Queensland
AGRICULTURAL JOURNAL

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DEPARTMENT OF PRIMARY INDUSTRIES

PRIMARY INDUSTRIES

Visitors to the field day held in conjunction with the opening of the J. Bjelke Petersen Field Station at Kingaroy showed keen interest when given an opportunity to inspect the work being done at the station.

MAY-JUNE 1975 Vol. 101 No. 3

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Contents

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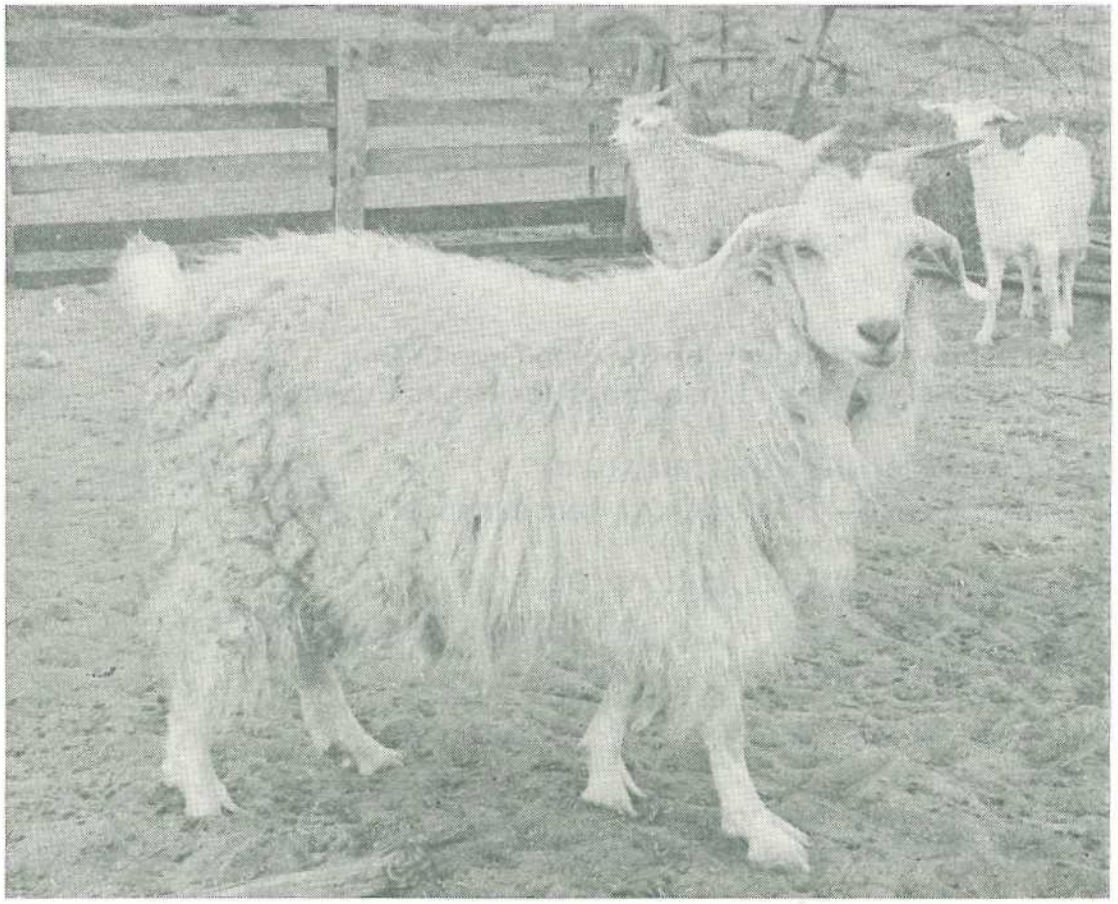
A producers view...

Mohair in Queensland

by K. W. Sykes, "Pleasant View", Miles.

DURING the past three years a significant increase in interest in Angoras has become obvious in Queensland. With fluctuating markets for rural produce the need for diversification has become most apparent. The possibility of increasing the small stock unit stocking rate, and the profitability of the property, by using Angoras has attracted the interest of an increasing number of Queensland farmers.

Below: Third cross female kid.



There is a number of registered Angora studs in Queensland. In addition more farmers are using Angora bucks to upgrade herds of feral goats on their properties.

The Angora is a commercial animal in its own right. The feature of the Angora which many farmers find attractive, however, is the manner in which Angoras complement other stock. The Angora is primarily a browsing animal and thrives in scrub or bushy country that provides them with leaves and roughage in addition to a basic pasture diet.

In scrubby or hilly country where other stock do poorly, Angoras turn unproductive bushland into valuable fibre. When Angoras are run with sheep or cattle the relationship is complementary. The Angoras eat mainly regrowth and scrub while the other stock eat the grasses and clovers.

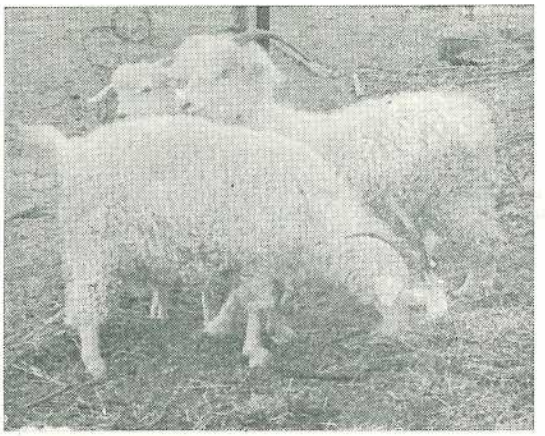
The main problem facing the newcomer to the mohair industry is the shortage of pure-bred females. Many farmers are overcoming this problem by using wild or milking goats, preferably those with short, soft white hair, and crossing them with a pure bred Angora buck. Provided a good quality buck is used it is a commercial proposition to shear the animals from third cross on.

The fifth cross Angora is eligible, upon classification, for entry into the stud book. To be successful in a grading programme, it is essential that only pure bred bucks of good quality are used.

Where sheep are run on a property, Angoras can be added without necessitating any additional outlay in equipment. The Angora suffers from much the same diseases and parasites as sheep. It is drenched, shorn, and dipped in the same way, and with the same equipment. It requires the same type of fencing.

Mohair grows at about 2·5 cm a month and it is necessary to shear twice a year to obtain a length for manufacturing (about 14 cm). Shearing usually takes place in March and September.

