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DEPARTMENT OF PRIMARY INDUSTRIES

HARVESTING a badly lodged barley crop on Messrs Bezby Brothers' property at Brookstead on the Darling Downs.

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Now 12 Areas of Soil Erosion Hazard

THE Queensland Government has declared a further six Darling Downs shires as Areas of Soil Erosion Hazard, making the total 11 for this rich agricultural district.

The Minister for Primary Industries (Hon. V. B. Sullivan, M.L.A.) said the latest declarations covered the shires of Glengallan, Rosalie, Wambo, Chinchilla, Millmerran and Crow's Nest.

The State total now stood at 12, with the Isis (near Bundaberg) land study area being the other area declared to date.

Mr. Sullivan said that the Soil Conservation Authority would submit project plans prescribing the land use practices and other complementary action required for erosion prevention and mitigation in the newly-declared areas.

At the same time, he announced plans for 'grass roots' participation, through establishment of local committees, in the soil conservation programmes on the Darling Downs. Reports indicated that reasonably good progress had been achieved in the Downs programmes and he expected greater advances in the expanded area as staff and facilities grew and experience increased.

'However, I am most anxious that all farmers involved understand fully the implications of projects prepared for their individual properties and have the opportunity to contribute their ideas on programme development,' he stated. 'Already, many excellent suggestions to improve planning procedures have been received from landholders.'

Mr. Sullivan said that the success of the Downs programme depended upon cohesive soil conservation planning and implementation within common drainage areas, with the individual farmer playing a decisive role.

'Based on this concept, I have decided that the local committee approach, adopted in the first project planning area more than 12 months ago, should be applied more widely. I expect that these advisory committees will be best set up in major planning, or drainage, areas,' the Minister said.

Where farmers in such areas were interested in forming local committees, he had asked Departmental officers to arrange for their setting-up. Provision existed in the Soil Conservation Act for such establishment.

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SEPTEMBER 1974

Establishing pasture on Eastern Downs

by J. K. CULL, Agriculture Branch.

TO obtain forage from either crops or sown pasture will cost money on the Eastern Darling Downs. The advantages of pasture are that it is less labour demanding, it is permanent and, once established, lack of suitable planting rain in a dry year does not mean a complete absence of feed.

In cultivated paddocks, no feed can be produced in annual crops until the next planting season. Pastures also provide protective cover against soil erosion.

The cultivation that annual fodder cropping demands is expensive. This cultivation during the fallow allows the accumulation of available nitrogen and sulphur compounds in the soil. This results from the breakdown of organic matter by soil organisms.

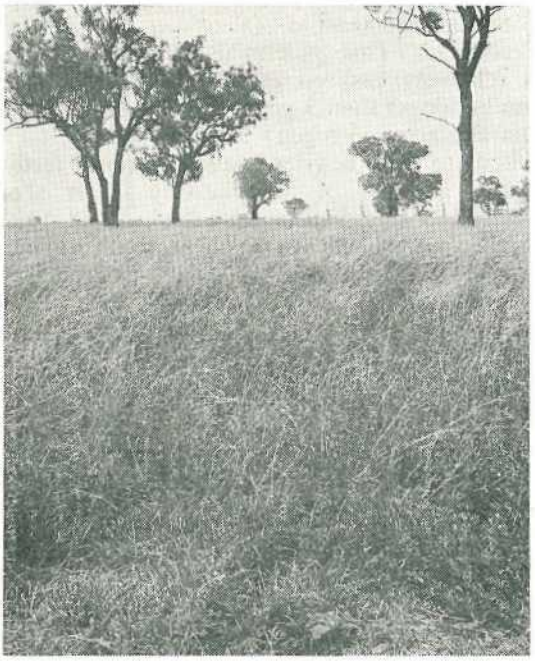
In older cultivation land, however, the store of organic matter is less and fertilizers are required to grow good crops. This application of nitrogen and sulphur is also needed to grow good pastures.

Gatton panic, Bambatsi Makarikari and lucerne growing on a Waco clay soil on Mr. D. Darr's property, Mt. Irving.

Rough pasture planting methods generally produce poor results. This risk is even greater with small seeded pasture species than with crops. Poor planting methods result in weak pastures. They also waste time and time is probably the most costly item. If the pasture is a failure, the paddock may give no financial return for several years. Attention to detail is therefore essential when planting pasture.

It can be difficult to obtain good pastures unless all factors affecting establishment are considered and corrected where necessary. Once a good stand has been obtained, it can be equally difficult to maintain this stand unless it is correctly managed.

Good pastures can be successfully established and maintained on most soil types on the Eastern Downs. It is the purpose of this article to point out those factors that should be taken into account.



A mixture of Rhodes grass, Gatton panic and lucerne growing on a Kenmuir gravelly—Southbrook clay loam on Mr. J. Donohue's property at Umbiram.

Species

One of the most important aspects in establishing a long-lasting and productive pasture is the choice of the correct species to suit the soil of the paddock being planted. The following are the major species adapted to the area—

Grasses

GREEN PANIC (*Panicum maximum* var. *trichoglume* cv. Petrie). This grass will establish in most light-textured soils such as scrub loams and clay loams, most red soils, any sandy soils and even dark clay loams which are stony. Green panic will not persist if established on heavy, cracking clay soils or in areas which experience heavy frosts. The planting rate is 3 to 6 kg per ha.

MAKARIKARI PANIC (*Panicum coloratum* var. *makarikariense*). This panic will grow well on heavy clay soils as well as in all the situations listed for green panic. It has slow growth as a seedling and produces little useful grazing in the first year after sowing. It is recommended only for soils not suitable for green panic. Green panic has much faster seedling growth. The planting rate is 2 to 4 kg per ha.

RHODES GRASS (*Chloris gayana* cv. Pioneer). Rhodes grass will grow on the full range of soil types. It is not as productive or as permanent as Makarakari grass on the heavy black soils. It tolerates lower soil fertility than does green panic, but will produce large quantities of quality feed only on fertile soils. Its stoloniferous (creeping) growth habit ensures that if there is an initially poor strike, the Rhodes grass will thicken up in the paddock.

Stock generally prefer green panic to Rhodes grass. Palatability can be improved by mowing or slashing any coarse growth left after grazing. The planting rate is 2 to 4 kg per ha.

BUFFEL GRASS (*Cenchrus ciliaris*). The taller cultivars of this species (for example, Biloela) will grow fairly well on the soils suited to green panic, especially the lighter soil types. It appears to be best suited to areas with hotter summer days which are found at lower altitudes away from the Great Dividing Range. Its place is more on lighter soils on the Central and Western Downs. The planting rate is 2 to 5 kg per ha.

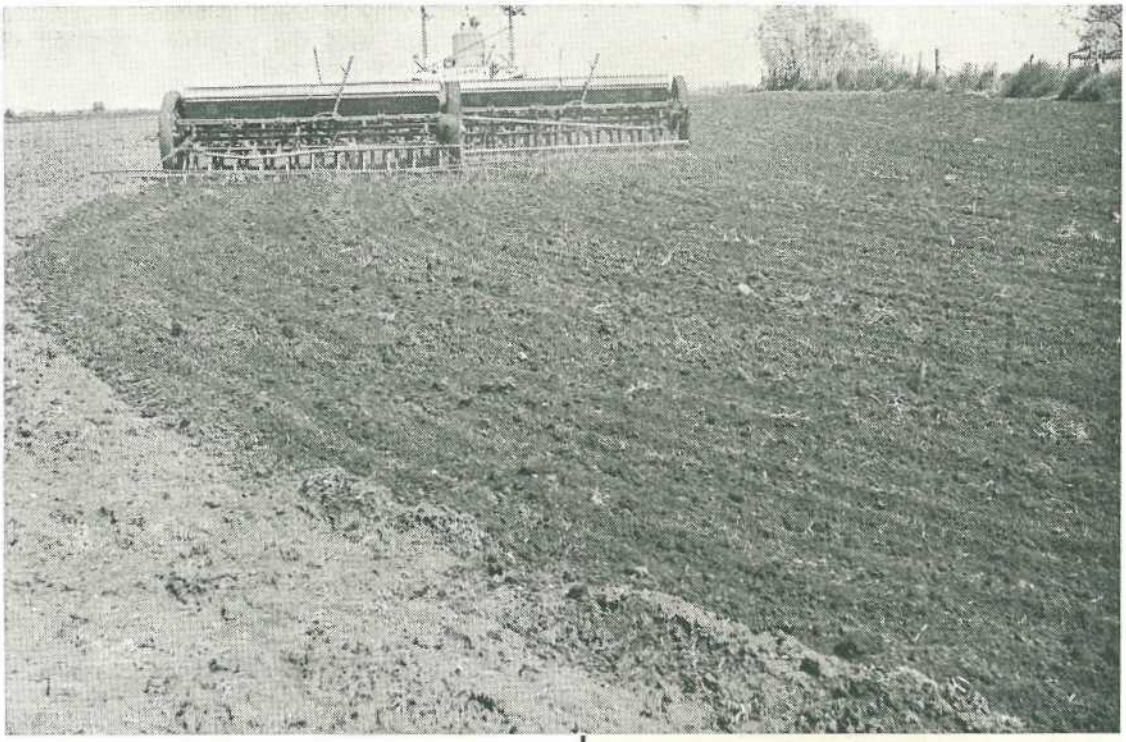
SORGHUM ALMUM (*Sorghum almum* cv. Crooble). This perennial grazing sorghum is relatively easy to establish. Its life span can be longer than 3 years if adequate fertilizer (particularly nitrogen) is applied. It is suited to the heavier-textured, more fertile soils. Because of its relatively larger seed size, it is a useful species for mixing with other smaller-seeded grasses which are both difficult and slow to establish in heavy soils. The planting rate is 2 to 6 kg per ha.

KIKUYU (*Pennisetum clandestinum*). Kikuyu is suited to the lighter textured more fertile soils such as red scrub soils or other loams. It needs a rainfall of more than 750 mm a year. It can grow reasonably well in waterways in drier areas provided soil fertility is adequate. Seed of two cultivars, Whittet and Breakwell, is now available. Kikuyu is planted by runners or by seed, the seed at 2 kg per ha.

PASPALUM (*Paspalum dilatatum*). Paspalum occurs naturally along drainage lines, creek flats and on wetter slopes of the Eastern Downs. Paspalum also needs an annual rainfall in excess of 750 mm. It can grow well on most soil types, but it will not persist on very low fertility soils. The planting rate is 6 to 8 kg per ha.

GATTON PANIC (*Panicum maximum* cv. Gatton). Gatton panic is more robust than Petrie green panic. It is reported to be a little more vigorous, drought resistant and more palatable than Petrie but requires higher fertility soils. Unfortunately, the current cost of this seed is too high for widespread planting. Should the price drop to somewhere near that of green panic, then Gatton panic will probably be used widely on the basaltic uplands. The planting rate is 3 to 6 kg per ha.

The green panic plants in this mixture with lucerne on a Purrawunda clay soil are too small to survive the frosts in winter. This occurs with February sowings when follow-up rains fail.



Final soil working before sowing green panic on an Oakey red brown earth at Jondaryan homestead.

NAROK SETARIA (*Setaria anceps* cv. Narok). Narok setaria is a cold-tolerant setaria that will grow better in areas with higher rainfall than the Eastern Downs receives. It has performed well with partial irrigation on the Downs and has grown better than expected under rainfall alone. Frost does not cause leaf damage to this grass until the temperature falls below minus 3°C. It has a lower peak of summer growth, good growth in both autumn and spring with a high digestibility. The planting rate is 2 to 4 kg per ha.

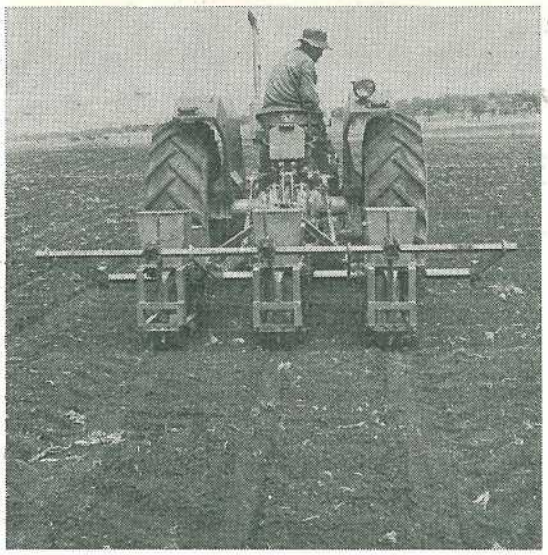
Two other perennial grasses appear interesting for this environment. These are *Bothriochloa insculpta* and *Urochloa mosambicensis*. The first has performed well in the first year of testing on a heavy black soil at Wellcamp. It is a stoloniferous grass which has grown well on poor fertility soils in Central Queensland.

The second grass is, of course, related to the annual *Urochloa panicoides* (liverseed grass). Its advantage over the various panics is that it is easier to establish because of its relatively larger seed size. It also spreads more easily following seeding in the paddock. In other areas, it has shown high crude protein values in midsummer. The leaf becomes brittle following frosting. Small areas show promise.

Legumes

Legumes are important, both as sources of nitrogen for the associated grasses and as additional protein in the animal's diet.

LUCERNE (*Medicago sativa* cv. Hunter River). Lucerne can be sown alone at 5 to 8 kg of seed per ha for grazing. It can also be sown with grasses to provide some high protein feed especially when grass growth is mature and low in protein. Its presence can improve the nitrogen fertility of the soil and ensure increased dry matter production with a slightly higher overall crude protein level.



TOP. A waterway sown with kikuyu seed using a Triad planter on a Charlton Craigmore soil at Wellcamp.

BOTTOM. Using a Triad planter to sow Makarikari seed on an Irving-Purrawunda soil near Mt. Tyson.

Planting rates in mixtures are mostly from 1 to 2 kg per ha. In special cases where a lucerne dominant pasture is required or is acceptable for a new pasture, a planting rate of up to 5 kg of lucerne plus the grass is sown per hectare.

Lucerne may be sown in almost every pasture mixture with the possible exception of those for very acid soils.

MEDICS (*Medicago* spp.) The medics are annual legumes which can be useful in a pasture mixture when good winter and spring rains occur. They are suited to most soil types except those acid soils with a pH of less than 6 (generally light-textured forest soils, either red 'snuffy' or sandy soils).

Cyprus barrel medic (*Medicago truncatula* var. *truncatula* cv. Cyprus) is suited to the driest situations with shallow soils. Jemalong barrel medic will give better yields on deeper, more fertile soils. Snail medic (*M. scutellata*) likes similar soils. It is more susceptible to frost damage but can provide some useful autumn growth as well as having a reputation of being less bloat-prone than the other medics. In pasture mixtures, planting rates range from 1 to 4 kg per ha using one or more of the medics.

STANDARD MIXTURE

Soil Types	Species	Rate per hectare
Upland forest soils—Chocolate clay loams with some stone and/or red loams as well as all friable scrub soils and sandy loam types	Green panic ..	4 kg
	or	
	Rhodes grass ..	4 kg
	with	
	Lucerne	2 kg
	Cyprus barrel medic	1 kg
	Jemalong barrel medic	1 kg
Lower slopes and flats—Black cracking clay soils or red-brown heavy clays	Makarikari grass cv. Pollock or Bambatsii	2–4 kg
	Lucerne	2 kg
	Jemalong barrel medic	1 kg
	Snail medic ..	1 kg

An alternative for the upland areas where good grass establishment is a problem is to include 4 to 6 kg per ha of sorghum almum with either the green panic or the Rhodes grass plus legumes.

A more detailed table of species, planting rates and fertilizer requirements for the various soil types of the basaltic uplands of the Eastern Downs is given in Table 1.

Time of Planting

Following rain, most soils and especially friable black earths, dry out to a depth of 1 to 2·5 cm very quickly. The soil below this depth dries out more slowly. If the seed is sown at a depth of 1 cm, the soil around it will not remain moist for many days after rain stops.

Pasture seed is generally small. Sufficient trials have been conducted to show that successful establishment can be obtained by sowing at a depth of 1 to 2 cm. The percentage of plants that emerge decreases as the depth of sowing increases beyond this.

Because most pasture seeds are sown on the surface and lightly covered with a harrow to obtain the desirable 1 cm sowing depth, it is the rain after sowing that will cause the first germination. It is essential to have the soil moist to depth before sowing. However, by the time you can get planting equipment onto the ground, the topsoil is already dry to a depth greater than 1 cm. In the ideal situation it should be necessary to receive only 10 mm of rain to link up the wet soil underneath with the surface soil.

Pasture seed should be sown at those times of the year when the surface soil is not likely to dry out quickly. These times are August, late January-early February, and midwinter.

In midwinter, soil temperatures are generally low and consequently seed sown in June and July seldom germinates at that time. Germination and emergence occur in the spring as temperatures rise. Successful plantings of pastures in these months have been made on fertile scrub soils using a light cover crop of wheat, barley or oats (using about 25% of the normal crop planting rate, for example, 8 to 10 kg of oats per ha). The cover crop minimizes the growth of broad-leaved winter weeds.

August and early September are normally dry months with mild temperatures but, when rain does fall, the topsoil remains wet for the 4 days necessary to start some of the grass seed germinating Soil temperatures are also rising at this period. Sowing in early August ensures that the seed has been sown before the rain falls.

Poor establishment will occur if young pasture seedlings are burnt off by heat-waves. These can occur from mid November to late January. Before young grasses establish their secondary roots, they are highly vulnerable to heat and moisture stress. Early January can be the worst period for heat waves.

Harvesting green panic on a Southbrook type clay loam on Messrs. L. R. and E. E. Hoopert's property, near Brookvale Park, Oakey.

Late January-early February is the period for the heaviest and most reliable rainfall. There is a good chance that the topsoil will be kept wet long enough for some seed to germinate. Sowing in mid January should be the aim. This should ensure that sufficient growing rain is received in the period between sowing and the first frost.

One important thing to remember is that, with most grass and legume seeds, not all of the seed germinates with the first rain. Generally, successive germinations occur with each rain. Do not plough a paddock out if a good strike is not obtained after the first rain period.

Weed Competition

Many pasture sowings have failed to establish because of strong weed competition. This can be a major problem with spring sowings. The two worst weeds are mint weed (*Salvia reflexa*) and liverseed grass along with other summer growing annual grasses.

TABLE 1

PASTURE PLANTING GUIDE

*Soil Type	†Average Depth	†Surface Colour and Texture	†Surface Structure	†Other Major Characteristics	Soil Suitability for Grass Establishment	Suitable Pasture Species	Rate kg/ha	Pasture Fertilizer Requirements
Waco Clay ..	Deeper than 1·20 m	Dark grey–brown heavy clay	Fine granular	Self-mulching surface	Fair	Makarikari	2–4	N S P
						Lucerne	2	
						Jemalong barrel medic	1	
						Snail medic	1	
						(Legumes oversown when grass is established)		
Irving Clay ..	Deeper than 1·20 m	Dark grey–brown clay	Granular	..	Fair	As above	As above	N S P
Craigmore Clay	Deeper than 1·20 m	Dark grey–black heavy clay	Coarse granular	Coarse blocky subsoil structure	Difficult	Sorghum almum ..	4–6	N S (P ?)
						Lucerne	1–2	
						Medics	1–3	
						or Sorghum almum	2–3	
						Rhodes	2	
						Lucerne	2	
						Medics	1–3	
						or substitute		
						Makarikari for Rhodes	2–4	
Ramsay Clay	Deeper than 1·20 m	Dark grey–brown heavy clay (mottled)	Coarse granular	Hard clay when dry. Stiff plastic clay when moist	Fair	As above	As above	N S
Charlton Clay	45–90 cm	Very dark grey heavy clay	Coarse granular	..	Difficult	As above	As above	N S
Purrawunda Clay	45–90 cm	Very dark greyish brown clay	Granular	Deep layer of decomposing basalt below dark overlay	Fair	Green panic or	4–6	N S (P ?)
						Gatton panic or	3–6	
						Sorghum almum or	4–6	
						Narok setaria with	2–4	
						Lucerne	2	
						Medics or	1–3	
						Makarikari (Oversow legumes later)	2–4	
Burton Clay Loam	90–120 cm	Dark reddish-brown clay loam	Weak crumb	Strong fine blocky subsoil structure. Manganese concretions	Very good	Green panic .. or	4–6	N P
						Rhodes .. .. or	4	
						Gatton panic .. with	4	
						Lucerne	2	
						Medics	1–3	

TABLE 1—*continued*

PASTURE PLANTING GUIDE—*continued*

*Soil Type	†Average Depth	†Surface Colour and Texture	†Surface Structure	†Other Major Characteristics	Soil Suitability for Grass Establishment	Suitable Pasture Species	Rate kg/ha	Pasture Fertilizer Requirements
Aubigny Clay	90–120 cm	Dark reddish–brown light clay	Weak blocky	Calcite nodules in subsoil	Very good	As above	As above	?
Clifton Clay Loam	45–90 cm	Dark reddish–brown clay loam	Weak crumb	..	..	As above	As above	?
Beauaraba Clay	25–45 cm	Dark brown–dark grey brown clay	Granular	Clayey weathered basalt in subsoil	Fair	Makarikari .. .. Lucerne .. .. Medics (Legumes oversown when grass is established)	2–4 2	N S
Southbrook Clay Loam	45–60 cm	Reddish brown clay loam	Fine blocky	Much surface stone	Very good	As for Burton Clay Loam	..	..
Mallard Clay Loam	45–60 cm	Brown to grey brown clay loam	Fine blocky	..	Very good	As for Burton Clay Loam; also Biloela buffel	2–5	N P S
Kenmuir Stony Clay Loam	25 cm	Brown–grey brown clay loam	..	Too stony for cultivation	Very good	Cyprus barrel medic Jemalong barrel medic AERIAL TOPDRESSING of seed plus superphosphate with sulphur	1–3 1–3 125 to 250 kg/ha	P S
Kenmuir Gravelly Clay Loam	25 cm	Brown–grey brown clay loam	Strong crumb	Basalt gravel through profile 5 cm or smaller	Very good	As above where cultivated; also as for Burton Clay Loam	..	N P S

* After 'Soils in the Toowoomba AREA, Darling Downs, Queensland' by C. H. Thompson and G. G. Beckman—Soils and Land Use Series No. 28, C.S.I.R.O. 1959.

† V. G. Cummins, Division of Land Utilisation, Department of Primary Industries (unpublished data).

Mostly, if either of these is present, it would be an advantage to cultivate the ground in the spring to reduce the weed population and then sow the pasture in mid January when the amount of weed seed has been depleted and the most favourable growing period for these weeds has passed.

If it is necessary to plant pasture in the spring and mint weed is the only major problem, control is possible with 2,4-D amine sprays applied at 1 litre of the 50% concentrate to 1 ha when the weeds are young and the sown grasses have established secondary roots. (This requires a follow-up rain after emergence). The 2,4-D spray will either kill or retard any legumes sown with the grasses. There are no ways of selectively controlling liverseed grass in sown pasture.

With both weeds, it should be remembered that, if you can successfully establish the pasture in the first year, then growth will normally be too strong for the annual weeds in the second year.

Quite often, the top growth of weeds is removed by mowing or forage harvesting at a height of 15 cm. This allows light into the the smaller grass plants which can then grow on.

If weeds are shading the young grasses going into winter, it is better to leave them there as protection from frost. The frost will kill and desiccate the shading leaves of most weeds.

Seed Quality

The low germination percentage of the seed of many grass species is one of the major reasons for poor pasture establishment. Depending on growing conditions plus harvesting methods employed, the percentage germination can vary from practically nothing to more than 60%. Seed is sold by weight. Some seed samples may contain a large percentage of inert matter, that is, straw, glumes, dead seed and leaves, as well as weed seeds and seeds of other grasses and crops. Ideally, it should contain only pure live seed of the particular grass.

The legal standard for the sale of green panic in Queensland requires that the samples have a minimum of 70% pure seed with a maximum of 29·5% inert matter and that 20% of the pure seed germinates over a 28-day period.

Against this, it is possible to buy green panic seed with less than 10% inert matter and with more than 50% germination. This means that over 45% of the actual seed bought will germinate. This type of sample would give three times as many plants per kilogram of seed sown.

With better seed, speed of germination is usually better and so there is enough of it (3% to 5%) which germinates within 4 days of rain to provide a satisfactory stand. The big problem is that the price per kilogram of the best and the worst seed is often the same or very close to each other.

When buying seed, inquire about its germination test. Inspect the seed if possible. Reject it if it contains a lot of inert matter.

The Department of Primary Industries Standards Branch provides a free seed quality and germination test for any seed a farmer intends to sow himself. This service can be used for home-harvested seed or for bought seed. To have the results before sowing, the seed sample should be forwarded at least 6 weeks earlier.

Remember, a germination test is performed under ideal conditions in a laboratory. Field conditions can markedly hamper germination and ultimate emergence.

For most small grass seeds, a germination test of more than 35% means that some of it should germinate in the 4 days before the surface soil dries out after rain. Always buy seed with the highest germination test of the sample.

