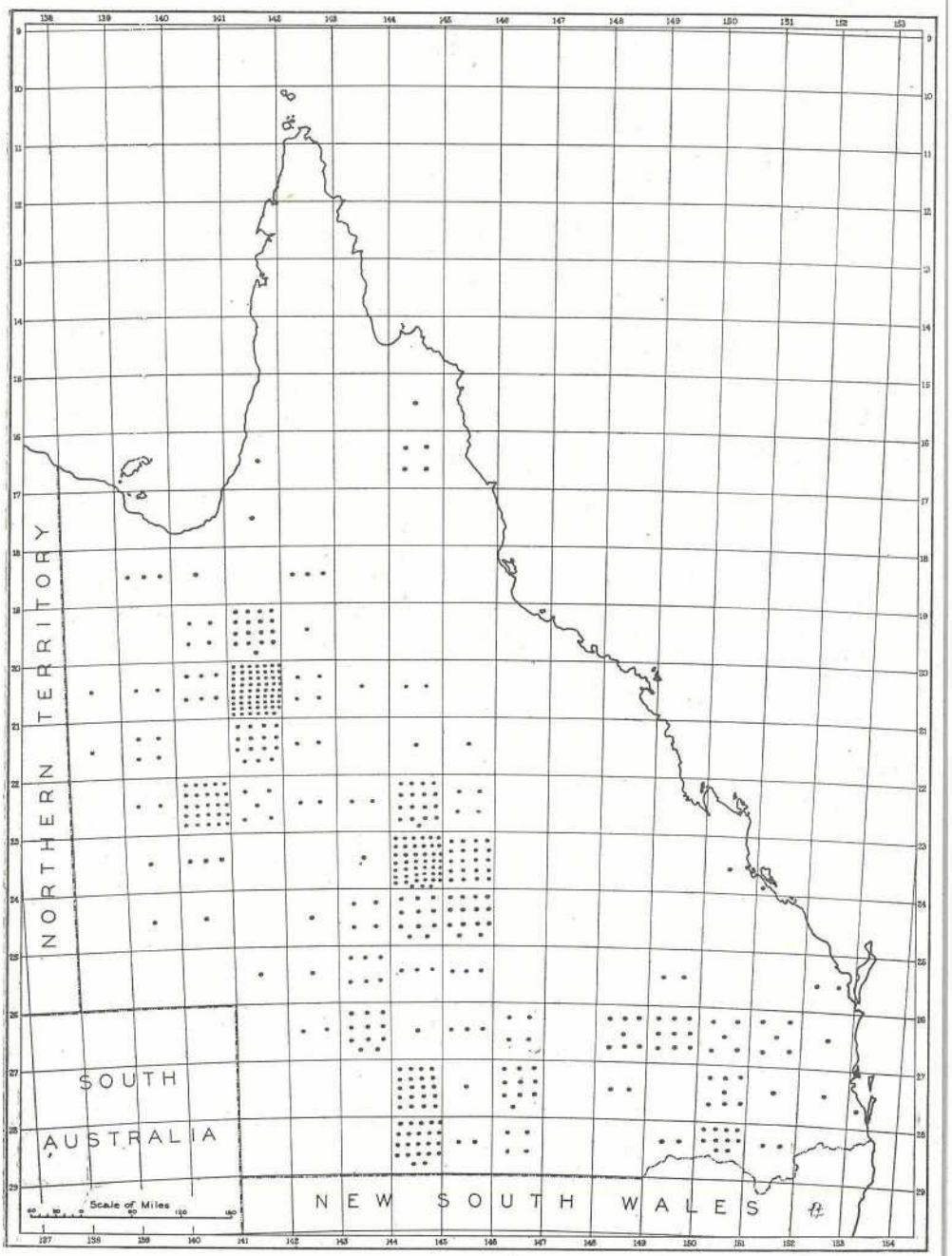


Fig. 3.

Distribution of Waters Analysed and Found to Contain 2-5 Parts Per Million of Fluoride.