Although this means extra handling, this is compensated for by the fact that Angoras do not suffer from fly strike and do not require crutching.

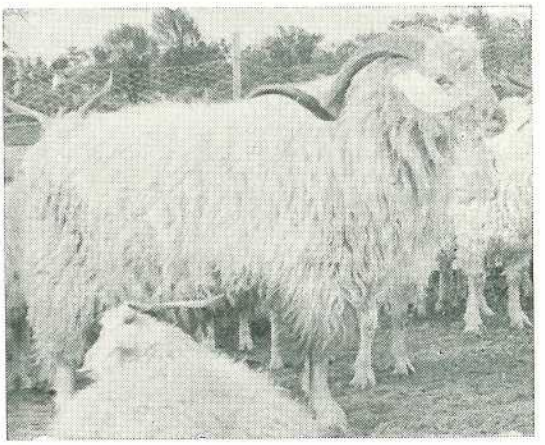


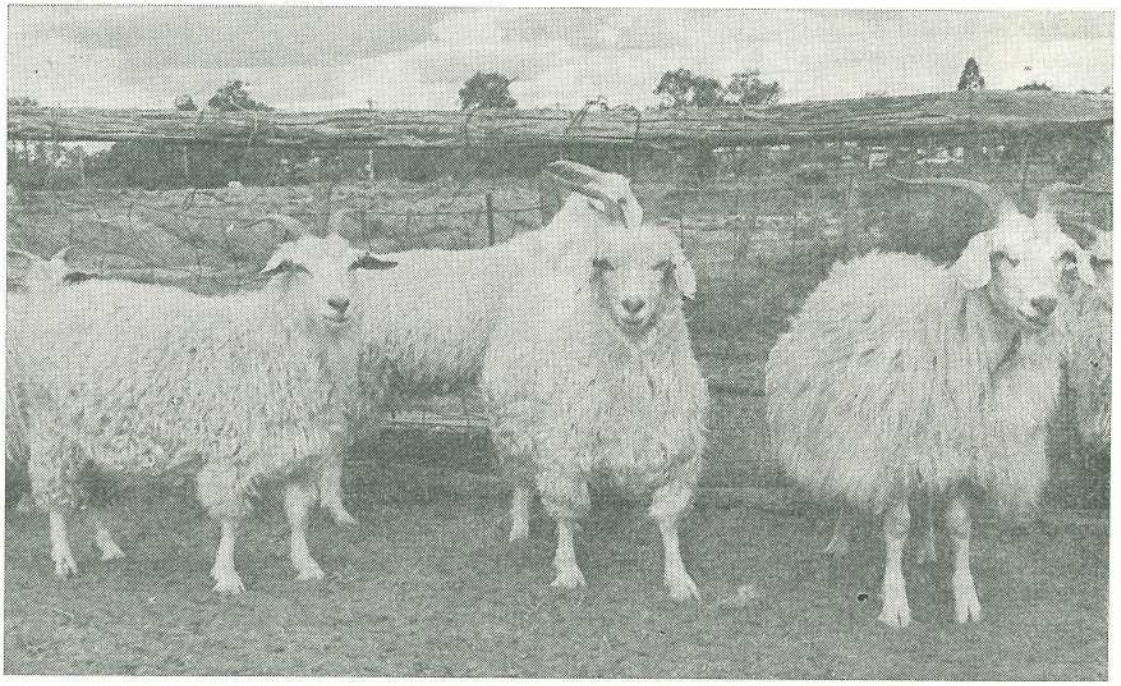
Three pure bred Angora females.

As mohair does not contain as much grease as wool it may be necessary to run the stand at reduced speed, or place the handpiece in a container of oil and kerosene between goats, to prevent the cutters overheating. This applies particularly to the slower shearer.

Lustre, handle, and warmth in relation to weight are the characteristics which separate mohair from other fibres. Mohair is often used in blends with wool and other fibres in fabrics to improve their appearance. Its uses include men's suiting, furnishing, rugs, upholstery, hosiery, etc. It is very popular with

Pure Angora buck.





Two pure bred females on left with a second cross wether on right.

home spinners for producing special effects. True mohair is always white.

The average female Angora will cut about 1 kg of mohair annually as a kid, 1·5 kg as a young goat, and 2 to 3 kg as an adult. The value of the mohair varies depending on quality, degree of kemp, vegetable matter content, etc. Mohair, like wool, is a fibre that varies in price from time to time. Taking the foregoing into consideration the following estimates of the price of locally grown mohair have been supplied by J. L. McGregor Pty. Ltd. of South Geelong, Victoria.

Description	Cents/kg
Kids according to quality, &c.	200–380
1st to 2nd year fine young goats	140–250
Coarse young goats	120–200
Fine adults	100–220
Medium to coarse adults	80–180
Light to medium kemp content	66–120
Medium to heavy kemp content	55– 88
Burry and kempy for carbonising	44–100
Light stain adult mohair	60–100
Color free	50– 80
Coloured, kempy and burry	40– 66

There is a ready market for Australian mohair. The majority of Australian grown mohair is sold to J. L. McGregor Pty. Ltd. of South Geelong, or through Mohair Traders Australia, of Clare, South Australia. Bale lots may be sold direct to Bradford Woollen Mills, England.

An established world demand exists for mohair. Approximately 15¼ million kg of mohair is produced each year throughout the world. South Africa produces about 4¼ million kg and is the world's largest exporter of the fibre. Turkey produces 4½ million kg which is principally used for domestic consumption. 4½ million kg is produced in Texas, with Lesotho producing slightly under 1 million kg, and lesser producing countries supplying a total of 1 million kg. Australia produces approximately 15 000 kg of mohair a year and imports $7½ million worth of mohair a year for the textile industry.

Although there are some Angoras of outstanding quality in Australia the average quality is below that of stud stock in South Africa and

Texas. One of the main faults found in Australian Angoras is an excess of kemp.

Kemp is a coarse, hair like fibre found mainly on the thighs and back, and sometimes spread throughout the fleece. The presence of kemp greatly reduces the value of mohair and should be carefully guarded against in the selection of bucks.

The average weight of mohair cut from Australian Angoras is lower than that cut from Angoras in South Africa and Texas. It is hoped that with the establishment of a quarantine island, sires may be imported from these countries to expedite the development of the mohair industry.

The Angora is not seen as a substitute for sheep, or as the answer to falling farm incomes. Where suitable conditions exist, the Angora can play its part in maintaining farm profitability.

