VOL. 80, PART 4 APRIL, 1955

DEPARTMENT OF AGRICULTURE

QUEENSLAND AGRICULTURAL JOURNAL

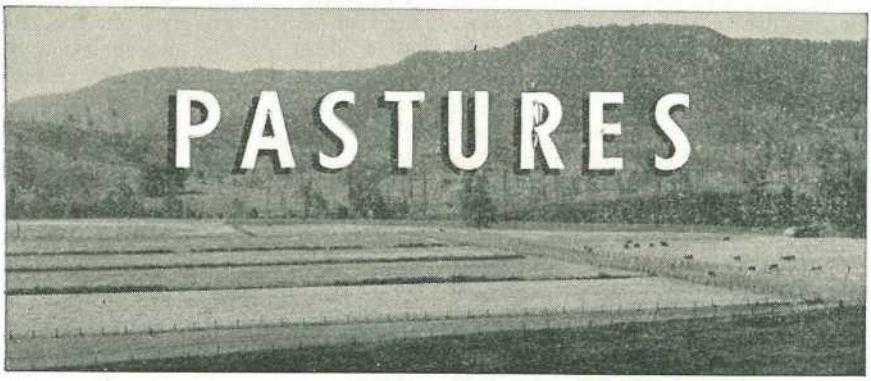
Koalas in a Brisbane Sanctuary.

LEADING FEATURES

Registered at the General Post Office, Brisbane, for transmission by Post as a Newspaper.

Queensland AGRICULTURAL JOURNAL

Contents



Pondage of Runoff Water by Contour Pasture Furrows.

By R. F. KELSEY, Soil Conservation Officer.

Pasture furrows are a series of level furrows constructed in pasture land at intervals down the slope. They are usually spaced from 10 to 20 ft. apart, the closer spacing being used on the steeper slopes. Their function is to pond the water which falls on the field so that it will soak into the soil for the benefit of the pasture and not be lost as runoff.

Because of the current interest of primary producers throughout Queensland in the use of these structures as a means of reducing runoff losses, lessening the attendant erosion risks and improving pasture, it is appropriate to consider the performance of a pasture furrowing project on a property in the Toowoomba district.

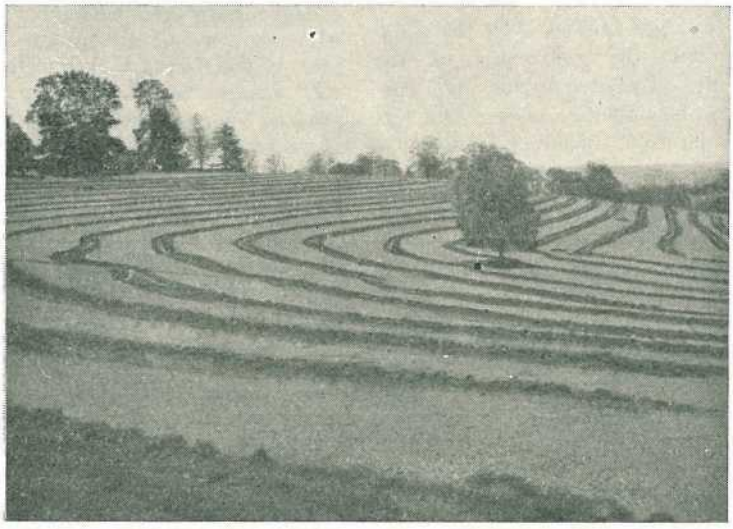


Plate 1.

A General View of the Pasture Furrowing Project at Toowoomba, Showing the Newly Constructed Pasture Furrows.

On this farm, pasture furrows were constructed in several paddocks comprising a total area of approximately 30 acres. The slope varied from 5 to 18%. This means that there was a fall of from 5 ft. to 18 ft. for each 100 ft. of horizontal distance. The lateritic red loam soil of this eucalyptus forest country exhibited poor structure with a compact surface horizon. All of the area treated had been cultivated intensively in the past but had been returned to pasture in recent years. The vegetation at the time of treatment was extremely poor and consisted of pitted blue grass (*Bothriochloa decipiens*), rat's-tail (*Sporobolus elongatus*) and only scattered paspalum and white clover.

The damaging effect of prolonged cultivation on such steep slopes was evident. Over a large area most of the topsoil had been eroded away and gully development had commenced. In some places, shoulders of soil stood out above the gravelly subsoil, giving a clear indication of the depth of soil that had been eroded. High headlands and silt deposits at the lower boundaries indicated where some of the eroded topsoil had lodged.

The compact surface soil, the steep slopes and the sparseness of the cover all contributed to the high percentage of runoff that occurred in this area, even from moderate falls.

Land Treatment.

On the lower slopes, guide lines for the construction of pasture furrows were surveyed at a 2 ft. vertical interval, which, on a 5% slope, represented a horizontal spacing of 40 ft. between the lines. When the furrows were constructed, one furrow was ploughed between each pair of the surveyed lines by estimating the centre position. The constructed furrows (including both surveyed and estimated lines) were therefore spaced at vertical intervals of 1 ft. and at horizontal intervals of 20 ft. (Plate 1.)

On the steeper slopes a vertical interval of 3 ft. was used for the surveyed lines, and on interpolation of one furrow between them, the vertical interval was reduced to 18 in.

The furrows were constructed during October 1953 with one run of a heavy patrol grader without any prior ploughing. Soil from all the furrows was thrown downhill. To avoid flow along the banks to any possible low spots, checks were constructed at intervals of every half chain by shovelling a mound of soil into the furrow.

The capacity of the furrows varied with the degree of slope of the land and with the nature of the soil. On the 5% slopes a cross-section area of 1 sq. ft. was obtained in the furrow without allowing anything for the bank. Such furrows at 20 ft. spacing have a capacity of 13,600 gallons per acre and are capable of storing nearly two-thirds of an inch of runoff from the inter-furrow spacing.

On slopes of 10% to 15% the cross-section area decreased to approximately .6 sq. ft. On the steepest and most eroded area it was considered too difficult and dangerous to endeavour to get adequate capacity with one run of the grader. However, it was found that if a light run was made, followed by a second grading run, an excellent furrow was obtained with a good continuous bank.

Owing to the drought conditions at the time of constructing the furrows, the planting of the furrows to pasture grasses was deferred until the following February, when more suitable conditions existed.

Costs.

The grader used was hired at a cost of £2 4s. per hour and the average cost of treating the 30 acres was £1 7s. per acre. Where the slope was no more than 5%, costs were approximately 10s. per acre. On the steeper area, where closer spacing of the furrows was required, and where many furrows needed two runs with the

Plate 2.

The Same Area as Shown in Plate 1, after the Passage of a Heavy Storm.

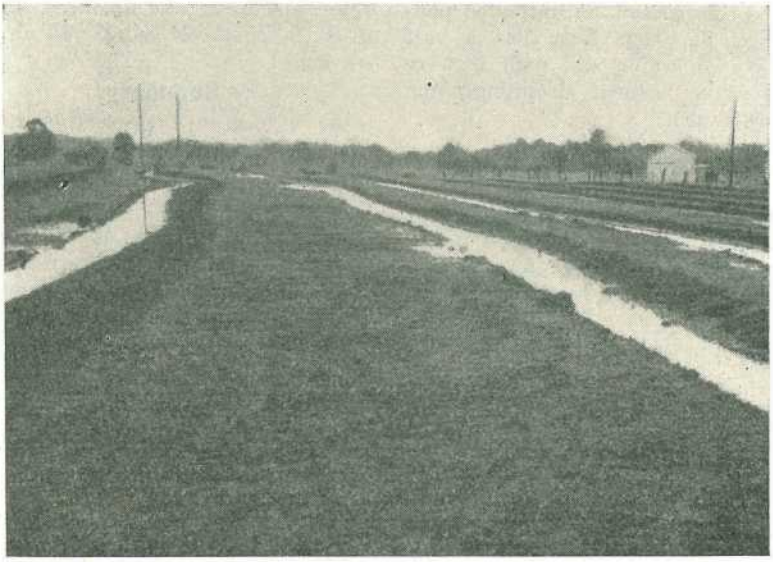


Plate 3.

Close-up of Pasture Furrows Showing Pondage of Water after a Heavy Storm.

grader to give the required capacity, the cost rose to 30s. per acre.

Performance of Pasture Furrows.

An intense summer storm occurred about 3 p.m. on December 27, 1953. It lasted for approximately 45 minutes and yielded 260 points. The soil was dry and dusty and owing to a series of unfavourable seasons the vegetative cover was sparse.

Results on the treated area were particularly satisfactory. Within 10 minutes of the commencement of the rain the rate of absorption into the soil had decreased, runoff commenced, and water began to accumulate in the furrows. The channels were filled in approximately 25 minutes. As the rain continued the water rose on the banks, thereby possibly trebling the capacity of the furrows. Some low spots were noticed in the banks, through which water flowed. In all such cases the banks below held and prevented any major breaks (Plate 2.) Water losses from the area were negligible and soil losses were insignificant.

As a comparison, an untreated paddock on the same farm lost a vast quantity of water and with it were swept away animal droppings and surface mulch.

During February 1954, a total of 1,445 points was recorded. Much of this rain was received in high intensity falls. At no time did any of the pasture furrows reach capacity nor was there any runoff from the 30 acres treated (Plate 3). The total volume of rain absorbed by the treated area during February was approximately 10 million gallons. The absorption of water into the soil during this month was more rapid than in December due to the improved surface cover of vegetation which had grown following the December storm.

During February, the furrows were sown to a pasture mixture comprising green panic, Rhodes grass and lucerne. The seed was broadcast into the channels and covered by raking. The result of this seeding was disappointing, but it is now felt that the seeding of the channels in areas with exposed clay subsoil requires to be supported by adequate fertilizer treatment.

In the steeper paddocks, where some paspalum and Rhodes grass existed prior to pasture furrowing, the response of these grasses was good. Their main growth came from the upper and lower sides of the bank and quickly covered the bank. At the end of the first summer the paddock carried a record bulk of feed, which may be attributed largely to additional water stored. The interfurrow space was far behind the banks in vegetative growth but was an improvement on previous years.

In the steepest and by far the most eroded section of the treated area, kikuyu grass has made excellent growth. The kikuyu had been planted 15 years previously to check erosion, but owing to continued loss of moisture and topsoil it had barely existed and was difficult to find. These plants now have a healthy appearance and are rapidly spreading along the furrows and over the banks. Rhodes grass is also colonising well in this section.

Summary.

As a means of preventing runoff, pasture furrows have been highly satisfactory on a red-loam forest slope near Toowoomba.

Whilst the response to the seeding of the furrows has not been encouraging, this must be attributed in some degree to the lack of suitable fertilizer treatment.

The paspalum and other existing vegetation responded well to the treatment and this competition has added to the difficult task of establishing improved pasture species.

Roots of various grasses planted along the furrows have survived and seeded; it would appear that, when planting material is available, this method of introduction of suitable grass species has much to commend it.

The Honey Flora of South-eastern Queensland.

By S. T. BLAKE (Botanist) and C. ROFF (Adviser in Apiculture).

(*Continued from page* 158 *of the March issue.*)

Broad-leaved Apple.

Botanical Name.—*Angophora subvelutina* F. Muell.
Other Common Names.—Apple, apple-tree.

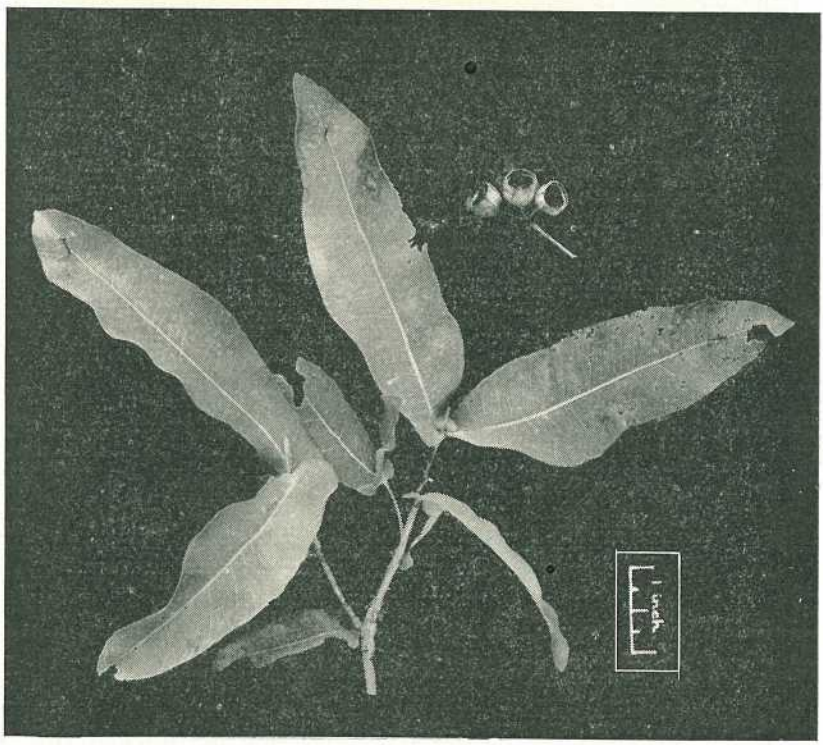


Plate 110.
Broad-leaved Apple (Angophora subvelutina). Leaves and seed-capsules.

Plate 111.

Broad-leaved Apple (Angophora subvelutina). Portion of trunk. Kalbar.

Distinguishing Features.—A crooked tree with grey, flaky, brittle bark, hairy twigs, heart-shaped greyish, slighty hairy leaves arranged in pairs, and bunches of white flowers with numerous stamens and shorter semicircular petals (Plates 110-112).

Description.—This is a crooked or spreading tree mostly 20-40 ft. high, with grey, flaky, fairly soft and brittle bark, and irregular branches. The leaves are grey-green, stiff, stalkless or nearly so, arranged in pairs along the twigs, shortly hairy like the twigs, heart-shaped or nearly oblong, pointed, 2-4 in. long, ¾-2 in. wide, and 1½-3 times as long as wide. The flowers are arranged in large bristly bunches at the ends of the twigs; they are white, about ⅝ in. wide, with five small tooth-like sepals, five semicircular petals, and numerous longer stamens. The seed-capsules are cup-shaped, with thin, ribbed walls, about ⅜ in. long and wide.

Distribution.—Widely spread in forest country in south-eastern Queensland, especially in the Moreton, Wide Bay and Burnett Districts, where it often occurs with blue gum on alluvial flats. It occurs also in coastal New South Wales as far south as Sydney.

Usual Flowering Time.—December-January.

Colour of Honey.—Dark amber.

Importance as Source of Honey.—Minor.

Importance as Source of Pollen.—Major.

General Remarks.—Broad-leaved apple is not a good honey tree.

The second-grade honey has a strong flavour and good density. Its granulating qualities are not known.

This tree produces pollen in quantity, which feature enhances its value to the beekeeper.

Plate 112.

Broad-leaved Apple (Angophora subvelutina). Kalbar.

Rusty Gum.

Botanical Name.—Angophora costata (Gaertn.) Domin.

Other Common Names.—Brittle gum, cabbage gum, orange gum, snappy gum, sugary gum, smooth-barked apple.

Other Botanical Name.—Angophora lanceolata Cav.

Distinguishing Features.—A tree with smooth, pink to pale grey, often rusty-stained bark, narrow very green leaves arranged in pairs, and large bunches of white flowers with numerous stamens and shorter semicircular petals (Plates 113-115).

Plate 113.

Rusty Gum (Angophora costata). Branchlet with leaves, buds and flowers. Inset shows seed-capsules.

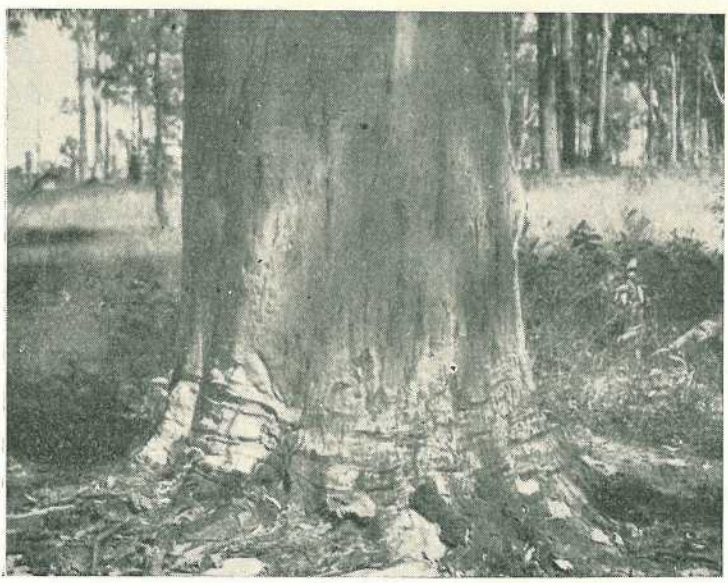


Plate 114.

Rusty Gum (Angophora costata). Portion of trunk.

Plate 115.

Rusty Gum (Angophora costata). Rosewood.

Description.—This is a tree up to 60 ft. high with bright green foliage. The trunk is often crooked and the crown irregular. The bark is smooth and shed each year in the same way as many smooth-barked eucalypts. When new, the bark is pink, but it turns light grey before the next shedding and becomes gum-stained here and there. The leaves are paler on the lower surface and are borne in pairs along the twigs; they are narrowed to each end, especially the tip, 2½-5 in. long, ⅜-1 in. wide, and 4-9 times as long as wide. The flowers are pure white and very showy, being produced in

large bunches at the ends of the twigs. They are about ⅜-½ in. wide, with five tooth-like sepals, five larger semicircular petals, and a large number of still longer stamens. The seed-capsules are cup-shaped, with thin walls, about ⅜-½ in. long and wide, sometimes with fairly prominent ribs.