Soil Preparation

The better the seedbed, the better will be the chances of obtaining a good establishment. Following an initial ploughing to 10 to 15 cm, the top 5 cm should be worked down as

finely as possible. At the same time, the seedbed should be compacted as much as possible. This removes the air inside the soil and slows down the speed of drying. Constant harrowing or rolling, if possible, will give a good compacted seedbed.

On sloping sites, a compromise has to be reached between good seedbed preparation and leaving the soil prone to erosion. With sloping paddocks, it may be necessary to broadcast the seed onto paddocks which, after reasonable working, have been ripped on the contour with a tool bar and duck feet. Most of the seed will drop into the bottom of the contour rills and will be covered by loose soil when it rains.

Planting Methods

The aim should be to place small grass seeds 1·5 cm below the surface. The methods of doing this are many.

The ideal way is to use a press wheel to pack the ground immediately in front of the seed, then drop the seed on this compacted soil and cover with 1 to 1·5 cm of compacted soil. The Triad press wheel planter does such a job.

Most farmers have combines and will use these where possible for sowing grass seed.

For green panic, Makarikari grass, paspalum and sorghum almum, plus lucerne and medics, the only problem with using a combine is setting the correct rate.

One method of finding the correct rate is to mix up enough seed for a hectare. Weigh off a tenth of it. Put it on top of every second run in the combine box. Set the combine on its lowest setting. Block the alternate runs off and start planting a tenth of a hectare. You will need a person on the back of the combine to watch that some runs do not run out of seed too quickly. Stop when most of the seed has run out. Work out roughly how much of the area you have sown. Readjust the combine to bring you nearer the correct rate. When you get the right rate, record it for next time.

If the lowest combine setting is not low enough, use every third or fourth combine run instead of every second run. This will give a row planting effect which is not desirable in weedy or hilly situations. However, good pastures have developed from these wider row spacings especially in drier situations.

Another method of slowing down the planting rate is to add dead grain to the mixture. The grain, such as sorghum, millet or barley, should be baked in the household oven for an hour.

Finely sieved sawdust has also been used to dilute seed. Too much sawdust may cause bridging in the combine box and so require constant stirring. Sawdust must be very dry to avoid clogging. Also, if left in the combine, it may sweat and become wet.

It is usual to pull the rubber tubes out of the boots so that the seed is not sowing through the combine feet, but is sprayed out behind. If the rear run of droppers is used, the seed will fall behind most of the combine feet. It can be made to drop further behind by tying the rubbers back. It is then possible to have the combine feet in the ground to do a shallow cultivation to remove weeds. The covering harrows will cover the seed sufficiently. If the seed is being covered too deeply, turn the harrows upside down. If it is still covering too deeply, discard the harrows and drag a board or a couple of light branches behind the combine.

For sowing large areas to pasture, a small-seed box mounted on the rear of the normal combine is useful. These boxes are geared down for low rates and they drop the seed behind the combine feet.

Triad Planter

The Triad planter is a precision depth type, single-row planter. The present commercial units consist of three planters mounted side by side on a tool bar at a distance varying from 80 to 100 cm apart.

The Triad consists of a seed box from which seed is dropped on the ground in front of a broad 15 cm wide steel press wheel which has a 2·5 cm wide x 1·8 cm deep steel band around the middle of the outside of it. The seed is dropped in front of this band and pressed into the soil to a depth of 1·8 cm. A concave roller coming behind the first wheel packs the soil on to the top of the seed. If

necessary, the fertilizer box can drop gypsum behind the second roller in a band over the seed row.

The use of gypsum should be restricted to soils that form a thick crust. These soils normally show very poor emergence with sowings of small seeded grain crops such as millets. Gypsum used at the rate of 125 kg per ha in a narrow band will give a high local concentration that will prevent crust formation immediately over the seed row.

Developmental research for this machine by Dr. J. K. Leslie and his co-workers showed that its main advantage is to achieve a good establishment from half the quantity of seed used in broadcast sowing. Therefore, the use of the Triad planter can be restricted to costly pasture seeds where the difference between sowing 2 kg and 4 kg of seed per hectare may be considerable (that is, more than $10 per hectare).

With the Triad planter, a firm seedbed, relatively free of surface stone, is required. The best results have been achieved on soil packed tight by harrowing and rolling before sowing. In a loose seedbed, the Triad will bury itself too deeply, thus sowing too deeply. The soil will not be compressed around the seed and will dry out quickly after rain.

With a three-row Triad, it is possible to sow nearly 1 hectare per hour once the machine is set right. Levelling the Triad is necessary before planting to ensure that planting at the recommended depth and satisfactory covering of the seed are achieved.

Inter-row cultivation is necessary for row planted grasses to minimize weed competition.

Fertilizer at Sowing

The use of general recommendations for fertilizer has to be coupled with the farmer's knowledge of the particular paddock. Phosphorous (P) deficiency can be determined by soil analysis. Nitrogen (N) needs can be predicted by past cropping history. Heavily and long-cropped paddocks are more likely to require nitrogen at establishment.

Where phosphorous is required, rates in the range of 125 to 250 kg of superphosphate per hectare are usually applied with the seed at sowing. Put the superphosphate in the soil with the seed to aid early root development.

On the other hand, any fertilizer coming in direct contact with inoculated legume seed will destroy the bacteria in the inoculum. Lime pelleting of the seed or putting the fertilizer into the soil before sowing the seed are two methods employed where it is necessary to inoculate legume seed.

Nitrogen fertilizers should not be sown down the same combine tubes as small grass seeds. In most situations where nitrogen is needed, about 30 kg of N per hectare could be applied before sowing such species as green panic, Rhodes, buffel or sorghum almum. For Makarikari grass, no nitrogen fertilizer is recommended as seedling development is too slow to make use of nitrogen applied at sowing time.

With all of these grasses, however, it is better to apply nitrogen after emergence when it is certain that a good stand has been obtained and that growth is being retarded through lack of nitrogen and/or sulphur (S). On most soil types except fertile scrub soils, an annual application of 250 kg of sulphate of ammonia per hectare in the late spring is necessary to maintain good growth and to obtain reasonable animal production. A lack of available sulphur as well as nitrogen is known to retard pasture growth on most of the basaltic soil types in the Eastern Downs.

Early Grazing Management

A new pasture is like any other crop. If it is eaten too soon or too harshly, it will suffer. No farmer would plant a paddock of oats and turn the cows into it the next day and leave them in it for the rest of the year. Similarly, with pasture, constant over-grazing will destroy it.

A light grazing when the secondary roots are well established will not hurt it. On the other hand, too many pastures of green panic, in particular, have been killed out in their first year by their being grazed to ground level just before winter.

Aim at having about a 15 cm of stubble on the new pasture for the first winter. Older plants can withstand heavier grazing but not constant over-grazing.

A rotational grazing system where paddocks are grazed for 1 to 2 weeks and then closed up for 4 to 8 weeks is desirable. This is particularly so on farms that are stocked to

capacity. If there is only one paddock of pasture on the farm, then it should be rotationally grazed in conjunction with crops. On many farms, the first paddock of pasture has been a failure because farmers have treated this odd paddock as a calf paddock or a dry paddock and grazed it constantly.

Lifelong Care

It should be realized that, to obtain full value from the care and attention to detail given during establishment, pastures on the Eastern Downs require rotational grazing and adequate fertilizers year in year out in their later life to reap the economic benefit from the money invested.

While freshly cleared scrub soils are usually quite fertile, older scrub soils and most forest soils in the area require regular applications of nitrogen, sulphur and, in many cases, phosphate fertilizers to support good pastures. This can cost from $8 to $25 per hectare a year. In the absence of adequate fertilizer, the areas will revert to native grasses and weeds.

Generally, most farmers will not appreciate the true value of pasture to their farms until they have established a number of paddocks. The pastures then become part of the grazing system used on the farm and not just something to fill up a useless paddock.

Fall in number of banana growers

INCREASED production costs and lower profits were the likely causes of a decline in the number of Queensland banana growers in 1973-74, said the Chairman of the Banana Industry Protection Board (Mr. F. W. Berrill).

He was commenting on planting statistics for the year ended 31 March, 1974.

The Queensland figures, with last year's figures in brackets, were—

Number of growers, 1 205 (1 313); total area, 3 131 hectares (3 487); area planted during year, 288 ha (558); area eradicated, 527 ha (545); area under Cavendish, 77 ha (84); Mons Mari, 2 270 ha (2 482); Lady Finger, 782 ha (917); other varieties, 2 ha (15).

The three major production areas were the Wet Tropics and North and South Moreton. Figures for these were—

Wet Tropics: Number of growers, 96 (100); total area, 1 066 h (1 157); area planted during year 179 ha (351); area eradicated, 256 ha (136); area under Cavendish, nil (nil); Mons Mari, 1 006 ha (1 156); Lady Finger, 0·2 ha (0·2).

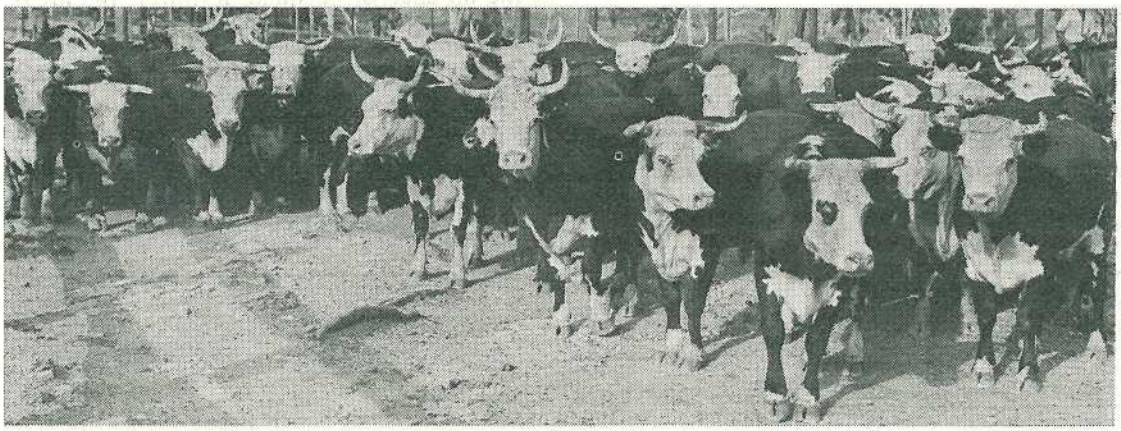
North Moreton: 746 (841); 1 431 ha (1 573); 70 ha (157); 153 ha (269); Cavendish, 57 ha (56); Mons Mari, 825 ha (890); Lady Finger, 549 ha (662).

South Moreton: 163 (170); 462 ha (575); 110 ha (104); Cavendish 11 ha (16); Mons Mari, 293 ha (348); Lady Finger 158 ha (129).

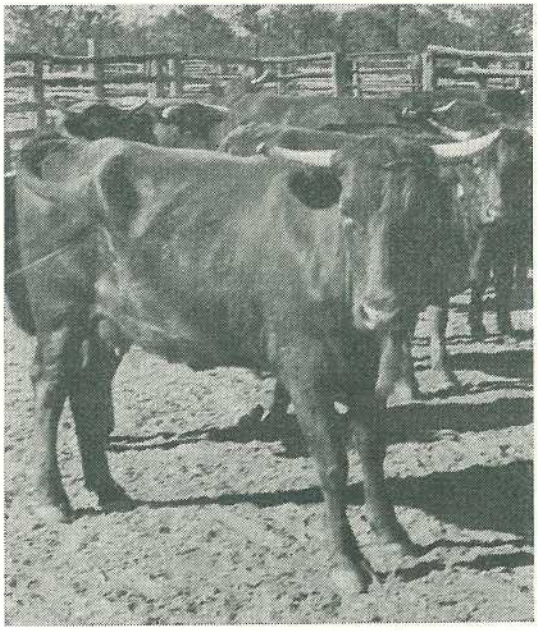
Mr. Berrill said that smaller growers obviously had been hit harder by rising costs and lower profits, resulting in a reduction in the number of growers and the area under crop.

'It is obvious that growers will have to strive to increase their efficiency still further to remain viable,' he said.

Horns do cause bruising



Horned cattle had twice as much bruising as hornless.



by Officers of Slaughtering and Meat Inspection Branch.

BRUISING is greater in horned cattle than in hornless animals.

This is the finding of a series of recent trials in Queensland. The trials were carried out by the Queensland Department of Primary Industries, the C.S.I.R.O. and the Australian Meat Board, in conjunction with the United Graziers' Association and co-operating graziers.

The trials dealt with cattle being fattened and going forward for slaughter. Great care was taken to ensure that groups of cattle were treated identically so that differences in bruising were, in fact, the result of the cattle being horned or hornless.

Bruised tissue trimmed off carcasses after slaughter was very carefully assessed to determine location and weight.

Groups of cattle in which both horned and hornless were present in equal numbers showed about one and a half times as much bruising as a group made up of hornless cattle only.

Groups were travelled to the abattoir over a variety of distances and using different types of trucks. Differences in bruising between horned and hornless groups were similar in all cases: horns caused twice as much bruising.

Thus, there can be no doubt that horns are a significant cause of bruising. This is a powerful argument in favour of dehorning.

Without the co-operation of all the organizations involved in these trials, it would not have been possible to conduct them successfully. Anyone interested in details of these trials can obtain them from Slaughtering and Meat Inspection or Beef Cattle Hubandry Branch officers of the Department of Primary Industries.

Appeal to cattle owners on disease

Mr. W. T. Hall, Director of Pathology at the Primary Industries Department's Animal Research Institute, Yeerongpilly, has appealed to farmers and graziers to advise him if they suspected that cases of bovine enzootic haematuria were occurring in their cattle.

He said today that the disease, also known as coastal or Illawarra red water, had been detected in the Brisbane Valley and Maranoa district.

Affected cattle bled from cancer-like growths in the bladder and lost condition. The urine was brown to red and contained blood clots. No cure was known and it might be several years before the symptoms became apparent.

The disease had occurred in many countries and the cause was blamed on bracken fern.

Suspect Rock Fern

Mr. Hall said he suspected that mulga or rock fern was another cause.

Mulga fern was extremely widespread, and cattle often were unable to avoid it when grazing.

In investigations carried out by Mr. R. A. McKenzie, a pathologist at the Institute, calves were being fed mulga fern in an attempt to reproduce the disease but a result was not expected for at least 3 years.

Mr. McKenzie was also examining the urinary bladders of stock slaughtered at Ipswich district abattoirs to see what changes were occurring in them. In this work, he was being helped by Stock Inspectors at Ipswich.

Crossing for introduced livestock

WHITE Swamp Gate, on the Queensland-New South Wales border south of Boonah, has been approved as an official crossing place for introduction of livestock into Queensland.

Announcing this, the Minister for Primary Industries (Hon. V. B. Sullivan, M.L.A.) said that, although it was not expected that large numbers of stock would be crossed at this point, it would benefit N.S.W. stock owners operating in the area.

The road via the Gate, which was about 8 km east of Wilson's Peak, was the most direct route to saleyards in Queensland.

Over the years, small numbers of cattle, mainly for slaughter, had been brought through the crossing, which was under the full-time supervision of a N.S.W. border gate inspector.

Mr. Sullivan said it had also been approved that the gatekeeper, Mr. A. W. Hackney, be appointed an acting Inspector of Stock under Queensland legislation to control the movement of Stock entering the State at this crossing.

This decision had been supported by the N.S.W. Department of Agriculture.

Cotton pest control at a glance

by Entomology Branch Officers.

THE following tabulation summarizes the recommended pest controls for cotton production in Queensland. Compilations of this kind cannot give comprehensive details on pest identification, cultural approaches to control or accurate data on the timing and need for specific chemical usage. The summary is presented as a reference or guide and details, where necessary, should be sought from extension officers of the Department of Primary Industries.

Pest	Description of Pest	Damage to Crop	Control—Pesticide Dosage Rates are active constituent	Remarks
Predominately seedling pest problems				
False wireworms *Gonocephalum macleayi* and related species	Larvae—light brown, elongate, tough skinned, up to 30 mm long. Beetle—inconspicuous dark greyish-black, rather flattened 7 mm long	Larvae attack roots, shoots and germinating seed. Damage reduces the stand of plants	lindane dust 1 g/200 m of row	Apply chemical to seed or as an in-furrow planting treatment. Addition of minimum moisture to seed will assist distribution of the insecticide on the seed. Germination may be affected if this concentration of lindane is in direct contact with seed for significant periods. To avoid damage treat seed within 24 hours of planting. Significant pest in some areas
Cutworms *Agrotis* spp.	Larvae—grey-green to dirty dark brown, soft bodied, up to 35 mm long. Moths—heavy bodied, dark greyish, night flying with a wingspan of 35 mm	Larvae chew through the stems of seedlings at and below ground. Damage reduces the stand of plants	trichlorphon 550 g/ha or endosulfan 750 g/ha	Proportionately lower dosage for band treatment to the rows. Important pest in occasional seasons
Cotton seedling thrips *Thrips tabaci*	Small, delicate, elongate, yellow to black insects, 2 mm long, with two pairs narrow, fringed wings	Thrips lacerate surface tissue and feed upon sap causing white blotches and distortion of seedling tissue	dimethoate 200 g/ha, omethoate 550 g/ha or monocrotophos 350 g/ha	Chemical control rarely required on actively growing seedlings. Proportionately lower dosage for band treatment to the rows
Aphids *Aphis gossypii*	Greenish, soft-bodied, winged or wingless insects, occuring in colonies usually on terminals and undersides of leaves, up to 2 mm long	Sap-sucking pests often associated with sticky honey dew and mould development, cause leaf distortion, lint staining and plant stunting	demeton-S-methyl 275 g/ha, omethoate 550 g/ha or monocrotophos 350 g/ha	Insecticide application usually not warranted as natural control factors, parasites and predators, are capable of good population reductions within a few weeks under most conditions

Pest	Description of Pest	Damage to Crop	Control—Pesticide Dosage Rates are active constituent	Remarks
Cotton jassids *Austroasca terraereginae*	Yellow, torpedo-shaped insects with, in the adult stage, two pairs of wings closely folded over the body, about 3 mm long	Adults and nymphs suck sap from undersides of leaves, cause leaf stippling, discoloration and distortion. Seedling stunting results from early attack, square shedding may follow later infestation	demethoate 150 g/ha, omethoate 550 g/ha or monocrotophos 350 g/ha	Specific control measures not usually required
Cotton tipworm *Crocidosema plebiana*	Larvae—small, white with a pink tinge except for head and first body segment which are dark brown. Moths—insignificant greyish-brown, wingspread of 12 mm	Larvae attack terminals, and young squares and leaves in terminals. Terminal loss results in production of several vegetation branches and ' bushy ' plants	endosulfan 750 g/ha or DDT 550 g/ha	A pest of significance in many seasons. Specific control may be required
Predominately foliage pest problems				
Cotton loopers *Anomis flava* and *Anomis planalis*	Larvae—green and up to 35 mm long or green with two white stripes along body and up to 33 mm long. Moths—light or drab brown with a wingspread of about 30 mm	Larvae feed on foliage causing reduction in leaf areas. High populations may defoliate plants	azinphos ethyl 550 g/ha, endosulfan 750 g/ha or monocrotophos 350 g/ha	Usually not a pest of major significance where chemical controls for bollworms have been used
Spider mites Tetranychid group	About 0·25 mm long with four pairs of legs and colour varying from shades of brown to green and red. Associated with webbing on underleaf surfaces	Mites extract sap from the leaves. Initially, damage is seen as yellowish patches, usually near the veins. Further feeding may result in leaf reddening and death of affected foliage	*Dicofol 550 g/ha, demeton-S-methyl 275 g/ha or monocrotophos 200 g/ha	**Early treatment is essential for best results.** Two applications at 4 to 7 days' interval are necessary to control established infestations. Mites are most severe when a number of chlorinated hydrocarbon treatments have been necessary for bollworm control
Monolepta beetle *Monolepta australis*	Squarish strongly built beetles 7 mm long, light yellow with cherry coloured band across wing base and circular spots on back	Attacks foliage causing leaf perforation and erosion of surfaces. Heavy infestations may cause virtual defoliation	†	**Rarely of importance**. Infestations usually of localized extent. Spot treatment will give control if the pest is located early

* Preferred for high volume application.

† Chemicals recommended for bollworms will control these pests on the rare occasions on which such treatments may be specifically required.

Pest	Description of Pest	Damage to Crop	Control—Pesticide Dosage Rates are active constituent	Remarks
Cotton leaf perforator *Bucculatrix gossypii*	Larvae—light green, relatively sluggish, about 7 mm long. Moths—small, grey and inconspicuous	Young larvae mine between the upper and lower leaf surfaces. Older larvae feed externally causing a characteristic shot holing particularly of older leaves	†	Relatively unimportant pest, rarely requires specific chemical control
Cotton web-spinner *Loxostege affinitalis*	Larvae—yellowish to dark green quick-moving, slender, about 18 mm long. Moths—brown and fawn coloured with a wingspread of 25 mm	Larvae skeletonize foliage. Feeding is associated with webbing and insect excreta. Seedlings may be killed, older plants may be defoliated	†	Specific chemical control should not be required. Clean cultivation to eliminate alternative hosts in and around cotton fields is recommended. As the insect has not been recorded to lay eggs on cotton control of alternative hosts, e.g. roly-poly, red pigweed, black pigweed, galvanized burr and Bathurst burr, is essential
Predominately square and boll pest problems				
Corn ear worm and native budworm *Heliothis armigera* and *Heliothis punctigera*	Eggs—pearly white, dome shaped, pinhead sized, laid singly on leaves and terminals. Larvae—pale green to dark brown with longitudinal stripes of different shades, up to 35 mm long. Moths—stout bodied, strong flying with wingsspread of 35 mm. Forewings reddish pink and hind wings creamy yellow with large, marginal, smoky area	Larvae attack squares, bolls and terminals. Feeding results in loss of squares and young bolls. One or more locks of older bolls may be destroyed. Fungal rots usually complete damaged boll destruction. Terminal feeding results in loss of very small squares and may cause terminal death	DDT 550g/ha. Control of large larvae may require 1 100 g/ha, endosulfan 750 g/ha or ‡DDT-chlorcam 720 + 2 000 g/ha	Small larvae may cause severe damage. Chemical control may be necessary at short intervals against high pest populations during the period of major square and boll production DDT resistance has been recorded in *H. armigera* populations in some areas. The resistance position and species identification are of major importance in selecting an appropriate insecticide. Avoid where possible alternative hosts, e.g. sorghum, maize and lucerne near cotton fields
Rough bollworm *Earias huegeli*	Larvae—mottled colour pattern of dark-brown, yellow and grey, spiny appearance 18 mm long. Moths—forewings partly straw coloured with large wedge-shaped greenish area. Hindwings silvery-grey, fringed with a brownish tinge; wingspread 18 mm	Larvae attack squares, bolls and terminals; damaged squares and young bolls are shed; lint and seed are destroyed in older bolls. Terminal attack and stem tunnelling may kill young plants and cause malformation in older plants	endrin 275–550 g/ha, endosulfan 750 g/ha or parathion 275–425 g/ha (Control of large larvae is very difficult to obtain)	**Elimination of bladder ketmia is a most important aspect of control.** Small larvae may cause severe damage and chemical control may be required at short intervals against high populations during the period of major square and boll production

Pest	Description of Pest	Damage to Crop	Control—Pesticide Dosage Rates are active constituent	Remarks
Pink-spotted bollworm *Pectinophora scutigera*	Larvae—salmon pink with a brown head and first body segment, 12 mm long. Moths—inconspicuous greyish-brown with wingspread of 18 mm	Larvae feed in the bolls destroying the lint and seed. As the larvae enter the boll early in their development the entry point is usually difficult to see and severe damage may occur before it is realized that the pest is present	DDT 1 100 g/ha	Destroy by slashing and ploughing in all crop residues as soon as practicable after harvest. This prevents over-wintering of the pests from season to season. **Avoid early volunteer plants, ratoon and standover cotton.** This pest is confined to central and northern Queensland areas. Several DDT applications are necessary to suppress existing infestations. **Good cultural control on a district basis makes chemical applications unnecessary**
Yellow peach moth *Dichocrocis punctiferalis*	Larvae—greyish-white, often tinged with pink, with darker oval spots on the body, up to 35 mm long. Moths—orange-yellow wings with conspicuous black spots, wingspread 25 mm	Larvae feed within bolls which become fouled with excreta and webbing	..	Specific control measures unwarranted. A minor pest in humid coastal districts, but insecticide treatments for bollworms keep populations to low levels
Cotton stainers *Dysdercus sidae* and *Dysdercus cingulatus*	Adults—bugs 12 mm long, upper surface predominately brownish-grey or reddish brown. Wing tips dark brown and with a conspicuous black spot in the middle of each forewing	Adults and nymphs pierce bolls to suck sap from seeds. Most active after bolls open. Causes reduction in seed germination and lint staining	..	Specific control measures unwarranted. Insecticide treatments for bollworms keep populations to low levels
Cotton harlequin bug *Tectocoris diophthalmus*	Adults—shield shaped bugs 18 mm long with colour patterns of yellow, orange, scarlet, metallic greens and blues	Adults and nymphs pierce bolls to suck sap. May cause shedding of small bolls and allow entry of rotting organisms to older bolls	..	Specific control measures unwarranted. Insecticide treatments for bollworms keep populations to low levels
Cotton seed bug *Oxycarenus luctuosus*	Adult bugs are black and white, about 3 mm long, with clear wings except for a dark area on each forewing	Nymphs and adults feed on maturing open bolls. Some lint staining may occur	..	Specific control measures unwarranted

† Chemicals recommended for bollworms will control these pests on the rare occasions on which such treatments rnay be specifically required.
‡ This combination for use where DDT resistance in *H. armigera* is present.