Further information regarding Angoras may be obtained from the President of the Angora Mohair Association of Australia, Border Regional Committee, Mr. Dale Pukallus, M/S 1889, Dalby or the Secretary, Miss Gwenda Batterham, Carbean, Karara, 4370.

Avoid Shrinkage Cracking in Concrete Dips

PRODUCERS building concrete plunge cattle dips in hot weather will need to take appropriate measures to avoid plastic shrinkage cracking.

This is the advice given by Mr. J. Kearnan, Cattle Tick Control Extension Officer, in the Department of Primary Industries.

This cracking sometimes occurs in the surface of fresh concrete soon after it has been poured. It is caused by rapid evaporation of moisture from the concrete surface.

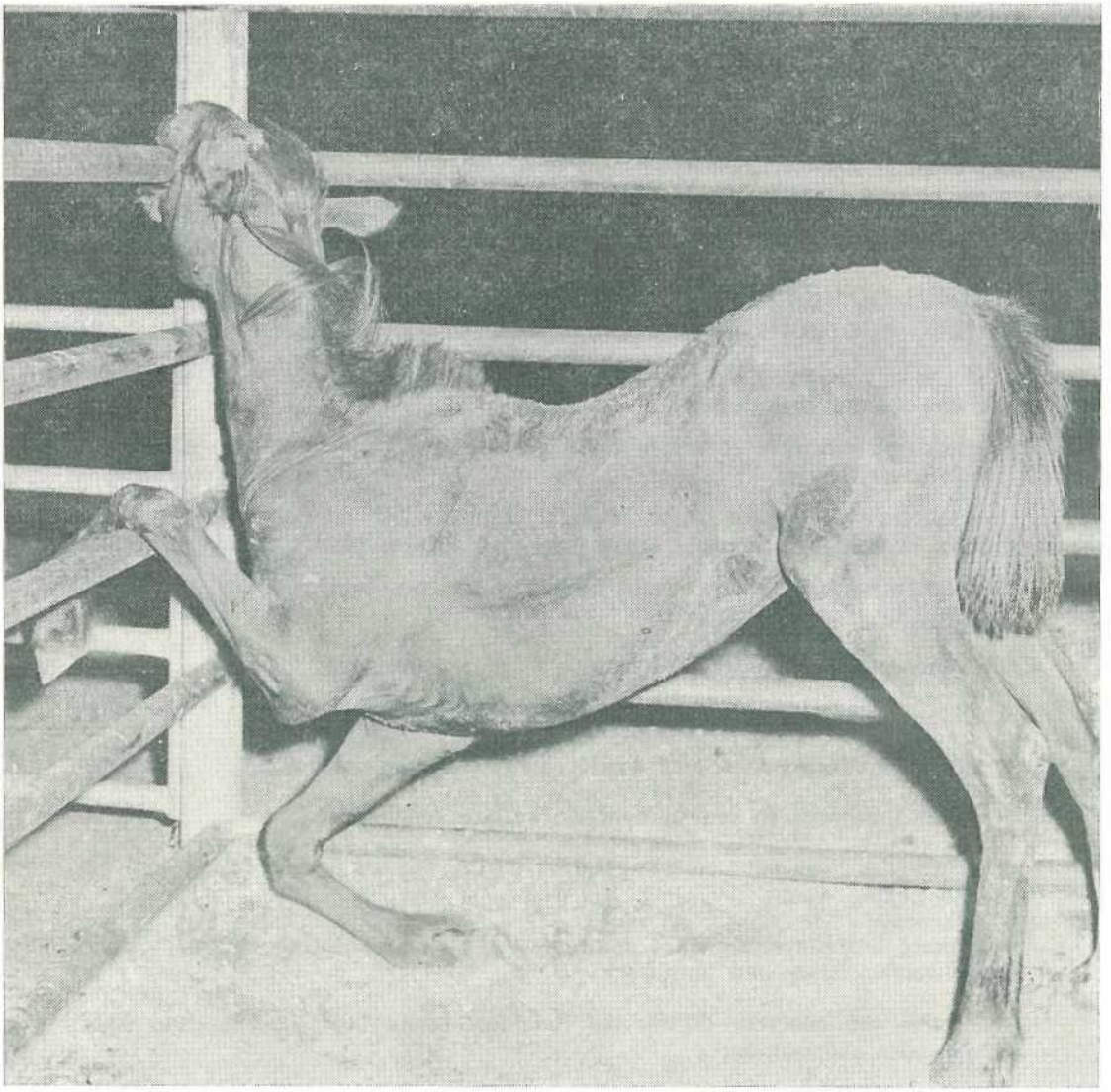
High concrete temperatures, high air temperatures, low humidity and high winds are the conditions, he said, which can increase the possibility of plastic shrinkage cracking.

Mr. Kearnan said producers could eliminate the possibility of this type of cracking occurring by taking these precautions:—

- Dampen the sub grade and forms;
- Dampen the aggregates if they are dry and absorptive;
- Erect windbreaks to reduce wind velocity over the concrete;
- Erect sunshades to reduce concrete surface temperatures;
- Lower the fresh concrete temperature during hot weather by using cool aggregates and mixing water;
- Protect the concrete with temporary wet coverings during any appreciable delay between pouring and finishing;
- Protect the concrete during the first few hours after pouring and finishing to minimize evaporation;
- Hand spraying water onto the concrete surface is effective to prevent evaporation.

Mr. Kearnan said that these precautions have been recommended by the Concrete and Cement Association of Australia.

Horse owners in Northern Australia can save valuable animals by keeping them away from the poisonous plant that causes Kimberley horse disease.