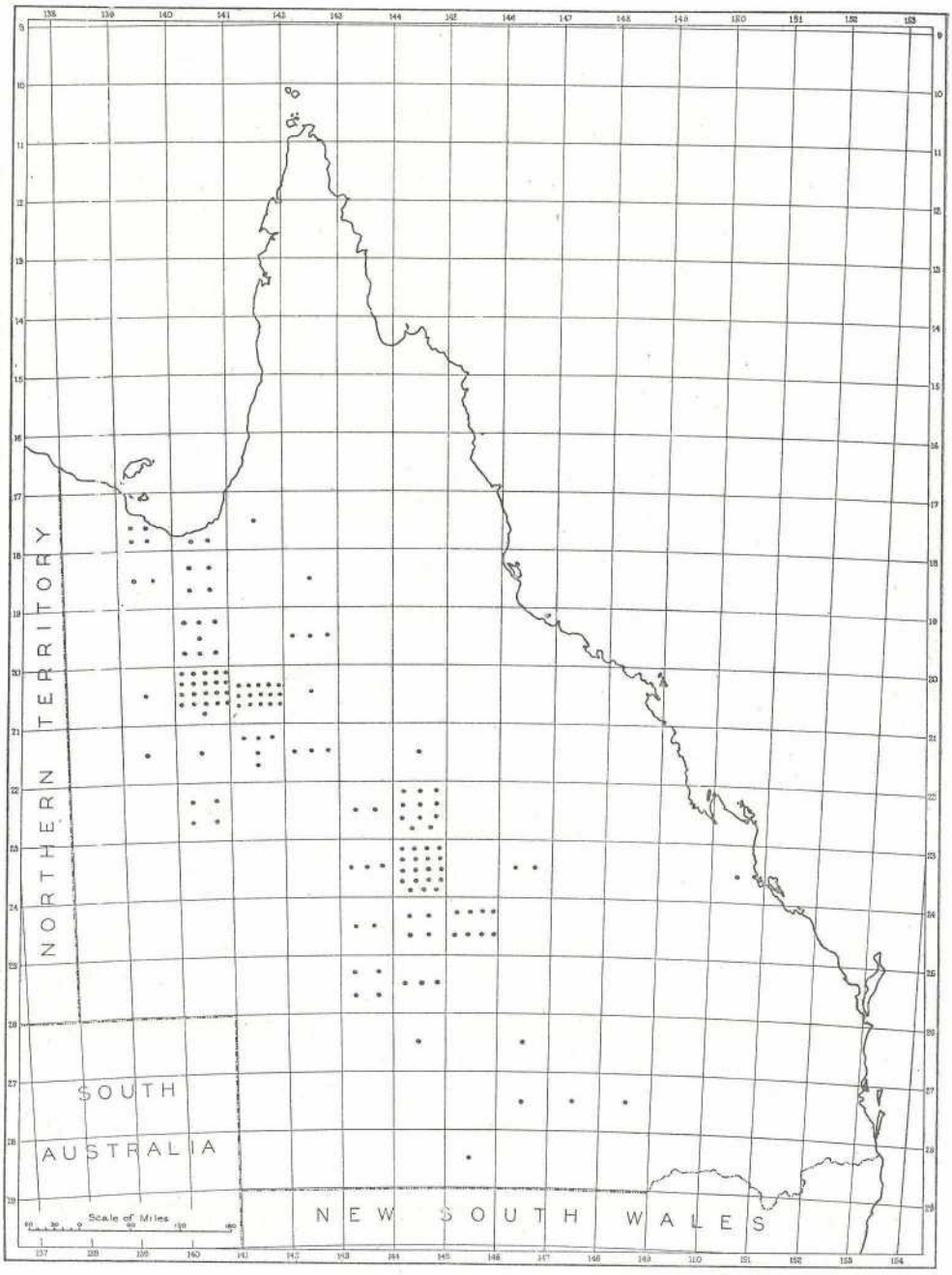


Fig. 4.

Distribution of Waters Analysed and Found to Contain 5-10 Parts Per Million of Fluoride.

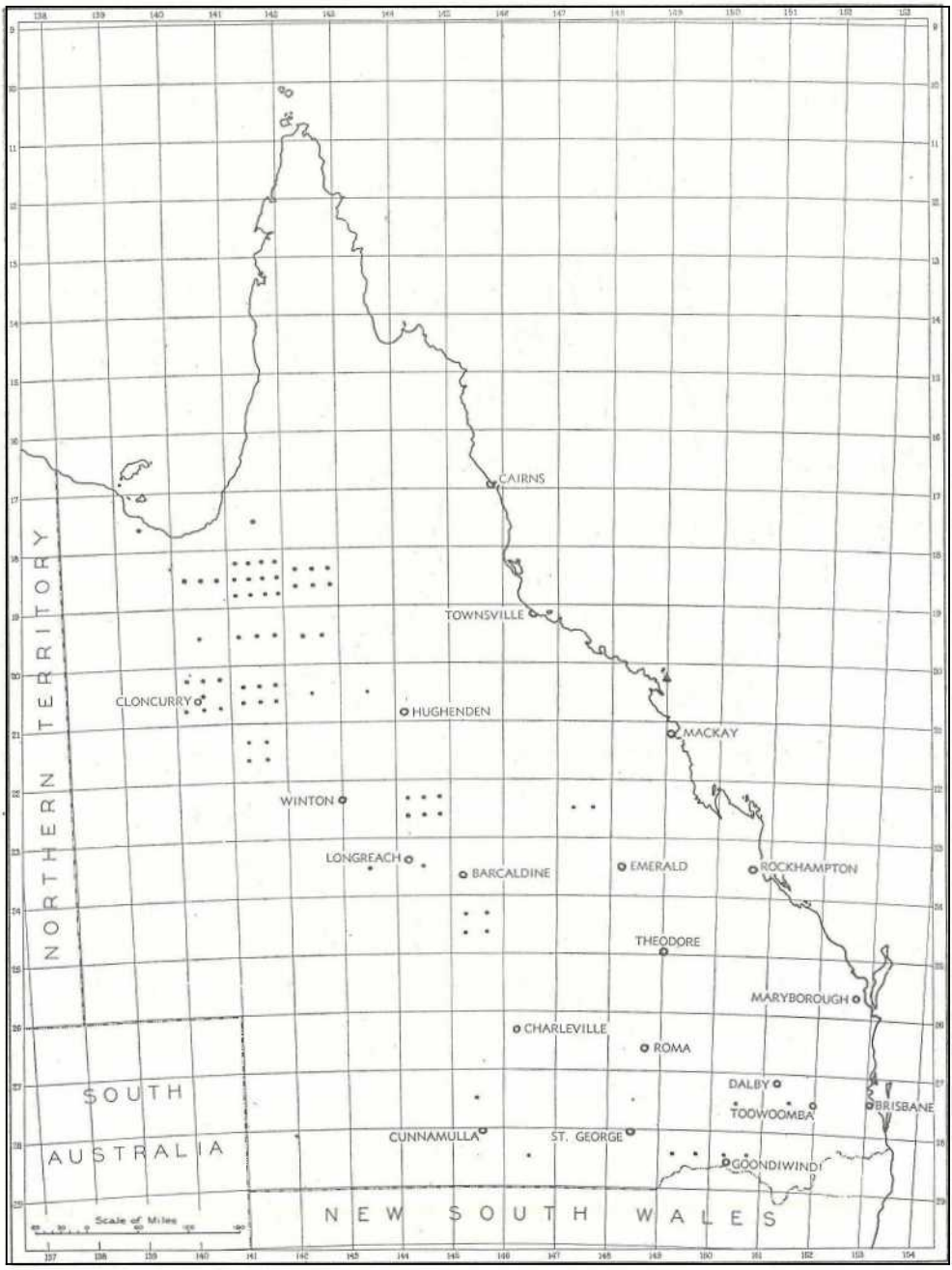


Fig. 5.

Distribution of Waters Analysed and Found to Contain More Than 10 Parts Per Million of Fluoride.

inspected. Sheep in the dry western pastoral country do not get worms, and therefore they do not need to be drenched. Lamb-marking percentages are so low on many properties where fluorosis occurs that there are very few surplus sheep for sale. Therefore the teeth of the sheep are not often looked at carefully.

As the result of closer settlement, sheep are now more likely to be kept on one bore for a long time. Large properties had big paddocks and the sheep were able to choose from several watering places. This meant they were not so likely to be kept on water containing a lot of fluoride for a long time.

INVESTIGATIONS IN QUEENSLAND.

Since 1945, detailed investigations have been made into fluorosis of sheep in Queensland. To start with, the problem was studied in the field. The areas where fluorosis occurred were mapped; water from all the bores was analysed; clinical surveys were made to see how badly affected were the sheep drinking the water containing sodium fluoride.

Later work at the Animal Health Station, Yeerongpilly, aimed at finding out if lambs could be affected before they were born if their mothers drank large quantities of water containing fluorine. It also aimed at finding practical means of control. This work will be dealt with in Parts 2 and 3 of this series of articles.

(1) The Survey of Artesian Waters.

Water from nearly all of the artesian and sub-artesian bores has now been analysed for fluoride. The distribution of these waters is shown in the maps (Figs. 1-5). Each dot represents a water sample from an area defined by 1° Lat. by 1° Long.

It will be noticed that most waters contained less than 2 parts per million of fluoride (Figs. 1 and 2). Such waters are not harmful even to young sheep, though levels in excess of 1 part per million can be harmful to children during the susceptible period when permanent teeth are being laid down. A considerable number of waters contained between 2 and 5 parts per million of fluoride (Fig. 3), a smaller number between 5 and 10 parts per million (Fig. 4) and over 70 of the waters examined had fluoride levels in excess of 10 parts per million (Fig. 5).