Distribution.—Rusty gum is widely distributed in forest country in southern Queensland on sandy soils or stony ridges, extending inland as far as the Warrego District. It is often found with spotted gum, with which it is sometimes confused, but rusty gum is not such a straight tree as spotted gum, the leaves are a lighter green and are found in pairs on the twigs; also the flowers have petals. It is found over much of eastern New South Wales.

Usual Flowering Time.—December-January.

Colour of Honey.—Dark amber.

Importance as Source of Honey.—Minor.

Importance as Source of Pollen.—Major.

General Remarks.—Rusty gum is an unreliable nectar-producer, yielding moderate harvests in only one year out of five. It has a short flowering period and blossoms and produces best during dry periods.

The honey, although second grade, has a palatable woody flavour and good density. The granulating characteristics are not known definitely, although many beekeepers state that it granulates slowly with a medium brown-coloured grain.

Rusty gum is valuable to the beekeeper as it yields large supplies of pollen, which stimulate breeding and quick build up of colonies. Any excess is stored by the bees for use in times of scarcity.

[TO BE CONTINUED.]

Cotton for Cash.

By K. B. ANDERSSEN, Adviser in Agriculture.

Cotton is one of the few field crops in Queensland at present capable of returning £100 per acre or better to the grower. This is, of course, dependent upon the adherence to certain basic principles such as those described below. This was clearly demonstrated in the Central Burnett during the 1953-54 season by Mr. A. H. E. Schultz, who produced a record crop of cotton on the property of Mr. R. Loakes, of Malmoe, via Mundubbera.

Grassland Rotation.

An important factor in good cotton production is the use of grassland in the rotation. This may be either virgin grazing country, or old cultivation land which has been sown down to grass for a period of 3-5 years. The cotton crop produced by Mr. Schultz was grown on newly cleared grazing land. As the land was ploughed well in advance, the fallow conserved valuable moisture for the coming crop.

Good Cotton Soil.

The soil type was a grey medium clay loam, 8-10 in. in depth, overlying a stiff clay, typical of the gum-top box and narrow-leaved ironbark slopes and flats of the Burnett Valley. Soils of this type are highly recommended for cotton production.

Effective Land Preparation.

The land was cleared of the ring-barked trees and stumps by pulling with a tractor and long steel rope. The area was ploughed in mid-August to a depth of 4 in. while the land was comparatively dry. In this rough state, the soil was able to absorb completely the 328 points of rain that fell in late August. Upon drying sufficiently for cultivation, the land was again evenly ploughed to a depth of 5 in., and then tandem-disced to produce a fine tilth. Nearly four inches of rain fell during October, and the area was re-disced and harrowed to produce the necessary fine seedbed.

Time of Planting.

Following the standard practice in the Central Burnett of planting in October, this crop was sown with a two-row maize planter on October 27. The variety used was Miller 43-9-0, a proven strain for central and sub-central Queensland cotton-growing areas. It was planted at the rate of 15 lb. per acre in rows 3 ft. apart, to conform with the standard row-crop cultivators used on this farm.

Little Cultivation Following Grass.

The advantages of the grassland rotation were reflected in the comparative freedom from the more troublesome annual weeds. However, two tractor-drawn tine cultivations and sporadic chipping were necessary to control weed growth, in particular summer grass and woolly-top Rhodes

grass. Chipping and thinning out operations required less than 1½ man-days for each acre of the crop.

The Growing Season.

Although the winter months of 1953 had been amongst the driest on record the good August rains provided useful subsoil moisture storage. This storage was further built up by the planting rains in October. While November and December were mainly dry and hot, the crop progressed nicely on the stored moisture until the flood-rain period of January-February. Over 17 in. fell during this period.

This was far more than the crop needed, but with soil in good structural condition, little damage was done and the crop responded well when the weather cleared. This wet season provided ample water to carry the crop right through to maturity, although the next three months were very dry again.

The fine autumn weather was a distinct benefit to the crop, since it enabled the bolls to develop under sunny, dry conditions. Prolonged wet weather during the final stages of growth encourages boll rots, and greatly reduces the quality of the exposed fibre.

Insect Control.

Immediately following the wet period a number of different insect pests became active on the crop. As damage was being done to the developing bolls, the crop was immediately sprayed, using a knapsack spray. A ·1% DDT emulsion was applied at a cost of about 5s. 6d. per acre for materials. Mr. Schultz estimates that this spraying saved him £30 to £35 worth of cotton per acre. This estimate was made by comparing his returns with those from an adjoining area which was planted at the same time but left unsprayed.

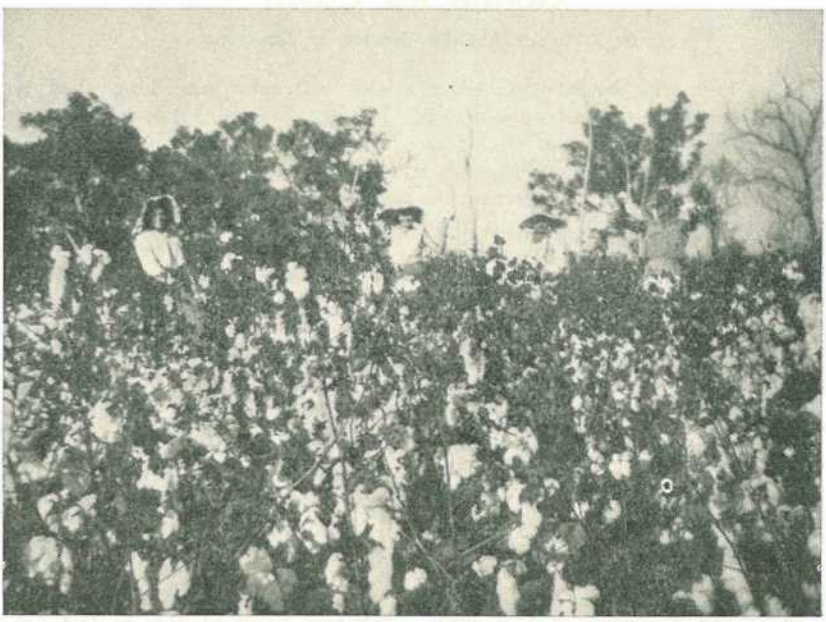


Plate 1.

Mr. A. H. E. Schultz's Cotton Crop at Malmoe, near Mundubbera, 1953-54 season. This crop averaged more than one ton of seed cotton per acre under rain-grown conditions.

The Harvest.

Picking was carried out in two stages. The first pick was made by experienced hand-pickers who picked in two grades (a prime grade and a second grade). These two grades were baled separately. The late crop was snap-picked by Mr. Schultz himself in late June.

Ginnery figures showed an average yield of 2,315 lb. of seed cotton per acre, giving a return of over £130 per acre. At the ginnery the cotton was classified into the following grades:—

24% was Good Middling Light Spot (1 inch).

44% was Strict Middling (1 inch).

32% was Strict Middling Light Spot (1 inch).

All these grades carry a premium over the standard grade and staple.

Main Reasons for Success.

The main features relating to Mr. Schultz's success with this crop were:—

(1) *The use of virgin grassland.*—Cotton grows best following grass, whether it be native grassland or a sown pasture such as Rhodes grass.

(2) *The soil type, which is ideal for cotton growing, and the variety (Miller 43-9-0), which is well suited to the district and soil type.*

(3) *The adoption of efficient farming practices by Mr. Schultz, who has grown cotton successfully for many years.* In a different season, an earlier land preparation might have been desirable, but in the season experienced each cultivation step was splendidly timed.

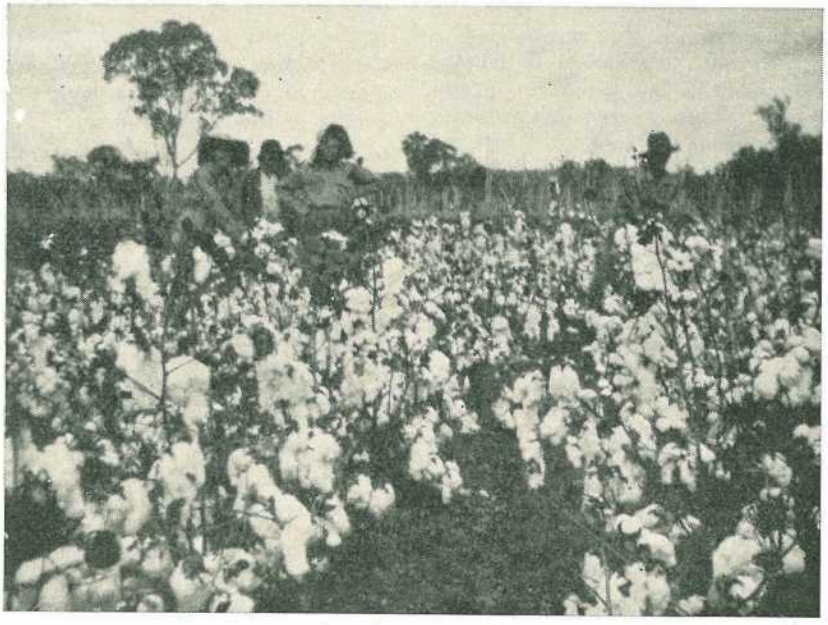


Plate 2.

Another View of Mr. Schultz's Cotton Crop at the Stage of First Picking. This fine crop was grown on newly ploughed grassland, and shows evidence of excellent farming practices.

ANIMAL HEALTH

Lantana Poisoning of Stock.

By S. G. KNOTT, Veterinary Officer.

Considerable economic loss is caused each year along the coastal and sub-coastal areas of Queensland from lantana poisoning.

Losses occur principally in cattle which have been introduced from districts or farms where lantana does not grow to country infested with lantana. Farmers wishing to improve their herds have purchased valuable stud cattle, often from other States, only to see them die from eating lantana, to which they are not accustomed.

Losses are often encountered in heifers which are reared in lantana-free paddocks but placed in infested paddocks when weaned or freshening. This is often the case when attempts at eradicating the plant have been only partly successful.

Deaths often occur in bullocks brought from lantana-free stock runs to coastal properties for fattening, or even while being agisted in lantana-infested paddocks awaiting slaughter.

Most animals which are reared in lantana-infested country eat a little all the time and appear to develop a tolerance towards it. However, this tolerance is not complete and losses can occur in such stock, especially when natural feed is short and there is a green shoot in the lantana, as is often observed after a burn.

The eating of only small amounts of lantana will produce symptoms in susceptible stock. Experimentally, it was found that 4½ lb. was sufficient to kill a 400 lb. beast.

Description of the Plant.

Lantana is a rambling shrub which often grows in dense masses up to 15 feet high. The stems are four-angled and bear short, recurved prickles. The leaves are opposite; they are bright green above and paler beneath and are about 2½ in. long and 1½ in. wide. They are carried on short stalks of about ⅓ in., rather pointed at the apex, rough to the touch above, and the veins and veinlets are clothed with white, rather soft hairs beneath.

The flower heads are in group of about three, each about 1 in. across and on a stalk about as long as the leaves, and consisting of several rows of small flowers which open progressively from outside inward. The fruits are fleshy and become a purplish-black colour when ripe.

There are two common varieties of lantana in Queensland—common pink lantana (*Lantana camara*) and the red-flowered variety (*Lantana camara* var. *sanguinea*). In the common form the flowers open pale cream with a yellow centre and turn lilac or pink before they wither; in the red-flowered form they open yellow and turn red.

Although many stockmen regard only the red-flowered variety as dangerous, both are poisonous to stock.

Stockowners introducing cattle into lantana-infested country should watch closely for early physical symptoms of the disease.

Plate 1.

Photosensitisation Due to Eating Lantana. Note the cracking and peeling of the muzzle.

Symptoms.

The first signs noticed are those of depression of the affected animal, the ears often are slightly drooping, and the muzzle becomes darkened and dry. Usually the beast is constipated and the dung passed is black and tarry.

The animal may be noticed shaking its head or perhaps kicking at or looking at its udder and teats. These are the premonitory symptoms of photosensitisation, which will be explained later.

If the mucous membranes of the eyelids and mouth are examined at this stage, it is generally noted that they are developing a yellowish tinge, due to jaundice arising from liver damage caused by the lantana.

At this stage the animal will seek out shady places, due again to the developing photosensitisation.

Jaundice becomes more marked and further examination of the mucous membranes of the mouth may reveal erosion of these membranes and on the tongue. This makes the mouth very sore and the beast is reluctant to eat. Milking cows cease lactating or diminish their milk yield. Symptoms of photosensitisation increase.

What is photosensitisation? Photosensitisation is a peeling and cracking of the skin and modified skin areas covering the body surface. When the poisonous principle in lantana (lantanin) is broken down by the liver, one of the products (phylloerythrin) circulates in the blood stream. When this comes in contact with the rays of the sun, it causes the skin eruptions known as photosensitisation; hence the importance of providing affected animals with adequate shade.

Photosensitisation may occur anywhere on the body, but is seen particularly on the muzzle, which becomes red, cracks and peels. It is also generally seen on the ears and causes them to crinkle at the edges and lose their hair. Another very common site is the teats, which become dry, cracked and reddish-black in colour. Further lesions may also be observed on the escutcheon and on any white-skinned patches on broken-coloured beasts.

The term "pink nose" is really a misnomer for lantana poisoning, as animals will display definite symptoms of lantana poisoning without developing a pink nose and subsequent sloughing of the outer skin of the muzzle.

Other symptoms observed include oedematous swellings of the tissues surrounding the eyes, similar to bee or wasp stings, and also of the submaxillary space under the jaw, down the dewlap and under the brisket and abdomen.

Usually the temperature is not raised.

The original constipation eventually gives way to diarrhoea.

As the condition progresses, wasting occurs and the eyes become sunken.

Death may occur in a few days (sometimes before the usual symptoms are displayed), or the animal may linger on for weeks before death or recovery occurs. Even if treatment is begun early, it is not unusual for over half the affected animals to die.

Growth and production of recovered animals may be temporarily or permanently retarded.

Post-mortem Examination.

A thorough examination of all external lesions and swellings should be made before the actual post-mortem dissection commences.

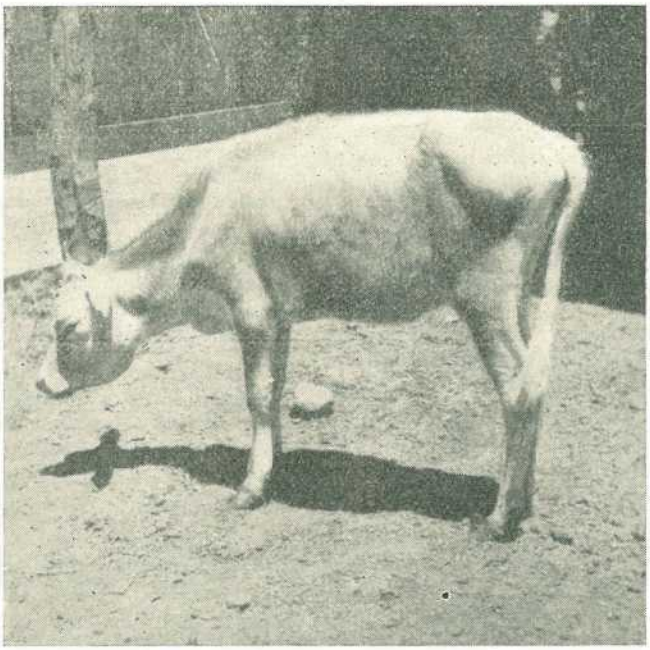


Plate 2.

Typical Attitude in Lantana Poisoning. Depression and drooping ears are evident.

Plate 3.
Swellings of Eyelids and Underjaw Sometimes Seen in Lantana Poisoning.

On opening the abdominal cavity, the most noticeable feature is the generalised jaundice present, as indicated by a yellowish discoloration or staining of all the tissues and organs.

The liver is generally swollen and is a rich bronze colour. This is especially evident when the surface is cut. The cut surface is friable to the touch.

The lining of the gall bladder is occasionally congested.

An inflammation is generally noted throughout the whole of the gastro-intestinal tract. This is often more severe in the small intestine than the large, but not always so, and may be of an haemorrhagic nature.

Treatment.

First ensure that any affected animal has no further access to lantana.

It is most important to provide adequate shade, with food and water readily available, to minimise the development of photosensitisation.

It is advisable to treat the affected beast with a mild purge. Probably the most suitable and readily available medicament for such a purpose is raw (not boiled) linseed oil. Adult cows may be drenched with up to a quart, depending on size. The dose for young heifers is reduced (½-1 pint). If necessary the dose is repeated. Paraffin oil may be used, the dose rate being ½-1 pint.

Oily purges are preferred as they tend to soothe the lining of the intestines.

Drenching with Epsom salts is preferred by some. The dose is 4-16 oz. according to size.

More severe purges, such as Istin, Diaquone and Altan, are occasionally used in severe cases of impaction.

Enemas may be used to advantage for impacted cases.

As stated previously, affected animals are loth to eat due to mouth lesions. Therefore, soft nutritious food must be provided. Freshly cut green feed and chaffed green lucerne are excellent. If the animals are used to crushed grain, then this should be provided in hoppers. If molasses is available, it should be provided, as it is appetising, soft and mildly laxative.

If the stock affected are not too long weaned, it is a wise plan to return them to bucket feeding with separated milk.

Control of Lantana.