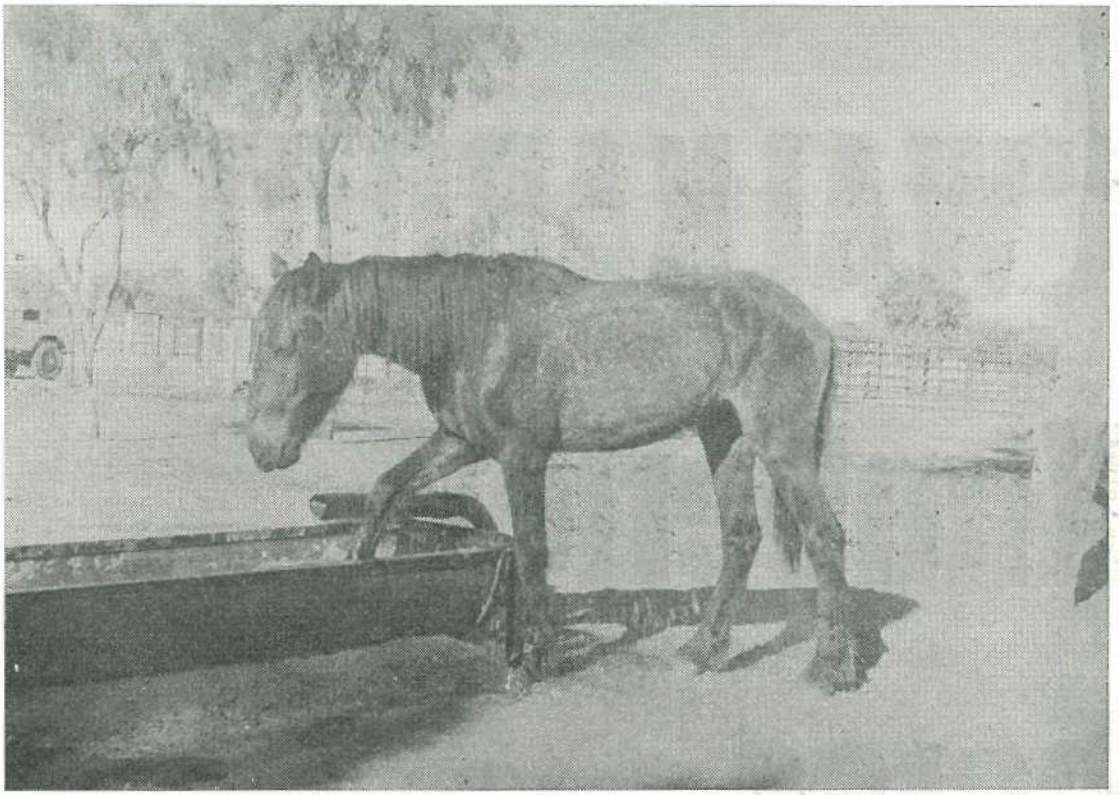


"WALKABOUT" Kimberley horse disease

by M. J. DEVER,
Inspector of Stock,
Biloela.

WALKABOUT was once thought to be caused by eating the leaves of the white-wood tree, but intensive research revealed that it was caused by ingesting species of Crotalaria, the commonest ones being *Crotalaria retusa* (wedge-leaf rattle pod) and *Crotalaria crispata.*

While several species are involved, the above 2 are most commonly implicated. Crotalaria species grow extensively in the far north, generally along river banks and flood plains. It grows most abundantly on alluvial soils subjected to flooding, particularly early in the wet season.



Horses affected with "Walkabout" may stumble or walk into objects and frequently show inco-ordination and often die of misadventure.

(photos by courtesy of the Northern Territory Administration)

The young stages of the plant seem attractive to horses and these are generally eaten during the early half of the "wet" (November to January), but the peculiar walking symptom does not usually develop for some months, or *even a year after the plant is eaten.*

For this reason it is difficult at times to connect the plant with the symptoms. It has been known for horses to be shifted from a *Crotalaria retusa* infested paddock when symptoms developed, and to continue to show symptoms in a paddock free of the plant.

In a particular experiment carried out in the Northern Territory it took two seasons to produce the disease in a mob of horses being fed *Crotalaria retusa.* However in some field cases, consumption of the plant over a period of 3 or 4 weeks leads to death in about 3 months.

Symptoms

The first sign is usually some loss of weight, but this is not as rapid or extreme as it is in Birdsville disease.

The main symptoms of this disease are depression, yawning, slow aimless walking, hence the common name "Walkabout disease". Affected horses frequently show inco-ordination of gait and may stumble into logs, fences or creeks. They may walk straight into solid objects or into a water hole and drown. Affected horses are reluctant to lie down because they have difficulty in rising.

They are also inclined to be irritable and may develop a depraved appetite. If the animal is suddenly startled, it may have a convulsion. Death usually occurs a few days after the first symptoms appear, and often results from misadventure.

Post Mortem findings

The toxic factor in the plant is a pyrrolizidine alkaloid and at post mortem the liver is always found to be affected. In long standing cases it is small and tough and dark with numerous pale spots giving it a mottled appearance. Microscopic examination of liver sections is able to confirm a clinical diagnosis.

Prevention

The disease is always fatal, so that it is necessary to keep horses away from the plant, particularly for the first half of the "wet". If the disease is a problem on a property, special horse paddocks may have to be built away from the areas where the plant normally grows.

This disease can at times be mistaken and confused with Birdsville disease which is caused by the ingestion of the plant Birdsville Indigo (*Indigophera dominii*).

Crotalaria retusa—commonly referred to as the wedge leaf rattle pod. It causes "Walkabout" in horses and grows abundantly in north Queensland on alluvial soils subject to flooding.

BIRDSVILLE HORSE DISEASE

Many properties in Western Queensland experience difficulty at times in keeping a work force of horses due to Birdsville disease.

This disease is caused by the ingestion of the plant *Indigofera dominii* (formerly known as *Indigofera enneaphylla*), commonly called Birdsville Indigo. The disease also occurs in Western Australia and the Northern Territory, while the plant is a native of India.

Birdsville Indigo is usually a flat spreading plant with central taproot and numerous thin branched, woody stems, usually prostrate and forming a mat. The leaves are alternate and most parts of the plant are covered with short, flat, grey hairs, making them appear grey-green in colour. However the plant can grow up to 30–45 cm in height.

The plant prefers sandy soils and is often evident around water holes. Despite its wide-spread distribution, poisoning of horses occurs only in arid and semi-arid areas. Depressions in "spinifex" country provide good conditions for this plant.

Horses usually have to be grazing on the plant for at least two weeks, before any effect is noticed. Therefore horses travelling through an area are usually not affected i.e. droving plants.

The plant has amazing recuperative powers and is often the first plant to respond after rain and it is this new growth which is so dangerous, although the dry plant will still cause the disease but takes a longer course.

Symptoms

Affected horses become dull and show progressive inco-ordination of gait, particularly in the hindquarters, often with dragging of the hind feet and wearing of the anterior surface of the hooves. When driven there is often sudden loss of hindquarter control, followed by collapse.