It is apparent from the survey that the greatest distribution of fluorided artesian water lies in the following areas:—

(1) The northern tip, near Croydon.

(2) East of Cloncurry.

(3) North-east of Longreach.

(4) South of Barcaldine.

An area west and north-west of Cunnamulla is also affected, but to a lesser extent.

This does not mean that all bore waters in these areas contain fluoride. The fluoride probably is taken out of some underground strata over which the water passes. The distribution of the rocks and the way in which the fluoride gets from the rocks into the water are not fully known. It does mean, however, that careful thought must be given before drilling new bores in areas where waters from many existing bores are known to contain sodium fluoride.

(2) Clinical Surveys.

The mouths of many sheep in areas where the bore water contains fluoride were examined. No trouble was found in the teeth of sheep drinking water containing less than 2 parts per million. Mild symptoms were found in the teeth of sheep which, from birth, always drank water containing 2 parts per million of fluoride. These were:—

(1) Larger "paper white" front teeth.

(2) Some uneven blotchy wear of the enamel on the front of the teeth.

More severe symptoms were seen in the teeth of sheep which always drank water containing 5 parts per million of fluoride. Excessive damage occurs in the front teeth and uneven wear of the back teeth occurs when sheep continuously drink water containing more than 10 parts per million.

In many cases it was not possible to relate the extent of the damage to the teeth with the amount of fluoride in the drinking water available to them. There were a number of reasons for this.

Everyone who lives in western Queensland knows the climate is very dry. As a result, water evaporates quickly. Bore drains, the dams in which they end, "turkey's nest" tanks and troughs have a rather large surface area for the volume of water they contain. The rapid evaporation of water from these large areas soon builds up the amount of fluoride in the water, for the fluoride does not evaporate.

Sometimes water which contains only 1 part per million of fluoride at the bore-head has contained as much as 5 or more parts per million a few miles down the bore drain. The reverse is also true. Some waters containing 5 parts per million at the bore-head have contained less fluoride at the more distant parts of the drains. This occurs when they run through deposits of kopi (calcium sulphate), which removes some of the fluoride from the water. It is clear, therefore, that the seriousness of the symptoms of fluorosis affecting sheep can only be related to the fluoride content of the water they drink, not to the amount of fluoride in the water at the bore-head.

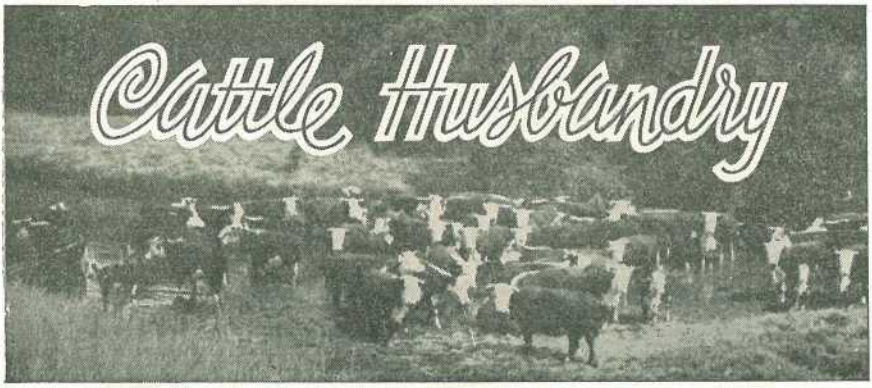
The age of the sheep when they start drinking water containing fluoride is also important. In Queensland, fluorosis is more likely to affect young sheep which drink contaminated water during the time that their permanent teeth are being formed under the gum. Even if adult sheep frequently drink water containing comparatively large amounts of fluoride, their teeth will not be damaged.

However, all sheep should, as much as possible, be kept off water containing fluoride for the first three years of their life. Damage caused before the sheep are three years of age may get worse as the sheep grow older.

The total amount of fluoride in the water and the frequency with which sheep drink affected water are also important. In flush seasons the sheep may get all the water they need from the lush herbage. Their additional requirements during hot weather may be met from surface water. In such cases, water from any bores which contain fluoride will not do the sheep much harm. During drought, however, the sheep may have bore water only to drink. If it contains more than 2 parts of fluoride per million there is some danger of serious damage. At such times, the hardness of the dry pasture stubble is also likely to increase wear of affected teeth.

We all know how the green grass growing along the edge of bore drains "will keep sheep going" during dry times. However, if this grass happens to be growing along the banks of drains containing fluorided water, it may contain a good deal of fluoride. This can add to the total amount of fluoride the sheep consume.

Sheep may also be moved from one paddock to another during the year. This may mean that they have a chance of drinking fluoride-free waters for at least some part of each year.



A Double Acting Sword Bail.

By W. F. MAWSON, Senior Adviser in Cattle Husbandry.

A modification of the standard sword type bail is in use at "Valley of Lagoons" station in North Queensland. The design was arrived at by the pastoral inspector for that property, Mr. J. T. Woodhouse, after a great deal of thought and experimentation.

Advantages.

The bail has three main advantages, namely:

(1) It is portable and can be used in an ordinary crush (for example, at the entrance to a dip). A saving can be thus effected because it is not necessary to have a separate crush for other operations such as speying. Because of their portability, the essential parts of the bail can be moved to any yard on the property.

(2) Being double acting, the bail is very fast in operation and a beast should never get through. When the bail is open it presents a V shape and cattle move into it readily.

(3) Because of its V shape when open, it is not possible for an animal to put its head beside the bail. This may happen in some types of sword bails. The design makes for smoothness and speed of operation.

Description.

Plans of the bail in the open and shut positions are given in Figs. 1 and 2.

Posts A and B are posts in a standard crush and should be not less than 10 in. in diameter. Post C should be similar in size to posts A and B and placed in the ground a clear two feet from post A.

Checks are made in each side of posts A and B at six inches from ground level. The pair of horizontal pieces (4 in x 3 in.) are fitted into the checks, one from each side. The ends of the horizontal pieces are bolted together through the posts. The space between the two horizontals should be about 2¾ in. This allows the 2 in. bail pieces to move freely.

The pair of upper horizontals are fitted in checks, one on each side of posts A, B, and C. There should be a slight overhang at each end. These horizontals are bolted together through each post and should be 2¼-2½ in. apart when fitted.

Bail pieces are fixed 6 in. apart at the bottom by means of bolts through the lower horizontals. The tops of the bail pieces are attached together and to the lever by means of two lengths of thin wire rope.

The lever operates through mortises in posts C and A and is attached to a bail piece by means of bolts and two steel straps. A bolt through the lever moves vertically in a transverse mortise in post C. This produces vertical movement of the lever at this point and insures that the upward movement of the lever pulls back the nearer bail piece.