The most effective means of dealing with lantana is to grub it or pull it out by the roots. Where this is not possible it may be sprayed with 2,4-D, although results with this chemical have not been entirely consistent. Indications at present are that in areas of high rainfall and good soil, lantana can be killed with 2,4-D applied at a concentration of 0.2% so as to wet leaves and stems thoroughly. In drier areas, the only good results so far have been by brushing the plants about February or March and spraying the regrowth when about 9-12 in. high. If 50% solutions are used they should be mixed with water at the rate of 1:250 (2 fl. oz. to 3 gallons).

QUICKER DROUGHT RECOVERY BY SOWN PASTURES.

Sown pastures in the Chinchilla district have produced feed after a drought three weeks earlier than native grasses, the Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) said recently.

According to a report by the Senior Agrostologist in the Department (Mr. S. Marriott), these trial pastures were established three years ago on Mr. C. Washington's property at Mandanyi, in the Chinchilla district, under the auspices of the Dairy Pastures Improvement Committee.

The pastures were sown on land which was formerly cultivated and grew fodder crops and wheat. Soil erosion became a problem and it was necessary to retire the land from cultivation at least temporarily.

Mixtures of green panic and lucerne, and Rhodes grass and lucerne, machine-planted in drills 14 in. apart, have provided valuable grazing ever since they were established. The lucerne, sown at the rate of ½ lb. per acre, has persisted remarkably well in both mixtures.

A close observation of the plots showed that these mixtures provided grazing for a much longer period than the native grasses and after a drought their recovery was quicker.

Mr. Collins said the results obtained on Mr. Washington's farm demonstrated the value of these improved pasture species in the Chinchilla district, both to provide high-quality fodder and to assist in checking soil erosion.

With technical assistance from officers of the Agriculture Branch of the Department, Mr. Washington has also shown that, in the Chinchilla district, fodder can be conserved successfully with a minimum of equipment and without having to employ outside labour.

Using a buckrake, he has already conserved a considerable quantity of fodder, mainly sorghum, in shallow trench and earth clamp silos. He has set as his target a drought standby of 500 tons of silage.

Fodder conservation, combined with pasture improvement, should do much to increase farm productivity and offset the effects of poor seasons.

Lettuce, Celery and Some Other Greens.

By C. N. MORGAN (Senior Adviser in Horticulture) and S. E. STEPHENS (Horticulturist).

Several crops are grown primarily as salad greens. Some of them are winter-growing species while others thrive during summer. All are used to a greater or lesser extent in Queensland according to their availability in particular areas. The crops considered here are lettuce, celery, common spinach, New Zealand spinach, orach, summer spinach and shallot.

LETTUCE.

Lettuce (*Lactuca sativa*, fam. *Compositae*) is a small, low-growing compact plant with crinkled leaves. It completes its development in from 7 to 10 weeks and towards the end of the vegetative phase the leaves usually—but not always—form a characteristic "heart." Lettuce is outstandingly the most important of the salad greens and in the past decade has not only become a major commercial crop on farming lands adjacent to the larger centres of population but is also widely cultivated in home gardens.

The plant is probably native to Central Asia.

Varieties.

Warm Weather Varieties.

Great Lakes.—Represented by Great Lakes, Early Great Lakes and Improved Great Lakes, which are very similar in appearance, having blistered frame leaves with finely serrated margins. The head is large, with an average weight of slightly over 1 lb., and the heart is firm and well covered. Great Lakes is a little darker in colour than the other two strains. They begin to mature in about seven weeks after planting, and harvesting continues for about two weeks.

Pennlake.—Derived from Great Lakes. The head is, however, slightly smaller and the heart is light green in colour. This variety is quick-maturing, resistant to tip burn and appears to be the most reliable of the available warm weather varieties.

Imperial 847.—A quick-maturing lettuce of medium size, with a firm, well-wrapped head which is partly exposed when mature; the leaf colour is light green. It is less tolerant of hot weather than Great Lakes and shows a tendency to bolting and tip-burn in summer.

Imperial 44.—In many respects similar to Imperial 847.

Seedless.—A large, slow-maturing lettuce with pale green leaves. It is grown to some extent in Central Queensland during warm weather.

Other warm weather varieties which are sometimes grown in the home garden are Mignonette, Green Mignonette and Iceberg.

Cold Weather Varieties.

Imperial Triumph.—A large lettuce, mid-green in colour with heavily blistered frame leaves, glossy compact wrapper leaves and a firm, rather flattened heart of high quality. Uniformity of plant type, attractive appearance and good carrying qualities have made this variety popular for winter crops.

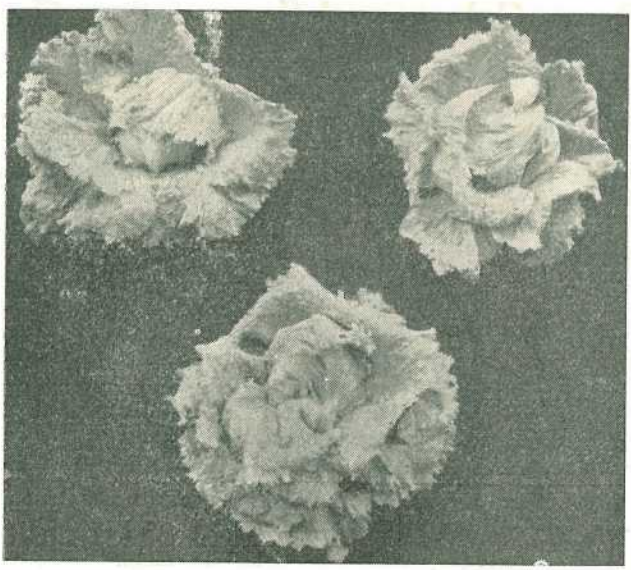


Plate 1.

Lettuce Varieties. Top: Imperial 615. Bottom: Imperial 847.

Imperial 615—Similar in many respects to Imperial Triumph but a lighter green in colour. Though a good quality lettuce, it has been replaced largely by Imperial Triumph in commercial plantings.

New York.—Has some characteristics of Imperial 615 but the leaves are dark green and the head is comparatively small, with a compact heart.

Other Lettuce.

Cos varieties have long, spoon-shaped leaves and elongate upright heads. They are fairly resistant to tip burn but do not carry well.

Leaf varieties.—Large non-hearting types of lettuce with heavily curled or crumpled leaves. They do better than the heading types in Central and North Queensland during the summer weather and are not prone to bolting. The leaves are all the same colour and often lack the crispness and flavour of the blanched leaves of head lettuce. Slobolt is one of the best known varieties.

Climate and Soil.

Temperature, moisture and soil are important factors in lettuce production. Good quality heads can be produced most easily when temperatures are moderately cool, at least as the crop is maturing. Extreme temperatures influence growth adversely; high temperatures produce loose-leafed plants which are prone to "bolt" or develop seed heads, and low temperatures, although they may not seriously injure young plants, can cause leaf burn and breakdown in the maturing plant.

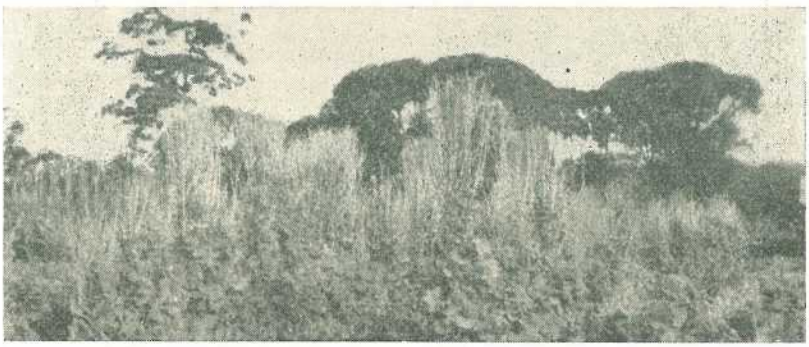


Plate 2.

Bolting in the Lettuce Crop. This is a characteristic of some varieties when the plants mature in warm weather.

A well drained soil is desirable, and sandy loams, loams, and clay loams may all be used for the crop. The chief requirements are good soil structure and high fertility, both of which are essential for a rapidly growing plant which matures its crop in a relatively short period.

Light sandy loams are best for the winter crop, but less suitable for summer crops because they tend to become too dry and hot for the plants. The heavy clay loams which remain cooler and retain their moisture reasonably well under hot conditions are therefore preferred for spring and early summer crops. In summer rainfall areas these retentive soils must be hilled to ensure good drainage for late summer and autumn plantings.

Moderately acid soils produce the best crops. Very acid soils (pH 5·0 and less) and alkaline soils (over pH 7·0) both give low yields by comparison with soils in the range pH 5·8 to 6·6.

A check in plant growth has an adverse effect on head quality in lettuce. For commercial production, therefore, it is imperative to have irrigation facilities on the farm.

Crop Rotation.

Lettuce are often grown each year on the same land. This practice is undesirable, for even though the structure of the soil may be maintained by frequent and heavy dressings with farmyard manure, diseases tend to take increasingly heavy toll of the crops. It is generally better to interpose plantings of other vegetables between successive lettuce crops. When crop rotations are not practicable, a short-term green manure crop between lettuce plantings is essential.

Plate 3.

Green Manure Crop Turned Under During Land Preparation for the Lettuce Crop.

Land Preparation and Fertilizing.

Land requires careful and thorough preparation for lettuce. Two or three ploughings, depending on the texture of the soil, are desirable and these should be followed by further cultivation until the soil is brought to a fine tilth. A float constructed from overlapping weatherboards nailed to a strong frame (Plate 4) is useful in the later stages of land preparation for levelling the soil and breaking down small clods.

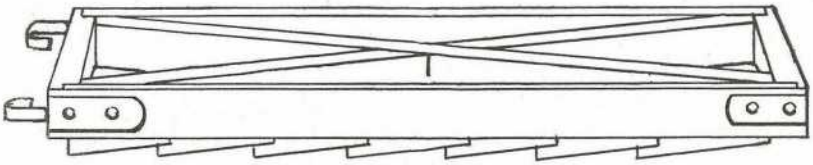


Plate 4.

Wooden Float. Used for levelling the soil and breaking down small clods; overlapping weatherboards for scraping action.

Any deficiency of organic matter must be made good by the addition of farmyard manure to the soil during the early stages of land preparation or alternatively by turning in a green manure crop grown expressly for this purpose.

The fertilizer used as a basal dressing may be blood and bone or a 5-13-5 mixture containing blood and bone. It is usually broadcast over the ground a week or so prior to planting and cultivated into the soil. The amounts used vary according to the soil type and range from 10 cwt. to 15 cwt. per acre (about 3-5 lb. per chain row).

During the growing period, side dressings with nitrogenous fertilizers such as sulphate of ammonia are usually necessary. Two applications at a rate of 2 cwt. per acre may be required, the first soon after thinning, and the second when the plants are nearly half grown. Side dressing fertilizers should be placed in a band along the

row just before an inter-row cultivation is scheduled. Excessive nitrogen should not be applied when the plants are hearting, as it tends to produce loose heads. Any fertilizer which settles on the leaves may mark them and it is therefore a good practice to irrigate the crop immediately after applying a side dressing. The total amount of side dressing fertilizer should not excess 4 cwt. per acre.

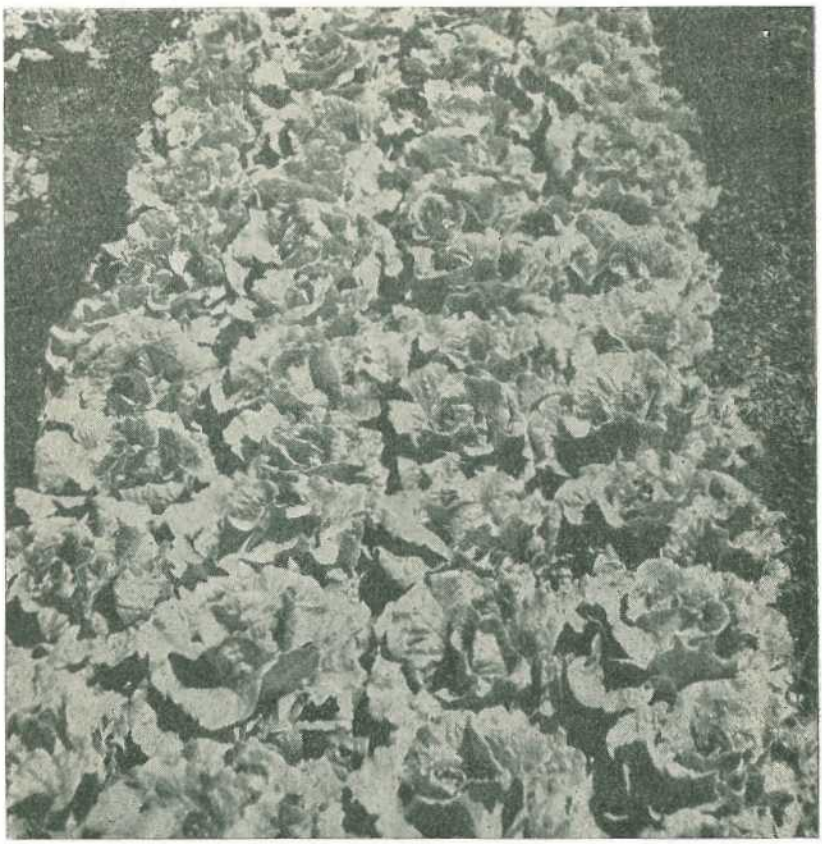


Plate 5.

Bedded Lettuce. Four rows of plants are established on each raised bed.

Planting.

Before mechanical seed planters came into general use it was customary to sow lettuce seed in beds and transplant the seedlings. This practice has now been largely replaced by direct sowing in the field.

One of two methods is usually adopted. The first is to build up beds about six feet wide by throwing in the soil with a plough, smoothing the surface with a levelling float, and then sowing the seed in four rows some 12 to 15 inches apart (Plate 5). Bedding up is particularly desirable on shallow or heavy land, as it increases the depth of friable surface soil under the plants and improves drainage. The second method does away with the raised beds, the crop being planted on level ground (Plate 6). This practice is quite satisfactory on deep and well drained loams or on sandy soils with a tendency to dry out when mounded.

A 15-inch row spacing is adequate when inter-row cultivation is done by hand hoes, wheel hoes or tractor equipment, but where horse-drawn implements are used a two-feet spacing is necessary.

The seed is drilled in continuous rows with a hand-operated wheel planter or with two or three planters of the same type drawn by a tractor. Shallow sowing is necessary. The normal depth of sowing is

Plate 6.

Single Row Lettuce Planting on Level Ground.

half an inch, but if the land has been well prepared and sufficient moisture can be maintained in the surface soil, even shallower sowing is desirable. Deep sowing is a common cause of faulty germination in lettuce crops.

Heavy seeding should be avoided, as the work involved in thinning is laborious and expensive. With carefully adjusted planters, a good stand of lettuce can be obtained with from 1 lb. to 1½ lb. of seed per acre.

The area planted at one time should be no more than the grower can harvest and the market can absorb within a period of one or two weeks. To ensure continuity of supply and the efficient use of the labour available for cultivation and harvesting, small sowings can be made at short intervals.

Thinning and Cultivation.

Overcrowding is a very common cause of poor heading in lettuce. Thinning of the young seedlings is therefore essential and it should be carried out when the plants are 2-3 inches tall. By that time, the plants are well established and can be blocked out with a small hoe to clusters spaced about 10 inches apart. The clusters are thinned by hand to single plants within two or three days of the hoeing. Blanks in the rows, if any, can be filled by transplanting some of the thinnings.

Cultivation should be sufficiently frequent to suppress weeds when they are young, as the crop may be set back by the removal of big weeds. Hand chipping is necessary in the rows, but, provided the crop is well grown, only two such chippings will be needed during the growing period. The first is usually carried out when the crop is thinned and the second a fortnight or three weeks later. The inter-row spaces can be cultivated with a wheel-hoe or with a small tractor fitted with hoes or other suitable attachments. Cultivation should always be shallow.

Irrigation.

Irrigation is essential for the lettuce crop. Surface irrigation entails accurate levelling of the land before planting or else contour planting, and therefore the overhead spray system is usually more satisfactory in commercial practice.

If the ground is fairly dry, the land should be irrigated a few days before sowing. After sowing, the area should again be watered and then kept moist to prevent the formation of a hard crust on the surface before germination is completed. A plentiful supply of water is necessary, particularly during the warmer months when evaporation and transpiration are high. Soil and climatic conditions influence irrigation practices and no hard and fast programme can be laid down. Two to three applications weekly are usually necessary in winter but more frequent watering will be required in spring and early summer. On well-drained light-textured sandy loams, it may be necessary to water every day in dry, hot weather.

Overhead watering during the middle of the day is undesirable in summer, as this practice may increase losses from tip-burn and slime. It is better to water the crop in the early morning or late evening when the plants are cool.

Harvesting.

Lettuce should be harvested as soon as they reach maturity, for overmature plants tend to be bitter and are usually unpalatable. Winter lettuce remain in the field until the hearts are firm; summer lettuce, on the other hand, are frequently loose leafed and may be cut when they reach reasonable market size. During hot weather, harvesting must not be delayed or the plants may run to seed.

The stem is cut as short as possible, preferably early in the morning of marketing day. The heads are then trimmed, graded for size and packed loosely in double-layer crates for market.

CELERY.

Celery (*Apium graveolens*, fam. *Umbelliferae*) is a native of Europe and western Asia, and the wild plant was first cultivated for medicinal purposes under the name "smallage." Varieties suitable for salad use were not developed until comparatively recently. Production in Queensland is limited to a few farms at Stanthorpe and near Brisbane.