An affected horse is reluctant to move and stands with its legs apart. Some horses spin about the front feet in tight circles. An affected horse frequently lies down, but with persistence can struggle to its feet. Some

Indigophera dominii—known as Birdsville Indigo or Nine-Leaved Indigo, it causes Birdsville horse disease in western Queensland.

animals show trembling and twitching of any or all the muscles of the head, body and limbs.

Chronic cases are typified by dragging of the toes of hind limbs, while stumbling is often associated with exercise. Chronic cases probably result from the grazing of small amounts of the plant over a longer period.

Post mortem findings

No abnormalities or changes are noticed on post mortem examination.

Prevention

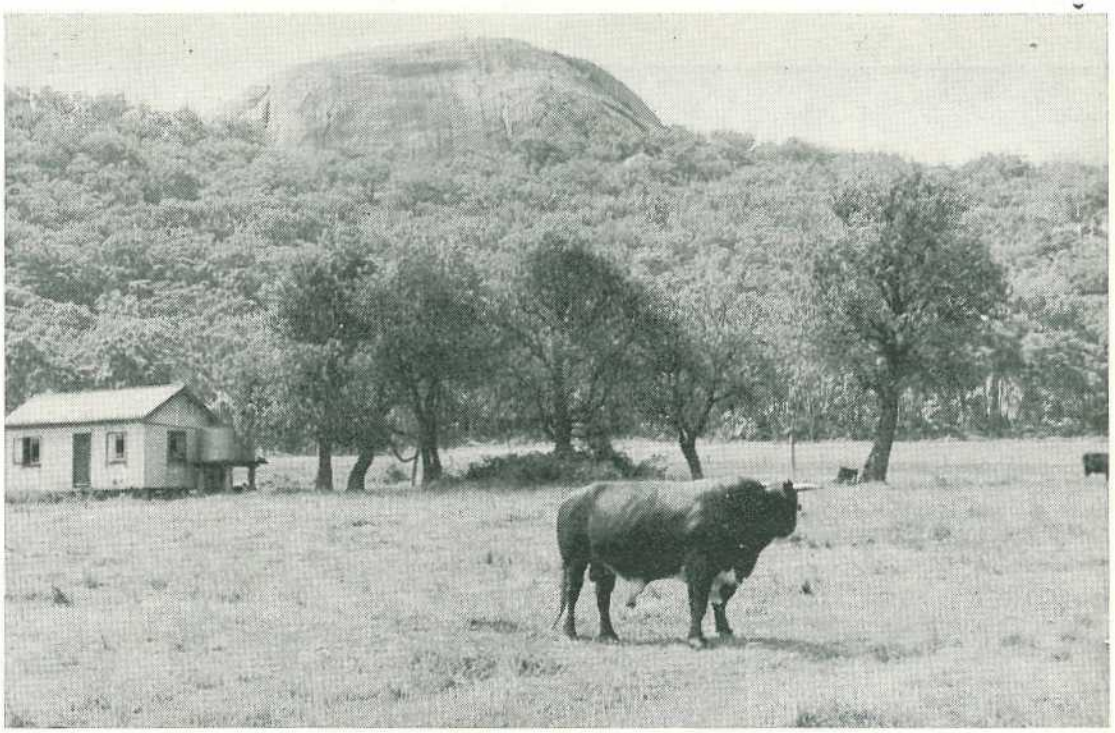
The best prevention is to remove horses from the area where Birdsville Indigo is growing and horse paddocks should be situated in areas free of this plant.

It has been claimed that affected paddocks can be rendered safe by grazing with sheep.

Trials have been carried out in the Northern Territory which show that feed supplemented with either peanut meal or gelatin does have a protective effect. Symptoms are thought to be due to an arginine deficiency.

The following table shows the main differences between Kimberley horse disease and Birdsville horse disease.

—	KIMBERLEY DISEASE	BIRDSVILLE DISEASE
Cause	*Crotalaria* species, especially *retusa* and *crispata*.	*Indigofera dominii*
Description	All have pea-shaped flowers and ripe seeds rattle when pods are shaken	Grows up to 30–45 cm in height with 5–9 alternate leaflets—Flowers are small and red
Symptoms	Slow aimless walking reluctant to lie down and will have difficulty in rising	Reluctance to move. Frequently lies down and with persistence can struggle to its feet
	Irritability, depraved appetite and yawning	Not found
	Sudden startling of animal may cause fits	Trembling and twitching of muscles after forced gallop, may show fits
	Walks into objects, buildings, &c.	Not found
	Not found	Typical inco-ordination of hind quarters with dragging of hooves of the hind feet
	Walks or leans against obstruction	Stands with legs apart
Chronic type	" Walkabout " symptoms with progressive and extreme emaciation over a period of weeks	" Toe-dragging " of hind limbs and tendency to stumble and fall without warning when ridden or exercised
Recoveries	Few if any animals completely recover	Complete recoveries of mild cases do occur
Post Mortem	Affected liver, usually reduced in size, and dark with numerous pale spots giving it a mottled appearance	No changes