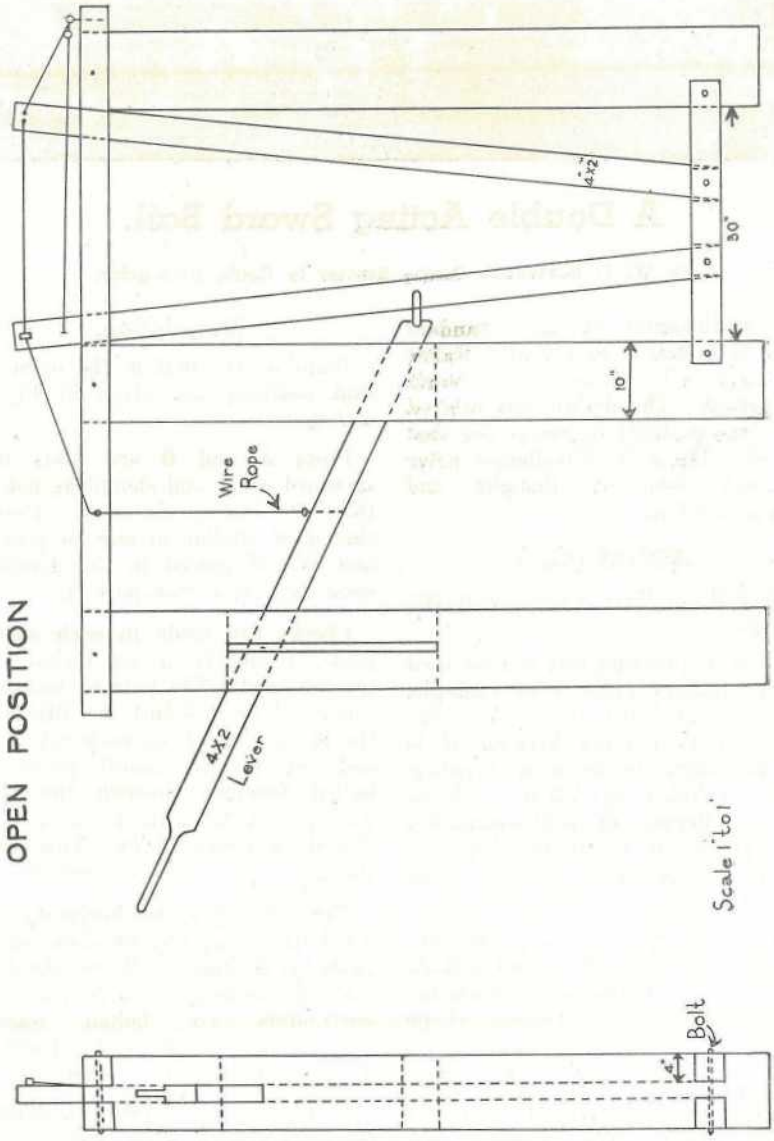


Fig. 1.

The Bail in the Open Position.

A wire rope is hooked into an eye bolt in the lever, runs over a guide bolt in an upper horizontal and through a D piece in the nearer bail piece, and fastens to the top of the second bail piece. The second wire rope is fastened to the second bail piece, runs through a pulley hooked into an eye bolt fitted into the farther end of the upper horizontal, and is then attached to the nearer bail piece.

Operation.

When in the open position the lever is at the high point, and both wire ropes are tight. Opening of the bail is positive and is brought

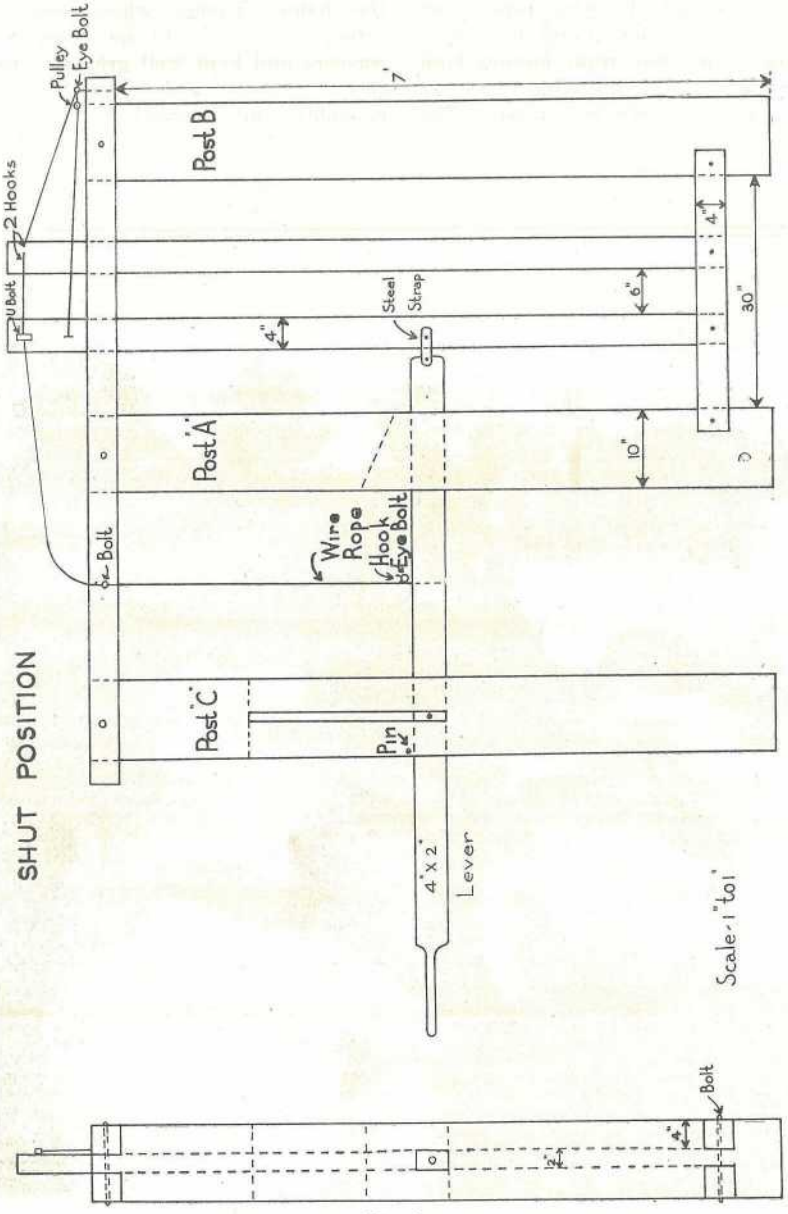


Fig. 2.
The Bail in the Shut Position.

about by the pull of the lever as it moves from the shut to the open position. As the nearer bail piece is opening, the wire rope which is attached to both bail pieces through the pulley operates to open the second bail piece.