The plant is a low-growing biennial with a dense crown of much dissected leaves, the long, fleshy, grooved stalks of which have a distinctive flavour and crisp texture. Seed is normally produced in the second year, but the flower head may appear during the first year of growth if temperatures in the seedling stage are low or if temperatures are high when the plant is maturing.

Varieties.

South Australian White.—A vigorous plant with long stems that blanch to a cream colour. When blanching is not practised the stems are pale green.

Golden Self-Blanching.—A variety with a large head that provides almost sufficient shade for natural blanching of the stems. The stems are short but of good quality.

Soils and Fertilizers.

The most suitable soils for the commercial production of celery are sandy loams with a pH of 6·0 or more and a high organic matter content, but the crop may also be grown on lighter soils with heavy applications of animal manure. Ample moisture is necessary throughout the growing period, and as the rainfall in most parts of Queensland is somewhat unreliable, irrigation is essential. Both surface and overhead irrigation systems are effective.

Dressings of animal manure, preferably sheep manure, at the rate of 25 tons or more per acre on sandy soils and 10-15 tons per acre on sandy loams are beneficial. They should be applied in the early stages of land preparation for the crop so that the added organic matter is thoroughly incorporated in the soil and does not interfere with the tillage operations needed to produce a good seedbed.

Planting in the field should be preceded by a basal fertilizer dressing at a rate of from 6 to 15 cwt. per acre, depending on the fertility of the soil and the amount of animal manure previously applied. On a fertile soil, a 4-8-12 or similar mixture is suitable, but on a sandy soil to which little manure has been added, mixtures with a higher nitrogen and phosphate content may be used with advantage.

Side dressings during the growing period are essential. About 3 cwt. per acre of ammonium sulphate may be applied in three equal dressings of 1 cwt. each a fortnight, five weeks and 10 weeks after transplanting, the last application being made shortly before blanching. The celery plant is a poor forager and the fertilizer should therefore be placed in a band close to the plant.

Planting.

Celery seeds are small—about 60,000 to the ounce—but only 10,000 to 15,000 sturdy plants are normally obtained from an ounce of seed. As the viability of the seed is often poor, fresh seed should always

be planted. Seedbed preparation must be thorough and sterilization of the soil is desirable.

Seedbeds are constructed 3 feet wide and sufficiently long to contain the number of seedlings required. The seed is sown thinly across the seedbed in shallow drills spaced six inches apart, and lightly covered with soil.

During the pre-germination period of from 5 to 14 days and the following three weeks the beds must be regularly watered to prevent the surface soil from drying out. An early thinning when the plants are about an inch high is frequently followed by a second thinning when the plants are between two and three inches high.

Before transplanting, the seedlings are hardened off by withholding water from the seedbed for a week to 10 days and the ground is then given a thorough soaking immediately before the plants are lifted. This is done when the plants are about four inches high.

Field Culture.

Soil preparation in the field must be thorough. The soil is deeply cultivated, graded off with levelling boards and worked to seedbed condition. Planting begins in February in southern coastal Queensland and in September on the cool Tablelands, the crop being established in single, double or multiple rows according to the preference of the grower. Double and multiple row plantings give a higher plant population per acre than single row plantings but increase the problem of controlling weeds. In single row plantings which require about 20,000 plants per acre, the rows are spaced 3 feet apart and the plants at 6 to 8 inches in the row. It is usual to space the double rows 3 feet apart with the paired rows 15 inches from each other, the plants being 10 inches apart in the rows. Approximately 26,000 plants are set in an acre of land by this planting method. Multiple row planting involves the use of beds which are wide enough to contain about 12 plant rows, these being 10 to 12 inches apart with a plant spacing in the row of 10 inches.

Successional plantings are desirable in order to ensure a prolonged harvesting period.

If the soil is in good condition the rows can be easily defined with the aid of any standard marker. The plants are then set out in drills at the required spacing with the aid of a dibble when the soil is reasonably moist. The transplants should be watered in or irrigated immediately after planting.

Once the crop is established, vigorous growth must be maintained by frequent irrigation. After each application of water, surface cultivation is practised to destroy young weeds and restore the surface mulch.

Blanching.

Celery may be blanched during the later stages of growth to improve its appearance, flavour and tenderness.

Formerly the plants were blanched by earthing up, but boards or paper may be used. Boards should be made up in sections about 12 feet long by 10 to 12 inches wide. One such board is placed on edge against each side of the row of plants, the top edges being held close

with cleats tacked over them or with stout wires bent to form three sides of a square and slipped over the boards. A little earth should be shovelled against the boards to keep them in position. Heavy internally tarred and reinforced paper may take the place of boards. It is cut into strips one foot wide, rolled out along each side of the row, and then held upright with long U-shaped wires pushed into the ground to keep the two strips in position. The leaves should remain exposed or they too will become bleached and spoil the appearance of the celery.

Blanching must not be carried on too long or the celery will lose flavour and become pithy; two to three weeks' protection is usually sufficient to produce marketable stems from the early or self-blanching varieties.

When celery is grown on the multiple row system, blanching is not necessary, at least for crops marketed in Queensland, where pale green stems find a ready sale.

Harvesting.

Harvesting is carried out with a sharp spade or knife, the plants being cut at or just below the surface of the soil. The outer ragged leaves and coarse and damaged stems are then removed and the base trimmed close. The trimmed heads should be taken under cover as soon as possible, washed in cold water, drained and then packed in well ventilated crates.

Plate 7.
Celery. Crop Ready for Harvesting.

COMMON SPINACH.

Spinach (*Spinacea oleracea*, fam. *Chenopodiaceae*) is a winter and spring vegetable with a high mineral and vitamin content. The edible portion of the plant is the compact rosette of leaves produced before elongation of the central growing bud into a flower stalk. The leaves are used as a cooked green vegetable.

There are two types of spinach, designated round-seeded and prickly-seeded according to the type of seed produced. Each type contains some varieties with smooth leaves and others with savoyed or crumpled leaves. Low temperatures cause intense savoying in the savoy varieties and a crumpling of the bases of the leaf blades in smooth-leaved varieties. On the other hand, high temperatures cause yellowing of the leaf margins, and in extreme cases of the whole plant.

Crop Management.

Spinach thrives on a well drained, fertile soil that is well supplied with organic matter and mildly acid to neutral (pH 6·0 to 6·8) in reaction. If excessive acidity has to be corrected, lime should be broadcast and lightly harrowed into the soil. The crop is relatively tolerant to salt.

As spinach of high quality is produced only by rapidly growing plants, liberal dressings of fertilizer are often profitable. On light loams, up to 10 cwt. per acre of a 10-6-10 or similar basal fertilizer is desirable, and on light sandy loams, side dressings of sulphate of ammonia may also be required at a rate of 1 cwt. per acre.

Seed must be fresh to obtain good germination. In most parts of Queensland, autumn and winter sowings are satisfactory, but the season may be extended into early spring on the southern highlands.

The seed is sown thinly in drills 12 inches or more apart according to the methods of cultivation. It may be necessary to thin the plants to a 5-6 inch spacing, but thinning need not be practised unless there is obvious overcrowding in the row.

The crop should be ready for harvest about eight weeks after sowing and the work is carried out in the afternoon when the leaves are slightly limp. The plants are cut at ground level, any damaged or discoloured outer leaves being removed before the heads are despatched in single layer crates to market. Loose packing is desirable. Spinach stores well under cold room conditions.

NEW ZEALAND SPINACH.

New Zealand spinach (*Tetragonia expansa*, fam. *Aizoaceae*) is not a true spinach, the plant being a low growing, sprawling and much branched annual with a spread of up to 4 feet. The leaves are rather small, triangular-ovate in shape and thick, with a silvery surface The edible portion of the plant is the succulent terminal part of the lateral shoots.

The plant is native to Australia, New Zealand, South America and Japan. In Queensland, it grows wild on coastal soils in summer and can withstand considerable drought and heat.

The seed is sown in spring when all danger of frost is past. It should be planted about an inch deep and the seedbeds must be kept moist for two or more weeks until germination is complete. Seedlings may be transplanted into rows four feet apart with the plants two feet apart in the row. If the seed is sown direct in the field, the rows should be spaced four feet apart and the plants thinned to two feet. Nitrogenous side dressings are required to maintain vigorous growth and the production of crisp, fresh tips. The terminal three inches of each branch is harvested periodically during the warm months of the year.

ORACH.

Orach, French spinach or mountain spinach (*Atriplex hortensis*, fam. *Chenopodiaceae*) grows well in hot dry climates that are quite unsuited to the common spinach and can be a useful green vegetable in western areas. In soils that are approximately neutral or slightly alkaline in reaction, the plant may grow up to 10 feet high.

There are four types of orach seed, some of which, such as the black, usually germinate badly. Yellow-brown seeds should normally be used for planting. Seeding should be carried out early in the spring; plants established later are usually less vigorous. Plant spacing depends upon whether the plants are to be harvested whole in the seedling stage or allowed to mature a leaf crop. In the former case, the seed is sown continuously in rows spaced 18 to 20 inches apart; if mature growth is desired, the rows should be 3-3½ feet apart. In light soils, the seed may be sown at a depth of one inch, but in heavy soils a half-inch soil cover is sufficient.

The plants reach a height of four to six inches in about six weeks and can then be harvested whole for culinary use. At this stage of growth, the crops that are to be held to maturity should be thinned to three feet in the rows. The tender tip leaves are stripped from these plants at regular intervals to give a continuous supply of vegetable greens. Sufficient leaves must be left on the plants to maintain growth over an extended cropping period.

There are four types of orach—Pale Green Leaved or White Orach, Green Orach, Red Orach, and Dark Red Orach. The vegetable is only infrequently listed in Australian catalogues, but overseas the varieties Triumph, Green Double Headed, and Glebe are commonly grown.

SUMMER SPINACH.

Summer spinach (*Amaranthus gangeticus*, fam. *Amarantaceae*) is a tropical vegetable that thrives in coastal areas during the summer months. Chinese gardeners who specialise in its production call it Yin-choy.

The seed is glossy black in colour and very small. It is difficult to sow sufficiently thinly for the production of good seedlings but reasonable spacing may be obtained by adding the right amount of seed to a watering can and watering the bed. The seedlings grow rapidly and are transplanted two to three weeks after sowing. They should be set out in the field in rows 18 to 24 inches apart with 6 to 9 inches between the plants, the soil having first been well prepared for the crop and liberally dressed with a complete fertilizer mixture.

In about 15 to 20 days after transplanting, the spinach should have reached a height of 10 to 12 inches and be fit to harvest. The whole plants are pulled from the ground and, after the roots are washed, tied into bundles for marketing.

In the home garden, single plants spaced about two feet apart are permitted to mature and the terminals of the branches are plucked for use as vegetable greens. These are palatable so long as the terminal portions of the branches remain succulent.

SHALLOT or ESCHALOT.

The shallot (*Allium ascalonicum,* fam. *Liliaceae*) is a perennial plant with an underground bulb. The crop is used mainly as a salad green, but sometimes the dry bulbs are used for seasoning or as a mild substitute for onions.

Propagation is by bulbils (or cloves) which are separated from the dry bulb and planted in early spring or autumn. The bulbils should be set out singly at 2-inch spacings in rows 9-12 inches apart in a rich, well prepared soil. A basal fertilizer such as a 5-13-5 mixture may be used when necessary at a rate of 4-6 cwt. per acre.

When grown for use in the green state, planting to a depth of at least three inches is essential for the production of long, well-balanced and succulent tops. In irrigated crops, plant growth is rapid and the shallots can be pulled in from 3 to 4 months. At this stage, the bulbs are still soft, the earthed portion of the stalk is white, and the aerial portion is quite green.

When grown for use as dry bulbs, shallow planting is practised and the soil is from time to time drawn away from the plants during the growing period until, as they approach maturity, they are practically sitting on top of the ground. This treatment encourages the filling out and hardening of the bulbs. The bulbs are not harvested until the tops have begun to wither, and after drying out they are divided and stored in a cool place.

DAIRY BULL TESTING SCHEME.

The Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) has announced that a project for testing dairy bulls, employing artificial insemination as an aid, is to be introduced in Queensland this year.

The project aims at identifying an outstanding sire that can be used for large scale improvement of the State's dairy herds.

Suitable Jersey bulls from selected Queensland studs will be mated artificially with a number of cows on about fifty farms in an area where herd recording is practised. The heifers born of these matings will be reared on the farms and production-recorded during their first lactation.

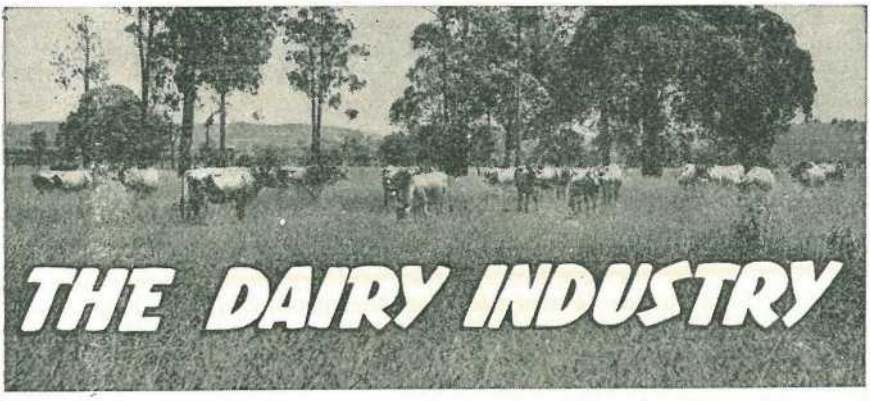
The breeding value of the bulls will be assessed from the average production of their daughters.

Although feeding and management of the heifers will vary somewhat on the different farms, the bulls will be affected equally because their progeny, being distributed throughout the area, will be subject to the same degree of variation in conditions. Also because matings will be randomised in all herds, each bull stands an equal chance of having daughters from good or bad cows.

The size and scope of the project has made it necessary to confine activities to one breed. Jerseys have been chosen mainly for the reason that there is an adequate number of herds of this bred under test in herd recording groups within a fairly restricted area.

It is hoped to carry out the project in the area covered by the Maleny, Mapleton-Kureelpa, Kenilworth and Landsborough-Caboolture herd recording groups. For its success a high degree of co-operation from a fairly large number of farmers will be required as well as careful organisation and supervision by officers of the Department.

The rewards in terms of herd improvement are, however, likely to be very well worthwhile.



Storing Rain Water for Dairy Use.

By R. R. FANNING, Dairy Officer.

An ample supply of rain water for use in the dairy cannot be too strongly recommended. As dry periods are frequently experienced, provision for the storage of rain water is of the greatest importance on Queensland dairy farms.

A large percentage of dairy farmers in Queensland depend upon a single 1,000 gallon tank as the sole source of water for cleansing purposes. This results in insufficient water being used and consequently hygiene is often not of the high standard which is essential for good quality milk and cream. For instance, where milking machines are used, at least 8 gallons of water per unit are required daily for effective cleansing. With only a 1,000 gallon tank, this amount cannot be maintained throughout the year and the farmer has to resort to well or dam water. This is, in many cases, of a hard nature and results in mineral deposits on equipment, and in addition increased expenditure on detergents and water softeners.

The following method of storage, as provided by Mr. A. Dale, of Long Flat, Gympie, is one well worth consideration by dairymen who intend building a milking shed on a sloping site needing a bulldozer or grader to level it.

Mr. Dale has overcome the expense of using earthmoving equipment by building a concrete tank on the lower side and erecting his separator room over the tank. The tank is 6 ft. deep and 14 ft. in diameter.

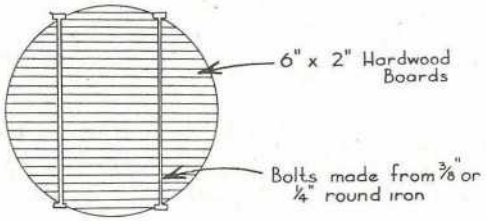


Plate 1.

Sketch of Wooden Covering Over Tank.

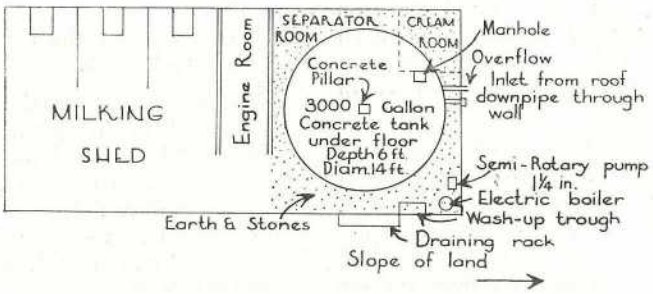


Plate 2.

Sketch of Layout of Milking Shed in Relation to Underground Tank.

This was done by removing sufficient earth to enable the top of the walls of the tank to be built to the required floor level. A concrete pillar, 1 ft. square, was placed in the centre to support the floor above. The concrete foundations for the walls of the milking shed were then laid, the height being approximately 18 in. higher than the top of the tank. This allowed for a wooden covering over the tank of hardwood boards (6 in. x 2 in.), which are clamped together by means of two long bolts, as illustrated in Plate 1.

On top of these boards a single layer of Ormonoid was laid.