The commercial product names listed hereunder are examples of the particular insecticide available and should not be construed to indicate recommendation of a particular company's product in preference to another which may have been inadvertently omitted.

Common Name	Commercial Name*	Dosage		
		Active constituent	Commercial product	
				Strength of product
azinphos ethyl	Q-thion, Kilathion A, Azphos, Gusathion A, Chemothion 40, Co-thion E	550 g/ha	1 375 ml/ha	40% w/v
DDT		550–1 100 g/ha	2·2–4·4 litres/ha	25% w/v
DDT-chlorcam		approx. 750 g/ha DDT + 2 000 g/ha chlorcam	4·0 litres/ha	18% w/v pp DDT 50% w/v chlorcam
demeton-S-methyl	Metasystox (i)	275 g/ha	1 100 ml/ha	25% w/v
dicofol	Kelthane	550 g/ha	2·3 litres/ha	24% w/v
dimethoate	Rogor, perfekthion	150–200 g/ha	500–675 ml/ha	30% w/v
endosulphan	Thiodan, Endosan	750 g/ha	2·1 litres/ha	35% w/v
endrin		275–550 g/ha	925–1 850 ml/ha	30% w/v
lindane (gamma BHC)		1 g/200 m	1 g/40 m 10 g/52 m	20% w/w 2·6% w/w
monocrotophos	Nuvacron, Azodrin	350 g/ha	875 ml/ha	40% w/v
omethoate	Folimat	550 g/ha	700 ml/ha	80% w/v
parathion	Folidol 50, Paramul 50	275–425 g/ha	550–850 ml/ha	50% w/v
trichlorphon	Dipterex	550 g/ha	700 g/ha	80% w/w
	Klorfon		925 ml/ha	60% w/v

* Commercial names which include the common names are not shown.

Tick fevers—and how to prevent them

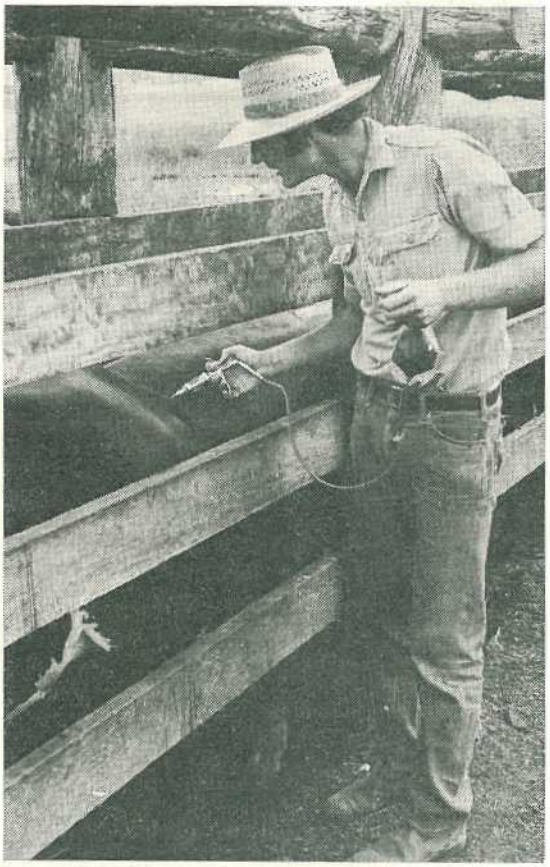
THE cattle tick (*Boophilus microplus*) is found on most cattle in coastal and sub-coastal Queensland. Most producers are familiar with the irritation and loss of condition associated with excessive tick infestation.

Many also realise that ticks can cause a serious disease known as tick fever or 'red water'.

Efficient property management demands control of both problems. Good tick control should be supplemented by tick fever control measures.

Most cattlemen agree that tick populations can be held at low levels. Unfortunately, the the age-old fear of having the herd too 'clean' and thus susceptible to tick fever often acts as a restraint on greater effort or better directed strategies.

Despite what is often believed, the presence of ticks does not necessarily ensure immunity to tick fever. A simple vaccination programme, as suggested in this article, is a more reliable method of preventing this infection.



Mr D. Slack, of Gayndah, vaccinating his young stock behind the shoulder in a crush. The animals are correctly positioned to allow for quick vaccination.

Causative Organisms

Ticks are responsible for transmitting three different microscopic organisms, all of which may produce their own type of tick fever.

Babesia argentina causes most tick fever; a similar organism *Babesia bigemina* infects most cattle but rarely causes sickness. The name of the disease caused by these two parasites is babesiosis. The third organism is *Anaplasma marginale* and the disease it causes is anaplasmosis. The incidence of anaplasmosis has increased in recent years. Before 1966 only about 7% of tick fever was caused by *A. marginale,* but now about 20% of tick fever is due to anaplasmosis, and the disease is a significant economic problem.

Microscopic examination of blood smears from an affected animal shows the causative organisms inside the red blood cells.

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by F. R. EMMERSON and S. G. KNOTT, Veterinary Services Branch; W. McGREGOR, Tick Fever Research Centre, Wacol.

Transmission

If *Babesia* are present in the blood of a beast, some parasites may be swallowed by female ticks during engorgement. Multiplication occurs in the tick, parasites invade the ovary, developing eggs become infected and the resultant larval progeny are infective.

When these larvae attach to another beast, transmission to the new host occurs by way of the young tick's mouth parts and saliva. With *B. argentina,* this occurs about 3 days after attachment, but is delayed for at least another 6 days with *B. bigemina.*

The transmission of anaplasmosis is quite different. Transmission from the engorged adult female to her progeny does not occur. Although the cattle tick is reputed to be a one-host species, it does not bite its host for all of its life and temporary detachment may take place. Thus, if cattle are in close contact, some are able to transfer to a new host. Anaplasmosis may then be transmitted if ticks have been exposed to anaplasma on the previous host. In addition, male ticks are migratory, and can transfer even more readily to a second host. They also have been shown to transmit infection.

Symptoms

Cattle suffering from acute babesiosis seek shade and water, show loss of appetite and a disinclination to move. If forced to walk, they may sway or stagger. Occasionally an animal may charge. This symptom and the severe depression and convulsions sometimes seen are associated with brain damage. Rapid loss of condition occurs. Advanced cases pass red urine though the term 'red-water' for tick fever can be misleading because it is not always seen and because it can occur in other diseases.

Close examination reveals high rectal temperatures from 105°F (40·6°C) to 108°F (42·2°C). Membranes of the eyes, gums and vagina may be very pale and/or yellow (jaundiced).

Anaplasmosis is usually of slower onset and longer duration than babesiosis. Sometimes the period of sickness extends over several weeks. Fever is less intense as a rule with rectal temperatures perhaps in the vicinity of 104°F (40°C) to 105°F (40·6°C) being recorded. Loss of condition, depressed milk production and abortion are symptoms in non-fatal cases. The urine is rarely if ever red but may be brownish. As with babesiosis, anaplasmosis affects all ages, but symptoms increase in severity with the age of the animal.

Post Mortem Findings

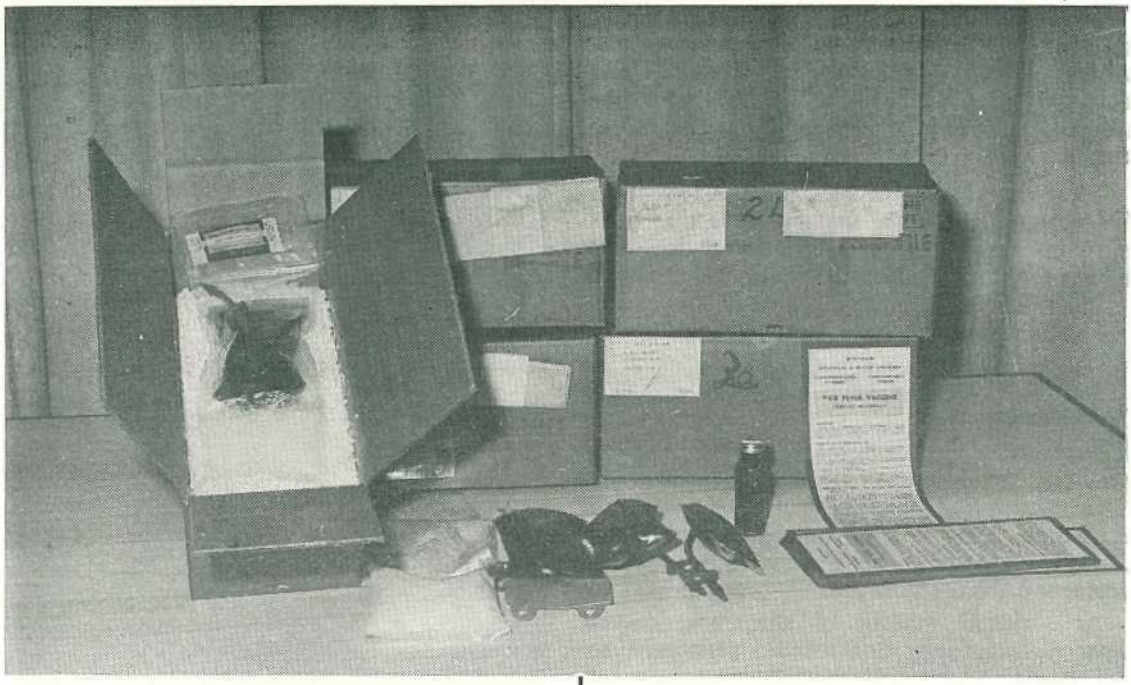
Pale or yellowish tissues are often seen. The liver is usually enlarged, orange or bronze, and the bile is thick and granular. The spleen is enlarged with a 'raspberry jam' consistency when cut. If urine is present in the bladder, it may be red for babesiosis.

It is most important to take specimens to identify which of the three tick fever organisms is responsible. These should be organ smears, particularly kidney, heart muscle, spleen and brain for *B. argentina.* To diagnose *A. marginale or B. bigemina* clean blood smears from an extremity are required. Obtain blood by cutting off the ear. Air-dry the blood smears and wrap them in clean tissue.

How Do Outbreaks Occur?

CATTLE BRED ON THE PROPERTY. When many ticks are constantly present, a relative state of harmony prevails with ticks perpetuating the passage of tick fever organisms through the herd without apparent sickness. Calves, through the immunity at first bestowed on them by their dam and later by another mechanism associated with age, are rarely affected. With many ticks, repeated exposure to tick fever organisms occurs before 9 months of age without any disease being seen. The exposures (or challenges), however, promote a lasting immunity against the disease. The longer the first challenge is delayed, the greater the chance that a clinical case of tick fever will eventuate.

In practice, the first challenge is frequently delayed in Queensland. Even when ticks are not deliberately controlled, their numbers fluctuate under the influence of climate and the stocking rate so that a state of harmony may not occur. When tick numbers fluctuate, not only are young cattle left susceptible, but sometimes the ticks themselves lose their infections. This can lead to a situation in which both ticks and cattle are devoid of organisms.



The various packs of tick fever vaccine that are available. The vaccine is chilled and placed in insulating material to keep it cool. It should be placed in the ordinary part of a home refrigerator immediately it is received.

It can be seen that, with low average incidences of the organisms in ticks, challenge and resultant immunity may not come at the most favourable age for some cattle. This may follow good tick control or occur naturally in areas where tick numbers periodically fall to low levels.

In most situations one tick per 2 000 to 10 000 ticks is infected with *B. argentina,* although wider variations occur depending on the numbers of ticks present, the presence of cattle capable of infecting ticks, the age of the cattle in the paddock (young cattle may infect ticks better than old animals) and the time of the year. In south Queensland, the disease incidence rises to a peak in autumn with the heavier tick burdens and possibly higher infection rates within the ticks. The peak incidence is later in north Queensland.

The absence of an early challenge by *B. argentina* has been clearly shown in a current field trial on five commercial properties in south-eastern Queensland. In spite of what appear to be reasonably high tick numbers over a 3-year period, 44% of cattle of average age 9 months had not been exposed to *B. argentina* infection. Twelve months later, 19% still had not been exposed, and so were still at risk.

A crush-side test being developed by C.S.I.R.O. may be a useful guide to the level of immunity in a herd.

TRAVELLING CATTLE. Cattle introduced to ticky areas for the first time are naturally at risk. Outbreaks even follow movements within ticky areas. Thus shifting cattle from paddock to paddock, property to property and district to district have all precipitated outbreaks.

As explained earlier, immunity may be low because the causal organisms may have been present in small numbers or absent on the property of origin.

Strain differences are suspected as a cause of outbreaks. Cattle coming from an area where the *Babesia* is of low virulence and not capable of causing disease could be troubled by more pathogenic organisms in another area.

TICK OUTBREAKS IN CLEAN COUNTRY. Tick fever is sometimes the first evidence that ticks have entered clean country. Some tick outbreaks in clean country are not accompanied by tick fever. This signifies that the causal organism must not have been present in the intruding ticks.

Prevention

Provided cows are immune, their calves are protected by immune substances received in the colostrum. This gives protection for about 2 months. Calves in this age group are quite susceptible to tick fever if they do not receive protection from colostrum.

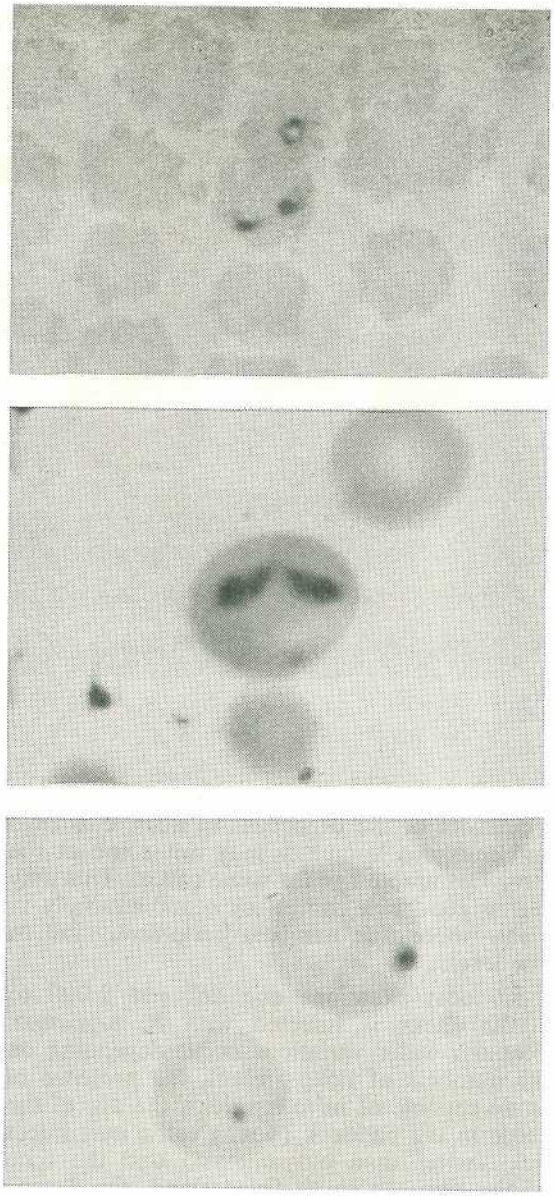
At about 2 months of age, most calves develop a natural, non-specific resistance to the disease and rarely develop symptoms of tick fever. At 7 to 8 months, they tend to lose this ability to deal with the infection and become susceptible, and so are liable to develop signs of tick fever if exposed after this age.

To protect them against *B. argentina,* one vaccination induces a lasting immunity in most cattle. This immunity can be improved by a second vaccination using a different strain of the organism in the blood.

The laboratory now routinely changes the strain of *B. argentina* in the blood every 5 months for users wishing to vaccinate more than once.

Thus, two vaccinations 6 months apart are recommended to impart a substantial long-lasting immunity. A third vaccination can be given but should be required only in exceptional circumstances.

Taking into account that young stock start to lose their natural immunity at 7 to 8 months of age, it is obvious that they should receive their initial vaccination before this time. Second vaccinations, if performed, should follow 6 months or so later so that immunization of cattle is completed well before breeding has begun. This avoids the risk of haemolytic anaemia in the new-born calf.



TOP. Babesia argentina *in a red blood cell. This organism causes 80 to 90% of field outbreaks of tick fever, and unvaccinated yearling cattle are highly susceptible.*

CENTRE. Babesia bigemina *in a red blood cell. This common blood parasite only occasionally causes tick fever in the field. It is not included in blood vaccine.*

BOTTOM. Anaplasma marginale *on the margin of a red blood cell. It causes anaplasmosis, a disease that mainly affects cattle over 2 to 3 years of age.*

Analyses of vaccination figures over a recent 5-year period during which 5·6 million doses of blood for vaccination were supplied by the Tick Fever Research Centre, Wacol, indicate a high level of protection by vaccine. Some failures were confirmed, most occurring within a few months of a single vaccination. Vaccine failures after two or more vaccinations rarely occurred.

At the time of the first vaccination, young stock may also be vaccinated against anaplasmosis, if this is considered a risk, by ordering a vaccine containing anaplasma as well as babesia. This bivalent vaccine is often called 'two-shot' or 'two-germ'.

In an outbreak of anaplasmosis in an adult herd, anaplasmosis vaccine may be used on its own when it is known that the immunity of the stock to babesiosis is sound.

Vaccines incorporating *B. bigemina* are not usually recommended mainly because they are needed infrequently in Queensland. Furthermore, the virulence of this organism in vaccine can be enhanced, and this may cause severe reactions in recipient animals. Such reactions can be difficult to detect in the early stages when treatment would be effective. Vaccination against *B. bigemina* requires very close supervision. Valuable animals forwarded to the Tick Fever Research Centre, Wacol, or the Animal Health Station, Oonoonba for immunization receive an inoculation with *B. bigemina.*

The use of 'bleeder' steers has not been recommended for some years. Results are unpredictable compared with the vaccine available from the Tick Fever Research Centre, Wacol, and Oonoonba. Bleeders kept tick-free cause reactions only 60 to 70% of the time. If they become infested with ticks, the organisms transmitted to them may not be attenuated as are those in prepared vaccine so that reactions may be severe. In addition, they may develop anaplasmosis, and transmit this if their blood is used for vaccination.

Zebu Cattle Resistant

The ability of Zebu cattle to resist tick infestations and reduce tick populations is well known. Zebu-type cattle are also relatively resistant to *B. argentina.* Although crossbred Zebu cattle inherit some resistance to *B. argentina,* this may not be sufficient to provide complete protection against tick fever and vaccination should be considered.

If susceptible cattle are to be introduced to tick-infested areas, they should be vaccinated no later than 6 weeks before movement. This allows the cattle time to recover from their reactions. If this is not possible, they should be vaccinated on arrival at their destination, and kept tick-free during the reaction period. Provided the journey is completed within 4 to 5 days, the cattle could be vaccinated immediately before departure. It is most important, however, to avoid reactions in travelling stock.

If the introduced cattle are to be kept relatively tick-free, a second vaccination 6 months after the first is recommended. When plans can be made well ahead for the introduction of cattle, for example, bulls going to a regularly-held sale, give two vaccinations 6 months apart on the home property. Time the second for at least 3 to 4 weeks before the departure of the cattle. If protection against anaplasmosis is required the cattle should be given 'two-shot' blood at the first vaccination.

Valuable stud animals may be immunized at the Tick Fever Research Centre, Wacol, or the Animal Health Station, Oonoonba. This procedure takes 4 to 6 weeks. There is a daily charge of $1.80 for adult animals and 90c for suckling calves.

Avoid vaccinations when conditions are unfavourable to the cattle, for example, while being travelled during very hot weather, if they are in very poor condition or if other diseases such as ephemeral fever are present.

Inoculation Reactions

Normally, reactions occur between 7 and 14 days after inoculation, and it is wise to inspect the mob daily during this period. Reactions are most obvious from the ninth to the twelfth day. Sometimes reactions occur up to 21 days or more after vaccination. This has been associated with a second vaccination, but is very uncommon.

A high percentage of inoculated animals do not show obvious symptoms, but fever can generally be detected if temperatures are taken during the middle stage of the reaction

period. Severe reactions are controlled by giving one of the available drugs. Treatment is indicated when the animal is obviously sick or when the temperature is 105°F (40.6°C) or greater.

Vaccinated cattle should be kept in well-watered, shady paddocks close to yards so that animals with reactions can be quietly drafted off and treated. Do not aggravate reactions by disturbing the cattle unnecessarily.

Treatment

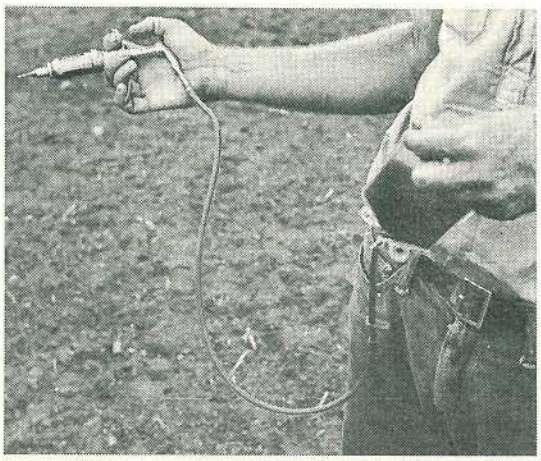
Two of the drugs used for the treatment of babesiosis, the more common form of tick fever, can be purchased by stock owners. They are imidocarb ('Imizol') and amicarbalide ('Diampron'). A third drug, euflavine ('Gonacrine'), is available on veterinary prescription only. All three drugs, when given according to directions, are non-toxic and effective. A group of drugs of which 'Acaprin' is the best known is now difficult to obtain in Australia. Drugs in this group are very effective, but can be toxic if used under adverse conditions.

Imizol is sold in 100-ml bottles and 1 000-ml resealable packs. Diampron is available in 50-ml bottles. Imizol is injected subcutaneously and Diampron intramuscularly.

Tick fever drugs normally have a long storage life, but should be discarded if serious discoloration occurs. Imizol may show crystalline deposits during cold storage but these disappear on warming. Deposits that occasionally develop in Diampron are more difficult to remove, and it may be necessary to discard some bottles.

Babesiosis

The dose rate for Imizol and Diampron is 2.2 ml per 100 kg (1 ml per 100 lb.) liveweight, and can be repeated after 24 hours if necessary. Imizol can be used at higher dose rates (4.4 ml per 100 kg or 2 ml per 100 lb. liveweight) to eliminate *Babesia* from an animal. At this rate, the drug also prevents acute tick fever in susceptible cattle exposed to infective ticks. If babesiosis occurs in fat cattle ready for the meatworks, all animals should receive Imizol at 4.4 ml per 100 kg liveweight (2 ml per 100 lb.). These animals should not be slaughtered for at least 14 days after treatment.



An automatic vaccinating syringe attached to the vaccine in a plastic pack. This permits quick use.

Special packs of vaccine are prepared for small numbers of animals. Use only clean, sterilized equipment.

When cattle are treated with Imizol at the higher dose rates, for example for anaplasmosis, they may need revaccination against babesiosis. This should not be necessary if the cattle are thoroughly immune at the time of treatment. Such cattle would be older animals that have been vaccinated at least once when young or that have been bred in a heavily tick-infested area.

Anaplasmosis

Imizol is also an effective treatment for anaplasmosis, the other form of tick fever occurring in Australia. This dose rate is 6.6 to 11 ml per 100 kg (3 to 5 ml per 100 lb.). Overseas investigations have shown that still higher levels of Imizol may eliminate *Anaplasma* from the animal. This work must be repeated in Australia and the toxic effects of high dosages of Imizol investigated before any recommendations can be made.

Imizol treatment would probably also be useful for anaplasmosis in meatworks cattle, but this approach has not yet been tested experimentally.

Another drug used for the treatment of anaplasmosis is oxytetracycline ('Terramycin'). This drug may be injected subcutaneously, intramuscular or intravenously at 11 ml per 100 kg liveweight (5 ml per 100 lb.) on two successive days. It should be injected slowly if administered intravenously.