In closing, the lever is moved downwards and the wire rope from the lever pulls the second bail piece inward. The wire rope joining both bail pieces through the pulley operates to close the nearer bail piece. The lever can be pinned in the shut position.

It will be noted that both wire ropes are always tight, irrespective of the position of the bail.

The bolts fastening both sets of horizontals and the lower ends of the bail pieces should be $\frac{1}{16}$ in. less than the holes through which they are fitted. Bolts should be fitted with washers and kept well greased. Both these matters make for ease of assembly and removal.

Farmers Listening to a Talk at a Field Day in the Coomera District.

The 1954 Baconer Carcass Competitions.

By F. BOSTOCK, Officer in Charge, Pig Branch.

The seventh Baconer Pig Carcass Competition conducted on a district basis by the Australian Meat Board in association with the Department of Agriculture and Stock, and with the co-operation of all sections of the industry, was judged at Mareeba (North Queensland), Rockhampton (Central District), Toowoomba (Darling Downs), and Brisbane (South-eastern District).

The championship was awarded to Mr. R. F. Pritchard, of Malanda (North Queensland) for a carcass by a Berkshire boar from a Berkshire x Large White sow which secured 92 points, a record Queensland score for these competitions. The carcass was very well proportioned, lacking only in body length, for which it lost five points, being 1 inch less than the standard set by Hammond for 143 lb. carcasses.

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

Prize.	Owner.	Breed.	Weight.	Points.
			lb.	
	NORTH QUEENSLAND.			
1st ..	R. F. Pritchard	Berkshire x Berkshire-Large White	143	92
2nd ..	F. L. Sides	Large White x Berkshire	128	88⅓
3rd ..	E. M. Johnston	Large White	135	87½
	CENTRAL DISTRICT.			
1st ..	L. G. Austin	Berkshire x Berkshire-Large White	142	85
2nd ..	H. E. Iker	Berkshire	143	84
3rd ..	D. H. and G. A. Britten	Tamworth x Berkshire	160	80½
	DARLING DOWNS.			
1st ..	Downs Co.-op. Dairy Assoc. Ltd.	Large White	145	85
2nd ..	C. R. Smith & Son ..	Wessex Saddleback ..	140	83½
3rd ..	D. J. Doig	Large White	126	83
	SOUTH-EASTERN DISTRICT.			
1st ..	G. Schulz	Berkshire x Berkshire-Large White	145	89½
2nd ..	R. H. Middleton ..	Berkshire x Berkshire-G. O. S.	139	88
3rd ..	F. R. J. Cook	Berkshire	152	87

The customary field days were arranged to coincide with the judging in each district. A feature this year was the large attendance of farmers at these functions. Officers of the Department of Agriculture

AVERAGE FOR EACH SECTION OF JUDGING.

——	Poss-ible Points	1948.		1949.		1950.		1951.		1952.		1953.		1954.	
		Average points obtained	Percentage of possible points.	Average points obtained	Percentage of possible points.	Average points obtained	Percentage of possible points.	Average points obtained	Percentage of possible points.	Average points obtained.	Percentage of possible points.	Average points obtained.	Percentage of possible points.	Average points obtained.	Percentage of possible points.
By Inspection—															
Hams	8	5·604	70·050	6·27	78·40	6·097	76·213	6·44	80·52	6·286	78·571	6·67	83·37	6·12	76·5
Shoulders ..	7	5·562	78·029	5·92	84·57	5·849	83·564	5·92	84·60	5·947	84·959	6·02	86·00	6·06	86·6
Streak	12	6·764	56·367	5·57	46·40	7·766	64·724	7·41	61·79	6·982	58·185	8·29	69·08	7·52	62·7
By Measurement—															
Eye Muscle ..	28	11·775	58·875	18·04	64·42	14·262	50·936	20·15	71·96	19·114	68·265	19·15	68·39	20·82	74·4
Backfat Thickness ..	20	15·489	77·445	15·26	76·30	14·572	72·864	15·45	77·23	14·729	73·643	15·97	79·85	16·00	80·0
Body Length ..	20	12·500	44·643	13·06	65·30	13·388	66·941	12·98	64·92	14·814	74·072	14·99	74·95	15·47	77·4
Leg Length ..	5	3·111	62·220	3·02	60·40	3·281	65·631	3·21	64·22	2·757	55·142	3·27	65·40	2·95	59·0
Total ..	100	60·805		67·97		65·218		71·57		70·629		74·87		74·94	

and Stock, in co-operation with the factory works management in each district, went to considerable trouble and expense to make these field days as instructive and interesting as possible by staging demonstrations and arranging addresses on subjects dealing directly and indirectly with pig production. Farmers were afforded the opportunity to inspect the carcases competing in the competitions together with the score card, and to inspect the bacon factory or meatworks.