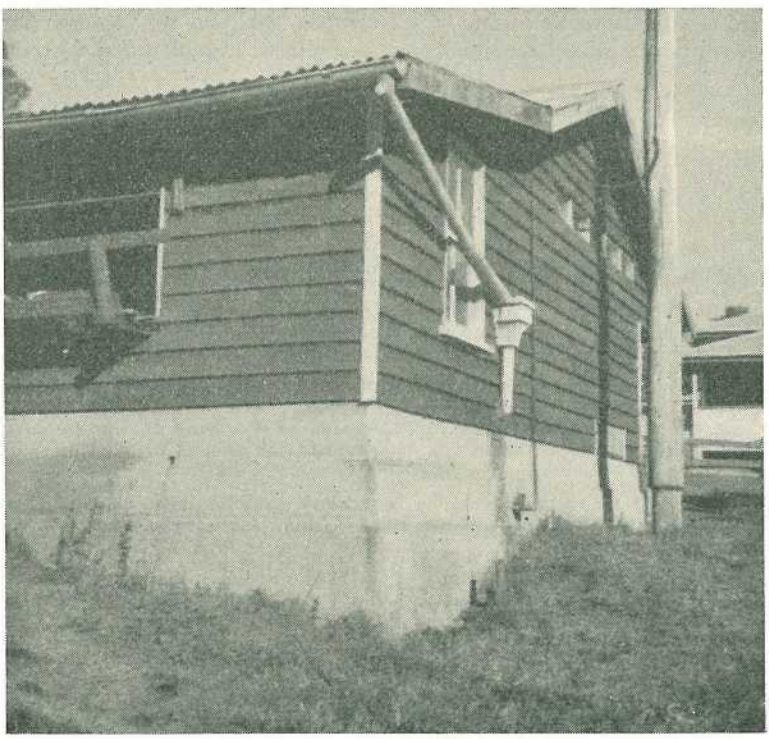


Plate 3.

Photograph Showing Inlet from Roof Downpipe Through Wall, and Below it the Overflow.

The space between the foundation walls and the tank was then filled with rocks and earth to the same level as the top of the tank, as shown in Plate 2.

Openings for a manhole 15 in. x 18 in., an inlet to take a strainer, an overflow and an opening for provision of a 1 in. pipe to the pump were cut in the wooden cover at the required positions. The concrete floor for the building was then laid in the usual manner. This then left a concrete dwarf wall 12 in. high around the outside edge for the bolting on of the ground plates for the walls.

When laying the floor a small raised wall was built around the opening for the man-hole and strainer to prevent the entry of water from the floor of the separator room. A metal cover was placed over the strainer to prevent the entry of foreign matter through the strainer.

Water is withdrawn by means of a 1¼ in. semi-rotary pump mounted on a small concrete post in a convenient position, handy to the electric boiler and wash-up trough.

The tank holds approximately 3,000 gallons, and the temperature of the water was 14 degrees lower than that of a 1,000 gallon surface tank taken on the same day. This source of water supply would be very satisfactory for circulation through milk coolers and could then be returned to the tank.

Approximately one ton of cement was used, the mixture being 5 to 1. Numerous large stones were dropped into the walls of the tank as the concrete was poured, thus making the 10 in. walls of the tank much stronger.

The cost involved in the building of a tank like this would be comparable with that of the cost of two 1,500 gallon corrugated iron tanks, tank stands, pipes and fittings. The concrete tank, however, would be a lifetime job, and would never have to be replaced as most tanks do to-day.

DEMONSTRATE NEW DAIRY CLEANING METHOD.

Methods of using the equipment designed for the re-circulation system of cleaning milking machines will soon be explained to Queensland dairy farmers by officers of the Department of Agriculture and Stock.

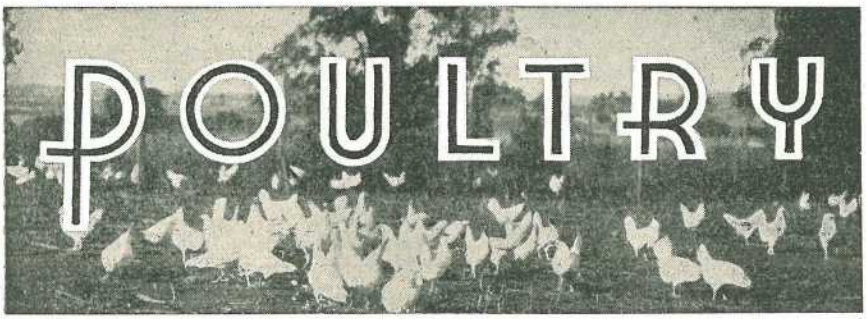
This special equipment, the Minister of Agriculture and Stock (Hon. H. H. Collins, M.L.A.) said recently, is now being manufactured by three milking machine firms. Sets are being purchased by the Division of Dairying in the Department, and at field days Dairy Advisers will demonstrate the system of cleaning milking machines by re-circulation.

Preliminary tests, supplemented by laboratory examinations, indicate that the re-circulation system offers promise of being a more effective method of cleaning milking machines.

With the new equipment, water is run through the machine over and over again until all parts have been cleaned. The same quantity of water used in the present cleaning system is required for re-circulation, but with the longer period of contact better use is made of the cleaning solution.

Officers in the Division of Dairying are now working out a method of operation suitable for use on farms. They will determine the periods of time that re-circulation should be allowed to continue in each step of the cleaning process and the most suitable detergent strengths.

Mr. Collins said the adoption of this system of cleaning milking machines by the dairy industry could play an important part in improving the quality of Queensland's dairy produce.



Sorghum Doesn't Harm Chickens.

By H. W. BURTON, Assistant Poultry Adviser.

More sorghum than ever before is being used in chick growing and laying rations in Queensland. So widespread has its use become that the demand exceeded the supply in 1954. Its increased popularity was due to the fact that even at its peak price sorghum was still £8 10s. a ton cheaper than wheat. Even if only the whole-grain portion of the ration consisted of sorghum, this meant a saving of over £200 a year in the feed bill for a thousand pullets.

Experiments in other States and overseas had shown that sorghum was a satisfactory substitute for wheat in laying rations. Our demonstration work on feeding sorghum to layers, recorded in the Departmental pamphlet "Sorghum for Layers," proved this under field conditions. What of its use for chickens?

Experimental work carried out some years ago at the N.S.W. Department's Experiment Farm at Seven Hills indicated that sorghum should be used to the extent of only 15% of an all-mash chick starter ration and that deaths and poorer growth resulted when greater amounts were used.

These results plus a deep rooted prejudice among farmers led the Queensland Department to re-examine the question of how much sorghum can be fed to chickens. We wanted to find out, firstly, how much sorghum meal could be substituted for wheatmeal; secondly, whether high levels of sorghum would cause deaths due to some toxic factor; and finally, whether these high levels of sorghum would retard growth.

THE EXPERIMENTS.

Four experiments were conducted during 1954 at the Poultry Section of the Rocklea Animal Husbandry Research Farm. The experimental rations were made as simple as possible and all contained the same amounts of bran, pollard, meatmeal, livermeal, salt, vitamins and minerals. Only the quantities of wheatmeal and sorghum meal were varied. Table 1 shows the composition of these chick starter mashes.

TABLE 1.

EXPERIMENTAL RATIONS.

Ingredient.	Group 1.	Group 2.	Group 3.	Group 4.
	lb.	lb.	lb.	lb.
Wheatmeal	60	40	20	..
Sorghum meal	..	20	40	60
Bran	22	22	22	22
Meatmeal (55 per cent. protein)	13	13	13	13
Livermeal	4½	4½	4½	4½
Salt	½	½	½	½
	100	100	100	100
Synthetic Riboflavin (milligrams)	160	160	160	160
Manganese Sulphate (grams)	16	16	16	16
Fish Oils A and D_3 (oz.)	2	2	2	2

Day-old cockerels for all four trials were obtained from commercial hatcheries. The chicks were brooded for a month in a four-tier electric battery brooder and then transferred to follow-on cages. At eight weeks of age they were removed from the cages and put into intensive pens on clean shavings.

To counter variation due to brooder follow-on or pen position, groups on the experimental rations never occupied the same position consecutively during the four trials.

RESULTS FROM THESE TRIALS.

The results obtained from the experiments are set out in Tables 2-5. They show the average weight gain to 12 weeks of age (Table 2), the total feed consumption per bird (Table 3), the "feed to gain" ratio (Table 4) and the number of deaths (Table 5).

The following comments are offered in respect to these results.

Weight Gains.

The growth rate in all experiments was very good, for 3 lb. at 12 weeks is considered quite satisfactory for heavy breeds and 2¾ lb. for light breeds. The weights gained as shown in Table 2 were much better than average. There was no apparent depressing effect on growth rate as has been found elsewhere.

TABLE 2.

AVERAGE GAIN IN WEIGHT FROM DAY-OLD TO 12 WEEKS OF AGE.

—	Ration 1.	Ration 2.	Ration 3.	Ration 4.
	oz.	oz.	oz.	oz.
Trial 1—White Leghorns	46·79	48·05	47·95	46·25
Trial 2—Crossbreds	58·54	55·86	53·58	52·31
Trial 3—Crossbreds	56·92	55·00	54·86	54·22
Trial 4—Australorps	51·34	55·14	56·56	54·71
Average Net Gains Over Trial Period	53·39	53·51	52·99	51·87

Food Consumption and Palatability.

The question arises, Do chickens dislike sorghum? Although chickens always pick out the coarse portion of a mash and leave the powdery material till last, they consume sorghum meal without hesitation. This has been proved in our trials, for the average feed consumed per bird on the ration containing 60% sorghum meal was 184·58 oz., compared with 178·95 oz. for the 60% wheatmeal ration.

TABLE 3.

Total Food Consumption per Bird.

—	Ration 1.	Ration 2.	Ration 3.	Ration 4.
	oz.	oz.	oz.	oz.
Trial 1—White Leghorns	153·50	159·10	159·20	167·20
Trial 2—Crossbreds	196·10	186·60	178·40	193·20
Trial 3—Crossbreds	182·00	184·00	189·00	178·40
Trial 4—Australorps	184·19	179·68	192·87	199·54
Average Consumption per Period	178·95	177·34	181·11	184·58

"Food to Gain" Ratio.

The "food to gain" ratio is obtained by dividing the average food consumed per bird by the average gain in weight and is a measure of food efficiency. In three out of four tests, 60% sorghum was the least efficient ration. However, this must be balanced against the lower cost of sorghum to get a true evaluation of its worth in chick mashes. The ration with 40% sorghum and 20% wheat was almost equal in efficiency to mashes with greater amounts of wheatmeal. It must be borne in mind that sorghum has a lower protein content than Queensland wheat; this could be responsible for a lower efficiency.

TABLE 4.

"Food to Gain" Ratios.*

—	Ration 1.	Ration 2.	Ration 3.	Ration 4.
Trial 1—White Leghorns	3·27	3·31	3·29	3·61
Trial 2—Crossbreds	3·35	3·34	3·42	3·69
Trial 3—Crossbreds	3·19	3·34	3·43	3·27
Trial 4—Australorps	3·56	3·25	3·41	3·61
Average over Period	3·34	3·31	3·38	3·54

* "Food to Gain" Ratio $= \frac{\text{Average feed consumed per group.}}{\text{Average gain in weight.}}$

Deaths.

All deaths that occurred during the experiments from day-old to 12 weeks were recorded and the birds sent to the Animal Research Institute, Yeerongpilly, for autopsy.

The fact that just as many chickens died in the groups fed 60% wheatmeal as in those on 60% sorghum meal shows that high percentages of sorghum were not responsible for deaths in this series of experiments.

TABLE 5.

DEATHS IN EXPERIMENTAL GROUPS.

—	Ration 1.	Ration 2.	Ration 3.	Ration 4.	Total.
Trial 1—White Leghorns	4	6	3	5	18
Trial 2—Crossbreds	3	1	1	2	7
Trial 3—Crossbreds	3	2	..	2	7
Trial 4—Australorps	3	1	1	4	9
Totals over Period	13	10	5	13	..

The heaviest losses occurred in the first trial with White Leghorns and most of these were due to faulty technique in debeaking. Debeaking losses in the other trials were practically nil.

The overall mortality of 6·4% can be regarded as normal.

SORGHUM—A CHEAPER FEED FOR CHICKENS.

From our results, it appears that sorghum can replace wheat in an all-mash chick starter ration. What are the economic implications?

The ruling market price of wheat in December 1954 was £29 10s. per ton, while that of sorghum was £21 per ton.

The relative costs of grain, which constitutes 60% of the ration in ration 1, 2, 3, 4, are as follows for one ton of feed.

Ration 1.	60% wheat	£17	14 0
Ration 2.	40% wheat, 20% sorghum	£15	18 0
Ration 3.	20% wheat, 40% sorghum	£14	2 0
Ration 4.	60% sorghum	£12	6 0

Ration 4 (60% sorghum meal) is the cheapest, but as it did not give quite as good a "food to gain" ratio as the other rations, ration 3 (20% wheatmeal and 40% sorghum meal) is preferred. Ration 3 produced equally good growth rate and "food to gain" ratio as rations 1 and 2, and is still much cheaper to feed than mashes with greater amounts of wheatmeal.

IN A NUTSHELL.

In trials in which sorghum meal up to 60% of the rations was fed to different breeds of chicks reared under ordinary farm conditions, chicks fared quite well on the highest level of sorghum used. Neither a depressing effect on growth nor losses attributable to sorghum were noted at this or lower levels of feeding. The 60% sorghum ration was not quite as efficient as a combination of 40% sorghum and 20% wheat. This ration proved to be the most economical ration used in these experiments.

Identification of Pigs.

By OFFICERS OF THE PIG BRANCH.

At a recent conference of Australian producers' and bacon manufacturers' representatives, a scheme for the grading of all pigs forwarded for slaughter throughout the Commonwealth was agreed to and provision made for premium payments for prime and first quality carcases.

With a comprehensive scheme of this nature in operation, the importance of proper and positive identification of all pigs will be readily understood. Therefore, every person interested in the sale or purchase of pigs for slaughter should be conversant with the various systems of identification.

In the regulations under "*The Pig Industry Act of* 1933," it is set out clearly that every pig offered for sale, barter or exchange shall be branded by the vendor with a body tattoo marking, or other approved method of branding. In the case of suckers, weaners, stores, or other pigs not

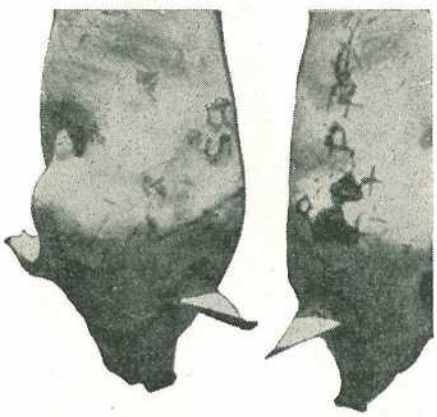


Plate 1.

A Close-up of Bacon Pig Carcases Branded Improperly and much Reduced in Value. The use of a firebrand, an instrument which may be used in the identification of carcases if properly heated and handled, may easily be nullified unless the work is carefully performed.

intended for immediate slaughter, ear-tattooing, or ear-marking is an approved method of branding; but such branding must be done within seven days prior to the disposal of pigs by sale or otherwise.

MARKING SYSTEMS.

Among systems of identification of pigs in regular use in Queensland are:—

Firebranding.

Body-tattooing.

Earmarking (inclusive of use of ear tags) and ear buttons.

Ear-tattooing.

Paint and hair-clip marking (including cutting of hair on tail—that is, bang-tail).

Firebranding.

For marking live pigs, firebranding has been in use throughout the world for many years and is used frequently by farmers here, especially by those who are not conversant with or in favour of other systems.

While there are many objections to identifying pigs by the use of a redhot iron brand the system has its

Plate 2.

Excessive Firebranding. It is an offence under the Queensland Pig Industry Act to illtreat a pig. Here is one result of excessive firebranding; also these brands have been placed in a most unsuitable position and are unnecessarily large.

place and doubtless will continue to be used. Efficient firebranding has the advantage that it is a method of marking live animals as well as carcases. In itself this method is effective if carefully applied with a suitable brand which is not overheated, or held too long, or pressed too deeply on the pig, as it results in a clear and legible skin and body mark. It is the abuse of firebranding which brings it into discredit, and it is often abused, as many otherwise suitable carcases have to be degraded or rejected because of excessive and cruel firebranding.

Suitable copper firebrands last longer than iron brands, although somewhat more expensive. The price varies according to design of letters or symbols. Only brands made specially for marking pigs should be used and of a size not exceeding $1\frac{3}{4}$ in. by $1\frac{1}{4}$ in. overall.