Control

There are several ways to control an outbreak of tick fever. While control measures are being initiated, it is most important to identify the organism causing the disease, that is, *B. argentina, B. bigemina* or *A. marginale.* This can be done by making smears from the blood of sick animals or from blood and the organs of dead animals. These are sent for microscopic examination to the Animal Research Institute, Yeerongpilly or the Animal Health Station, Oonoonba.

Your local veterinary surgeon or Department of Primary Industries Veterinary Services officer can organize the investigations. An early, accurate diagnosis is a great help, especially when initial control measures do not work as well as expected.

Babesiosis

Outbreaks caused by *B. argentina* in fully susceptible cattle may be quite severe. Death and acute sickness of several animals over a period of a few days suggest a severe outbreak is developing. The recommendation for controlling severe outbreaks is to treat **all** animals in the affected group immediately with Imizol at 4·4 ml per 100 kg liveweight (2 ml per 100 lb.) This cuts off the outbreak sharply.

Remove excessive tick burdens by dipping, but avoid dipping any animals that are obviously very ill. Handle cattle quietly during treatment and ensure that good natural or supplementary feed is available for several weeks. One treatment with Imizol should be sufficient even for acutely affected cattle, but the group should be inspected daily for a week until all evidence of the outbreak has disappeared.

Approximately 4 weeks after treatment, the cattle should be inoculated with blood vaccine. Reactions to this inoculation are usually mild or inapparent, but cattle should be checked during the 9 to 14 days after inoculation.

Less severe outbreaks can be controlled by treating the sick animals in the mob with any available tick fever drug and vaccinating the remainder. With this approach, the mob should be dipped as soon as possible to remove the infecting ticks. Following vaccination, the cattle should be kept under observation for 3 weeks, particularly during the first 9 to 14 days after vaccination when most reactions from vaccination occur. Outbreaks in cattle shifted from one ticky property to another or in young cattle reared in ticky country are generally not severe, and could be controlled by this method.

Imizol can be used to protect susceptible cattle when first introduced into ticky country, but it is essential to vaccinate these animals with blood vaccine approximately 4 weeks after the Imizol treatment. This approach can be recommended if ticks are numerous and vaccination cannot be carried out immediately.

Imizol may be used on susceptible cows and heifers that are well advanced in pregnancy. These days, vaccination is not regarded as a likely cause of abortion in pregnant cattle, and haemolytic anaemia in calves from cows vaccinated during pregnancy is seldom a problem. Some owners may, however, prefer to avoid vaccination until after an animal has calved. In this case, temporary protection can be conferred by one or more injections of Imizol. Such animals still require vaccination after calving.

Although vaccination of clean cattle with blood vaccine is a straightforward and relatively safe procedure, Imizol used 4 weeks before vaccination may help less experienced

operators, and be useful when small mobs of very expensive cattle have to be done. Imizol treatment could apply also to susceptible, very weak cattle particularly when travelling into tick-infested country on agistment. Further stress from tick fever reactions would be thereby avoided.

Some owners regard the double handling required when Imizol is used before vaccination as an unnecessary inconvenience and expense. Introduced cattle reared in ticky country are often at least partly immune, and vaccination with blood vaccine is all that is necessary.

Anaplasmosis

When anaplasmosis is diagnosed, the procedure is to treat the sick animals, dip, and vaccinate the remainder with anaplasmosis blood vaccine. It is important to reduce the transmission of the disease by keeping ticks off the cattle, and repeated short-interval dipping may be necessary.

The cattle should be given plenty of feed, water and shade during the course of the disease and also during vaccination. It may take 8 to 10 weeks for this disease to be brought under control, and the cattle should be kept under observation during this period. Those showing signs of illness such as prolonged fever, anaemia, obvious loss of condition or appetite should be treated.

Vaccine

The vaccine used to protect cattle against tick fever caused by *B. argentina* contains the live tick fever parasites diluted in a special mixture of salts and bovine plasma. It is prepared and supplied by the Tick Fever Research Centre, Wacol.

Blood containing the parasites is obtained from calves approximately 2 weeks old. Before use, these calves are purchased from areas west of Brisbane, such as Warwick and Oakey, which are free of cattle ticks. The calves must be from cows that have been born and reared in tick-free country. If not, the calves acquire antibodies against *Babesia* from the mothers. These antibodies tend to prevent infection of the calves and hinder the production of vaccine.

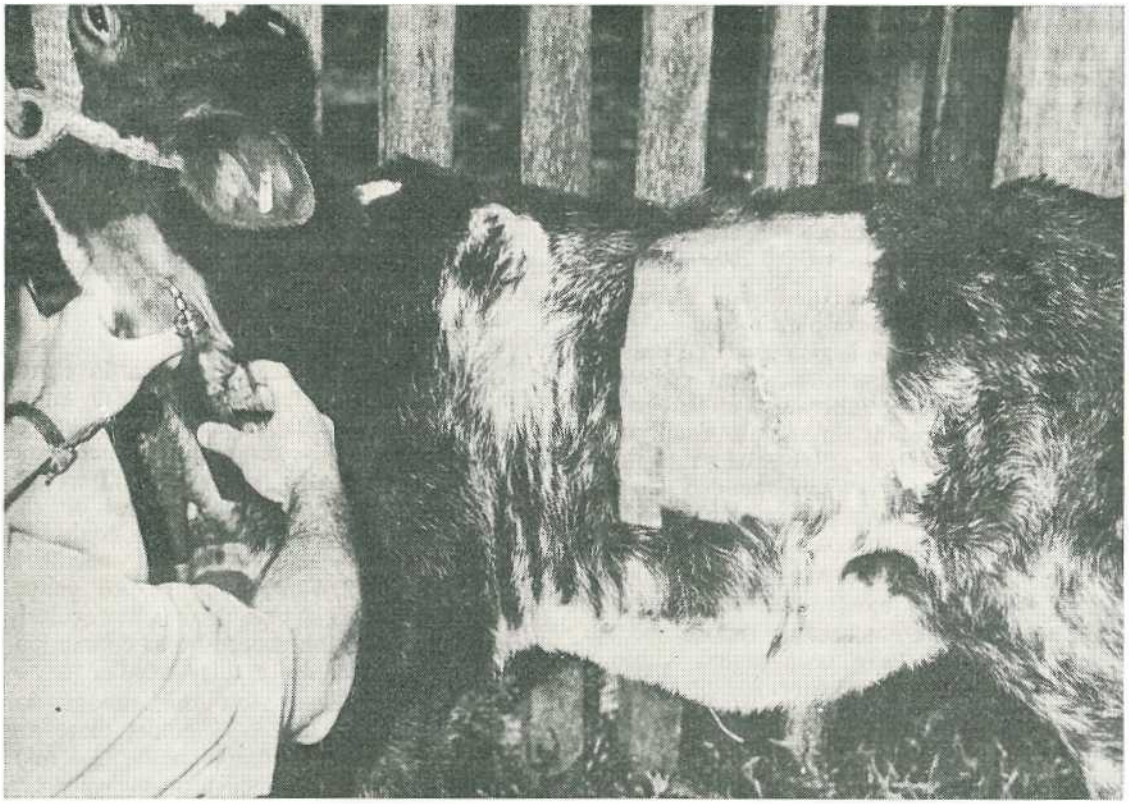
On arrival at the Centre, the calves are given a health check to ensure that they are suitable for vaccine production. Special precautions are taken, such as providing individual units and strict attention to hygiene to reduce the risk of disease in the calves.

The next procedure is to splenectomize each calf, that is, surgically remove its spleen. This is done to make the calf more susceptible to tick fever. After it is infected by inoculation, a rapid build up of *B. argentina* occurs. Frequently, there are more than 200 million parasites in each ml of blood at the height of the infection. To collect these parasites, the calf's blood is exchanged with that of a healthy beast. Approximately 4 litres of highly infective blood is drawn from the calf in stages, and, in return, the calf receives uninfected blood drawn from bullocks held at the Centre for this purpose. This procedure uses the carotid artery and can be repeated two or three times on the one calf. Several calves are used each week to produce infective blood for the vaccine.

Great care is taken to prevent the blood from becoming contaminated with bacteria that may be in the environment. Heat is damaging to tick fever parasites and it is necessary to store the infective blood in the cold-room. Even so, the parasites gradually die. Because of this, the blood is discarded if not used for vaccine production within 7 days of collection.

Before it is used as vaccine, a sample is taken from the 4 litres of infective calf blood, and the tick fever parasites are counted under a microscope. Once the number of parasites in the blood is known, the standard vaccine can be produced. This contains 10 million parasites in each 2 ml dose. To obtain this number, the calf's blood has to be diluted. The concentration of infective calf blood has to be increased each day during its week of usefulness to allow for the death of parasites during storage.

Bovine plasma is the basis of the diluent for the parasites. To provide this, a group of bullocks is held at the laboratories. These bullocks, together with the bullocks used as donors for the blood transfusions, have never been exposed to cattle ticks or tick fever. They are subjected to regular health tests.



A donor calf supplying blood for tick fever vaccine. The flank is shaved as the calf has previously had its spleen removed. This permits rapid multiplication of the tick fever organisms in the red blood cells of the calf and also reduces their virulence when they are injected into susceptible cattle.

The bullocks provide 5 litres of blood at a time, and can be bled several times in a fortnight without harm. A modified dairy separator removes the red blood cells from the plasma which is further purified in a laboratory centrifuge. Plasma is then mixed in equal parts with the special salt solution designed to aid parasite survival. The final product is a clear, golden colour.

Several different strains of tick fever parasites are used in the vaccine. Those not in use are maintained in frozen storage at the laboratory. At 5-month intervals, the strain is changed in the vaccine so that cattle receiving a second vaccination have their immunity boosted. (Second vaccinations are less effective if the original strain is used).

Not all vaccine strains are tick-transmissible. This quality diminishes after a strain is brought in for use in vaccine, and is probably due to the parasites being constantly maintained by blood inoculation in cattle.

To produce anaplasmosis vaccine, splenectomized calves are infected by inoculation of a laboratory strain of *A. centrale*. This resembles, but is not as pathogenic as *A. marginale*, the parasite which causes anaplasmosis in the field. The reaction to *A. centrale* progresses slowly. Parasites are plentiful in the blood for long periods.

Blood for making the vaccine is drawn from the jugular vein of the calf, and an estimation of the number of parasites in the blood is made in the laboratory. This blood can be

diluted in the diluent described above to give a standard number of 10 million parasites in a 2 ml dose of 'straight' anaplasmosis vaccine. More frequently, the *A. centrale* blood is diluted and mixed with the vaccine against *B. argentina.* This is commonly called 'two-germ' or 'two-shot' vaccine.

Caring for the Vaccine

Vaccines are made up daily and dispensed into 100, 50 and 25-dose plastic bags. A glass bottle holding 10 doses is also used. To prevent excessive death of parasites, each container of vaccine leaves the laboratory chilled in ice and packed in insulating material. Each package contains a label describing the strain used, the vaccine dose and recommended storage conditions. A comprehensive pamphlet advising how the vaccine should be used is included.

Most users will find the ice completely melted when they receive the vaccine. The water will not leak out because the ice and the vaccine container have been sealed within a plastic bag at the laboratory.

Users should use their judgement in deciding for how long a batch of vaccine is useful. As a general principle, it is advisable to use the vaccine within a day or two of its arrival. Under the most favourable conditions, however, the vaccine is effective for about a week. Good conditions are mild weather and a relatively quick trip to the property (not more than 12 hours from the time of despatch).

On receipt, the effectiveness of the vaccine is prolonged if it is kept chilled when not being used. Thus, it should go straight into the refrigerator on arrival and, if possible, be taken to the yards in an ice-box. Although the vaccine is designed to withstand some degree of harsh treatment, users should be wary of vaccine that has been held up in transit for 2 or more days in summer temperatures. When chilling vaccine, ensure that it does not freeze.

Sometimes small clots form in the vaccine but, provided they are small enough to go through the syringe, the efficiency of the vaccine is not affected. Clots are seldom large enough to prevent the vaccine from being used but, if this does occur, users are requested to advise the laboratory.

With the use of a clear diluent and a relatively small, variable amount of calf blood, the appearance of the vaccine varies. Generally, it looks like very 'thin' blood, but sometimes its appearance is darker and thicker. Both types are effective. Vaccine that is allowed to stand undisturbed for some time may settle. The red blood cells deposit on the bottom of the pack. These should be redistributed by gentle shaking before using the vaccine.

Using the Vaccine

The vaccine is injected into cattle either subcutaneously or intramuscularly using either a single shot or automatic syringe. The syringe and needles should be thoroughly cleaned and boiled in clean water before and after use. Avoid using disinfectants or alcohol on the syringe and needles as residues could be harmful to the vaccine. A suitable needle is about 20 mm (3/4-in.) long by 16 gauge. It is a good idea to change the needle regularly during the inoculation procedure as contamination can be spread by a dirty needle.

Before use, always test the syringe for accuracy of the dose. As a guide, there are 14, 2-ml doses to the fluid ounce (28.4 ml). Alternatively a metric, medicinal measure can be used. To compensate for some wastages and inaccuracy, the vaccine packs contain a few more doses than shown on the label. However, it is important to adjust the syringe to deliver an accurate 2-ml dose as giving even a fraction of a ml over per dose can cause shortages.

Other inoculations can be combined with tick fever vaccination. Thus, cattle can be treated for internal parasites and vaccinated against other diseases such as leptospirosis or blackleg. Use a separate syringe for each inoculation, and preferably inject each on opposite sides of the animal.

If there is any doubt about the vaccine, its use, or any unusual reactions in the cattle, owners are requested to contact the laboratory or their nearest D.P.I. Veterinary Services Branch officer.

Orders and Costs

Orders for tick fever vaccine should be received at the laboratory at least 24 hours before it is to be despatched. Remember to state the quantity and type of vaccine required,

the date and method of despatch, the address of consignee and the person to be charged. Precise instructions about transport are particularly important in ensuring that the vaccine reaches its destination. By arrangement, the vaccine may be collected at the laboratory.

The single-dose vaccines cost 12c per dose with a minimum charge of $2, including freight. Mixed anaplasmosis and babesiosis ('two-germ') vaccine costs 17c per dose with a minimum charge of $2, including freight. These charges are subject to review as production and distribution costs rise.

The tick fever vaccine service is unique in that each order is processed individually, sometimes within hours of receipt. The exact quantity of fresh vaccine is made up, packed carefully and sent perhaps 1 600 km (1 000 miles), sometimes by up to four different modes of transport. Most consignments reach their destination in less than 24 hours. Occasionally, however, parcels go astray or are held up in transit. The laboratory is aware of the inconvenience this causes on the property, and expects to be notified immediately the expected vaccine fails to arrive. Sometimes missing consignments can be traced or the vaccine resupplied at short notice.

Since 1964, approximately 9 million doses of tick fever vaccine have been supplied to vaccinate cattle in Queensland, Northern Territory and Western Australia. Many improvements have been made to the vaccine during this period, but research is continuing to improve its safety, keeping qualities and efficiency.

Many stock brands not being used

ABOUT one-third of Queensland's 92 000 registered three-piece horse and cattle brands are not being used.

Many are lying idle in sheds and barns, on tankstands or on fence posts.

The Minister for Primary Industries (Hon. V. B. Sullivan M.L.A.) said today that three-piece horse and cattle brands were in short supply.

The shortage followed an amendment to the Brands Act requiring that all sale cattle bear one brand and also reflected the growing interest in cattle production.

'It would help the industry and my Department if owners of unused brands would write to the Registrar of Brands, Department of Primary Industries, William Street, Brisbane, 4000, asking that their registration be cancelled,' Mr. Sullivan said.

'If possible, owners should state when the brand was last used because the Act requires that it not be used for 5 years before registration can be cancelled and a new brand issued.'

Mr. Sullivan added that, if the brands were in more than one name, all registered owners must sign the request for cancellation.

If the owner had died, the signature of the executor, or administrator, of the estate was required.

Queensland bandicoots

by G. GORDON, Fauna Conservation Branch.

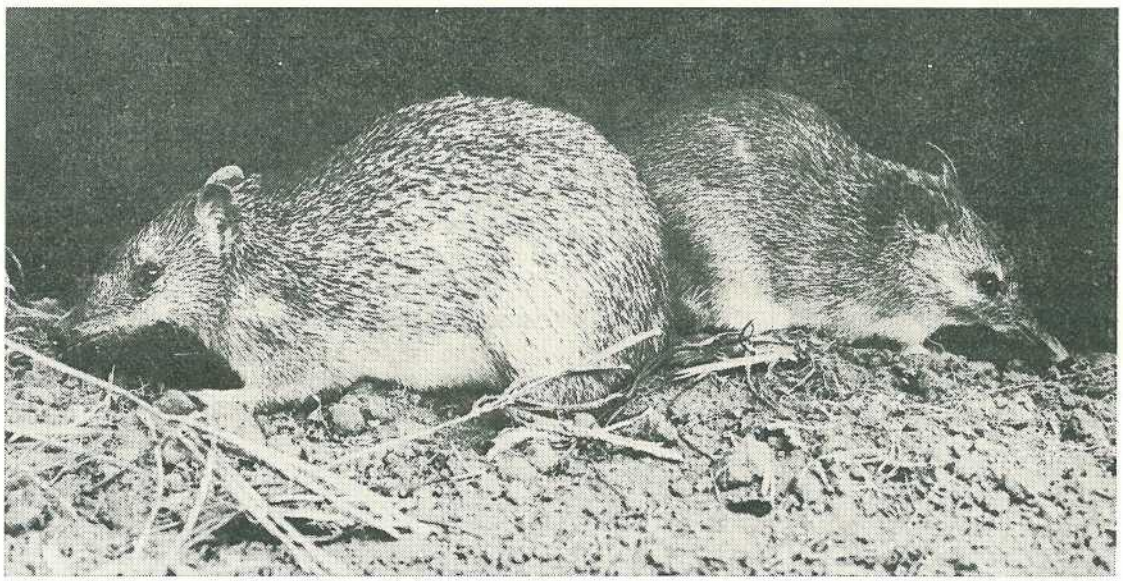
ANIMALS that are closely related to each other generally have a broadly similar approach to the problem of obtaining a living, or continuing in existence in a hostile world.

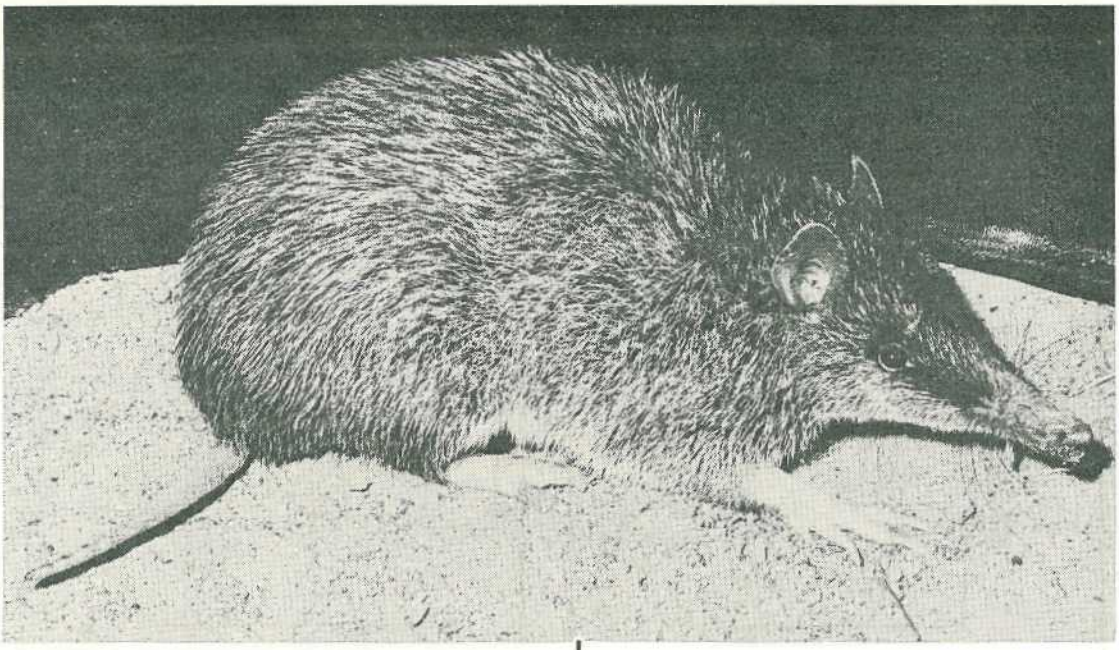
Marsupials, which in number of species comprise slightly more than half of the Australian mammals, are divided into a small number of groups of closely related species, united both by descent and by way of life. The bandicoots are one of these groupings, possessing a very characteristic form and ecology that readily separates them from other Australian mammals.

All bandicoots possess a distinctive, long, pointed snout, apparently useful for poking into holes and crevices in search of elusive insects. They may be easily recognized as they are the only Australian marsupials that possess both a pair of fused toes on the hindfoot and several pairs of lower incisor teeth.

Other marsupial groups have only one of these characteristics. Fused toes, the nails of which are separate for use as a comb in grooming, are absent from the marsupial mice and cats. The incisor teeth, usually five pairs in the upper and three in the lower jaw, distinguish them from the mainly herbivorous marsupials, the possums and kangaroos and wombats which have but a single pair of lower incisor teeth.

The two common bandicoots of coastal Queensland, the shortnosed bandicoot, *Isoodon macrourus* (left), and the long-nosed bandicoot, *Perameles nasuta* (right). ➘





The rarely seen rufescent bandicoot, *Echymipera rufescens*, known in Australia only from the McIlwraith Range, Cape York Peninsula.

Other distinguishing characters of bandicoots include the pouch, which sensibly has the opening at the rear end, ensuring that the young have the shortest possible journey to the nipples at birth; and the forefeet, each with only three fully-clawed toes.

There are probably between 17 and 19 species of bandicoots occurring over Australia and New Guinea. Five of them are present in Queensland.

Common Shortnosed Bandicoot

The shortnosed bandicoot, *Isoodon macrourus* Gould, is the familiar night-time visitor to the lawns and gardens of most parts of coastal Queensland. In some areas, such as on the Atherton Tableland, the somewhat similar longnosed bandicoot, *Perameles nasuta* Geoffrey, is also common.

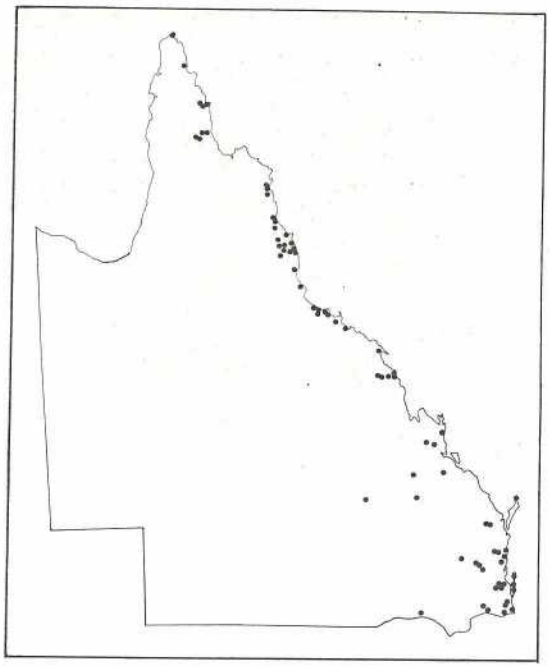
Shortnoses are more stockily built than longnoses, with a shorter, less acutely pointed snout and shorter rounded ears. They are coloured a grizzled brown on the back and sides, and white underneath. They usually live in areas with a low ground cover, such as in grassland, low shrubbery or crops, in open forest, woodland and cleared country.

They thrive in unused land in the outer suburbs of Queensland towns (for example, in lantana and weed-covered gullies and overgrown vacant allotments), and in some districts occur in rain-forest.

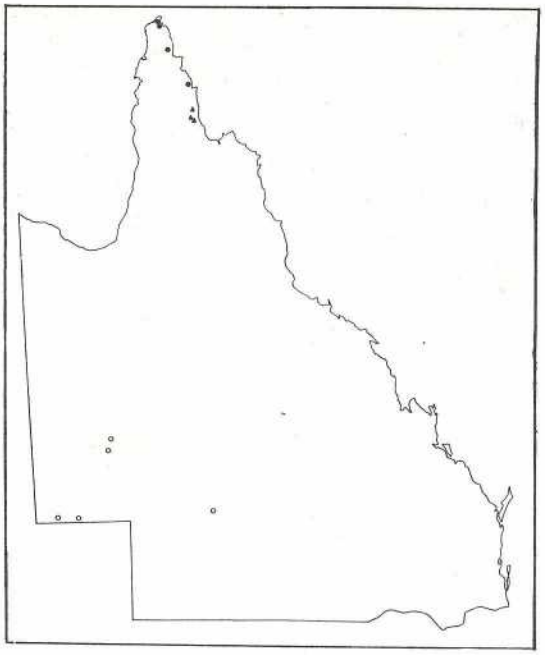
I. macrourus occurs from the tip of Cape York to the Gosford district on the New South Wales coast, mostly on the coastal plain and adjacent ranges, but in places more than 200 miles inland into lower rainfall country. It is the most frequently encountered bandicoot throughout this range.