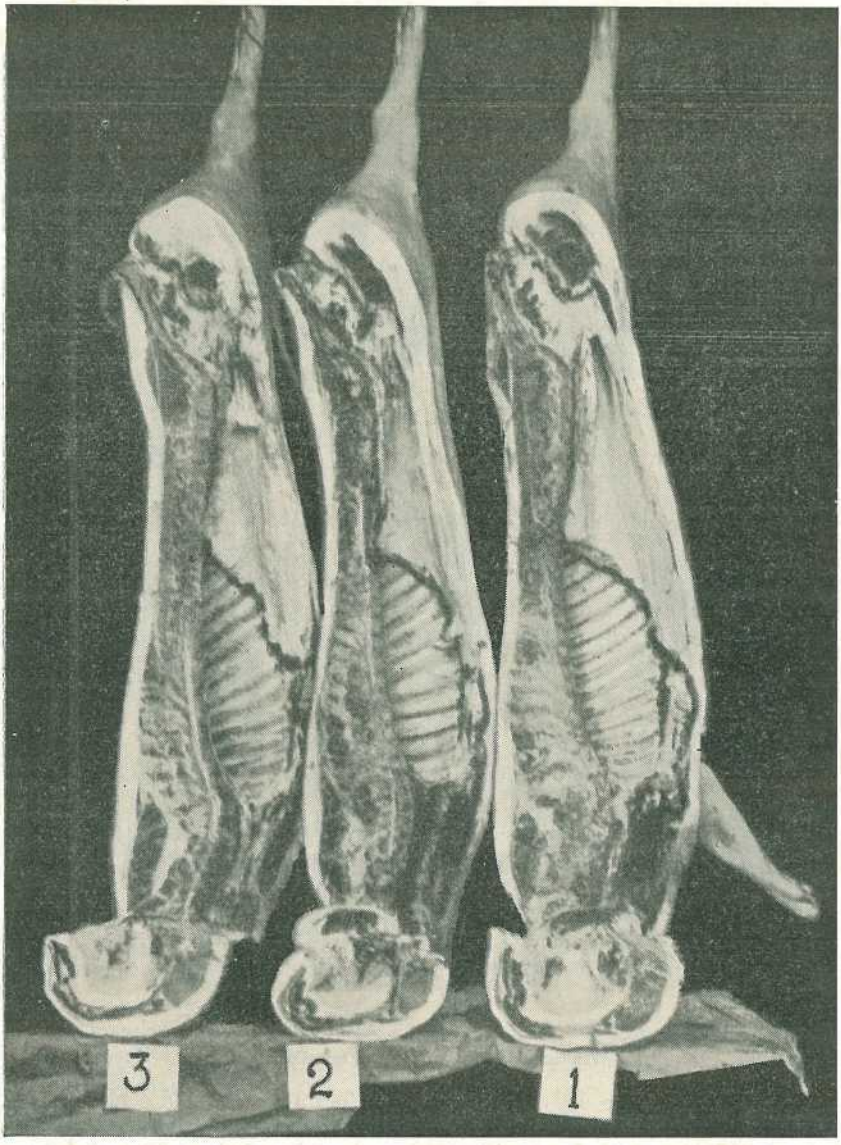


Plate 1.
Winning Entries in North Queensland.

The Hammond system of carcass appraisal was again used for judging. To qualify for entry into the competitions, the pig must have been sired by a purebred boar and the dressed carcass weigh not less than 120 lb. and not more than 180 lb.

Entries were less by 29 than last year and of the carcasses presented for judging 10 were disqualified, four being underweight and six overweight, leaving 121 to compete for the championship.

It is thought that the Cured Baconer Carcass Competitions conducted by increasing numbers of Country Show Societies were the cause of the reduced number of entries this year, and it would appear from the popularity of these competitions that a similar state of affairs will be experienced next year.

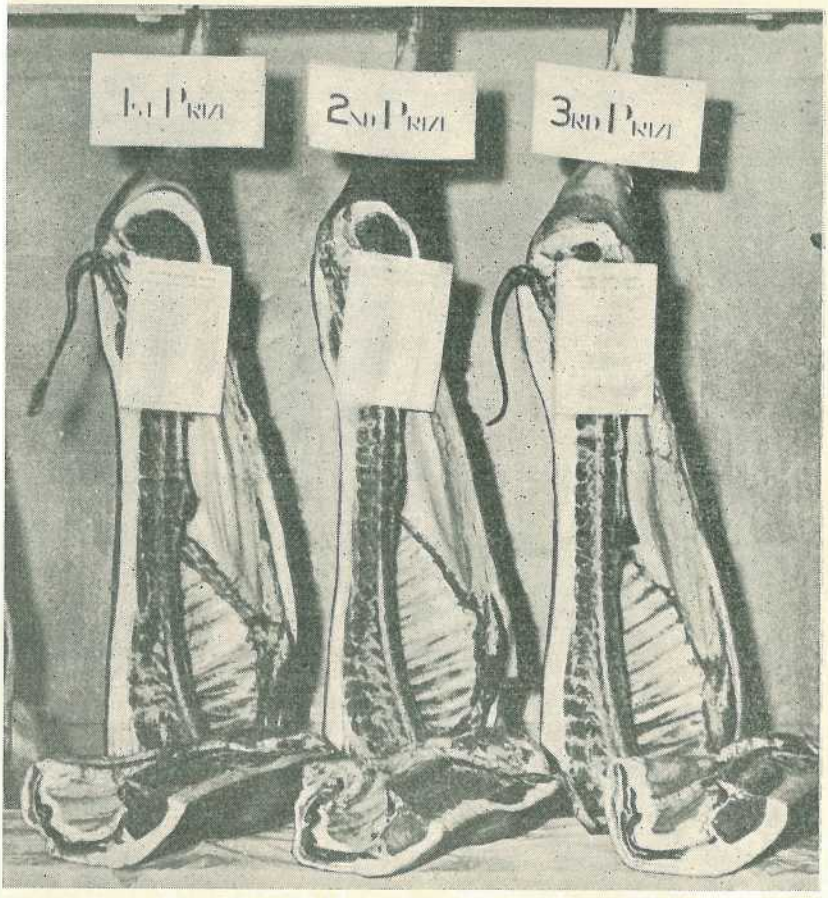


Plate 2.

Winning Entries in the Central District.

At Mareeba, the 18 entries all qualified for first class certificates; at Rockhampton, 13 entries received first class certificates, 4 second class certificates and 1 no recognition (scoring below 60 points); at Toowoomba, 39 entries received first class, 9 second class and 7 no certifcate; at Brisbane, 25 received first class and 5 secured second

class certificates. First class certificates are awarded for carcasses scoring 70 points and over, and second class certificates for carcasses scoring 60 points but under 70 points.

The top score of 92 points is the highest yet awarded in any of the competitions, as is also the average score of 74·94%. At Mareeba and Brisbane the general quality showed an improvement over last year's entries, but at Rockhampton and Toowoomba quality was not