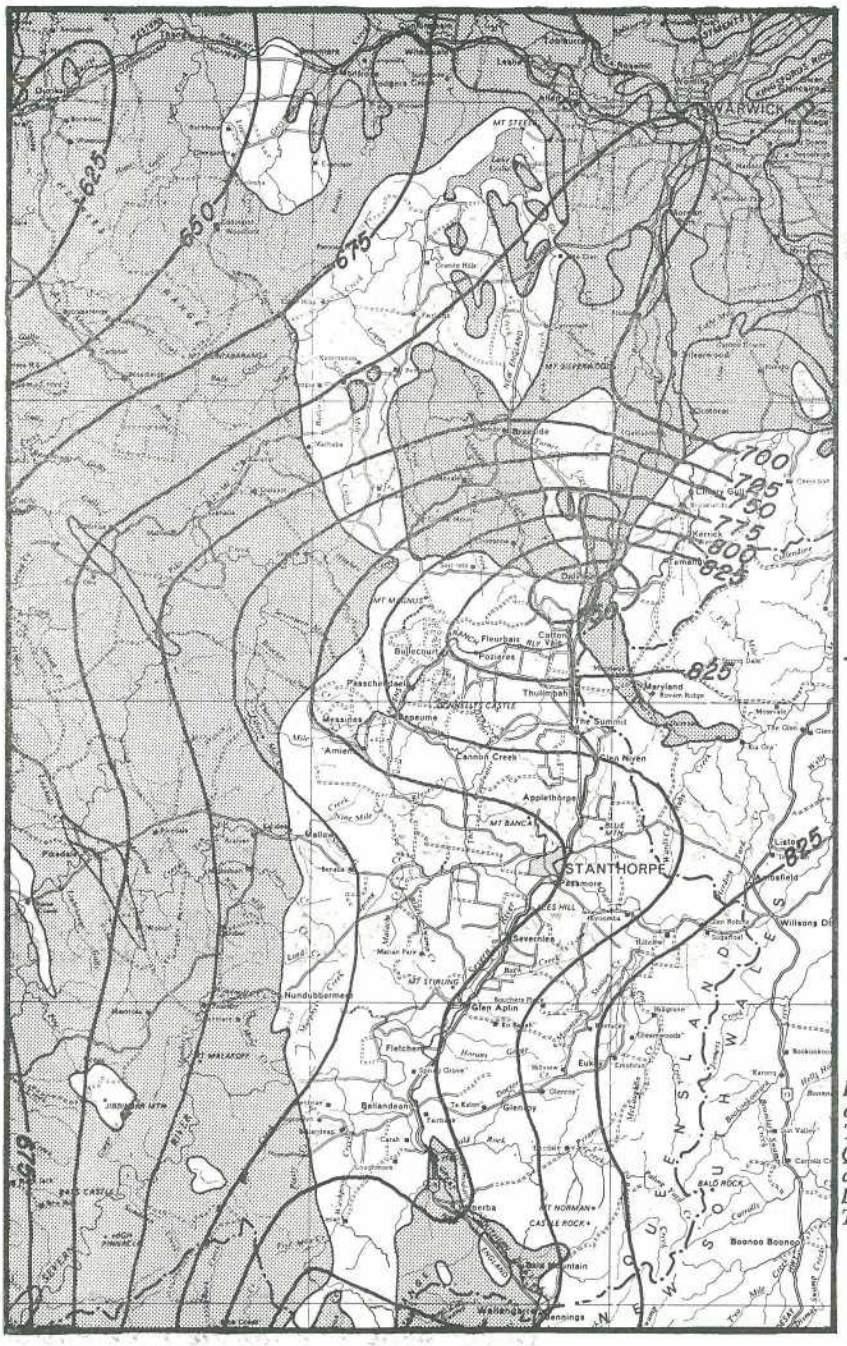


Pasture and Fodder crops for the Granite Belt

Above: Steep rough land with narrow valley floors at Wyberba.

by I. F. SWANN,
Agriculture Branch.

THE GRANITE BELT of south-east Queensland is a northern extension of the New England Tableland of New South Wales.



SCALE 1:500 000

10 5 0 10 km

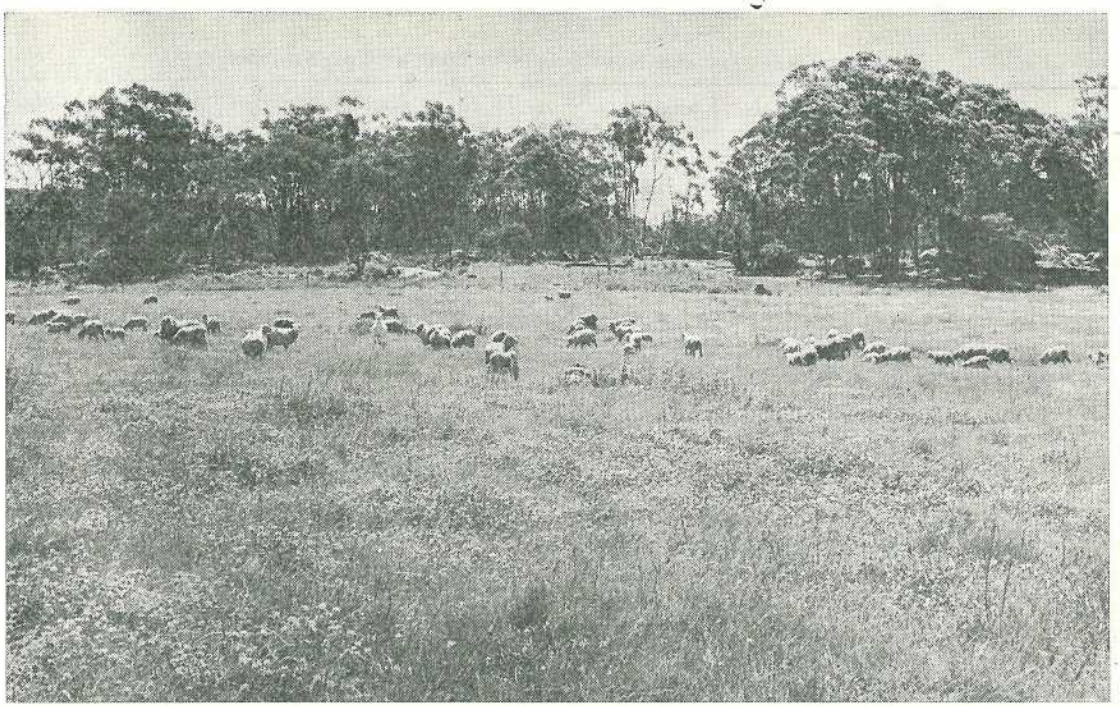
LEGEND

70 Isohyets (mm) 30 year mean.

Permian – Triassic Granite

Non-Granitic Areas.

Base map, isohyets and geolog extracted from The Granite an Traprock Area of South Eas Queensland – A Land Inventor and Land Utilisation Study Division of Land Utilisatio Technical Bulletin, in preparation



Improved pasture on undulating land at Mt. Tully.

It is best known as the State's main temperate fruit area and is an important vegetable producing district. The major pastoral industry is fine wool production but sheep breeding, fat lambs and beef cattle have become important with the introduction of pasture improvement.

The total area is about 105 000 hectares, most of it within the Stanthorpe Shire with small areas in the Rosenthal and Glengallan Shires. Stanthorpe (population about 3 600) is the principal business centre.

Topography

Topography ranges from rugged mountainous to flat country, with a general elevation of 762 to 914 metres. Mt. Norman in the south-east (1267 m) is the highest point. Drainage is mainly westward into the Severn-McIntyre river system, but streams on the northern fringe flow into the Condamine system.

Climate

The Granite Belt is Queensland's coldest district. Light snow falls in most years. About once in 3 years falls several centimetres deep occur in the more elevated areas.