Firebranding has one special advantage in that it is used to identify live pigs belonging to various owners of mixed consignments to

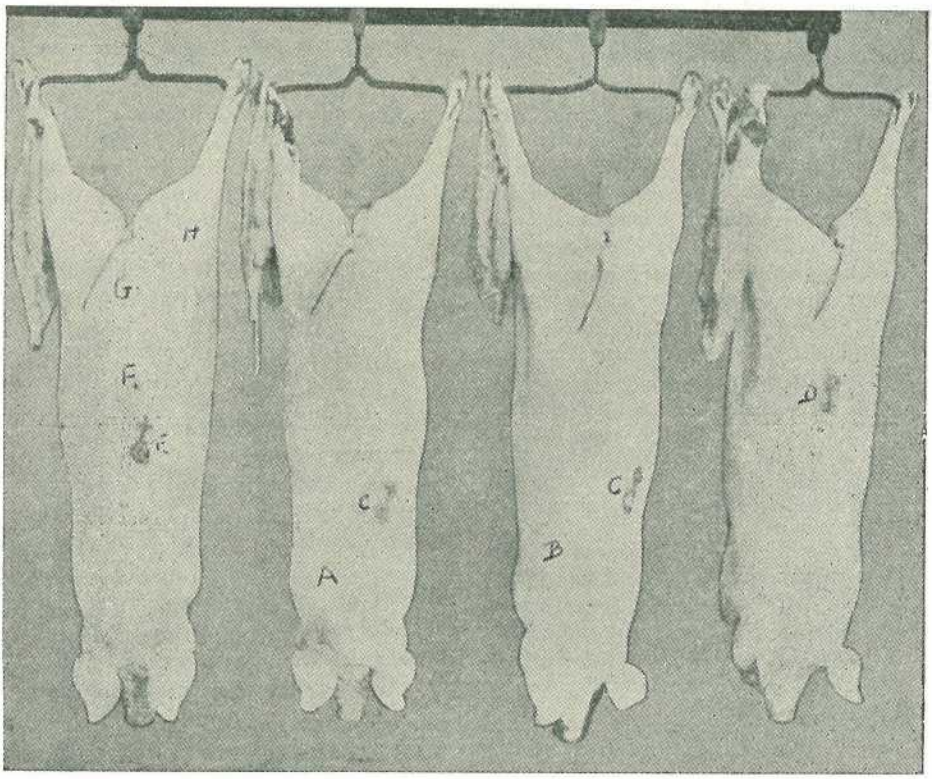


Plate 3.

Relative Merits of Different Positions for the Brand. "A" is the position preferred by bacon curers, and is referred to as "off the top of the shoulder yet not too far down side." "B" also is a good position for firebrands or tattoo; there is a risk in this position, for if the animal moves quickly during branding the brand may slip and blur. "C" is not a good position: its situation along the centre line of the back results in the disfigurement of the mark in the process of dressing the carcase. "D" is decidedly objectionable. "E" is even more objectionable. The positions marked "G" and "H," or any other position on the loins or hindquarters, are also most objectionable and result in the carcase being degraded. Where pigs have a heavy coat of hair, it would be preferable and much more effective to clip the hair off the spot before applying the firebrand.

saleyards and bacon factories, consignments in which the body-tattooing of carcases would not be sufficient. In some instances, however, ear-marking of such pigs could be used to advantage and with less objection than firebranding.

Where properly applied, firebrands on pigs will be legible for about two months, but afterwards they become difficult to decipher either on the live animal or on the carcase.

Body Tattoo-marking.

Tattooing is the best and most practical way of marking for the identification of pork and bacon pig carcases and this method has been generally adopted by bacon curers and pork exporters in Queensland. Correct identification of carcases is, of course, necessary in the treatment of pigs by factories, especially where payment is made on a basis of official grading. Moreover, it is necessary to identify owners of pig carcases in order that refunds or non-payments may be correctly adjusted where, on slaughter, carcases or parts are condemned as unfit for human consumption. Body-tattooing is particularly valuable in thus identifying ownership and also in providing necessary information in tracing disease to the place where it originated.

This method of identification has been thoroughly tested and has given general satisfaction, but the measure of efficiency is entirely dependent on the care used in handling the instrument and the provision of enough suitable ink or paste. The quality of the ink or paste used is very important. Of several preparations which have been subjected to experiment in Queensland, four stand out as being superior to all others. They are:—

(1) Indian marking ink (blue or black). This pigment, while more expensive than the others, is probably the most efficient and adaptable, and in actual use is very easily applied.

(2) "Zebra" stove polish in paste form has given excellent results, as has liquid stove polish sold under the trade name of "Zebo."

(3) Sherwin Williams black paint in oil has been used extensively by the proprietary bacon factories with satisfactory results.

These preparations are readily procurable in country centres. If not obtainable locally, they may be obtained from city firms. It is necessary to have a soft pad and a container to hold the paste, paint, or ink. When all is ready, the tattoo needles are dipped in the paste or ink, the needles being well covered; the pig is then struck firmly with the marker (Plates 5 and 6). The best position on the body for the tattoo mark is on the shoulder just off the top and slightly below top of neck. A sharp blow is required in order that the needles will penetrate the

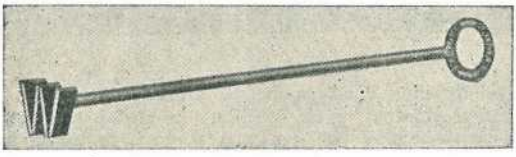


Plate 4.

Firebranding of Pigs, unless done very Carefully, is an Objectionable Method of Identification. Where the firebrand used is of a suitable pattern its use in the identification of live pigs submitted for sale or on mature animals intended for slaughter after sale is permissible. This type of firebrand, manufactured especially for the purpose, is the only type recommended: it leaves a small, neat, and distinct mark if properly applied.

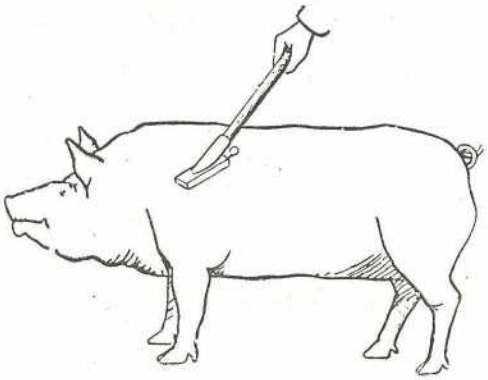


Plate 5.

The Pig-body Tattoo, showing Position favoured for the Identification Mark on the Carcase.—This instrument is supplied by manufacturers complete with nickel-plated headpiece and wooden handle. The numerals are mounted in polished aluminium blocks, the positions being altered in a few seconds by means of an adjusting screw. Spare numerals and dummy blocks may be ordered; tattoo ink or paste is supplied in quantities as required. If carefully handled, the one set of letters and numerals should be satisfactory for many years.

skin, and after each pig is marked the needles should be again covered with paste or ink. Actually, although the needles are sharp and the blow heavy, the pig does not feel much pain and apparently does not suffer injury, for it is very rarely that even a slight bruise is noticeable after slaughter if tattooing is done properly.

It is stressed again that this system of body-tattooing is not recommended as a means of identification of live pigs—not even of white-skinned pigs. Its value lies in the legibility of the tattoo mark on the carcase, the ease with which the tattoo mark may be read and the fact that its application does not result in disfiguration or other injury. It also is stressed again

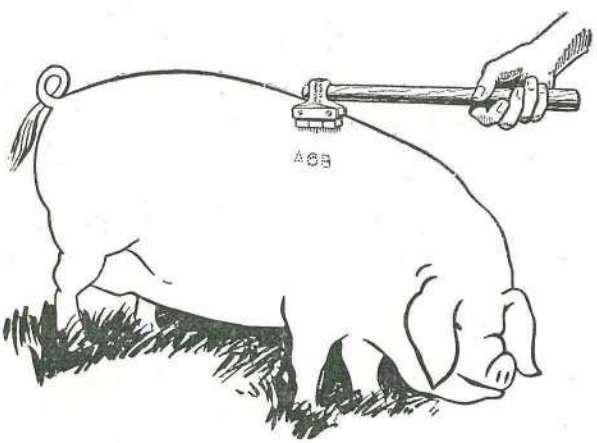


Plate 6.

The "Two-Way Tattoo Pigmarker" is Constructed to Withstand Hard and Constant Use. The headpiece is made of aluminium with steel-pointed needles, the wooden handle being adjustable for use in two positions—one permitting use in hammer fashion, the other with spear-thrust action. The illustration portrays position for branding.

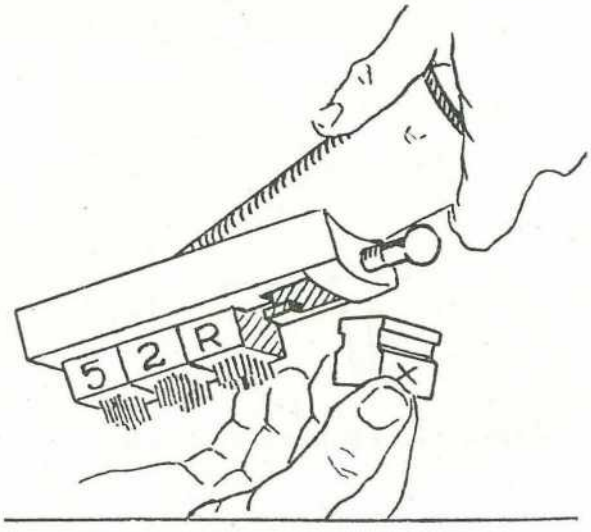


Plate 7.

Inserting Numerals or Letters in Body-tattoo Instrument. The metal screw for adjusting position of blocks is shown.

that the efficiency of tattooing as a means of identification depends on—

(1) The effective use of the tattooing instrument.

(2) The use of an instrument of a reliable type with strong, sharp needles.

(3) Taking time to do the job properly.

(4) The use of a reliable brand of ink, paste, or paint.

WHEN MARKING SHOULD BE DONE.

As the law places the responsibility of identification on the vendor, whether he be farmer, agent, dealer, or manufacturer's representative, it is essential that the pigs be identified before sale or delivery. Therefore, the pigs should be marked on the farm prior to despatch or be identified by the agent (1) when being weighed over the scales at the railway siding or loading-place, (2) when being penned for sale, or (3) when received for consignment direct to factories. The law also makes it compulsory for persons who handle pigs to keep proper records.

This is prescribed by the *Pig Industry Act* as follows:—

> Every agent, auctioneer, dealer, factory, or butcher shall keep a record in respect to every transaction in pigs with which he is concerned.
>
> Such record shall include the date, the number, description, and distinguishing marks of such pigs, the name and address of the vendor, and the name and address of the purchaser, and such other particulars as may be prescribed.
>
> Such information shall be made available to an inspector upon request by the inspector to the auctioneer, agent, or dealer, as the case may be.

WHERE MARKS SHOULD BE PLACED.

In all systems of identification it is essential that while being marked pigs should be confined in a small pen or race, or that they should be marked in the vehicle, if such vehicle is convenient for the purpose, in which they are to be transported.

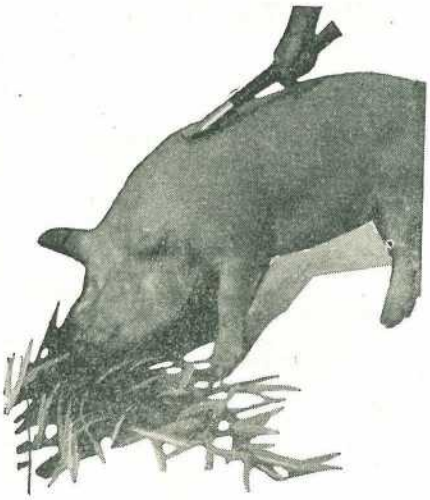


Plate 8.

Showing Operator Using the Body-tattoo Instrument. Note position approved for marking pigs.

When there are no conveniences and the person identifying the pigs is inexperienced, it should be practicable, in order to avoid duplication of tattoos, to attach a small pad soaked in ink or paste to that portion of the hammer head of the instrument not fully occupied by letters or numerals, this merely to leave a paint mark on the hair of the pigs as they are marked, for on black pigs in particular the animal may be marked twice in the same position unless some such precaution is taken.

After pigs have been slaughtered and de-haired the tattoo letters or numerals show clearly in the form of black dots, such tattoo marks being legible even if the pigs had been tattooed several weeks beforehand. In the body-marking of pigs with tattoos there is no necessity for any preparatory treatment of area on which the tattoo is to be applied, except that the area should be clean and free from accumulations of mud. The instrument should be kept clean, and sufficient ink or paste should be used, otherwise the results will be unsatisfactory. Farmers not conversant with this method should attend at pig sales where tattooing is carried out. When visiting a bacon factory or meatworks, inquiry should be made from the management as to results of these several systems of identification.

GRASS HAY CONSERVATION IN THE BEAUDESERT DISTRICT.

In the account of grass hay conservation at Nindooinbah given in the December issue of the journal, the cost of baling wire was not included in the list of costs. This approximates 8s. 9d. to 11s. per ton, according to the source of wire.

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 31st March, 1955).

Berkshire.

A. P. and N. Beatty, "Deepdene," Barambah road, Nanango
S. Cochrane, "Stanroy" Stud, Felton
G. Handley, "Handleigh" Stud, Murphy's Creek
J. L. Handley, "Meadow Vale" Stud, Lockyer
O'Brien and Hickey, "Kildurham" Stud, Jandowae East
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, "Beau View" 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, Middle Creek, Pomona
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, "Burdell," Goovigen
N. F. Cooper, Maidenwell
R. H. Coller, Tallegalla, *via* Rosewood
E. J. Clarke, "Kaloon" Stud, Templin
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
C. E. Edwards, "Spring Valley" Stud, Kingaroy
G. 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
G. J. Hutton, Woodford
E. R. Kimber, Coalstoun Lakes

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. 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
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
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
S. and S. Ouglitchinin, "Pinefields," Old Gympie road, Kallangur
C. Wharton, "Central Burnett" Stud, Gayndah
S. Jensen, Rosevale, *via* Rosewood
Kruger and Sons, "Greyhurst," Goombungee
V. V. Radel, Coalstoun Lakes

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
H.M. State Farm, Numinbah
D. B. Alexander, "Debreczen" Stud, Kinleymore, *via* Murgon
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
G. H. Sattler, Landsborough
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
H. J. Armstrong, "Alhambra," Crownthorpe, Murgon
Q.A.H.S. and College, Lawes
R. H. Coller, Tallegalla, *via* Rosewood

Wessex Saddleback.

W. S. Douglas, "Greylight" Stud, Goombungee
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
F. K. Wright, Narangba, N. C. Line
G. J. Hutton, Woodford
R. A. Collings, "Rutholme" Stud, Waterford
W. R. Dean, "Trelawn," Tandur, *via* Gympie
M. Nielsen, "Cressbrook" Stud, Goomburra
G. J. Cooper, "Cedar Glen" Stud, Yarraman
Mrs. R. A. Melville, "Wattledale Stud," Beenleigh road, Sunnybank
A. J. Stewart, "Springbrook," Pie Creek road, Gympie
S. and S. Ouglitchinin, "Pinefields," Old Gympie road, Kallangur
R. J. Hicks, M.S. 98, Darlington, *via* Beaudesert
Kruger and Sons, "Greyhurst." Goombungee

British Large Black.

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

The Case for the Mules Operation.

By G. R. MOULE, Director of Sheep Husbandry.

Effieient methods to prevent blowfly strike in sheep have been available since 1941, but the blowflies that strike sheep still cause serious loss to Queensland. Blowflies cause losses in different ways. Many of them are small losses, but when they occur year in and year out they become important. Some of them are large losses and can amount to hundreds of thousands of pounds. Those that occurred during the fly-wave of 1950 could serve as an example.

Many sheep died; some of them were full-woolled and others were in lamb. When ewes with lambs at foot were struck they usually lost their lambs. Even if their lambs did not die, struck ewes did not cut as much wool as those that remained free from strike. Wool was lost when strikes were dressed; the fleeces from many struck sheep were tender. More labour was required and when the cost of blowfly dressings and jetting fluids was added it was obvious the fly-wave cost many property owners large sums of money.

Crutch strike in ewes is by far the biggest part of the blowfly problem in Queensland. Strikes do start on other parts of the sheep, such as the tail or on other parts of the body, on the pizzle of rams and wethers and on the head of rams. Not many woolgrowers differentiate between strikes starting in the crutch and those starting on the tail. Both are often referred to as breech strike, but it is well to differentiate between crutch and tail strike because different control measures are used for these two kinds of strike.

While strike occurring on the body, such as on the point of the shoulders or on the withers, can cause heavy losses, bad waves of body strike do not occur every year. On the other hand, some ewes are struck in the crutch or on the tail in most years. In fact, it may not be an exaggeration to say that breech strike accounts for 90% of the trouble in 90% of the years.

Therefore, the prevention of breech strike is usually the most important part of any blowfly control programme. However, the prevention of breech strike does not depend on any one single method, although certain operations are more important than others. However, before they can be considered it is necessary to consider the cause of blowfly strike in sheep.

THE CAUSE OF STRIKE.

Two factors are important in the development of strike:—

(1) Blowflies that will strike sheep.

(2) Sheep that are attractive to flies.

There are over 100 different kinds of blowflies in Australia, but fortunately only a few of these strike sheep. Of these the green blowfly (*Lucilia cuprina*) starts most strikes, although the brown blowflies may occur in some seasons in central and southern Queensland.

Because they start the strike, the green and brown flies are known as primary blowflies. These flies breed mostly in struck sheep. They will also strike carrion. However, here their maggots suffer badly from the competition from the maggots of other flies and from beetles. As a result very few survive to grow into mature flies. Therefore, protecting the sheep from blowfly strike removes their breeding ground. This promises to be the best way to prevent rapid increases in fly populations.

Sheep have a natural attraction for the green blowfly. However, they will not lay their eggs on just any sheep. When the wool on the sheep's breech is kept moist with urine or soft fluid droppings, the underlying skin becomes sore and inflamed. Bacteria multiply quickly and the moist area smells rather like rotting meat. These odours attract blowflies and when they lay their eggs the moist fleece provides everything the maggots need—food, warmth, moisture and protection.

Several factors influence the activity of bacteria in the wool around the breech area of ewes. They are:—

(1) The size of the bare skin around the vulva and anus.

(2) The way in which the sheep's tail has been cut.

(3) The length of the wool in the crutch.

PREVENTING BREECH STRIKE.

Crutching.

Crutching is one of the oldest methods of preventing breech strike. It allows the crutch to dry out and it is unusual for sheep to be struck within the first six weeks after crutching.