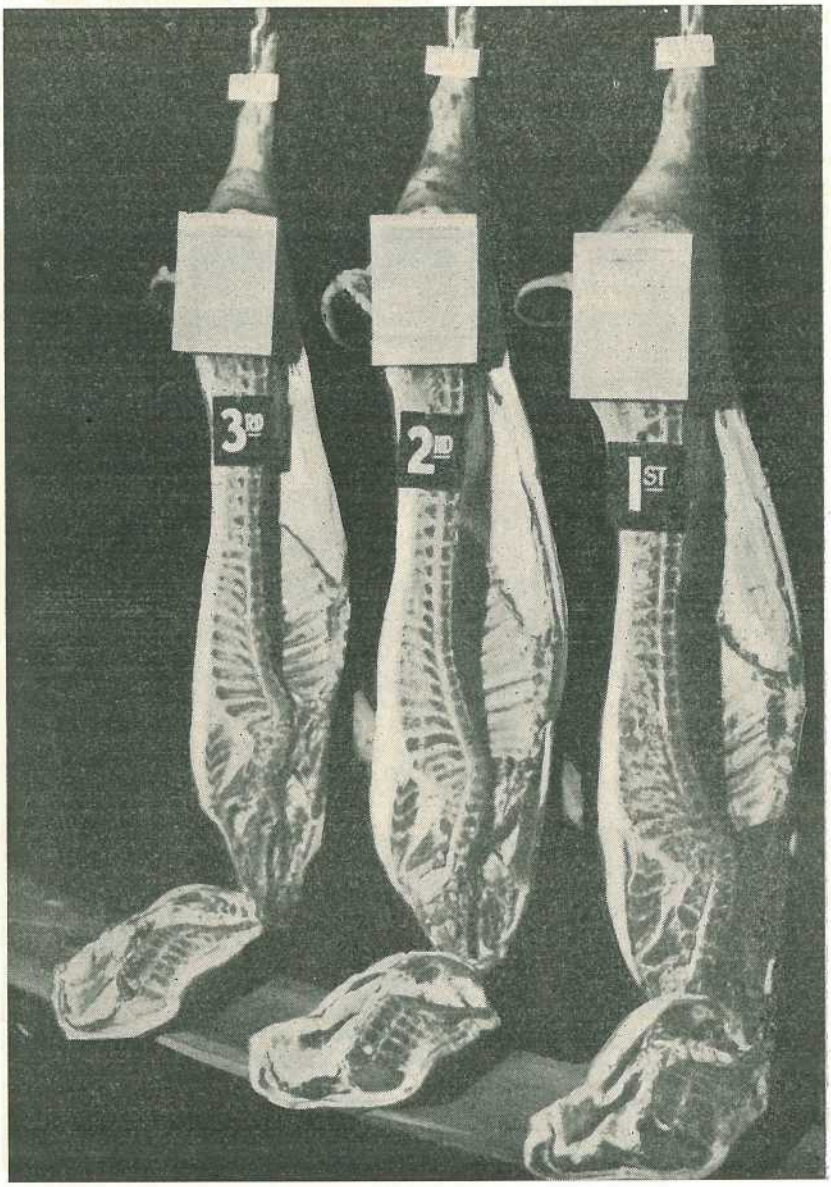


Plate 3.

Winning Entries in the Darling Downs District.

up to the usual standard, 85 points being the top score secured at these centres.

The hams did not maintain the improvement shown last year, the falling off being noticeable in all districts.

Shoulder development appeared to be equal to the previous year, with a few heavy shoulders appearing in all districts.

Streak or belly again scored reasonably well, but there is still room for much improvement. The percentage of overfat and thin streaks appearing in each district could be reduced if more care and thought were given to the rations fed.

Eye muscle scored well and was an improvement on previous years. However, it would be pleasing to see a much larger proportion of really well-developed eye muscles, and this again could be achieved with careful selection and attention to rations fed, especially during the early life of the pigs.

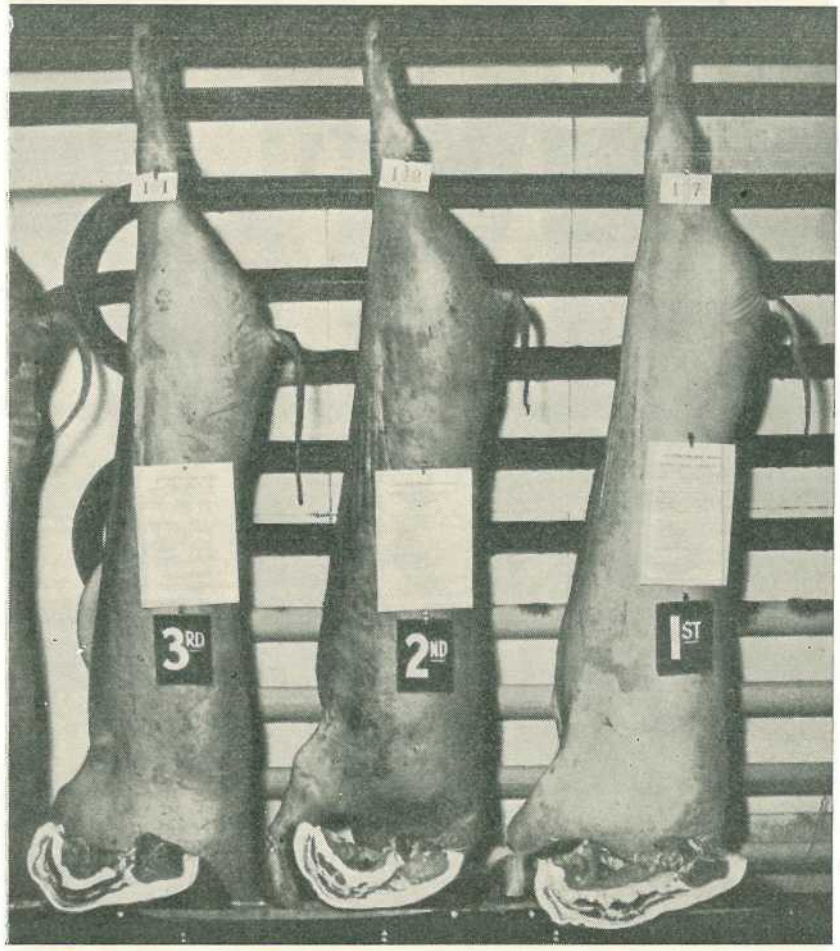


Plate 4.

Winning Entries in the South-eastern District.

The absence of excessively overfat carcasses was again noticeable, particularly in the Mareeba and Brisbane areas. With the trend today towards lean bacon, it is hoped farmers will market their pigs in prime condition, thus assisting to eliminate the overfat pig, which is causing so much concern in the industry at the present time.

Body length has considerably improved in the Mareeba and Brisbane areas, but at Rockhampton and Toowoomba, scores for this section were disappointing, and careful selection of breeding stock will have to be practised if body length is to be again improved in these areas.

Leg length was too long in all districts. The best average score in this section was recorded in the Toowomba area. There still appears to be a tendency on the part of breeders to overlook this point.

The overall percentage of 74·94% is slightly higher than last year and is a very creditable effort on the part of all competitors. I would like to offer my congratulations to the championship winner and to those scoring 1st, 2nd and 3rd place in their respective districts, as well as to all competitors on the quality of the carcasses exhibited and the spirit in which the competitions were contested in all districts.

WAXING TRIALS ON NORTHERN BANANAS.

The newly-developed technique of dipping bananas in a wax emulsion may save northern growers from heavy losses on consignments railed to Brisbane during the summer. Wax dipping has delayed ripening of southern-grown bananas and thus extended the keeping life by several days.

In the past, North Queensland banana growers have been handicapped in their efforts to market attractive fruit in Brisbane. The summer heat, coupled with the long rail haul, has caused northern bananas to arrive in Brisbane mixed ripe and in poor condition. Wax dipping may help to overcome this loss in quality during transit.

Stating this recently, the Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.), announced that trial consignments of bananas are being wax dipped in Tully and railed to Brisbane for examination.

Members of the Tully Fruit Growers' Association are particularly interested in the trials and are co-operating with the Department.

Mr. Collins said that though excellent results had been obtained by waxing fruit grown in southern Queensland the performance of the treatment under tropical summer temperatures was not yet known.

Brucellosis-Tested Swine Herds.

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 A semi-annual or annual re-test of the herd, as determined by the Director, is required.

TESTED HERDS (As at 30th October, 1954).

Berkshire.