The frost-free period is approximately 180 days. The average occurrence of light frosts is from 10 April to 11 October, and heavy frosts from 1 May to 29 September. Summer temperatures are almost 2°C cooler than Warwick and almost 4°C cooler than Dalby.

Average annual rainfall on the eastern fringe is about 850 mm decreasing to about 700 mm in the west. Besides the higher rainfall the eastern areas have greater rainfall reliability in late summer, more wet days each month and are more prone to overcast weather and fog.

TABLE 1

AVERAGE RAINFALL AND NUMBER OF WET DAYS AT TWO STATIONS

—	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Year
GLEAMWOODS (Eukey)													
Rainfall (mm) ..	110	96	78	37	45	62	54	41	51	79	79	104	836
Wet Days ..	10	11	11	8	7	8	8	7	7	9	9	10	105
BENDEE (West of Granite Belt)													
Rainfall (mm) ..	98	76	55	31	40	51	43	36	45	77	74	93	719
Wet Days ..	8	8	6	4	5	6	5	5	5	7	6	8	73

Soils and Land Use

Dominant soils have coarse, sandy to sandy loam surface horizons, 20–60 cm deep, overlying sandy clay subsoils. Extensive areas of 'skeletal' soils also occur, especially in the mountainous southern region. These soils have coarse sandy surface horizons, 20 to 120 cm deep, overlying decomposing granite rock. All soils have low moisture holding capacity, particularly the shallow coarse sands. Rainfall penetration is rapid except on some old cultivations which develop surface crusting.

The soils are infertile, especially lacking in phosphorus, and nitrogen is quickly leached from most of them. Soil reaction is slightly to strongly acid, with a tendency to increasing acidity in old cultivation land.

The most suitable pasture soils are the deep sandy loams. In the wetter areas they support pastures based on white clover but where annual rainfall is below 750 mm they are better suited to lucerne. The shallow coarse sandy soils are the least favourable but they do play a useful role in the wetter areas (above 800 mm).

Soils are sometimes recognised by the dominant timber species present. A general outline of suitable pasture soils on this basis is as follows:—

HIGH RAINFALL ZONE (ABOVE 775 mm). Most clover based pastures are grown in this zone. The best pasture soils occur on the range top near the N.S.W. border and also on valley floors. Range top soils are indicated by manna gum (*Eucalyptus viminalis*) and the valley floor soils by New England peppermint (*Eucalyptus nova-anglica*).

The dominant vegetation on most other soils is New England blackbutt (*Eucalyptus andrewsii*). These soils range from good deep soils on some lower slopes to the coarse sandy soils on higher slopes which have little value.

Coarse sandy soils in the steep rocky country to the south of this zone often support tumbledown gum (*Eucalyptus dealbata*). These have little potential for pasture development.

LOWER RAINFALL ZONE (BELOW 775 mm). Clover based pastures in this zone are restricted to narrow strips along some valley floors. These wet areas are indicated by red gum (*Eucalyptus amplifolia*) and sometimes New England peppermint.

Lucerne based pasture is very successful on some soils but has failed on others. Soils that have proved suitable include those located south and west of Ballandean which feature fuzzy box (*Eucalyptus conica*) and some on the edge of the Granite Belt west of Dalveen which support a mixed forest with New England blackbutt common. As well, narrow-leaved ironbark (*Eucalyptus crebra*) which is dominant on granitic areas north of the main Granite Belt sometimes indicates good lucerne soils.

Shallow soils and those that become waterlogged are not suitable for lucerne, and some of the well drained soils may also be unsuitable. However, lucerne is worthy of at least trial sowings on all deep well drained soils.

The Role of Improved Pastures

Native pastures consist of summer growing grass species such as spear grasses (*Aristida sp.*), love grass (*Eragrostis leptostachya*), windmill grasses (*Chloris spp.*), and the spring growing wallaby grass (*Danthonia racemosa*). Carrying capacity and animal performance are limited by the short growing season and the low quality of mature growth.

Improved pastures have markedly increased carrying capacity (See table 2), and have allowed graziers to diversify from dry sheep to sheep and cattle breeding. The total area of improved pastures on the Granite Belt in 1973 was about 13 000 ha. Considerable potential for further development remains.

TABLE 2

STOCKING RATES ON PASTURE

—	Dry Sheep Equivalent Per Hectare	Approx. Cows + Calf $\left(\frac{DSE}{14}\right)$ Per Hectare
Native pasture (rung country)	1·2 to 2·5	not usually run
Good lucerne pasture ..	7	0·5
Good white clover pasture	10	0·7
Good irrigated pasture ..	35	2·5

Types of Improved Pastures

There is considerable variation in recommended pasture mixtures depending upon rainfall and soil type. Seven different mixtures are suggested in table 3.

Pastures for the High Rainfall Zone (Above 775 mm)

(a) *Clover-Temperate Grass Mixtures* are recommended for most pastures that are sown on prepared seed beds in the high-rainfall zone. White clover is the key component. When it grows vigorously and is well grazed

Native pasture on undulating land at Dalveen.

it supports a 'nitrogen cycle' which in turn promotes strong grass growth and eventually a grass dominant pasture.

Grass dominant pastures cannot be developed by this principle in the low-rainfall zone or on soils that dry out quickly because clover growth periods are too short. In these situations the introduced temperate grasses have little value.

Generally a mixture of white clover and fescue provides a suitable pasture. However, other species are often added to the basic mixture and may have advantages in certain situations. The most commonly used additional species are discussed below:—

Red clover may provide more grazing than white clover in the first year but it disappears within 1 to 3 years.