However, if you are relying on crutching alone to control breech strike, you may have to crutch the ewes two or three times a year. This requires a certain amount of organising, such as engaging teams, mustering, and cleaning the shed. This can be a big disadvantage because it may be difficult to find a suitable team quickly during a serious fly-wave. It may also be difficult to get them on to your property or to keep sheep up to them if the weather remains wet.

Crutching is also expensive, especially as the incidental expenses, which range from the cost of mustering to that of woolpacks, have to be added.

Spretting and Jetting.

If you have your own plant it is easy to organise spretting or jetting. Outside labour is not required, and given good yards and plant a 3-man team can put through 2,000 sheep a day. The protection given by jetting depends largely upon the materials used. Tremendous advances have been made in the manufacture of jetting fluids. Some will protect sheep from fly strike for quite long periods, but irrespective of the fluid used jetting has to be done carefully and thoroughly.

The capital charge against the spretter or a jetting plant is not very high, and either provides a very useful first reserve that can be brought into use quickly and easily.

Jetting or spretting demand additional mustering and handling of the sheep. Therefore, the labour charges for this work must be considered with the final cost. The wool of sheep worked through the yards may become dusty. This lowers wool prices.

Docking and the Mules Operation.

The Mules operation and correct tailing of lambs are the two most important developments in blowfly control.

The Mules operation increases the size of the bare skin around the vulva

and anus. This is clearly demonstrated in Plate 1, which shows the stretching of the bare area on a lamb one month after it had been treated with the Mules operation. The bare area measures 4 inches across; that of an untreated animal of the same age is only 1½ inches. The greater size of the bare area prevents soiling of the wool on the breech with urine or faeces. Therefore, the crutch of treated sheep remains clean and dry. Areas attractive to flies do not develop.

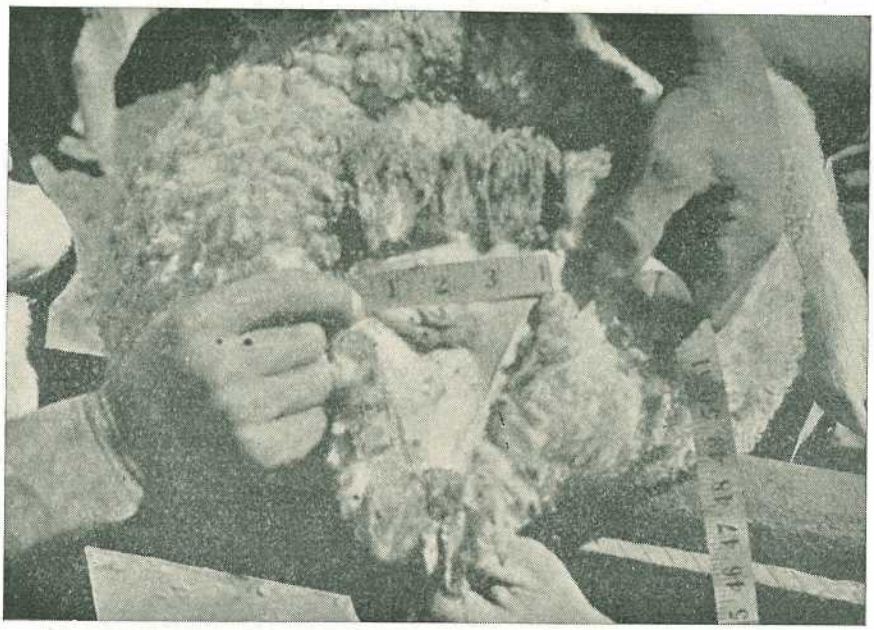


Plate 1.

Showing the stretched Bare Area on a Lamb One Month after the Mules Operation.

It is well known that wrinkly breeched sheep are more likely to be struck than those with a plain breech. However, even the wrinkly breeched sheep that have been treated with the Mules operation are not so likely to be struck in the crutch as plain breeched sheep that have not been treated.

This fact is clearly shown in Table 1 setting out the number of strikes per 100 sheep. Four groups of ewes were used in the experiment. The sheep in two were completely plain breeched; those in the other two were wrinkly breeched. One of the groups of plain breeched sheep and one of wrinkly breeched sheep were treated with the Mules operation, and one group of plain breeched sheep and one of wrinkly breeched sheep were left untreated. The experiment lasted 12 months, during which all crutch strikes were carefully recorded.

TABLE 1.

Effect of Mules Operation on Crutch Strike.

Crutch Strikes per 100 Ewes in Twelve Months.

—	Strikes in Mulesd Ewes.	Strikes in Ewes not Mulesd.
Completely plain breeched sheep ..	4	19
Wrinkly breeched sheep	4	98

Two factors are of major importance in the docking of lambs' tails. They are:—

(1) The way the tail is cut.

(2) The length of the tail.

In cutting lambs' tails it is important to turn the bare skin from the under-surface of the tail back over the severed stump. Doing this ensures that when the tail wound heals there is no wool growing opposite the vulva, in a position where it is likely to become soiled by urine. This is one way of making sure that the sheep do not get struck on the tail.

The length at which you cut the lamb's tail is important for two reasons. The lamb's tail will heal quickly if the wound does not become heavily infected with bacteria. Cutting lambs' tails short increases the risk of infection from the bacteria in the faeces. If the tail is cut long enough to cover the tip of the vulva, the docking wound is not so easily infected. Therefore, tails cut at this length heal more readily and they are not so likely to be struck after marking.

Even after the tailing wounds have healed, sheep whose tails are cut level with the tip of the vulva are not so likely to be struck on the tail or in the crutch.

This is shown in Table 2, in which the number of strikes per 100 sheep starting in the crutch and on the tail are shown. The ewe lambs in this experiment were not treated with the Mules operation. They were divided into three groups so that there were the same number of wrinkly and plain breeched sheep in each. The tails of the lambs in one group were cut just level or a little below the tip of the vulva. The tails of the second group were cut about level with the top of the vulva and those of the lambs in the third group were cut short. The number of strikes per 100 sheep was recorded for 12 months. The strikes were divided into those starting in the crutch and those that started on the tail.

TABLE 2.

EFFECT OF TAIL LENGTH ON BREECH STRIKE.

Crutch and Tail Strikes per 100 Ewes in Twelve Months.

Tail Length.	Crutch Strikes.	Tail Strikes.
Level with tip of vulva	29	4·8
Level with top of vulva	45	10·7
Short tail	53	17·9

Every lamb has its tail cut, and the way it is done influences the extent to which it will be struck during the remainder of its life. The same argument applies to the Mules operation. Correctly done, the Mules operation and good marking will protect the sheep for the rest of its life. When combined with the best tail length the Mules operation will reduce breech strike to negligible proportions, provided the sheep are given a mid-season crutching.

This is clearly shown in Table 3, which sets out the number of breech strikes per 1,000 ewes during a whole year. Four groups of ewe lambs were taken; each contained the same proportion of wrinkly breeched sheep. The tails of the sheep in two groups were cut level with the tip of the vulva; those of the lambs in the other two were cut short. Two groups were treated with the Mules operation; the lambs in one of these groups had short tails and the other had long tails.

TABLE 3.

EFFECT OF MULES OPERATION AND TAIL LENGTH ON BREECH STRIKE.

Breech Strikes per 1,000 Ewes in Twelve Months.

—	Tail Length.	
	Vulva Covering Tail.	Short Tails.
Mules operation performed ..	9	83
Mules operation not performed ..	209	562

Besides these precise experimental results the Mules operation is now backed by many years of field trial. Woolgrowers all over the State are agreed that when combined with the right tail length it is the most effective means of reducing breech strike.

OBJECTIONS REFUTED.

A few woolgrowers still argue against its use. Those who do have never tried it, but it may still be worthwhile examining the reasons they give for not doing it.

Cruelty.

Some woolgrowers, most of whom have done a good deal of lamb-marking and the other usual operation procedures undertaken by men on the land, consider the Mules operation to be cruel.

No doubt the man who is keen on his sheep is anxious to protect them from any unnecessary suffering and there is probably none worse than that caused by repeated attacks by blowflies. As the Mules operation is such an efficient preventive against crutch strike it is the obvious method to adopt to prevent the suffering it causes. When performed by an experienced operator it is done quickly and easily; healing is rapid and the sheep are comparatively safe from crutch strike for the rest of their lives.

Surely it is a good deal kinder to the animals to perform the operation and protect the sheep for life than to let them endure the misery and discomfort of several strikes!

Why Treat Plain Breeched Sheep?

It is often stated by woolgrowers that their sheep are bred for plainness of breech and accordingly there is no need to perform the Mules operation. Obviously these people have not appreciated the importance of the stretching of the bare area and they consider the Mules operation to be simply a matter of de-wrinkling. The answer to their argument is found in Plate 1 and in the results set out in Table 3, showing that Mules-treated sheep are less susceptible to crutch strike than perfectly plain breeched untreated animals.

Disguising Wrinkly Sheep.

Some growers object to the Mules operation on the grounds that it disguises wrinkly breeched sheep and they consider this may upset their breeding policy. Actually the Mules operation does not interfere with breeding policy at all, as any slight alteration it makes to the conformation of the sheep is hardly likely to deceive the experienced sheepman. In addition, field observations indicate that sheep which would have been culled for excessive development would most likely have some other defect that would lead to their being rejected from the flock.

The Longer Tail and Increased Shearing Costs.

Some woolgrowers object to the longer tails because of the increased rates which have to be paid for shearing. The decision must surely rest on which will be most expensive—paying a couple of pounds per thousand extra for shearing or standing the losses resulting from several hundred strikes per thousand sheep per year.

In any case, if it is not considered desirable to cut the lambs' tails long enough to cover the tip of the vulva, consideration can be given to performing an operation to remove a considerable amount of the wool-bearing skin from the upper surface of the tail.

This is most easily done at marking time before the tail is docked. Sharp dagging shears are used and the cut should commence well above the base of the tail with a sharp V and gradually extend in width, leaving a thin fringe of wool-growing skin on each side. The cut should extend well down the centre of the tail and the end result is shown in Plate 2.

This operation draws the wool-growing skin well up over the mid-line of the tail, thus helping to protect against tail strike.

Effect of Strike on Weight.

Struck sheep are consistently lighter than their unstruck fellows—often by as much as 5 lb. The more strikes the sheep receive the lighter they are—in one trial those that were struck five times weighed 60 lb. off shears while those that were struck once or twice weighed between 64·5 and 67·5 lb.

A similar result was observed at the conclusion of another trial when the young ewes were classed and 17% more sheep were culled from the group that had not been protected from fly strike by the Mules operation. As the sheep were all from the same flock and

Plate 2.
Showing Special Tail Operation.

ECONOMIC IMPORTANCE OF BLOWFLY CONTROL.

The development of efficient methods of blowfly control has made it possible to study the effects of blowfly strike on wool production and lamb-marking percentages. Observations of this type have been made by officers of C.S.I.R.O., from whose work all the figures quoted in this article have been taken.

were run under similar conditions, the higher culling rate from the groups not protected by the Mules operation can be attributed to fly strike.

Effect of Strike on the Wool Cut.

The cut per head of the sheep treated with the Mules operation and which consequently remained free of fly strike in any experiment can be regarded as the potential wool production for the flock. The cut per head of the group that was not treated with the Mules operation would then represent the level of production of the flock in the presence of the usual amount of fly strike. On this basis, fly strike in one trial caused a loss of 5 oz. of wool per head from shearing to shearing. This represented 2·5% of the wool produced.

The cut per head of the sheep decreased as the number and/or size of the strikes they received increased. This effect is clearly shown in Table 4, which compares the effect of strikes of different sizes on the cut per head of the more wrinkly breeched sheep in the experiment.

Tenderness of the fleece also seemed to be associated with larger strikes. This is shown in Table 5, in which a large strike is considered to be one 5 inches or more across.

Strike and Lamb-marking Percentages.

The effect blowfly strike has upon the rates at which flocks reproduce is also apparent. The fertility of ewes that are struck is lower than that of ewes that are not struck. In one trial only 75% of the ewes struck from before mating to the end of lambing produced lambs; 92% of the unstruck ewes lambed. Multiple strikes had an important effect on the fertility of the ewes. The percentage of wet ewes declined with the increased number of strikes. The details are set out in Table 6.

TABLE 4.

Effect of Fly Strike on Wool Cuts.

—	Unstruck Sheep Protected by the Mules Operation.	One Small Strike.	Two to Four Small Strikes.	One Medium Sized Strike.	One Large Strike.
Number of sheep ..	190	27	18	16	15
Average cut per head ..	lb. oz. 12 4	lb. oz. 12 0	lb. oz. 12 0	lb. oz. 11 11	lb. oz. 11 0

OTHER ADVANTAGES OF THE MULES OPERATION.

There are several other indirect advantages to be derived from applying the Mules operation. These may be stated as follows:—

Crutching.

It is far easier to crutch sheep which have been treated by the Mules operation. This is an important factor both to the man who does his own crutching and to the owner who has this work done by contractors. It means better work and greater contentment amongst the shearers and there are less stained pieces.

TABLE 5.

Effect of Fly Strike on Wool Cuts.

Association of Size of Strike with Tender Wool.

—	Number of Sheep Struck.	Percentage of Sound Fleeces.	Percentage of Tender Fleeces.
Small or medium strikes only	111	85	15
At least one large strike	75	56	44

Jetting and Spretting.

While it is not usually necessary in Queensland to jet or spret sheep which have been treated by the Mules operation and which are crutched once a year, it may have to be done if it is difficult to arrange for crutchers. Should this occur, it will be found that it is a good deal easier to get even penetration of the wool by the jetting fluid. This, of course, means better jetting or spretting and better production.

simple job, which can be expeditiously performed. This means more time is available for constructive work such as the erection and maintenance of improvements. This was well borne out during the war when station labour was difficult to obtain. Properties which practised the Mules operation on each year's "drop" of ewe weaners soon had complete flocks which had been treated. Relieved of the work usually associated with fly control, the available labour could be devoted to constructive work.

TABLE 6.

EFFECT OF MULTIPLE STRIKES FROM BEFORE MATING TO END OF LAMBING UPON THE PROPORTION OF WET EWES.

Number of Strikes.	Percentage Wet.
Protected by Mules operation—Not struck	92
Not protected by Mules operation—Struck once	88
Not protected by Mules operation—Struck twice	73
Not protected by Mules operation—Struck three times	58
Not protected by Mules operation—Struck four times	47

The Fly's Breeding Ground.

It has been shown conclusively that the primary fly (that is, the one which initiates the majority of strikes), breeds mainly in strike on living sheep. The Mules operation virtually robs the fly of its breeding ground and in this way it is an important direct attack on the fly population itself.

Relief from Worry.

One of the most important indirect advantages of the Mules operation is the mental relief it affords owners and managers, who in the days before the Mules operation could never feel quite certain that there was not a bad smash just around the corner as the result of a fly-wave suddenly developing. If the sheep have been subjected to the Mules operation even the worst fly-wave is unlikely to be responsible, either directly or indirectly, for heavy losses.

Property Management.

The Mules operation has an immense effect on property management. It reduces blowfly control measures to a minimum and what used to be a continuous and onerous task is now a

CONCLUSIONS.

In the light of present knowledge, which has been gained from carefully planned experiments and substantiated by extensive field experience under most severe fly-wave conditions, the control of breech strike is readily achieved in Queensland by adopting the following methods:—

(1) Performing the Mules operation on all ewes, and where necessary on the wethers.

(2) Cutting lambs' tails level with the tip of the vulva, and turning the unwoolled skin from the under-surface of the tail back over the severed stump and/or performing the special tail operation.

(3) Undertaking a mid-season crutching.

(4) In an emergency which prevents the usual crutching, jetting or "spretting" if necessary.

As the emphasis is on performing the Mules operation correctly, seek the assistance of a Sheep and Wool Adviser, who will demonstrate the correct technique to use.

The Problem of Environment and Breed Improvement.

By J. S. F. BARKER, Assistant Husbandry Officer, Animal Research Institute, Yeerongpilly.

Does the environment influence the improvement of breeds of livestock, and if so, how?

These questions must be examined in connection with any programmes for animal breeding undertaken in Queensland, particularly because of the range of environments under which our stock are kept. The choice of environmental conditions under which to practise selective breeding thus presents a problem of great practical importance—one for which genetical theory has not yet provided a complete solution.

This, then, is the problem: Will the best results be achieved when selection is carried out under the commercial environment, or will better results be attained under some other environmental conditions—for example, under conditions more favourable for the expression of the desired character?

In our beef and dairy cattle industries at present, the latter programme is used. The commercial breeder looks to the studs to provide genetically improved strains (that is, strains that are potentially higher producers).

In general, the cattle studs are situated in the temperate climates of southern Queensland, New South Wales and Victoria, the animals are fed on good pastures, young beef animals are often suckled on dairy cows and may be hand-fed to an uneconomic extent, and animals are often housed for a considerable portion of the year.

Animals that perform well under these conditions are selected to be the parents of the next generation, and it is expected that inherited production potential will be improved. These animals are bought by commercial breeders, perhaps situated in an area vastly different climatically from that of the stud and where the stock run under conditions that are generally far from perfect.

What evidence is there that this is sound policy and better than breeding in the environment where the breed is expected to live and produce? In a paper published in 1947 (Animal breeding in relation to nutrition and environmental conditions. *Biological Reviews,* Vol 22, pages 195-213), Dr. John Hammond, the well-known English authority on animal production, stated: . . . "it would appear that the character required is best selected for under environmental conditions which favour its fullest expression, and that once developed it can also be used in other environments, provided that other characters, specially required by that new environment, are also present in the animal."