Its closest relatives occur in separate populations in the northern parts of the Northern Territory and in southern New Guinea, indicating a former land link with that island.

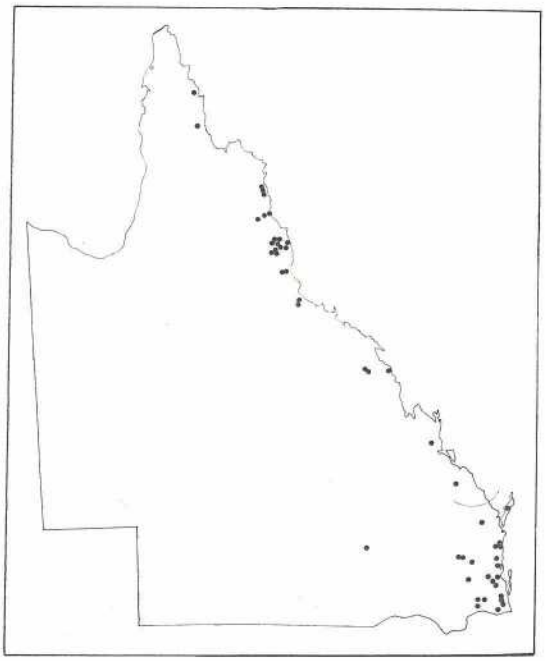
The diet of shortnoses is mixed and includes insects (and occasionally other small invertebrates) and plant material such as berries, grass seeds and pieces of plant fibre (for example, sugar-cane). However, they seem to prefer insects to other foods.



Locality records in Queensland of the shortnosed bandicoot, *Isoodon macrourus.*



Locality records in Queensland of the rabbit-eared bandicoot, *Macrotis lagotis* (open circles), the shortnosed bandicoot *Isoodon obesulus* (solid circles), and the rufescent bandicoot, *Echymipera rufescens,* (triangles).



Locality records in Queensland of the longnosed bandicoot, *Perameles nasuta.*

Food is mostly obtained from on the ground or in low vegetation, or by digging in the soil. Normal nightly activity consists of a fairly continuous and random search for food over their home regions, without stopping for too long in any particular spot. This pattern of movement is adapted to searching for a scattered food supply, such as insects, which may occur unpredictably anywhere throughout the area. They probably also spend some time maintaining their nests and resting.

They normally rest in the day-time in nests situated on the surface of the ground in thick vegetation. Nests are composed of plant debris raked in from the surroundings, with a chamber inside for the animal and an entrance, a loose section in the nest wall, in one or both ends.

They are known to rake soil onto the top of the nest in wet weather, apparently as an aid to waterproofing, and I have examined such nests after heavy rain and found them

quite dry inside. In very wet weather animals cease activity for the night and remain dry in their nests.

Occasionally wild animals rest up in the day-time under grass tussocks or in hollow logs. In captivity, they sometimes form primitive burrows, 30 or 45 cm deep if they are disturbed unduly in surface nests in their cages or deprived of material for surface nesting. I have no knowledge of these animals burrowing in the wild.

So far as is known, shortnoses are very solitary animals, resting alone in the day-time and moving about alone at night. Young become independent of their mothers soon after weaning (about 2 months old), and adults come together only for mating or when fighting.

Shortnosed bandicoots have a high reproductive rate, probably higher than that of any other marsupial apart from other bandicoots. This is achieved by several mechanisms combined—

1. High litter size (up to seven young).
2. Fast development of young to weaning (about 2 months of age).
3. Short gestation (probably 12 days).
4. A type of allantoic placenta which apparently enables the short gestation.
5. Birth of a new litter at about the time of weaning the previous litter, enabling rapid succession of litters in favourable conditions.
6. Early sexual maturity—as young as 3 months in good conditions.

The obvious question arises: what is the reason for this high output of young? Bandicoot young receive much less maternal care than other marsupials and so are more subject to death from various hazards. This high reproductive output must therefore compensate for the greater loss of young.

But this only moves the problem farther back. Why do bandicoots give their young so little maternal care in the first place? Do they adopt a deliberate survival strategy of producing many young with little maternal care, sacrificing the lives of their young for greater output, in the manner of many insect species? And if so, what pressures occur in their mode of life to make such a strategy necessary or advantageous?

Thus, it may be necessary for survival that they take rapid advantage of favourable environmental changes, occurring for example after seasonal changes in vegetation, or regeneration of their temporary habitat after firing.

The surplus young may be used for colonizing such habitats. On the other hand, the large numbers of young may simply be produced as a result of competition for genetic survival, each animal striving to produce the maximum number of breeding offspring to ensure continuance of its own genetic line.

Other Queensland Bandicoots

Other bandicoots are fairly similar in biology to the common shortnose with the greatest differences occurring in the rabbit-eared bandicoot of the south-west.

Isoodon obesulus Shaw, the second shortnose, is restricted to a small area of eastern Cape York Peninsula, from the township of Iron Range north to the tip. It is possibly uncommon or rare even in this area. It differs in appearance from *I. macrourus* only in body size and certain skull characteristics. Its occurrence here is rather mysterious. Its closest relatives occur in a broad arc stretching, with large interruptions, around the coast from south-eastern New South Wales along the southern coast and up into northern Western Australia and the western parts of the Northern Territory. Possibly it was more widely spread in the past, being subsequently pushed out of north-eastern Australia in the face of competition from *I. macrourus,* lingering on only in Cape York.

The longnosed bandicoot, *Perameles nasuta,* is a light grey or fawn colour dorsally and laterally, and white underneath. Ears are longer than those of shortnoses and, if bent forward, will almost reach or will overlap the eye. They are generally more lightly built than shortnose species.

In Queensland, they occur along the better watered coastal strip in a number of separate populations from the southern border to Iron Range in Cape York Peninsula, chiefly exploiting habitats that are open at ground level,

with relatively little low plant cover or with short grasses.

The prime Queensland occurrence is in rain-forest areas: *P. nasuta* is the common rain-forest bandicoot. They also occur less commonly in country that includes open short-grassed paddocks and shrubby eucalypt forests. In north Queensland, distribution correlates entirely with the presence of rain-forest (or former rain-forest areas) and adjacent country. Moving farther south into New South Wales and Victoria, longnosed bandicoots become increasingly common and occur in typical *Isoodon* habitat.

Echymipera rufescens Peters and Doria, the rufescent bandicoot, is easily distinguished by the black fur on the top of the head and muzzle and the short, almost naked, black tail. It differs from other Australian bandicoots in possessing only four pairs of upper incisor teeth. All others have five. Its only known distribution in Australia is in a small patch of rain-forest on mid Cape York Peninsula, to the east and north-east of Coen. The rain-forest straddles the McIlwraith Range and reaches down along the watercourses draining away from it to the east and west.

E. rufescens occurs more commonly in New Guinea. It apparently migrated from there to Cape York but, for some reason, has not survived in rain-forest patches north of Iron Range, or managed to establish in habitat farther south on the Cape, although other New Guinea immigrants have done so.

The fifth Queensland bandicoot, the bilby or rabbit-eared bandicoot, *Macrotis lagotis* Reid, apparently occurs sparsely in south-western Queensland in arid country in the region of Boulia and farther south.

Its distinguishing characters are the long, rabbit-like ears and the long tail, with a brush of hairs on the end. It differs in other respects also. It lives in deep burrows and, according to recent reports, may have a smaller reproductive rate than other species through lower litter size and lack of litter succession.

They seem to be more sociable than other bandicoots, apparently forming pair bonds and living with their younger offspring. These differences may be adaptations to desert life, for example, burrowing provides escape from desert heat and better water conservation.

Status and Conservation

Before white settlement, bandicoots in Australia successfully exploited a wide range of environments, from the arid central deserts and through some of the inland plains and woodlands to the coastal eucalypt and rain forests.

Many coastal bandicoots have coped well with the altered environment that followed white settlement. Their greatest decline has occurred in the inland areas that have received the most intensive grazing pressure.

The pastoral industry, aided by rabbits and introduced predators such as foxes and cats, has pushed bandicoots out of the semi arid parts altogether. Thus, in Queensland, rabbit-eared bandicoots have suffered the most serious reverses. They apparently occur no longer in the semi arid parts, but are widespread, and of uncertain abundance, farther west. As this far western region is unlikely to be subject to any change in land use in the future, they should be safe there.

The common longnosed and shortnosed bandicoots are well adapted to exist in present and future conditions and are, indeed, of minor nuisance value to some people because they carry various species of ticks and disfigure the better-kept lawns with their noctural diggings.

Status of the shortnose, *I. obesulus* of Cape York is uncertain. Its small geographic range, lying entirely outside of national parks and fauna reserves and its uncertain adaptability to white settlement makes its situation precarious, although this region may not be developed in the near future.

The rufescent bandicoot ranges from sparse to common in different regions of its restricted habitat and the only threat to it lies in any future utilization of the McIlwraith rain-forests (at present a timber reserve, under the Forestry Department). This area would form an ideal site for a future fauna reserve, or scientific reserve of the national parks system, as it harbours much if not all of the upper Cape York rain-forest fauna.

Avoid costly bruising in broilers

A common sight in broiler processing plants. Bruises like this one cost the broiler industry thousands of dollars every year.

WITH the large-scale acceptance of the modern broiler as an economical source of food protein, poultry processors are deeply conscious of the need for a well-processed and well-presented product.

It is therefore imperative for processors to withhold from the market any carcasses that, because of their unsavoury appearance, would be rejected by buyers.

Carcass condemnations are of vital concern to processors, and ways and means of reducing rejects should be sought continually.

A bruise can be described as tissue injury without laceration. Bruises can be inflicted up to 10 seconds after bleeding is started or until blood pressure drops to zero.

A Brisbane processor reported bruising accounting for rejections as high as 20% in some flocks. In the United States, a figure of $50 million a year has been estimated as the financial loss experienced by processors. The average plant in Delmarva (U.S.A.) is reported to lose $500 a week due to bruising.

According to one processor, a cost of 3·5c a bird is incurred when removal of tissue is required.

In studies made in Georgia, 90% of bruising occurred during crating and transport from farm to the killing plant.

This study listed the following important causes of bruising—

- Overcrowding in crates
- Rough handling
- Breast irritation (at least 50% of birds 'ride on their breasts' during transport)
- Careless unloading

Studies have shown that, over a two-year period one catching crew continually produced birds with less bruising than two other crews.

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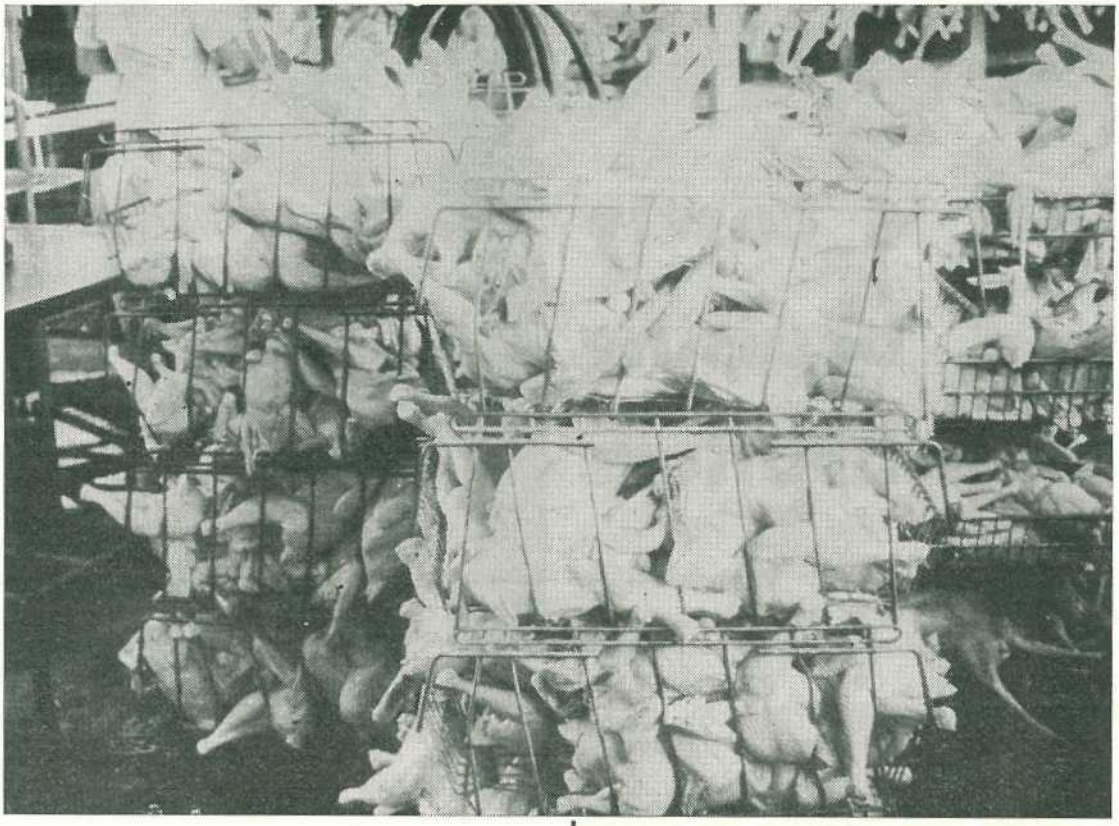
by G. D. STEWART, Poultry Husbandry Officer.



The extent of the bruising problem can be gauged from these crates of bruised carcasses at a processing plant. The bruised parts are removed and the carcasses cut up and sold as chicken pieces.

Occurrence of bruises

One American study showed that 39% of bruises occur on the breast, 30% on the legs, and 31% on the wings.

In contrast to the above figures, another American study found that breast bruising accounted for 60·2% of the total bruising and leg and wing bruises accounted for 32·3% and 7·5% of the total bruising respectively.

It seems that the occurrence of bruises depends to a large extent on the type of feeding and watering equipment in the shed, the methods used to catch the birds before loading, the method of restraining the birds on the truck, and the state of the roads over which the birds have to travel.

A survey at one Brisbane processing plant using weldmesh frames for catching and fixed cages on the truck showed that 78% of bruising occurred on the breast, 12% on legs and thighs, and 10% on the wings (Table 1).

TABLE 1

Bruise location	%
Breasts	78
Legs and thighs ..	12
Wings	10

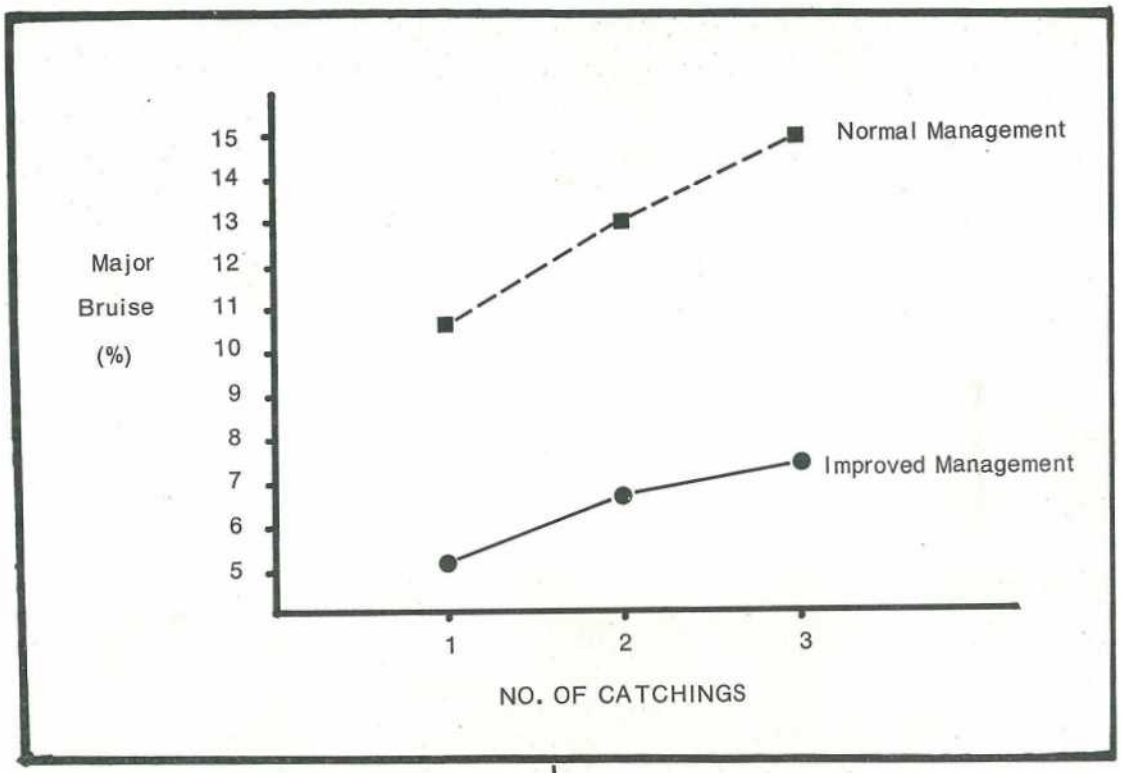


Figure 1.

The factors responsible for bruising can be broadly divided into three categories. These are—

1. FACTORS OVER WHICH THE FARMER OR THE PROCESSOR USUALLY HAS NO CONTROL. These include the genetic make up of the bird concerned; the nutrition of the bird during rearing; and the sex of the birds (females are reported to bruise more easily than males).

2. FACTORS OVER WHICH THE FARMER HAS SOME CONTROL. These include—

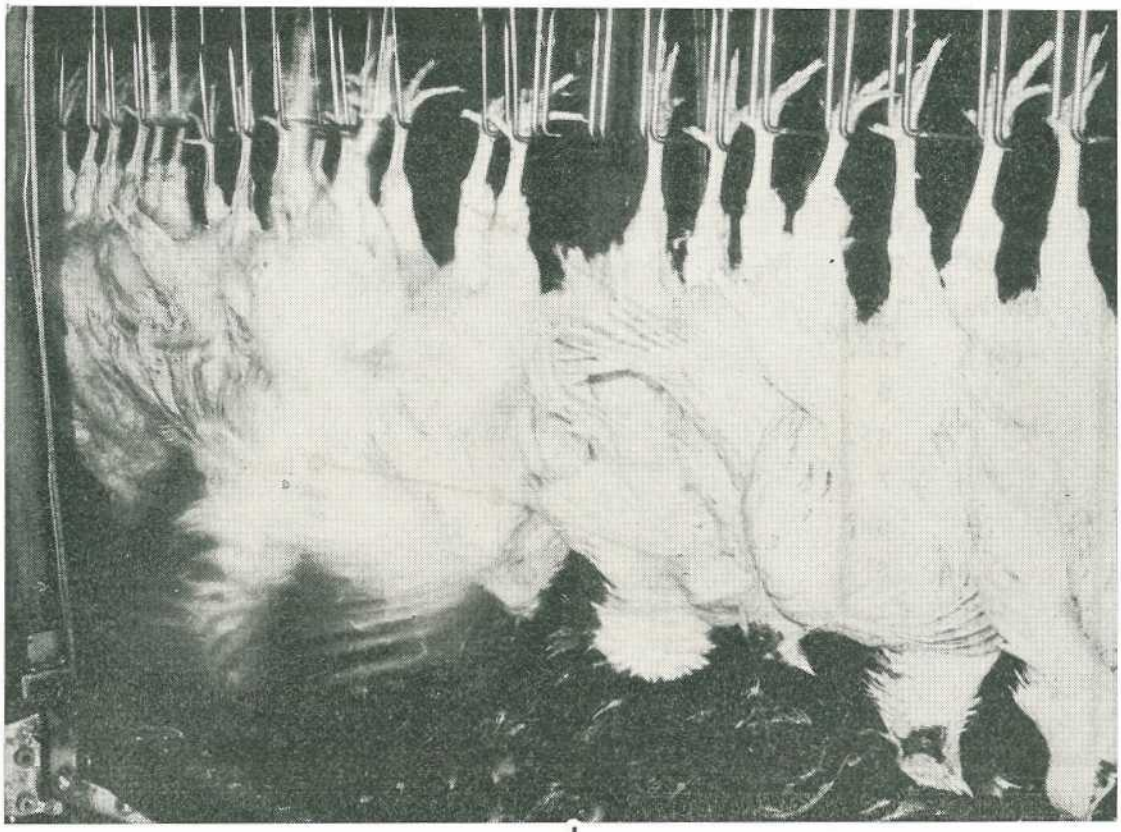
Equipment type. In a recent Brisbane study, tube feeders caused significantly less bruising than continuous trough feeders.

Equipment management. All feeders, irrespective of the type, will cause increased bruising, especially of the breasts, if they are set too low. This is particularly important in the last week or 10 days before slaughter as most bruises on poultry take at least 5 days to disappear.

An experiment was conducted in Brisbane to look at the effect that incorrect setting of feeding equipment had on the bruising incidence.

Two similar size commercial sheds of 14 000 birds with the same trough feeding and watering systems were used in the experiment. In one shed, the equipment height was adjusted periodically so that it remained level with the back height of the birds and, at catching, the feeders were lifted so that the birds were not driven over them during the catching operations.

In the second shed, the trough feeders were left under the farmer's normal management system (which was to have the lip of the troughs about 15 cm off the litter) and the feeders were not lifted at catching time.



Birds struggling violently on the processing line after bleeding has been initiated. This struggling can lead to a marked increase in bruising, especially wing tip bruising.

Carcass bruises were recorded on the processing line after plucking and scalding, and before evisceration. Any carcass which would have been down-graded by the processing plant staff because of bruising was recorded and bruises such as these were considered to be major.

A major bruise is of economic importance to the whole industry because the processing plant must employ staff to remove the bruised area. This added cost of processing is reflected in the return paid to the grower and the cost per kilogram to the consumer.

The results obtained from the trough feeder experiment showed that, by using the improved management system, the incidence of bruising was reduced by up to 8% compared with the amount of bruising that occurred under the farmer's normal system (Figure 1.)

Similar results were obtained when this experiment was repeated using tube feeders.

The farmer's activities. Routine activities within the shed should be kept to a minimum. Every time the birds are disturbed the chances of bruising are increased. A good stockman can walk through the shed causing a minimum of stress: a bad stockman will cause the birds to panic and pile up every time he enters the shed.

Lighting. Birds tend to move much less when the light intensity is low, hence reducing the chance for bruising to occur. The important consideration seems to be light intensity rather than the colour of the light.

Equipment removal before catching. The incidence of bruising will be greatly increased if the birds have to climb over feeders and waterers left in their path while being herded into the catching area.

3. FACTORS OVER WHICH THE PROCESSOR HAS SOME CONTROL. Farm practice is one major factor contributing to bruising percentage but certainly the role of catching teams in delivering birds from the farm to the processing plant cannot be overlooked. As outlined in the introduction, much of the total flock bruising has been attributed to the catching and loading operations.

Perhaps one point that is not stressed nearly enough in the literature is that birds can bruise up to about 10 seconds after bleeding is initiated. Some managements tend to underplay this and concentrate mainly on pre-slaughtering plant handling when, in fact, much bruising is inflicted through clumsy handling and ignorance at the processing plant itself.

For example, it is common to see birds being dragged out of fixed cages on their breasts because their legs are taken out from under them. Small crates are dropped off the trucks onto conveying systems rather than placed gently onto the conveyor or sliding ramp.

The workmen responsible for placing the birds on the shackles at the plant often end up holding the birds by the thighs as they place them on the slaughtering line, or else they run their hands down the birds' thighs as they release them onto the shackles.

Catching and loading. Catching team education and training are important so that catchers realise why they should handle the birds in a particular manner. The motto adopted by some managements that 'experience is the best teacher' could well be costing them far more than the value of a few hours' instruction on basic bird handling and catching procedures.

One major cause of bruising is the number of times the catching crew is in the shed before all the birds are caught.

An all-too-common sight at a processing plant. The shackling man drags the bird from the truck cage by pulling its legs from under it. The result can be severe breast bruising.

A study was conducted near Brisbane to look at bruising incidence as related to the number of previous catchings in a commercial shed of broilers having pan type feeders and hanging plastic waterers. The results from this experiment showed that the incidence of bruising increased by up to 50% every time a new catching was done.

Some of the problems facing the catching team are—

HOW TO DRIVE THE BIRDS TO THE CATCHING AREA. Observations have shown that the worst way is to wield bags, pick up the birds and throw them forward into the flock, or to try to move the birds too quickly.

The use of opaque material such as plastic or hessian seems to give best results when this is used as a barrier in front of which the birds are herded.

Birds will move more easily down a side wall than across the shed. It is sound practice to divide the shed into a number of sections at catching time by partitioning it with a series of opaque barriers. It is pointless to pen more birds than can be caught within a reasonable time. This procedure would keep stress factors to a minimum.