S. Cochrane, " Stanroy " Stud, Felton
G. Handley, " Handleigh " Stud, Murphy's Creek
J. L. Handley, " Meadow Vale " Stud, Lockyer
R. G. Koplick, " Melan Terez" Stud, Rochedale
O'Brien and Hickey, " Kildurham " Stud, Jandowae East
E. Pukallus, " Plainby " Stud, Crow's Nest
G. C. Traves, " Wynwood " Stud, Oakey
E. Tumbridge, " Bidwell " Stud, Oakey
Westbrook Farm Home for Boys, Westbrook
M. K. Collins, "Kennington Stud, Underwood Road, Eight Mile Plains
H.M. State Farm, " Palen " Stud, Palen Creek
A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
H. H. Sellars, " Tabooba " Stud, Beaudesert
D. T. Law, " Rossvill " Stud, Trouts road, Aspley
R. H. Crawley, " Rockthorpe " Stud, *via* Pittsworth
F. R. J. Cook, " Alstonvilla," Wolvi, *via* Gympie
Mrs. I. M. James, " Kenmore " Stud, Cambooya
H. L. Stark ," Florida," Kalbar
J. H. N. Stoodley, " Stoodville," Ormiston
H.M. State Farm, Numinbah
V. G. M. and A. G. Brown, " Bardell," Goovigen
R. E. Paulsen, " Crest " Stud, Binjour Plateau, M.S. 670, Gayndah
M. G. and R. H. Atkins, " Diamond Valley " Stud, Mooloolah
L. Puschmann, " Tayfeld " Stud, Taylor
Dr. B. J. Butcher and A. J. Parnwell, " Hartley Grange " Stud, 684 Logan road, Greenslopes
W. F. Ruhle, " Felbar " Stud, Kalbar
C. E. Edwards, " Spring Valley " Stud, Kingaroy
G. J. McLennan " Murcott " Stud, Willowvale
H. M. Wyatte, " Deepwater " Stud, Rocky Creek, Yarraman
C. F. W. and B. A. Shellback, " Redvilla " Stud, Kingaroy
R. J. Webber, " Webberberry " Stud, 35 Caxton st., Petrie Terrace
J. C. Lees, "Bridge View " Stud, Yandina
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
A. C. Fletcher, "Myola " Stud, Jimbour
Q.A.H.S. and College, Lawes
E. F. Smythe, "Grandmere" Stud, Manyung, Murgon
The Marsden Home for Boys, Kallangur
M. F. Callaghan, Lower Mount Walker, via Rosewood
J. B. Lotz, M.S. 794, Kalbar

Large White.

H. J. Franke and Sons, " Delvue " Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
J. A. Heading, " Highfields," Murgon
K. B. Jones, " Cefn " Stud, Pilton
R. G. Koplick " Melan Terez " Stud, Rochedale
R. Postle, " Yarralla " Stud, Pittsworth
B. J. Jensen, "Bremerside" Stud, Rosevale *via* Rosewood
E. J. Bell, " Dorne " Stud, Chinchilla
L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
H. R. Gibson, " Thistleton " Stud, Maleny
H.M. State Farm, Numinbah
K. A. Hancock, " Laurestonvale " Stud, Murgon
V. P. McGoldrick, " Fairymeadow " Stud, Cooroy
S. T. Fowler, " Kenstan " Stud, Pittsworth
M. D. Power, "Ballinasloe" Stud, Swan Creek, via Warwick
H. L. Larsen, " Oakway," Kingaroy
C. Allison, " Colrene " Stud, Lake and Reserve roads, Slacks Creek
Mrs. I. G. Utting, " White Lodge," Mountain road, Cooroy
N. E. Meyers, Halpine Plantation, Kallangur
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
G. I. Skyring, " Bellwood " Stud, *via* Pomona
O. J. Horton, " Manneum Brae " Stud, Manneum Kingaroy
M. E. Bryant, " Maryland Brae " Stud, Blunder road, Oxley
Miss G. R. Charity, Coondoo, Kin Kin.
W. J. Blakeney, "Talgai " Stud, Clifton
F. K. Wright, Narangba, N. C. Line
O. B. Vidler Manneum, Kingaroy
K. F. Stumer, French's Creek, Boonah
Q.A.H.S. and College, Lawes
R. S. Powell, "Kybong" Stud, Kybong, *via* Gympie

Tamworth.

S. Kanowski, " Miecho " Stud, Pinelands
N. R. Potter, " Actonvale " Stud, Wellcamp
D. F. L. Skerman, " Waverley " Stud, Kaimkillenbun
A. C. Fletcher, " Myola " Stud, Jimbour
Salvation Army Home for Boys, " Canaan " Stud, Riverview
A. J. Surman, " Namrus " Stud, Noble road, Goodna
Department of Agriculture and Stock, Regional Experiment Station, Kairi
E. C. Phillips, " Sunny View," M.S. 90, Kingaroy
F. N. Hales, Kerry Road, Beaudesert
T. A. Stephen, " Withcott," Helidon
W. F. Kajewski, " Glenroy " Stud, Glencoe
A. A. Herbst, " Hillbanside " Stud, Bahr Scrub *via* Beenleigh
R. G. Koplick, " Melan Terez " Stud, Rochedale
H.M. State Farm, Numinbah
D. B. Alexander, " Debreczen " Stud, Kinleymore *via* Murgon
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F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
P. V. Campbell, " Lawn Hill " Stud, Lamington
H. J. Armstrong, Alhambra," Crowntharpe, Murgon
Q.A.H.S. and College, Lawes

Wessex Saddleback.

W. S. Douglas, " Greylight " Stud, Goombungee
D. Kay and P. Hunting, " Kazan " Stud, Goodna
J. Gleeson, " Iona Vale " Stud, Kuraby
C. R. Smith, " Belton Park " Stud, Nara
H. H. Sellars, " Tabooba " Stud, Beaudesert
H. Thomas, " Eurara " Stud, Beaudesert
D. T. Law, " Rossvill " Stud, Trout road, Aspley
J. B. Dunlop, " Kurrawyn " Stud, Acacia road, Kuraby
A. Curd, " Kilrock " Stud, Box 35, Jandowae
F. K. Wright, Narangba, N. C. Line
W. R. Dean, " Trelawn," Tandur, via Gympie
C. Allison, " Colrene " Stud, Lake and Reserve roads, Slacks Creek
M. Nielsen, " Cressbrook " Stud, Goomburra
G. J. Cooper, " Cedar Glen " Stud, Yarraman
M. E. Bryant, " Maryland Brae " Stud, Blunder road, Oxley
J. E. Heath, "Springlea " Stud, Murgon
Mrs. R. A. Melville, "Wattledale Stud," Beenleigh road, Sunnybank
A. J. Stewart " Springbrook," Pie Creek Rd., Gympie

British Large Black.

H. W. Naumann, "Parkdale " Stud, Kalbar