If this is accepted, it can be argued that most rapid progress in selecting for meat-producing capacity will be made by selecting in an optimum environment—that is, temperate climate and adequate nutrition. If it is then desired to transfer the improved strain to a tropical area, such as the northern beef cattle country of Queensland, then it can be argued further that this potential for beef production will be retained provided that either selection is then carried out within the strain for heat tolerance and ability to develop under poor nutrition, or the strain is crossed with another strain possessing these characteristics.

This line of thought is open to criticism for several reasons. It involves two implicit assumptions of questionable validity.

Firstly, that we know exactly what we are selecting for. That is, if selecting for beef production, the assumption is that in an optimum environment we can select for those characters that will also give high beef production in a poor environment. However, we select on the basis of weight gains or weight at a particular age. As will be shown later, it is likely that in an optimum environment we could be selecting for appetite, whereas in a less favourable environment efficiency of feed utilisation is the more desirable character for high beef production. Therefore, if selection is carried out under optimum conditions, it is unlikely that a strain would be obtained that would give high production under poor conditions. At some future date, when more is known about the physiology of domestic animals, it may be possible to determine exactly what characters are required to give high production under poor conditions and then to select for these under optimal conditions.

Secondly, it assumes that once selection is carried out for production under optimum conditions, the strain can be taken to tropical areas and then selected for heat adaptation. If we select in the tropical environment for beef production, then it is obvious that we would select animals adapted to the environment, because these animals would do best and thus produce best. Naturally, adaptation to a particular environment and production in that environment will be closely associated. It is probable, however, that the genetic factors that control productivity in a temperate climate are largely different from the controlling factors in a tropical climate. Thus, if we select first for production in a temperate environment and then transfer the strain to the tropics with the aim of incorporating heat adaptation, then the time spent in selection in the temperate environment will be largely wasted. In selecting for heat adaptation, we will be selecting for production in the tropical environment and therefore, probably to a large extent, selecting against those factors in the strain that controlled production in and adaptation to the temperate environment.

Consider now a second school of thought whose members believe that the animals should be selected in the environment in which they and their progeny will live and produce.

Most geneticists would agree with this, arguing that performance for growth rate or any such character in a favourable environment has a different genetic basis from performance in an unfavourable environment. That is, the genotype* that is superior in one environment could not be expected to be superior in another, particularly where the two environments differ considerably, as from temperate to tropical or high to low plane of nutrition.

In the definitions of genotype and phenotype, the relation of these to the environment is shown (see footnote). That is, the phenotype of an animal is the product of reaction of the genotype and the environment. Does it seem reasonable, then, to suppose that rams selected to show a good phenotype for wool production in the southern highlands of New South

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* *Genotype* and *phenotype*. The genotype of an animal is its breeding value or the potential it possesses that it may pass on its offspring. On the other hand the phenotype is the appearance and measurable production ability of the animal, i.e., the visible expression of the various characters making up that individual animal. It is often convenient to consider the genotype and phenotype for particular characters of an animal, e.g., milk or meat production. If a cow produced 600 gallons of milk per annum, then that would be her phenotype for milk production. This same cow, however, may have a genotype that would give her the physiological capability to produce 800 gallons per year. This potential may not be realised because of disease or poor feeding. Conversely, a cow may appear better than she really is because of advantageous environmental effects.

Wales or the Riverina would give progeny showing an equally good phenotype when used in western Queensland? Obviously not, because the best phenotypes in the two areas would be expected to result from the interaction of different genotypes with the vastly different environments. This is a case of what is known as a genotype-environment interaction.

An example of such an interaction may be seen in the results of a strain trial being run by C.S.I.R.O., in which four strains of Merino sheep are being bred at three stations—Cunnamulla, Armidale and Deniliquin. In the following table, some preliminary results for the percentage of sound fleeces of two of the strains at two stations are given:—

Station.	Strain.	
	Fine wool non-Peppin.	Strong wool non-Peppin.
Armidale ..	80	75
Cunnamulla ..	77	88

It is obvious that for this character the fine strain is better at Armidale, while the strong wool strain is better at Cunnamulla. The first school of thought mentioned in this article requires that such interaction does not exist or at least is very small. This is most improbable, for reasons already mentioned. Additionally, it has been stated by another authority (Prof. J. B. S. Haldane: The interaction of nature and nurture. *Annals of Eugenics,* vol. 13, pages 197-205, 1946): " . . . . on current practice far too much attention is paid to performance in highly favourable environments . . . In consequence a breed of cattle may be 'graded up' so as to give a high milk production under optimal conditions. But it may actually give a lower one under poorer conditions, particularly when allowance is made for deaths."

Recent research with mice in Britain reported in 1952 by D. S. Falconer and M. Latyszewski (The environment in relation to selection for size in mice. *Journal of Genetics,* vol. 51, pages 67-80) supports the genotype-environment interaction theory. Mice were used as the experimental animals and selected for body weight. The experiment was thus given the maximum relevance to livestock breeding. A population of mice that was genetically uniform was divided into two groups: Group A were fed as much as they wanted (full feeding), while Group B were fed the same food but with a restriction to 75 per cent. of the normal intake (restricted feeding). In each group the heaviest mice at 6 weeks of age were selected as parents of the following generation. In the fifth and seventh generations of selection, one litter from each group was placed in the opposite environment.

The results of the experiment are shown in Figure 1 and may be summarised as follows:—

(1) Body weight increased in both lines of mice, but the improvement on restricted feeding was slightly less than that on full feeding.

(2) When the environments were exchanged at the fifth and seventh generations, the body weights of the mice from the full feeding line, when raised on restricted feeding, were less than those of the restricted feeding line and in fact showed practically no improvement over the unselected level of the restricted feeding line. On the other hand, the body weights of the mice from the restricted feeding line when raised on full feeding were only slightly less than those of the full feeding line and showed a marked improvement over the unselected level for full feeding.

Thus the important conclusion for livestock breeders from this experiment is that improvement of the genotype for rapid growth on a high plane of nutrition carried with it no improvement for growth on a low plane, while improvement of the genotype for growth on a low plane

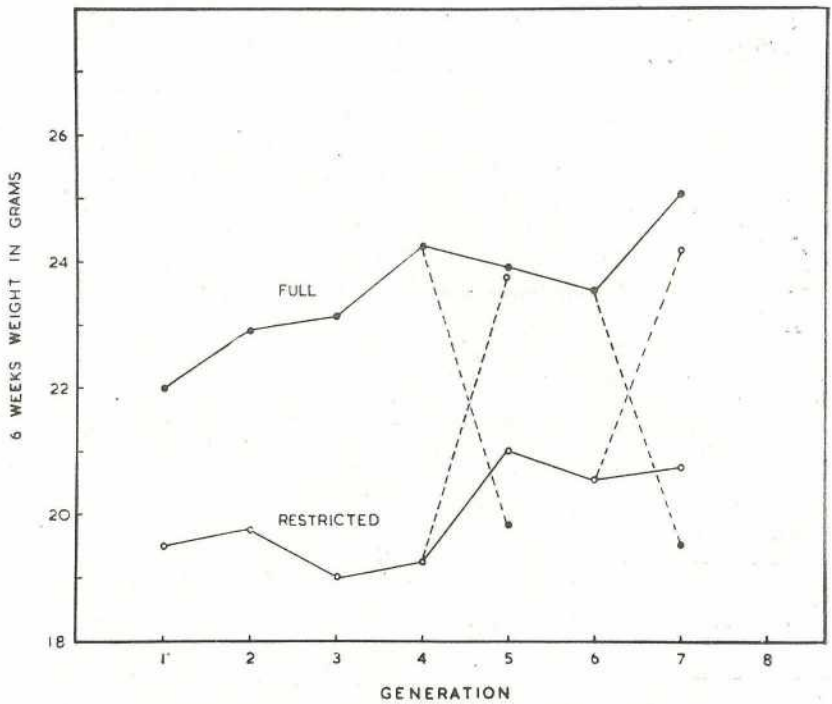

Figure 1.

Response to Selection For Six-weeks-weight in Two Strains of Mice. Lines marked "full" and "restricted" show the mean six-weeks-weight of each generation. Points connected by broken lines are means of mice raised on exchanged diets. (After Falconer and Latyszewski, 1952.)

did carry with it a considerable improvement for growth on a high plane.

In these lines, selection was practised for a particular observable character—growth rate to six weeks of age. In actual fact, the basis of this character may have been genetically different in the two lines. In line A on full feeding, selection may really have been for appetite, while selection in line B may have been for efficiency of food utilisation. This would explain the observed results. This possibility is supported by the fact that in the high diet line the increased weight was achieved by increase in fat percentage in the body, while in the restricted diet line selection resulted in an increase of non-fatty (muscle) tissues. Applied to beef production, this is important, because it is increased muscle production that is desirable.

The important point is that in these mouse populations, performance was best improved by selection under the conditions in which subsequent performance was measured. The experiment shows how a "good environment" policy can be detrimental. Thus the ability to perform well in the luxury environment of our studs might not be maintained under conditions of poor nutrition. Similar experiments with farm animals are needed to confirm this work. One such experiment has been conducted in New Zealand, by separating identical twin pairs of calves and feeding them on different levels of nutrition. The results, reported by Dr. J. Hancock in 1953 (Studies in monozygotic cattle twins.

VII. The relative importance of inheritance and environment in the production of dairy cattle. *New Zealand Journal of Science and Technology,* Section A, Vol. 35, pages 67-94) agree in general with those of the above mouse experiment. It was also concluded that it appeared unwise to attempt to select dairy cattle in good environmental conditions if they are to perform in much poorer conditions; also that "the feeding of stud stock on an uneconomically high level of nutrition is not justified on the grounds that it otherwise would not be possible to discriminate between good and poor producers." It seemed desirable, however, to maintain an *economic* level of nutrition.

Summing up, there are sound reasons for arguing that selection of livestock should be carried out under the environmental conditions in which the selected animals and their progeny are destined to live.

CALF IDENTIFICATION SCHEME.

The Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) has announced that a system of identifying calves is being introduced into dairy herds in the State's herd recording scheme. It will affect the progeny of more than 50,000 dairy cows now under test in Queensland.

As the positive identification of female dairy cattle is essential for herd improvement purposes, it has been decided to make the calf identification scheme available as a free service to each member of the group herd recording scheme. In return, the owners of herds will be expected to comply with the rules governing the identification of calves.

Farmers who plan to breed from their highest producers, as indicated by the records of their production over a number of lactations, must know beyond doubt that each animal has the production backing attributed to it. The value of many years' careful breeding work will be lost if heifer progeny cannot be correctly identified.

The rules of the new calf identification scheme require all heifer calves which are to be reared for herd replacements to be marked as soon as possible after birth. This applies, however, only to grade and unregistered purebred calves.

The method of identification will be by tattooing suitable marks in both ears. The animal's right ear will be tattooed with a letter to indicate the group and numbers to indicate the herd. The calf's serial number, together with a letter to indicate the year of birth, will be tattooed in the left ear.

Mr. Collins said this service will enable farmers to keep a reliable breeding record of all animals on their farms. Such information will be of great value when used in conjunction with herd recording results to plan future breeding programmes for the herd.

SAVING ON FERTILIZER AND LIME FREIGHTS.

Buyers of lime and fertilizers can save a considerable amount in freight charges if they are able to have their purchases consigned in truck lots.

Bagged lime and fertilizer are classed under the manure rate for minimum loads of 6 tons and 5 tons respectively for distances up to 250 miles and 7 tons over 250 miles. Where less than the minimum truck load is consigned, the Agricultural (A) rate is charged, the minimum charge for this rate being 3s. 8d. per consignment.

The manure rate also applies to lime consigned in bulk (unbagged), but the minimum load is still the same as for bagged lime and a declaration must be made on the consignment note that the material is "for use as a fertilizer." This declaration must also be made for consignments of bagged lime to secure the manure rate.

The table on the next page sets out the freight charges for fertilizer, lime and some other commodities. It is seen from the table that the freight on a 6-ton truck load of lime for 50 miles would be 18s. 10d. per ton, whereas that on 1 ton for 50 miles would be 32s. 3d. Thus a 6-ton truck load could be railed 50 miles for £5 13s., whereas only 3½ tons could be railed the same distance at the Agricultural (A) rate.

Further details may be obtained from station masters.

	Manure Rate.		Agricultural (A) Rate.	
	Commodity.	Minimum Load.	Commodity.	Minimum Load.
Examples of Commodities Classed under Rate	Lime (in bags) as artificial manure Fertilizer (in bags)	6 tons to 250 miles 7 tons over 250 miles 5 tons to 250 miles 7 tons over 250 miles	Lime (in bags) as artificial manure Fertilizer (in bags) *Sorghum Grass Seeds Agricultural Seeds (not otherwise specified) Bags and bales *Chaff, Hay, Straw Barley, Maize, Millet, Panicum, Sudan Grass and Sunflower Seeds	Actual weight; minimum 3s. 8d. per consignment

Mileage.	Rate per ton.	Rate per ton
	s. d.	s. d.
50	18 10	32 3
100	21 0	50 10
150	29 6	63 5
200	38 9	75 10
250	41 5	86 1
300	44 6	93 8
500	53 4	130 11

* A special freight applies to these commodities when consigned to "ports". Manure rate can only be secured for consignments in truck lots.

MARKETING

The Outlook for Sterling Convertibility and its Significance for Queensland's Rural Exports.

By H. SPRING, Division of Marketing.

The approaching convertibility of sterling will increase the marketing problems associated with most of our rural exports. Competition will increase with the wider sources of supply and greater ranges of quality available to British and other buyers when sterling again becomes a universally accepted currency.

Some notable steps towards convertibility have already been taken in the United Kingdom—the re-opening of the great commodity exchanges and the London gold market, the freeing of cotton and cereal imports (for internal use) from dollar restrictions, and the relaxation of import licencing. Further steps in this direction are to be expected until international trade again assumes a world-wide pattern.

Approximately half the world's trade is carried out in sterling. The fortunes of this great international currency are therefore a matter of prime concern to all the trading nations of the world. To Australia as a member of the "Sterling Area" they are of particular concern.

We have watched with admiration and sustained interest the long struggle to reinstate the English pound to its former prestige as a universally accepted currency. After years of patient endeavour, of hard-won success and disappointing failure, the goal of full convertibility for sterling appears to be not very far away. This prospect is bright for the future of world trade generally, but for some of our primary exporting industries it carries a challenge and a problem.

Exchange controls of every sort, although devised only to protect or conserve the currency, confer effective trade protection on many of the industries of the country (or area) which imposes them. Thus the limited convertibility of sterling gave an effective trade protection to many industries within the sterling area against the goods from countries with which trade was restricted by exchange controls. The challenge to our exporters of full convertibility is the challenge of world competition; the problem is the problem of streamlining production and marketing techniques to the point where we are able to meet this competition effectively.

In the years before the outbreak of war in 1939 sterling was freely convertible throughout the world. Great Britain as banker for the sterling area maintained sufficient reserves of foreign currencies to meet the various demands of holders of sterling wishing to convert it into any other currency. The sterling area itself was simply a voluntary association of countries wishing to carry out their external trade in sterling. In other words, it was an association which the members found financially convenient. Canada, although a member of the British Commonwealth, had long been, financially, a member of the dollar area.

After the outbreak of war most of the foreign members left the sterling area so that it then comprised much

the same area as it does to-day—the countries of the British Commonwealth (excluding Canada), the Irish Republic and some of the small countries of the Middle East. The severe economic strains of war and the necessity to prevent the flight of capital led those who remained in the sterling group to impose rigid exchange controls.

When the war ended in 1945 the reserves of the sterling area had been greatly depleted. There was an urgent need for capital investment to rehabilitate war damage and wear and tear, but much of the material necessary for this purpose could be obtained readily only from the dollar area. But the dollar earnings of the sterling area had been greatly affected not only by the large diversion of resources to war purposes but by the decline in "invisible" earnings. These latter had come mainly from overseas investments and shipping; but many of these investments had to be sold to finance the war and shipping services had been greatly reduced.

The leeway has been made up slowly —by dollar loans and gifts from the United States and Canada, by the devaluation of sterling in relation to the dollar in 1949, by the gradual building up of industries and earning capacity within the sterling area, and by the close supervision, through exchange control, of dollar expenditure. The gradual rehabilitation and development of industry within the sterling area has contributed to the solution of the problem mainly in two ways—by increasing the volume of goods available for export to the dollar area, and by expanding the production of goods which otherwise would have to be procured from the dollar area.

The increasing strength of sterling has allowed the gradual relaxation not only of controls on currency and import quotas but also of consumer rationing in the United Kingdom. These are signposts on the road to wider freedom of trade and greater monetary freedom generally. There was a period about the middle of 1954 when an important body of opinion was ready to predict the full convertibility of sterling almost immediately, but it now appears that full convertibility will be achieved gradually, removing one restriction after another until exchange controls are finally abandoned.

The significance of this development for Queensland's exporters of rural products will vary from one industry to another and it is not proposed to attempt here to examine in detail the likely effects on any particular export. There are certain observations, however, which have a general application.

Those industries such as dairying whose main competitors are within the sterling or soft currency areas are not likely to be affected to as great an extent as others, such as fruit canning and (apart from special agreements) grains and sugar, which face strong competition from dollar sources.

In respect of any particular commodity there are obviously many factors to consider and these are subject to change with seasonal conditions, industry agreements and so on. But the approaching convertibility of sterling has introduced one further variable into the complex of factors which our exporters will have to consider when weighing up market prospects. No doubt full convertibility of sterling will increase the competition which many of our exports will have to face. If we fully appreciate this probability in advance we can start preparing for it now.