HOW TO RESTRAIN THE BIRDS FOR CATCHING. Catching frames are in common use and these vary from solid weldmesh construction to ceiling-suspended hessian or plastic partitions. Undoubtedly, the solidly-constructed frame offers much greater chance of causing bruising as the birds strain against it. If the birds can get their heads through the barrier, then they will keep pushing against their breasts, thereby greatly increasing the breast bruising incidence.

Thigh bruising can easily be caused at the processing plant through poor shackling procedures.

It appears that the best type of holding frame is a ceiling-suspended hesian barrier. The birds do not pile up easily and, because they cannot see through it, they have little tendency to try to escape through or over it. An advantage of hessian over plastic is that the birds can breathe through the hessian.

The use of a blackout during the catching operation is by far the most satisfactory. In the dark, the birds do not move about much and are not excited. The fact that birds do not have to be driven into a particular catching area greatly reduces the stress under which the birds are placed. When the lights are turned off, the birds tend to squat and the catchers can move easily through the catching area with little or no disturbance to the birds.

Under this system, the birds do tend to creep to the outside of the catching area and care must be taken to ensure that some piling up does not occur, especially in the corners. The dust level is also significantly reduced because the birds do not move about much.

HOW TO GET THE BIRDS LOADED. The biggest problem is avoiding double and triple handling of the birds. Every time a bird is picked up, the chances of its being bruised are increased. In Brisbane, three major methods are being adopted by commercial companies.

1. *Placing the birds in fixed cages using a hand-up system.* This involves double handling and the birds are generally thrown and pushed into the cages which have side openings. Normally, two or three catchers supply one man who does the actual loading.

The normal cage size for this type of operation is about 90 cm x 90 cm x 30 cm high. Depending on bird size, up to 34 birds are placed in each cage.

A big disadvantage of this system is that the birds are loaded at varying heights. The literature reports that, as loading height varies, so does bruising incidence. The best height appears to be waist height which makes it easy to place the birds in the cages. An advantage of this system is that cage size remains constant.

2. *Placing birds in mobile crates using a hand-up system.* Once again this is a double handling system. The advantage over the first

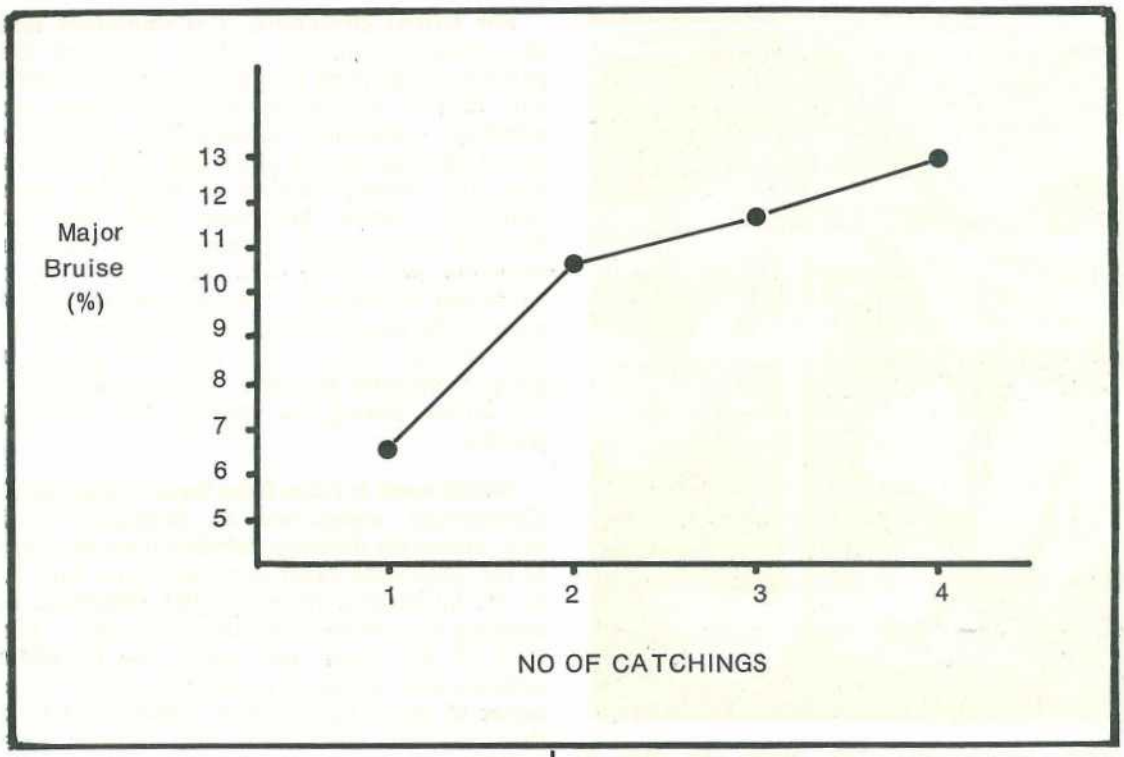


Figure 2.

method is that the birds can all be loaded at a height that is suitable to the loaders and then the crates are shifted into position. The birds are loaded through the top of the crate. As these crates are much smaller, each crate is filled in the one loading operation, usually with eight to nine birds. The average size is about 55 cm x 55 cm x 30 cm high.

The biggest single disadvantage with this type of system is that crate damage can easily cause an increased incidence of bird damage. Because of the system of stacking the crates on the trucks, it becomes necessary that the loaders stand on the crates and crate distortion results. It is imperative for processors to keep their crates in good order if bruising is to be kept to a minimum. Care must be taken to ensure that crates, once loaded, are not dropped into position on the truck.

3. *Using the catchers as the loaders.* Ramps are fitted to the trucks and catchers take their birds up the ramp and load them directly into the crates and then return to the shed via another ramp. The truck driver is then responsible for placing the crates into the correct position on the truck.

This system avoids double handling, but it is much harder on the catching crew. A problem with this style of loading is that farm layout does not always allow for easy placement of the ramps onto the trucks. The easiest loading occurs when the ramp is able to be placed horizontally from the door of the shed directly to the tray of the truck. On some farms at present, the ramps have to be inclined up to 40 deg. or more from the shed door to the tray of the transport vehicle. One can imagine the problems faced by the catchers when steep ramps are in use during wet weather.

Rough loading into fixed cages can lead to increased bruising. The birds are being thrown into this top cage.

Who accepts responsibility? The need for a higher paid leading hand in each catching team has generally been well recognized. A man who will accept this extra responsibility can save the processor a lot in reduced smothers, bruises and damage to catching and loading equipment.

Who prepares the shed for catching? If the catchers are to do efficient work, it is important that, when they arrive at a shed, the feeders and waterers have been removed to facilitate easier catching.

With the sale of more and more fresh poultry, there will be much greater emphasis placed on selecting birds of the particular weight being demanded at the time by the consumer. The result of this selection may be a reduction in complete 'one-go' clean-outs that now commonly occur.

For partial clean-outs, it is important that the expected number of birds required are partitioned off from the remainder of the shed and feeders and waterers in this area are removed. Automatic feeding lines should be raised throughout the shed and then lowered after the desired number of birds has been removed. Some processors will have to demand the removal of feeders and waterers from the area of the shed where birds are to be caught or moved. The alternative is that growers be penalized for excessive bruising in their flocks. This would probably result in better husbandry practices being employed by the farmer during the growing and catching periods.

Which route is taken from farm to processor? Commercial companies in Brisbane noted that, unless the distance travelled from the farm to the processing plant is greater than, say, 30 to 50 kilometres, there is little difference in bruising as a result of distance travelled. The state of the roads over which the transport vehicles have to travel is more important. It is better to travel farther on a higher class road than to take short cuts over a poor road surface.

From the study on bruising, these points emerged.

- Bruises can be defined as tissue injury without laceration.
- Bruising incidence can be significantly reduced when proper care is taken by both the farmer and the processor.
- Once a bruise has occurred, it will take at least five days to disappear.
- Bruising can occur up to 10 seconds after bleeding in the processing plant has begun.
- Correct management of feeders and the waterers during the rearing period is essential.
- All equipment should be moved out of the bird's way before catching.
- Bruising is expensive to both the industry and the consumer and any means of reducing it should be constantly sought.

Timber control in Central Queensland—3

by E. R. ANDERSON, Agrostologist; and G. R. BEESTON, Ecologist.

Eucalypt Communities

The eucalypt communities are the major vegetation types in inland Central Queensland and for most of the area grazing is based predominantly on native pastures. Since the area was first settled, fire has been used as a management tool to remove the accumulated bulk of dry grass, thus making the new season's growth more accessible to stock and removing patchiness caused by uneven grazing.

Some investigations by the C.S.I.R.O. indicate that fire on its own is of limited effectiveness in controlling woody regrowth. The vegetation has evolved in the presence of fire and many of the species present are resistant to burning or require fire for their regeneration.

The often quoted usefulness of fire for regrowth control is largely or wholly the result of some other factor such as grazing. Where drought is a recurring threat to animal production, the wholesale burning of native herbage each year is not good management since even low quality herbage can be used to maintain cattle if supplemented with urea and molasses.

Mechanical clearing of eucalypt communities has many drawbacks, particularly if low or uncertain rainfall or poor soil prevents the the introduction of an improved pasture. The disturbed soil, rather than stimulating growth of native grasses and herbs, encourages an influx of 'weeds', often of low grazing value,

Biloela buffel grass established on poplar box country after clearing and ploughing. This 20-ha paddock is near the homestead and is used as a weaner and hospital paddock. The photograph was taken just before the start of the wet season (plate 12).

which is not followed by a build up of useful native grasses. Furthermore, if the lignotuber is not removed, vigorous regrowth occurs. Therefore, unless a vigorous pasture species can be introduced, it is preferable to kill trees without disturbing the soil and destroying the native grass community.

HIGHER RAINFALL ZONE (750–1 100 mm). *Ironbark-bloodwood.* The narrow-leaved ironbark–long fruited bloodwood areas can be developed by mechanical or chemical means.

In the mechanical method, the land is cleared and ploughed, and a legume-based pasture established. Either Townsville stylo or, on the better soils, green panic and Siratro can be sown. Annual applications of 125 to 250 kg superphosphate per hectare are usually essential for success.

With effective ploughing, regrowth problems are slight. Regrowth which does occur can be basal sprayed with Tordon 255. Cost can limit the extent of this type of development.

A cheaper method of establishing the pasture is to kill the trees by injecting them with Tordon 105 and sowing Townsville stylo into the undisturbed soil after burning the native pastures. There are usually few regrowth problems from suppressed seedlings in this type of country.

Poplar box and poplar gum. The principles for development are similar to those for the ironbark-bloodwood areas but the soils are generally poorer. As a result, the perennial legume-grass pasture is not as reliable, although Townsville stylo is still well suited to this country.

LOWER RAINFALL ZONE (LESS THAN 750 MM). At present there are no proven pasture legumes for widespread use in these areas. Early maturing Townville stylos can be used on the wetter side of this zone and the perennial Siratro may have a place in well-managed areas. Annual applications of 125 to 250 kg of superphosphate per hectare are required.

The sowing of introduced grasses (for example, buffel grass and green panic) into this type of country without soil disturbance invariably fails. The low productivity in relation to the costs involved in cultivating a seedbed restricts the use of sown grass pastures to small areas that can be managed properly and used for special purposes such as weaner, hospital, bull or horse paddocks. (See plate 12).

Where suitable native grasses are present to respond after the death of the trees, chemical thinning is the main method of development available. Suitable species include forest blue (*Bothriochloa bladhii*), pitted blue (*Bothriochloa decipiens*), desert blue (*Bothriochloa ewartiana*), satin-top (*Bothriochloa erianthoides*), golden beard grass, Queensland blue (*Dichanthium sericeum*), brown top (*Eulalia fulva*), black spear grass and kangaroo grass.

The major species of the original timber can be killed by injecting Tordon 105 and the regrowth controlled by basal bark spraying with Tordon 255.

Within specific communities the following comments can be made:

IRONBARK COMMUNITIES. The narrow-leaved ironbarks cause little trouble and the response of native pasture is good. Where suitable, Townville stylo can be introduced. Within the silver-leaved ironbark (*Eucalyptus melanophloia*) areas there are numerous situations and it is difficult to generalize. Where the soils are fair, the treatment is the same as for narrow-leaved ironbark. If the soils are poor, as indicated by a shallow or very sandy topsoil, the quality of the native pasture response may not warrant treatment, and seedling regeneration can be a problem.

ALLUVIAL SOIL COMMUNITIES. The alluvial soils are usually of high fertility but grass pastures can be difficult to establish if the soils are heavy clays. Mechanical clearing of coolibah (*Eucalyptus microtheca*) can fail unless carried out when the soil is moist so that the lignotuber is removed from the soil.

Chemical thinning of these areas results in an excellent native grass response and is usually the best method of handling coolibah country (see plates 13A and 13B). Similar remarks apply to blue gum (*Eucalyptus tereticornis*)–Moreton Bay ash–long fruited bloodwood areas. In the southern parts of the region lucerne (*Medicago sativa*) grows well with

grasses such as green panic on cleared and cultivated alluvial soil and can give a highly productive, but usually short-term, pasture.

POPLAR BOX COMMUNITIES. Poplar box occurs mainly on texture contrast soils with red and yellow earths of secondary importance. The native pasture ranges from fair to poor. The likely response to chemical treatment must be gauged from the particular native grasses present. When fair native pasture is present (suitable grass species would include those mentioned earlier for the eucalypt communities) a good response can be expected from chemical treatment.

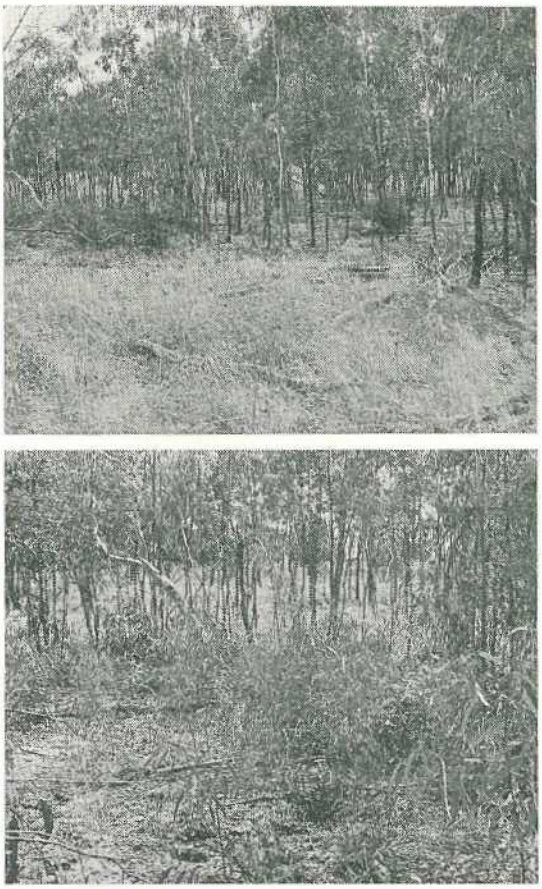
On poorer soils where the grasses are of inferior grazing value, a useful response from chemical thinning would be doubtful. Species of inferior grazing value include wire grass (*Aristida* spp.), love and stink grasses (*Eragrostis* spp.), windmill grasses (*Chloris* spp.), bottle washer grasses (*Enneapogon* spp.), barbed wire grass (*Cymbopogon refractus*) and umbrella grass (*Digitaria divaricatissima*).

Conclusions

Increase in grass growth and animal production can usually be obtained by removing the original vegetation. This is possible by drastic action, that is, mechanical removal of timber, cultivation and introduction of improved species, or by the more subtle approach of chemically killing the timber which does not disturb the soil.

Long-term benefits from timber control will occur only if a stable pasture develops, be it native or introduced. Regrowth will nearly always occur and this can be controlled. See Table 9 for a summary of chemical control of woody weeds in Central Queensland.

The economic feasibility of development will depend on the amount of timber initially present, the likely regrowth problem and the productive capacity of the land. As a general rule, however, sufficient is known to ensure that major increases in productivity can be achieved and maintained if intelligent well-planned timber treatment is carried out and a regrowth control programme is undertaken.

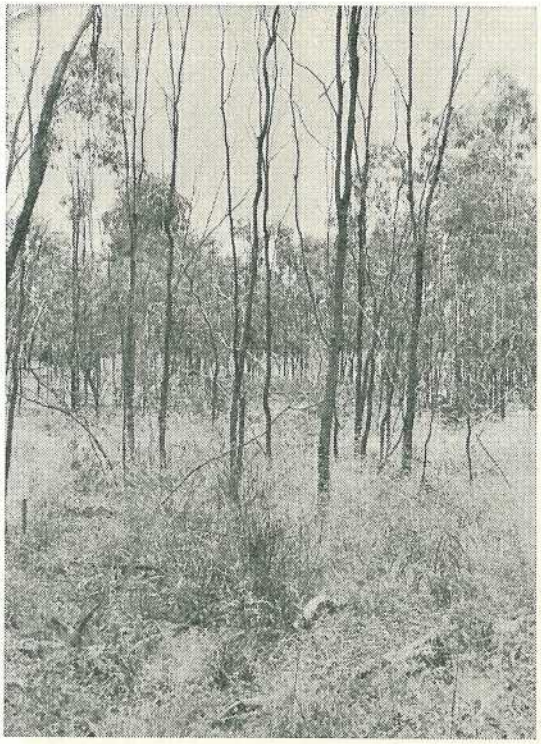


Where coolibah seedlings are cut off at ground level and swabbed with herbicide (foreground) no regrowth occurs and the grass responds (top, plate 13a).

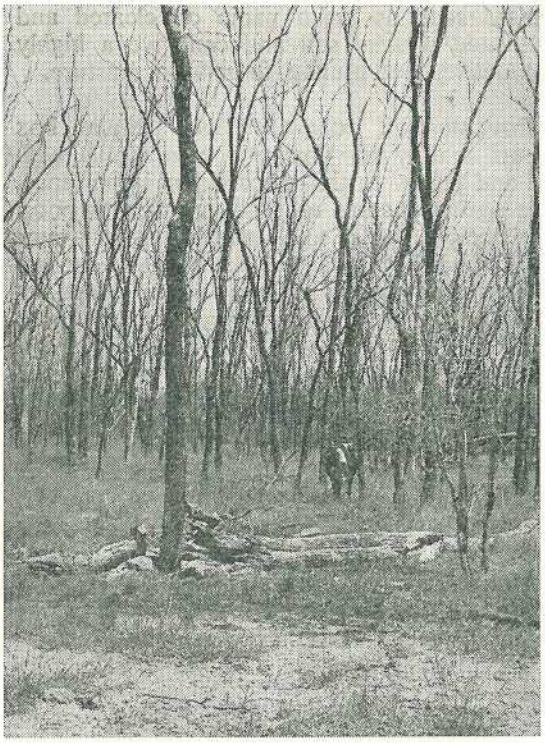
Regrowth (and lack of grass response) after cutting without herbicide application (bottom, plate 13b).

Acknowledgements

The authors thank several officers of the Department of Primary Industries stationed in Central Queensland and Brisbane for information and comments. Table 9 is derived largely from information published by the Lands Department. Financial support from the Australian Meat Research Fund and the Commonwealth Extension Services Grant is gratefully acknowledged.



Good kill of coolibah seedlings, and grass response, following stem injection with Tordon 105 (plate 14).



Poplar box woodland which has recently been killed by injection with Tordon 105. Note the response of the native grass (plate 15).

TABLE 9

METHODS OF CHEMICAL CONTROL OF SOME CENTRAL QUEENSLAND NOXIOUS AND WOODY WEEDS

Common Name	Botanical Name	Chemical or Product	Mixing Rate	Application	Remarks
Bitter bark ..	*Alstonia constricta*	Tordon 255 ..	1 part in 20 parts of diesel oil	Basal bark spray	Thoroughly spray base of regrowth up to 40–50 cm
		2,4,5–T ester (40%)	1 part in 8 parts of diesel oil		
Brigalow ..	*Acacia harpophylla*	2,4,5–T ester (108%)	1 part in 4 parts diesel oil	Aerial spraying at 28 litres/ha	Spray when soil is moist
Brush box ..	*Tristania conferta*	Ammate X ..	2 teaspoons per tree	* Cut stump ..	Use on saplings: apply crystals to 'V' cut in stump. Method reliable on trees on deep soil, but on shallow soil not as reliable
				* Holes in butt of tree	Application to larger trees —holes 1·5 cm in diameter and 4 cm deep, drilled 5 cm apart near ground level

* Method laborious for large-scale use.

TABLE 9—*continued*

METHODS OF CHEMICAL CONTROL OF SOME CENTRAL QUEENSLAND NOXIOUS AND WOODY WEEDS—*continued*

Common Name	Botanical Name	Chemical or Product	Mixing Rate	Application	Remarks
Brush box—*continued*		Tordon 255 ..	1 part in 50 parts diesel oil	Basal bark spray	Variable reactions. No kill in trees growing in a deep soil (over 60 cm). However when soil is shallow (40 cm or less) 100% kill obtained in October spraying, decreasing to below 50% in December and June spraying
Currant bush	*Carissa ovata*	Tordon 50–D ..	1 part in 50 parts water	Overall spray (high volume)	Complete coverage of foliage essential
Devil's fig ..	*Solanum torvum*	2,4,5–T ester (40%)	1 part in 20 parts water	Overall spray (high volume)	Not to be used in legume pastures
		Tordon 105 ..	1 part in 20 parts water	Cut stump and swab	Can be used in legume pastures
		2,4–DB ..	1 part in 250 parts water	Overall spray (high volume)	Can be used in legume pastures
Eucalyptus ..	*Eucalyptus* spp. See Tables 7 and 8 for Dawson gum control	2,4,5–T ester (40%)	1 part in 40 parts diesel oil	Cut stump and swab	Will control most species. Late autumn or winter best time for inland species. Not as critical on the coast
		2,4,5–T amine (20%)	1 part in 9 parts water		
		Tordon 255 ..	1 part in 50 parts diesel oil	Basal bark spray	Thoroughly spray base of plant up to 40–50 cm. Controls young saplings up to 7·5 cm in diameter
		Tordon 105 ..	1 part in 4 parts water	Stem injection, 2 ml/per cut	
Harrisia cactus	*Eriocereus martinii*	Fenoprop ester (TP–70)	1 part in 70 parts water	Overall high pressure spray (high volume)	Spray plants thoroughly, anytime of year
	E. tortuosus and *E. regelii*	2,4–D sodium salt	Neat	Cut off plants just below ground level (4 cm) and apply one tablespoonful of dry powder on freshly cut butts	Cut off tops must be destroyed by burning, spraying or crushing and dusting with 2, 4–D powder
Lantana ..	*Lantana camara*	Tordon 50–D ..	1 part in 100 parts water	Overall spray (high volume)	Spray young regrowth (Mar.–May) thoroughly wetting foliage. In lower rainfall areas (under 1 250 mm/yr), brush plants in Feb.–Mar. and spray young regrowth when 20–30 cm long
		2,4–D amine (50%)	1 part in 250 parts water		
Creeping lantana	*L. montevidensis*	Dichlorprop (DP–60)	1 part in 200 parts water	Overall spray (high volume)	Apply when plants are growing vigorously in moist soil and preferably when flowering

TABLE 9—*continued*

METHODS OF CHEMICAL CONTROL OF SOME CENTRAL QUEENSLAND NOXIOUS AND WOODY WEEDS—*continued*

Common Name	Botanical Name	Chemical or Product	Mixing Rate	Application	Remarks
Limebush ..	*Eremocitrus glauca*	Tordon 50–D ..	1 part in 50 parts water	Overall spray (high volume)	Spray plants thoroughly to point of run-off. Treatment best when plants actively growing
		2,4,5–T ester (40%)	1 part in 20 parts diesel oil	Basal spray ..	Thoroughly spray base of plant up to 40–50 cm
Noogoora burr	*Xanthium pungens*	2,4–D amine (50%)	1 part in 500 parts water	Overall spray (high volume)	Spray before seed set between Feb. and April
		2,4–D amine (50%)	1 part in 20 parts water	Directional misting	
Parkinsonia	*Parkinsonia aculeata*	2,4,5–T ester (40%)	1 part in 40 parts diesel oil	Basal bark spray or cut stump and swab	Thoroughly spray base of plant up to 40–50 cm. Treatment best carried out in Autumn
Poison peach	*Trema aspera*	2,4,5–T ester ..	1 part in 40 parts diesel oil	Basal bark spray or cut stump and swab	Thoroughly spray base of plant up to 40–50 cm
Rubber vine	*Cryptostegia grandiflora*	Tordon 50–D ..	1 part in 50 parts water	Overall spray (high volume)	Add wetting agent
			1 part in 1 part water	Stem injection, 2 ml/cut	Inject at ground level
		Tordon 255	1 part in 50 parts diesel oil	Basal bark spraying	Thoroughly spray base of plant up to 40–50 cm
		2,4,5–T ester (40%)	1 part in 40 parts diesel oil	Basal bark spraying	
		2,4–D amine (50%)	1 part in 50 parts water	Cut stump and swab	
			1 part in 250 parts water	Overall spray (high volume)	Use on young growing plants up to 1·2 m high
Sandalwood	*Eremophila mitchellii*	2,4,5–T butyl ester (40%)	1 part in 40 parts diesel oil	Basal bark spraying	Use on stems up to 10 cm thick Thoroughly spray base of plant up to 40–50 cm
			1 part in 40 parts diesel oil	Cut stump and swab	
Swamp mahogany	*Tristania suaveolens*	Ammate X ..	See treatment	for brush box	
Yellowwood	*Terminalia oblongata*	2,4,5–T ester (40%)	1 part in 40 parts diesel oil	Cut stump and swab	Has given some success
Zamia ..	Species of—*Bowenia*, *Cycas*, *Macrozamia* and *Lepidozamia*	Power kerosene	Neat	Apply liberally to growing point	Results inconsistent
		Tordon 50–D ..	1 part in 1½ parts water	Apply to cavity made in growing point of zamia	Method showing some promise in Mackay district. Trials in progress. Quantity of mixture applied: 15 cm diameter plant, 5 ml; 15–25 cm diameter plant, 10 ml; Plants greater than 25 cm diameter, 1 ml per 2·5 cm of diameter

GENERAL NOTE—Overall spraying and misting should not be done when rain is imminent.

Maize varieties for the new season

MAIZE varieties available to Queensland growers for planting in the 1974–1975 season are listed below.

Certified seed produced during the 1973–74 season is—Q692, Q739, Q1280, PQ301, QK217, QK218, QK231, QK232.

Seed of varities fully recommended or suggested for trial plantings only is—

QUEENSLAND CERTIFIED HYBRID MAIZE SEED GROWERS' ASSOCIATION: Q23, Q739, PQ500, Q692, Q1280.

NORTH QUEENSLAND HYBRID MAIZE SEED GROWERS' ASSOCIATION: QK217, QK218, QK231, QK232.

DEKALB SHAND SEED CO. PTY. LTD.: XL45, XL306, XL361, XL81, XL389, DK805A, XL347, XT664.

ANNAND AND ROBINSON: RX404.

YATES SEEDS LTD.: PX50, GH390.

OTHER SEED MERCHANTS: GH128, GH390, GH134.

In the tables, no attempt has been made to rank any of the varieties in order of preference in any of the regions. Varieties listed 'for trial' may be planted in limited areas for evaluation purposes: insufficient evaluation has been made in your area.

Should these varieties continue to perform well and be equal with or superior to the recommended varieties, they will join or replace them in future years.

It is suggested that farmers consider planting a trial area of the 'for trial' varieties. It would be appreciated if the local adviser were informed of these trial plantings; he will be very interested to observe the performance of the varieties.

by Officers of Agriculture and Plant Pathology Branches.

Plant populations

The planting rate figures quoted for most districts refer to the desirable established population. To get this population without subsequent thinning of stand, it is necessary to know the germination percentage of the seed and the seed size to calculate the potential number of seeds that will germinate per kilogram of seed.

From this figure, an amount to allow for field losses must be subtracted. In a well-prepared seedbed under good moisture conditions, a loss of 10% would be considered normal.

Maize seed sold by the major producers is generally very high quality. The grade size and average seed count per kg for Queensland certified maize seed for which the minimum laboratory germination is 90% are—

3 large flat 2 600 seeds/kg
2L medium lge, flat 2 800
2 med. flat 3 100
1 med. flat 4 000
1S sml. flat 4 400
O.L. lge. round 3 100
O.S. sml. round 3 500

DISEASES

Diseases for which field assessment was made in the 1973-74 season include common leaf blight (*Drechslera turcica*), maydis leaf blight (*Drechslera maydis*), head smut (*Sphacelotheca reiliana*) and maize dwarf mosaic disease.

Turcicum or common leaf blight

The fungus *Drechslera turcica,* which produces large spindle-shaped leaf spots commonly up to 15 x 5 cm in size, caused blighting in most maize areas throughout the State

Turcicum leaf blight was severe in north Queensland, at Kingaroy and on the Darling Downs.

To reduce the blight severity and its possible effect on yield, farmers have available for planting many hybrids with low susceptibility. From observations and ratings on regional maize trials in south-eastern Queensland, the four most susceptible and most resistant varieties commonly recommended are tabulated below. The other early maturing varieties tested were intermediate in reaction.

Most susceptible Group	Least susceptible Group
XL45	Q739
XT664	XL81
PX50	XL389
XL361	DK805A

If equally productive and suitable, adapted hybrids with resistance are available for their area, farmers are advised to consider planting these instead of the susceptible hybrids which could sustain severe blighting in seasons favouring blight epidemics.

Maydis leaf blight

Drechslera maydis can attack all aerial portions of the maize plant including the ears and tassels. Small, elliptical leaf spots, usually less than 20 x 5 mm, distinguish maydis leaf blight from common blight.

In south-eastern Queensland maize areas, race T of *D. maydis* caused severe blighting in the 1972–73 season on varieties in T cytoplasm. The absence of maydis blight in these areas in the 1973–74 season can be attributed to the exclusive use of varieties in N cytoplasm. To date, race O of the pathogen is confined to the north Queensland maize areas and attacks varieties in N cytoplasm. The use of normal cytoplasm does not afford control of maydis blight caused by race O of the pathogen and all of the varieties tested are susceptible to some degree.

Head smut

In north Queensland and certain areas of the south Burnett district, head smut of maize caused by *Sphacelotheca reiliana* is prevalent. The attention of growers is drawn to this disease which can seriously reduce yield if its build-up in fields is ignored. Levels exceeding 10 to 50% infected plants have been recorded for experimental plots of susceptible varieties in recent seasons.

Maize seedlings become infected during emergence by smut spores carried on the seed or in infested soil. The parasitic mycelium develops systemically in the host and galls form after the ears and tassels appear. The host tissue in these galls is replaced by masses of brown to black spores.

Seed treatment may destroy externally-borne spores on the seed but will not protect the plants against infection in smut-infested soil. By practising crop rotation, avoiding paddocks with a history of smut and sowing the most resistant varieties available farmers can combat this disease. The QK hybrids (QK217, 218, 231 and 232) and GH390 have demonstrated very high susceptibility to head smut. Varieties which were least susceptible in these trials include Q692, Q739, Q1280, GH128, XL389 and XL81.

Maize dwarf mosaic disease

Maize dwarf mosaic disease has been troublesome in many south Queensland maize crops during recent years. Levels of infection exceeding 50% have been regularly recorded. Maize dwarf mosaic is caused by the Johnson grass strain of sugarcane mosaic virus which is transmitted by aphids. Infected plants of susceptible hybrids show conspicuous stripes or mosaic and ringspot patterns. Severe stunting may result, particularly where plants are infected early. The virus is maintained between seasons in Johnson grass and, in frost-free areas, on winter-cultivated sorghum.

Disease control cannot be effectively achieved with insecticides and Johnson grass eradication is usually not practicable. Control of the disease is achieved through the use of resistant hybrids. The degree of resistance to maize dwarf mosaic disease is indicated by the footnotes at the bottom of the table.

Many hybrids of American parentage are highly susceptible to the disease, although some recently-released hybrids of this type have satisfactory resistance to maize dwarf mosaic. Plants with severe symptoms have low yields.

The recommendations are basic information only: consult your local Department of Primary Industries for further information.

DISTRICT RECOMMENDATIONS

District	Planting Time	Variety E = Fast maturing M = Mid season L = Slow maturing	Plant Population plants/ha
Mareeba–Cooktown–Peninsula	December–January (January preferable at Cooktown)	L : QK217*, QK218* FOR TRIAL: L : QK231*, QK232*	35 000
Atherton Tableland	December–mid February	L : QK217*, QK218* FOR TRIAL: L : QK231*, QK232*	35 000
Ingham	April–May	L : QK217*, QK218* M : PQ500† M-L : GH390†, Q692* FOR TRIAL: M : XL81†	30 000–35 000
Burdekin (Townsville, Ayr, Millaroo, Bowen)	April–July	IRRIGATED M-L : XL389† M : XL81†, DK805A M-E : XL361	70 000 (XL361, XL81) 50 000 (others)
Central Coast Region (Rockhampton, Rossmoya, Dalma and Boyne Valley)	December–January	L : Q692*, Q23†, Q1280* GH128* M : PQ500† FOR TRIAL : M-L : XL389†, GH390† M : XL81†	20 000–25 000
Callide–Dawson (Biloela, Theodore, Moura, Baralaba, Goovigen, Wowan, Bauhinia)	end December–early February early February	L : Q23†, Q692*, Q1280*, GH128* M : Q739*	20 000–30 000
Sub-Coastal Burnett (Central and Upper Burnett)	mid November–early January	L : Q1280*, GH128*, Q692* M-E : DK805A, Q739*, XL81† FOR TRIAL : M : XL389†	18 000–30 000
Coastal Burnett (Bundaberg, Maryborough)	late August–early January	L : Q1280*, GH128*, Q23† GH390†, GH134 M : DK805A FOR TRIAL : M : XL81†, XL389†	25 000–35 000
South Burnett (Goomeri, Murgon, Kingaroy, Nanango, North Rosalie)	October–December (mid November–mid December preferable)	L : Q1280*, GH128*, GH390† Q692*, Q23†	22 000–30 000
	October–mid December (mid November–mid December preferable)	M : XL81†, Q739*	27 000–35 000
	mid November–mid December	FOR TRIAL : M : XL389†, F18, G9, RX404 Add about 5% Q692 to plantings of Q1280 and GH128 when pollination is a problem	
Near North Coast (Gympie, Cooroy, Kilkivan, Eumundi, Pomona)	November–January	M-L : GH390†, Q1280*, GH128* FOR TRIAL M : XL81†, XL389†	30 000 (rain-grown) 50 000 (irrigated)

District	Planting Time	Variety E = Fast maturing M = Mid season L = Slow maturing	Plant Population plants/ha
Brisbane–Moreton (Lockyer, Brisbane and Fassifern Valleys, Beaudesert and coastal Moreton)	September–December	L : Q692*, Q23†, Q1280*, GH128*, PQ500†, GH390† M-E : Q739*, XL81† E : PX50† FOR TRIAL : M-L : XL389†, XL306†, XT664	25 000–40 000 (raingrown) 50 000 (irrigated)
DARLING DOWNS **Northern Downs**	October–November	L : Q692*	15 000–25 000
	October–December	M-L : XL389† M : XL81†, PQ500† M-E : Q739*, XT664, DK805A E : XL306†, XL347	
Central Downs	October–December	M-L : XL389† M : XL81†, PQ500† M-E : Q739* E : XL306†	20 000–30 000
Southern Downs	October–December	M-L : XL389† M : XL81†, PQ500† M-E : Q739* E : XL306†, XL347	25 000–40 000
All Districts—Irrigation‡	October–December	L : Q692* M-L : XL389† M : XL81†, PQ500† M-E : Q739*	50 000–60 000

* High resistance to maize dwarf mosaic disease.

† Moderate resistance to maize dwarf mosaic disease.

‡ Slow maturing varieties have higher irrigation requirements and may not be adaptable to the cropping system.

Fibreglass plunge dip for cattle

PLUNGE dipping is still recognized within the cattle industry as the most effective way to apply a chemical to control the cattle tick (*Boophilus microplus*).

Concrete, concrete blocks, steel and wood have been the materials used in building these dips. Current trends indicate that concrete dips are the most popular.

At present, farmers and graziers are having great difficulty in obtaining the required materials to build dips. Even when the materials eventually become available, skilled labour to do the actual building is a further hurdle.

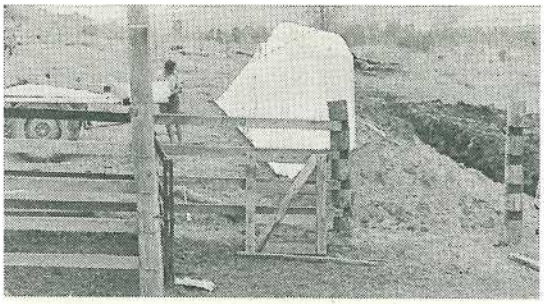
The solution to these problems could well lie in a fibreglass plunge cattle dip.

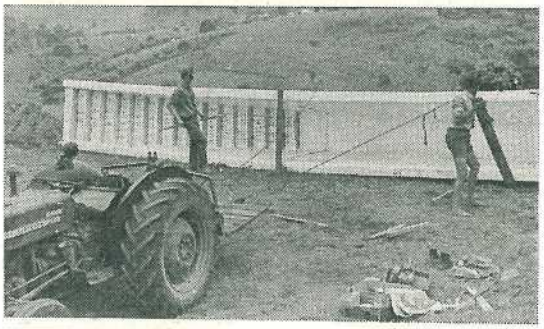
Fontana Products, at Banyo, have built such a dip based on plans submitted to them by the Veterinary Services Branch of the Department of Primary Industries. A trial dip is installed on Mr. A. Gehrke's property at Laidley.

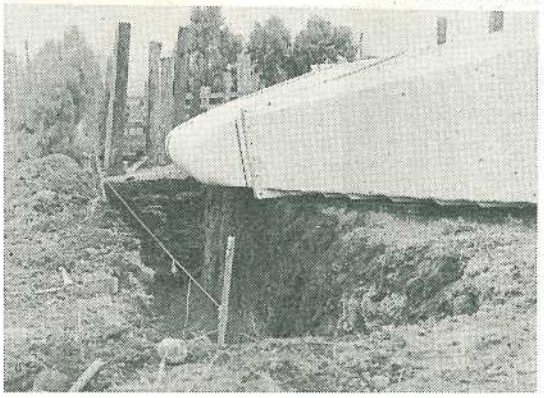
This dip is under observation to detect any faults that could reduce the dip's longevity. The factors to be observed include the effects of continual dipping, the occurrence of damage and the effect of soil pressure on the dip when it is empty and also during wet and dry weather.

Fibreglass Dip

The fibreglass dip is made of a high grade polyester resin reinforced with low alkali type glass fibres. The wall is built up starting with a gelcoat layer on the mould surface, followed by laminate and finished with a protective coat called a surface coat.







The fibreglass dipping vat is ready for lowering into the hole.

TOP. The vat is positioned upside down ready for sliding in.

CENTRE and BOTTOM. The vat viewed from both sides as it is lowered into the hole. The centre picture shows the builders sliding the 600 kg vat down wooden slides. The bottom picture, taken at the same stage of construction and from the other side, shows the vat edging over the trench.

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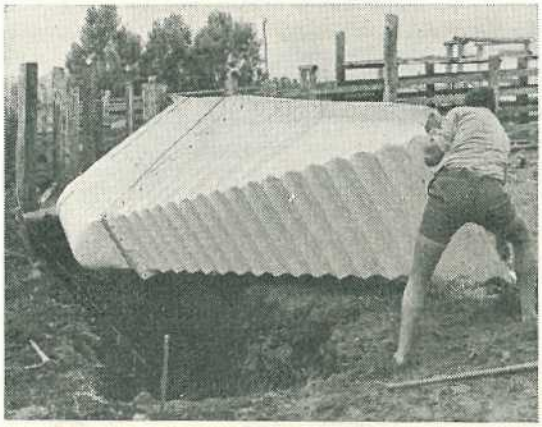
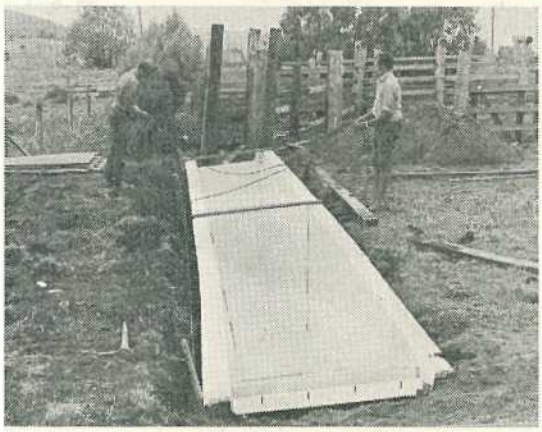
by J. F. KEARNAN, Tick Control Extension Officer.





TOP. Turning the vat upright for the final lowering. BOTTOM. The vat in position.

The gelcoat is made of polyester resin without glass reinforcement. It is heavily pigmented and contains some mineral fillers for improved abrasion and impact resistance.

The laminate is a conglomeration of glass fibres and polyester resin. The fibres are distributed at random or oriented in the direction of the maximum load. Correct laminate thickness, glass orientation and glass:resin ratio are the critical factors in the strength of the vat.

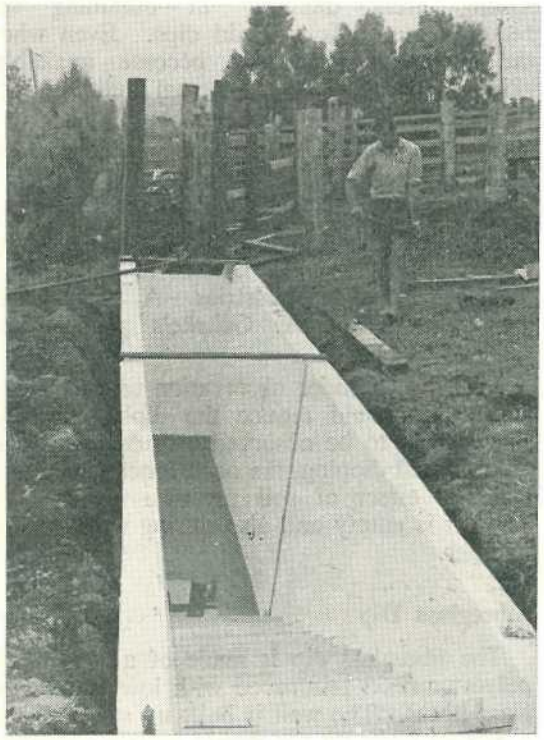
The surface coat is similar in composition to the gelcoat and protects the exposed glass fibres from chemical attack.

The walls are 3·2 mm ($\frac{1}{8}$ in.) thick or slightly greater. Ribs have been built in at intervals along the length of the dip to give added strength.

Advantages

The advantages of a fibreglass dip are many and include—

- SPEED OF INSTALLATION. The dip can be installed in less than a day in a prepared excavation. If the site is not too rocky, a back hoe can prepare the hole in 4 hours.
- LIGHT WEIGHT. The dip is made in two pieces. Its total weight is 600 kg and can be handled easily by four men. This avoids the need to use heavy handling equipment. Its light weight affords great savings in freight and handling costs.
- MOVABILITY. If it is desired, the dip can be pumped out, removed from its location and reinstalled at another site.
- EASE OF REPAIR. One of the greatest advantages of fibreglass articles is that, in case of damage, repairs can be carried out on the spot quickly and cheaply. Special skill or expensive equipment is not needed. Repair kits with instructions are supplied.



The vat, now in position, is filled with water to a depth of 60 cm and the job of packing sand around the sides has begun.

- NO CORROSION OR RUST. Chemicals used in tick control will not corrode fibreglass. Additionally, fibreglass will not rust.
- NO LEAKAGE OR SEEPAGE. The dip is leak-proof. The walls of the dip protrude above ground level to prevent flooding.
- PLIABILITY. The properties of fibreglass are such that it will not crack with earth movement.
- NO CORNERS. The curvature at the bottom of the dip ensures that dirt accumulates in the centre of the dip. This makes for easy cleaning. This curvature reduces the dip's capacity as it eliminates corners.
- SIMPLE TO INSTALL. Skilled labour is not required to install the dip but the instructions should be followed carefully.

Disadvantages

If there are any disadvantages, they are not yet clear. Problems have occurred with other types of pre-fabricated dips, mainly with their ability to withstand the pressure of the earth after rain. There is a possibility that the walls of this dip may buckle slightly.

Since Mr. Gehrke's dip has been installed, Fontana have strengthened and increased the number of ribs on new dips to give added stiffness.

Installation

The initial step is to prepare an area of level ground approximately 12 m x 2 m (38 ft. x 6 ft.). Care should be taken to peg the excavation squarely, to have the angle of the walk-out correct and to have an even taper on the excavation sides. The excavation dimensions are shown in the instructions.

To prevent the harmful effects of soil contraction and expansion, it has been found with similar projects that the structure is best packed in sand. Therefore, once the hole is dug, a 15 cm (6 in.) layer of sand should be placed on the bottom.

The next step is to align the two halves of the dip beside the excavation. The dip is supplied in two pieces to save freight and for easier handling. Leave a 10 cm (4 in.) gap between the mating flanges. Material to join the halves is supplied. A hardener is mixed in the putty. This putty must be used within 1 hour after mixing although this does depend on the temperature.

The putty is distributed freely over the flange area and the two pieces are pulled together with bolts and nuts which are fitted into pre-drilled holes. The heads of the bolts and nuts are covered with surplus putty.

The dip is now ready to be turned on its side and lowered into the excavation. It is important that no more than 2 hours elapse between the time of mixing the putty until the dip is resting in the ground.

The joint is sealed by using resin and fibreglass tapes. To do this, hardener is mixed with resin and this is painted over the joint. The fibreglass tape is then laid on the painted strip. More resin is applied to this tape until it is thoroughly saturated. A second layer of tape is then applied in the same fashion as the first.

The dip should be well protected from moisture and left overnight to harden.

When satisfied that the dip is level, fill with water to a depth of 60 cm (2 ft.). This amount of water will still leave the steps dry. Sand is added to the hole in which the dip is sitting until the water level is reached. The sand is then compacted by adding water.

The next step in the installation is to fill the steps with a six to one concrete mixture. Steel reinforcement has already been cast into the steps. A fibreglass retaining wall on each step is supplied to make a satisfactory mould.

Once the concrete is set the water level is raised in 60 cm increments, similarly backfilling with sand. When the dip has been set into the ground the concrete work connected with the jump-in and draining pen can be finished.

Dimensions

The overall length of the fibreglass dipping vat is 10·7 m (35 ft.). The width at the top is 1·07 m (3 ft. 6 in.) tapering to 60 cm (2 ft.) at the bottom. The deep section is 4·3 m (14 ft.) long and the walk-out 7 m (22 ft. 6 in.). The jump-in is level to promote efficient head wetting.

The dip allows a 9 m (30 ft.) swim and the depth of water at working level at the jump in end is 2 m (6 ft. 6 in.). The capacity is approximately 11 000 litres (2 400 gal.).

In April 1974, the dip retailed at $1 320.

Veterinary crush for horses

This veterinary crush for horses at 'Swan's Lagoon' Cattle Field Research Station, Millaroo, is simple to build, efficient and inexpensive.

by A. E. HOLMES and
R. M. DODT, Beef Cattle Husbandry Branch.

A simple and efficient horse crush is a useful facility for the horse breeder. A crush built at 'Swan's Lagoon', the Department of Primary Industries' Cattle Field Research Station at Millaroo, has proved an effective design.

It has been used for deworming, vaccinations, teeth rasping and for restraint during minor surgery, but perhaps the most important use for this crush has been for teasing and pregnancy testing mares.

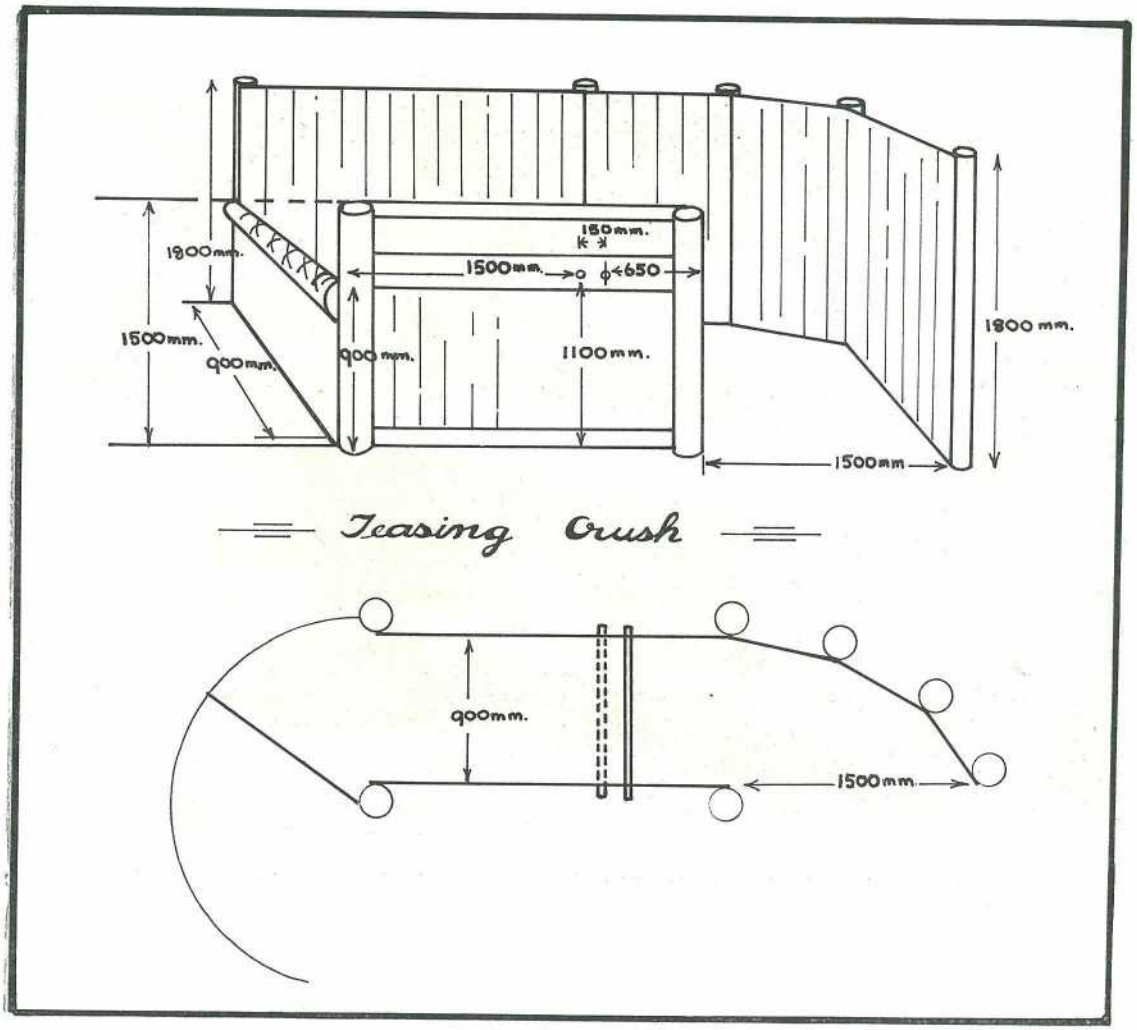
The crush can be readily incorporated into an existing yard, though its erection adjacent to the stallion yard will permit greater efficiency in teasing mares.

Construction

The crush is made with 150 x 25 mm (6 in. x 1 in.) sawn timber battens on 150 x 50 mm (6 in. x 2 in.) sawn timber rails and round posts. Since all posts are required to support heavy weights they should be 150 mm in diameter, free of sap at the small end and 1 m (3 ft.) in the ground. Dimensions of the crush are shown on the plan.

Battens on the rear wall should not be more than 50 mm apart. The front wall is battened in to a height of 1·1 m (3 ft. 6 in.) with a top rail at 1·4 m (4 ft. 6 in.). This rail can be made either of 150 x 50 mm sawn timber or a freely rolling 100 mm (4 in.) or 125 mm (5 in.) pipe.

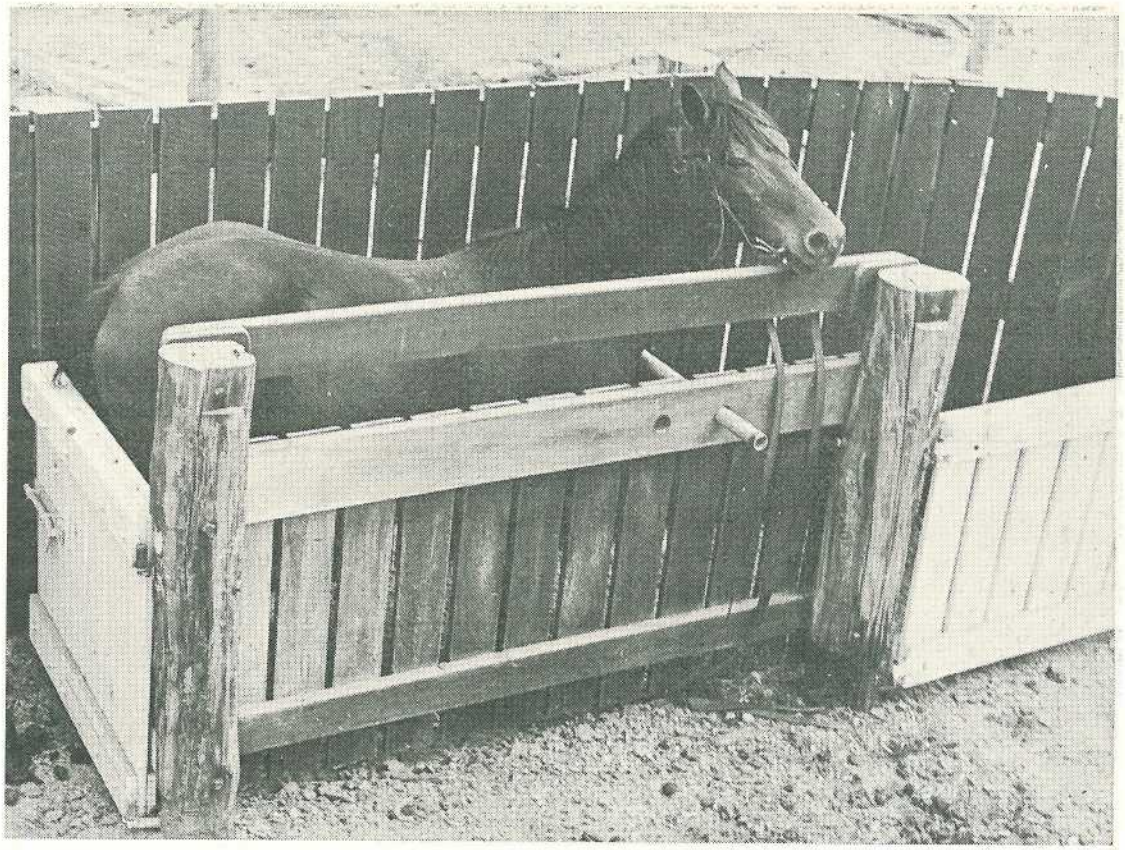
The freely rolling pipe is better if the crush is to be used extensively for teasing mares since this prevents any injury to the stallion, should he rear up and strike out. This can be made by sliding a 125 mm pipe over a 100 mm pipe previously bolted to the posts at either end of the crush.



The dimensions of the rear gate are very important, especially when the crush is used for pregnancy diagnosis. It must be high enough to prevent the mare from kicking the veterinarian and low enough to allow free access for diagnosis. The recommended height is 0·9 m (3 ft.) and the battens must be fitted flush together.

The height of the front gate is less important, and though at Swan's Lagoon it is only 0·9 m high, an improvement would be to raise it to the same height as the front wall of the crush. This is especially necessary if the crush is to be used to restrain young or unbroken horses. It should be of similar construction to the front wall of the crush depending on the height of the door. Both front and rear doors should be fitted with barrel bolt type latches to ensure quick and simple closing.

A length of 30 mm (1¼ in.) pipe placed in front of the horse restricts back and forward movement and holds the horse towards the rear of the crush. Holes 40 mm (1½ in.) in diameter are drilled through the sides of the



The mare in this crush is held securely. The risk of either the horse or the operator being injured is reduced to a minimum.

crush. These should be 1 m above the ground to hold the pipe. Drill three or four holes to allow for both big and small horses and, over the end of the pipe as a safety precaution, fit a rounded protector. This prevents the horse from being cut should he jump forward while the pipe is being inserted.

Operation

The operator leads the horse into the crush through the rear door, which should then be shut immediately. The horse must be backed towards the rear door, and once in this position the pipe placed in front of it. The hole selected for the pipe should be one that ensures that the horse is kept as close as possible to the rear door. The animal is now adequately restrained and ready for whatever operation is to be carried out.

The pipe rail may or may not be used when teasing mares. However, it is of great assistance when deworming and teeth rasping and essential for pregnancy diagnosis. If a horse persists in kicking at the rear door while in the crush it is advisable to apply a nose twitch.

This crush greatly reduces any chance of injury to either the horse or the operator. It is simple to erect and costs are not high.

Prunes

PRUNES are a special variety of royal-purple plum. The fruit is picked after it has fully ripened on the tree.

It is carefully cleaned and washed, then dehydrated so that the moisture content is reduced to about 18%. Before being packed, the prune plums are pasteurized, steamed and their moisture content restored to 26 to 32%.

Prunes have an exceptionally high content of natural fruit sugars which can be assimilated quickly. This makes them particularly useful when quick energy is required. They are rich in iron, vitamin A and thiamine, riboflavin and niacin.

Today's moisturized prunes require little cooking to bring out all their plump, natural goodness. If they are allowed to stand overnight before eating, they grow plumper and the juice richer. A stick of cinnamon, lemon or orange slice can be added for extra flavour.

Prunes can easily be plumped by covering them with hot water, placing the lid on the container and allowing them to soak for 24 hours. To pit prunes for stuffing, cut one side of the prune with a pair of scissors and gently squeeze out the pit.

DEVILS ON HORSEBACK—Slice rind off four rashers of bacon and cut each rasher in half. Slit and stone eight prunes and soak until plump. Stuff the prunes with 2 oz. of Danish Blue cheese, mashed together with an ounce of crushed almonds. Skewer each prune firmly between two rolled half rashers and grill, turning often until the bacon is golden brown. Serve hot garnished with croutons and parsley.

—Victorian Department of Agriculture.

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Home hints

SOAK new tea towels in cold water with half a packet of Epsom salts. This removes the dressing and makes them soft and absorbent in one wash.

A small nylon nail brush kept in the kitchen is ideal for cleaning lemons or oranges when the rind is needed for grating. It is also useful for cleaning the grater after use.

Avocados are delicious served with raw oysters and a little mint sauce.

To remove obstinate rust stains from porcelain baths and basins, soak three or four thicknesses of blotting paper or paper hand towel lengths in bleaching fluid and cover the stain. Leave overnight. The following morning, clean the bath or basin in the usual way.

If you have difficulty in putting on or taking off clothes over rollers, put on your shower cap, you'll be surprised how easily frocks and pullovers and the like will slip off without disturbing your set.

Hygiene

PERSONAL hygiene is largely a matter of personal pride, and a desire to help the body function as efficiently as possible.

Some waste products are sent out of the body in perspiration manufactured by the skin in its tiny glands. This perspiration is a factor in the skin's major duty—maintaining body temperature.

It is by daily bathing that the skin surface is cleared for free and healthy action of the sweat glands. Washing removes the accumulation of bacteria, grime, and oil formed by sebaceous glands which lubricate the tiny hairs on the skin.

Personal hygiene includes care of the hair, teeth, hands, feet, eyes, ears . . . right through to finger-nails and toe-nails. The products for achieving cleanliness are widely advertised and, generally, there is little difficulty choosing a soap, or shampoo to suit personal needs. However, if you have a special problem, such as dandruff, dry skin, or more complex skin disorders, extra care is necessary; in some cases, your doctor (or dermatologist) may recommend a special, medicated product.

It is a good idea to avoid lengthy showers in hot water, and to be sparing with soap if your skin is sensitive. Bath oils, and skin-softeners after showering help keep the skin smooth and supple. Hair care also is an individual matter—oily hair requires shampooing more often than dry hair, and some types of hair are more manageable than others; however, cleanliness and grooming will depend on the time you are prepared to devote to them.

Just as you would ensure that you had clean, tidy clothes (especially undercloths), you should also make sure that toilet articles, such as towels, brushes and combs, toothbrush face washer or sponge, are washed clean properly and regularly. Keep your bathing equipment separate from others, and make sure you use only your own articles.

Further information on care of the teeth, eyes, feet, and so on is contained in pamphlets available from the Queensland Health Education Council, P.O. Box 155, Fortitude Valley, Q. 4006.

—Queensland Health Education Council

Noise pollution

NOISE, often termed 'stressful or unwanted sound', is one of the major causes of deafness among workers in certain industries today.

Authorities differ on just how much noise the human ear can withstand without being irreparably damaged, but most agree that continued, excessive noise can cause permanent loss of at least some degree of hearing.

However, industries are not the only culprits in creating noise pollution, and some of the loudest noises can be produced by the motor mower, food blenders, knife sharpeners, garbage disposal units, even by a noisy exhaust fan, or a vacuum cleaner.

Sound pressure level is measured by the decibel scale. This ranges from zero decibels for the faintest audible sound (for example, less than a low whisper or a rustling leaf), up to the 100 to 140 decibel level, where the sound is deafening, and on the border of physical pain. Included in the 'deafening' category, are the sounds of a noisy kitchen, a subway train, an amplified 'rock' band, a jet airport, and at the top of the list, a shotgun blast!

Normal conversation rates at about 60 decibels, which is classed as 'moderate' (in the 40 to 60 decibel range).

There are two main ways of dealing with noise pollution; by eliminating or minimizing the noise, or by protecting yourself against its effects.

Unfortunately, some things, such as heavy farm and earthmoving equipment, roadmaking and maintenance machinery, and household noise, cannot be completely silenced, so we must tolerate a certain amount of noise in our lives. Ear muffs can provided effective protection, and properly-fitted ear plugs also help block out some of the damaging noise.

Hearing, once lost, cannot be regained, although hearing aids can alleviate the problem.

If no protective measures are adopted, the person constantly subjected to loud noises may end up unable to hear even ordinary conversation and therefore isolated by a 'wall of silence', which only very loud noises can penetrate.

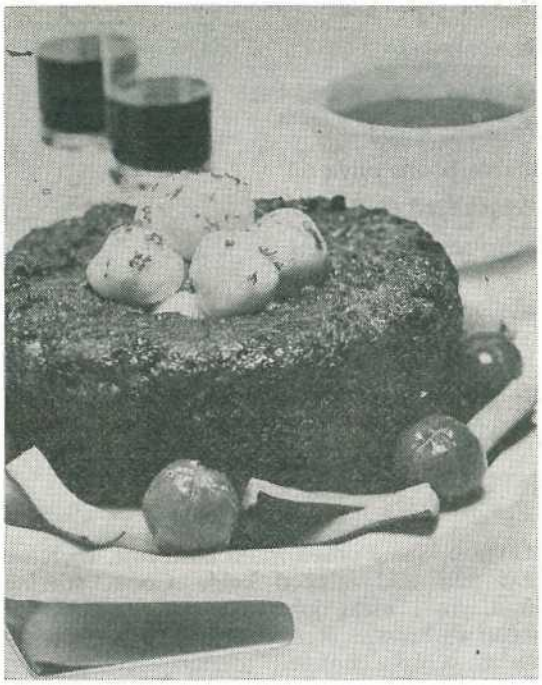
—Queensland Health Education Council

Thrifty cooks try beef mince

MINCED beef sales are ever-increasing as the thrifty cook finds it an economical way to present varied and interesting meat dishes. From the simplest hamburger to the more involved dishes, it is a means of presenting meat dishes in endless variety.

Every cooking method can be used for this handy meat, whether it be cooked in the oven, grilled, barbecued, pan-grilled or fried, or gently braised or cooked 'en casserole'.

All of the following receipts have been kitchen-tested by Tess Mallos, Food Consultant to the Australian Meat Board. The Australian standard metric cup and levelled spoon measures are used in the recipes.



Using minced beef is one of the many ways a thrifty housewife can keep her budget costs down. This Beef and Vegetable Ring recipe is one of the many appetizing meals that can be prepared from beef mince. It will please all the family.

Beef and Vegetable Ring

INGREDIENTS

1 kg (2 lb.) finely minced beef
1 medium onion, finely chopped or grated
2 eggs
¾ cup coarsely grated zucchini
¾ cup coarsely grated carrot
1 medium, ripe tomato, peeled and chopped
1½ cups soft breadcumbs
1½ teaspoons salt
Freshly ground black pepper
2 tablespoons chopped parsley.

METHOD. Place minced beef in a basin. In another basin, beat eggs; add onion, prepared vegetables, breadcrumbs, salt, pepper and parsely. Blend well then fold into ground meat, mixing lightly but thoroughly. Lightly press meat mixture into a greased ring cake pan and cook in a moderate oven 180°C (350°F), for 1½ hours. Pour off juices (use if making gravy) and unmould onto oven-proof serving plate. Return to oven for 15 minutes to brown. Serve garnished with cooked vegetables. Serves six to eight.

Spanish Meat Ball Kebabs

INGREDIENTS

750 g (1½ lb.) finely minced beef
1 medium onion, minced or grated
¼ cup barbecue or other spicy sauce
½ cup wholemeal flour
1 egg
1½ teaspoons salt
Freshly ground black pepper
Stuffed spanished olives.

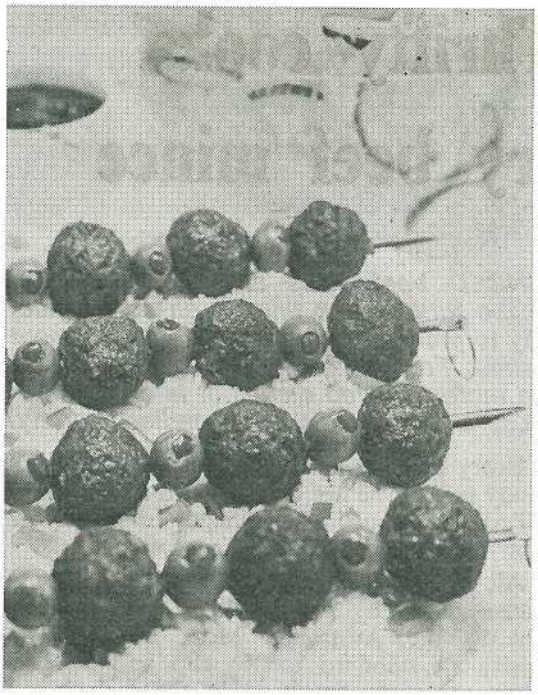
METHOD. Mix all ingredients, except olives, until well blended. Shape into small balls the size of a small walnut. Place on a tray and chill in refrigerator for 1 to 2 hours. Thread onto skewers, placing an olive between each meat ball. Brush while cooking with the same sauce as was used in the meat mixture. Serve with saffron rice. Serves six.

Chilean style Beef

INGREDIENTS

500 g (1 lb.) minced beef
2 onions, sliced
2 tablespoons olive oil
¼ cup sliced stuffed olives
¼ cup seedless raisins
2 cup corn kernels, fresh, canned or frozen
1 large, ripe tomato, peeled and chopped
⅛ teaspoon crushed red pepper
1 teaspoon ground cumin
1 teaspoon salt
¾ cup beef stock.

METHOD. Sauté onion in oil until soft. Increase heat and add minced beef. Cook, stirring often, until meat juices evaporate and beef begins to brown. Reduce heat and add olives, raisins, corn, chopped tomato, red pepper, cumin and salt. Stir well to blend then add stock. Cover and simmer gently for 20 minutes. Pile into a serving dish and serve with cooked, dried beans (haricot, lima or red kidney) or boiled rice. Serves four.



Another appealing recipe is for Spanish Meat Ball Kebabs, reflecting the influence of the Moorish occupation of the Iberian Peninsula many years ago. Simple to make, the recipe adds an exotic touch to the home-maker's repertoire.

Agricultural Bank interest rate

THE rate of interest charged by the Agricultural Bank on certain loans to borrowers was increased to 9·625% from 1 August 1974.

In announcing this the Minister for Primary Industries (Hon. V. B. Sullivan, M.L.A.), who administers the Agricultural Bank, said the increase was in line with the abrupt rise in interest rates affecting the economy generally.

Mr. Sullivan said that the last increase in the Agricultural Bank interest rates was on 1 November 1973.

He said the new rates to be charged by the Agricultural Bank would apply to loans (both overdraft and new contracts) to borrowers under the Agricultural Bank Loans Act, the Farm Water Supplies Assistance Acts and the Soil Conservation Act.

Mr. Sullivan added that the position would be reviewed from time to time in the light of the Commonwealth Loans rate then applying.

Phytophthora Root Rot of Lucerne

PHYTOPHTHORA root rot *(Phytophthora megasperma* var. *sojae)* is one of the most important diseases of lucerne in Queensland and is widespread in many lucerne-growing areas.

It results in serious losses through a reduction in stand density and poor growth. The fungus causing the disease requires free water for its dispersal and consequently thrives under high soil moisture conditions.

SYMPTOMS

The above-ground symptoms of the disease vary. Affected plants may show yellowing, stunting or wilting of tillers. The characteristic symptom of the disease, however, is the presence on the tap-root of a light-brown, discoloured area up to 5 cm long. While this rotted area is sometimes very close to the crown, it may be seen up to 30 cm below the soil surface.

Internally, the light-brown colour generally extends in advance of the external discoloration. As infection progresses, the tap-root becomes cinctured and the bottom part of the root system rots away, leaving only the upper stub of the tap-root remaining. This is often covered by a mat of fungal growth.

Tap-roots with as many as four distinct discoloured or rotted areas present have commonly been observed. At this stage, plants are usually yellow and badly wilted and some deaths may result. However, not all plants affected in this way die.

If wet conditions favourable for the development of the fungus do not persist, plants often temporarily overcome the setback by producing an abundance of roots above the rotted area. Such plants remain unthrifty but are capable of a reduced yield if a regular supply of water by irrigation is maintained. However, where irrigation is not available, these plants become badly stressed in dry weather and are easily pulled out during pasture renovation operations.

Phytophthora root rot can cause complete loss of plants in areas of paddocks where conditions are particularly favourable for attack. More often,however, affected plants are scattered throughout a paddock thus causing a gradual reduction in the stand.

The disease is more prevalent on young lucerne in its first year of growth, but sometimes older stands may be attacked.

SPREAD

Wet soil conditions favour the development of the disease. It is spread rapidly and over considerable distances by water moving over the soil. The root rot develops freely in times of heavy rainfall, and is more prevalent in the lower sections of the paddock. In irrigated stands, it is common on the bottom end of bays where drainage is impeded.

Although sometimes found on deep, friable soils, the disease is generally more severe in heavy soils or where there is an impervious clay layer near the surface. It is quite possible that such areas will produce good crops in drier years.

The disease is more commonly noticed in the warmer months of the year, particularly during spring.

CONTROL

Although it is unknown how long the fungus will survive in the soil, it is advisable to avoid replanting land with lucerne after a thin stand has been ploughed in. It has to be remembered that even a small, residual population of the fungus in the soil can build up rapidly in wet weather.

Adequate surface drainage will assist in minimizing damage and particular care should be taken to avoid prolonged over-wetting of the soil during irrigation.

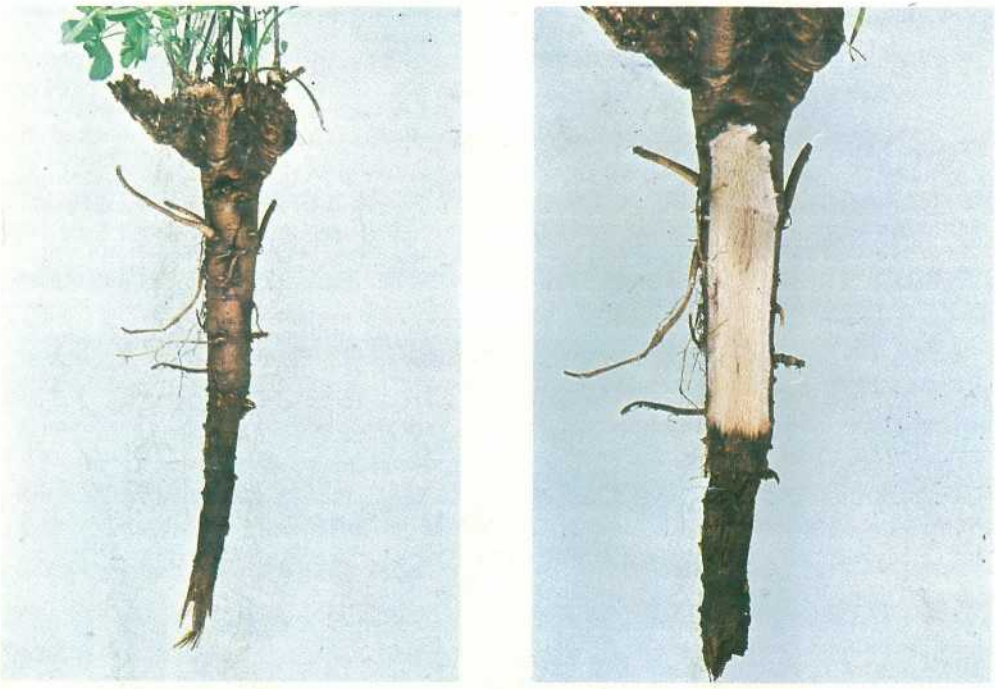
Growers planting lucerne on heavy soils or soils with impervious clay layers near the surface may expect to have relatively short-lived stands if prolonged wet weather occurs.

It is apparent that some lucerne cultivars possess resistance to phytophthora root rot and investigations are proceeding to develop cultivars suitable for root rot endemic areas.

– Plant Pathology Branch

Further information can be obtained from the nearest Plant Pathology office or by writing to the Director, Plant Pathology Branch, Department of Primary Industries, Meiers Road, Indooroopilly. Q. 4068.

Diseases of Lucerne—1



Phytophthora root rot. Upper left: affected plant showing rotted area on the tap-root. Upper right: section of diseased tap-root. Lower: early symptoms on young plants.