TABLE 3

PASTURE MIXTURES—EXAMPLES

Species	Cultivars (Varieties)	Mixture Number with Sowing Rate kg/ha						
		1	2	3	4	5	6	7
White Clover (*Trifolium repens*)	Louisiana, Grasslands Huia or Ladino	2	2	3	2	..	1	1
Red Clover (*Trifolium pratense*)	Grasslands Turoa	1	..	1	..	..	1	..
Subterrannean Clover (*Trifolium subterraneum*)	Geraldton or Woogenellup ..	..	..	..	..	..	2	..
Lucerne (*Medicago sativa*) ..	Hunter River	..	..	..	4	3–6	..	..
Medic (*Medicago truncatula*) ..	Jemalong	..	..	..	·5	1	..	..
Fescue (*Festuca arundinacea*) ..	Demeter, Oregon or Tall ..	4	4	2	3	..	3	..
Phalaris (*Phalaris tuberosa*) ..	Australian	..	..	2	..	..	..	..
Cocksfoot (*Dactylis glomerata*)	Currie or Brignoles	..	..	2	..	..	..	..
Ryegrass (*Lolium perenne*) ..	Kangaroo Valley	2	..	4	1	..	2	..
Total Seed (kg/ha) ..		9	6	14	10·5	4–7	9	1

SUGGESTED SITUATIONS FOR VARIOUS PASTURE MIXTURES

Mixture	Rainfall Zone	Land
1. (Standard Mixture)	Above 775 mm	Fine-medium deep soil. Flat wet areas
	Above 800 mm	Medium-coarse soils
2. (Low Rate Mixture)	As for 1	As for 1
3. (High Rate Mixture)	Above 800 mm and irrigation	Use on the better pasture soils
4. (Lucerne + temperate)	Above 775 mm	Mixed patches of well drained soil and wet land
5. (Lucerne)	Below 800 mm	Deep, well drained soils that are known to suit lucerne
6. (Marginal mixture)	700–775 mm	Suggested as a trial mixture for areas that are too dry for white clover and unsuitable for lucerne
7. (Oversown clover)	Above 800 mm	Undulating shallow rocky soils
	Above 775 mm	Fine-medium soils. Flat, wetter areas

Perennial ryegrass produces more than fescue in the first year but is usually lost within 2 or 3 years. It persists better under irrigation where it probably produces more and better grazing than fescue. Ryegrass should be included in all irrigated pastures but not as the sole grass species except for very short term pasture. (*Note.* The annual Wimmera ryegrass should not be used in this type of pasture.)

Cocksfoot is as productive as fescue on the better soils but it is less reliable under harder conditions. It can be included in the better dryland situations and in irrigation mixtures.

Phalaris is a very good grass in favoured situations but its performance on the Granite Belt has been erratic. It can be included in irrigation mixtures on those dryland soils where it is known to grow well.

Mixture 1 (Table 3) suggests a fairly standard sowing rate of grass at 6 kg/ha and clover at 3 kg/ha. For the sake of economy the red clover and ryegrass may be deleted (Mixture 2) without loss of production after the first year. Pastures have been successfully established with fescue at only 2 kg/ha, but this rate is too low when germination conditions are marginal. If white clover is growing naturally on an area the seeding rate for clover can be reduced to 0·5 kg/ha of an improved strain.

Heavier seeding rates, especially for grasses, give more reliable and faster pasture establishment and should be used whenever costs permit. In some pastures fescue is sown at 8 to 10 kg/ha (plus clover), or a mixture of grasses such as mixture 3 is used.

(*b*) *Oversown White Clover* (*Mixture* 7). Clover can be established in the high-rainfall zone by oversowing clover seed with superphosphate (but not mixed) into native grass. This method has a place on land that does not warrant preparation for mixed pasture.

Because it is cheap and profitable, pasture development with oversown clover is sometimes used on land that is suitable for mixed pasture. However, it is better to use clover-temperate grass mixtures on suitable land because grass "burns off" less than clover in dry periods and therefore less feed is wasted; as well there is less danger of stock losses through bloat. Oversown clover should not be used on areas intended for mixed pasture in the near future; it is much more difficult to introduce temperate grasses into established clover than into native grass.

The chances of a good establishment with oversown clover are probably less than one in three, so repeat sowings may be necessary. If there is some natural clover on an area, or if a thin stand is obtained from oversowing, it will thicken up when fertilized annually. It may take 2 to 3 years to get a good clover sward.

Subterranean clover has been included successfully with white clover at Wallangarra; it is inexpensive and is worth a trial at light rates.

In the low-rainfall zone oversowing is less reliable. If it is used more reliance should be placed on medic (Jemalong) than on the clovers.

Pastures for the Lower Rainfall Zone (Below 775 mm)

Lucerne is the main pasture on the drier areas, but it is only suited to the deeper, well drained soils. Since much of the lucerne environment is too dry for temperate grass the native grasses are often relied upon to form a mixture with lucerne.

Lucerne–Clover–Temperate Grass Mixture (*Mixture No. 4*) is common in the Severnlea area in paddocks containing mixed soil types. The better drained soils support lucerne while the wet areas are better suited to clover. Fescue is the predominant grass because it is adapted to both types of land.

Lucerne (*Mixture No. 5*) pastures are grown on suitable soils below 800 mm rainfall. A light rate of medic (Jemalong) is included with the lucerne as standard procedure. It is adapted to similar soil and climatic conditions and is a fair legume alternative after the lucerne dies out.

The expected life of a lucerne pasture is 4 to 8 years. Good persistence depends largely upon correct fertilizer treatment. Replant lucerne stands are generally more difficult to establish and are less productive than the original stand. Nematode build-up in the soil could be one of the reasons for this.

Corrective measures for the "replant problem" have not yet been determined, but tentative suggestions are:—maintain a medic-native grass pasture for a few years after the lucerne dies out and grow one or two annual grazing crops or soybeans before replanting lucerne. Old cultivations can also present lucerne establishment problems because of increased perennial weeds and decreased fertility.

Subterranean Clover–Temperate Grass Mixture (Mixture 6)

Subterranean based pastures have shown some promise on areas that are too dry for white clover and unsuitable for lucerne. These pastures are based mainly on subterranean clover, fescue and Kangaroo Valley ryegrass, with less emphasis on white clover.

Other Pasture Species

In addition to the common mixtures, a wide range of species is grown in particular situations. Some of these are mentioned briefly here:—

Grasses

Paspalum (*Paspalum dilatatum*) seed is not often sown but it volunteers in areas that suit it, usually the damp flat areas. It makes good summer growth and provides fair dry feed during winter.

Kikuyu (*Pennisetum clandestinum*) grows best on the medium textured soils in the high rainfall zone but seems better adapted to the drier slopes than paspalum. It is a summer species but provides fair winter grazing if spelled in autumn. It must grow with good clover or receive nitrogenous fertilizer to be highly productive.

In the past it has been planted by runners and this has restricted its use to waterways and other selected areas. The recent introduction of commercial seed (cultivars Whittet and Breakwell) may lead to larger areas of kikuyu. Early impressions are that kikuyu seed may be best included in spring or March sown pastures. Rates of 0·25 to 0·5 kg/ha are sufficient where a slow rate of establishment is acceptable.

Ronpha grass (*Phalaris tuberosa* x *P. arundinacea*) is used in marshy situations and is very productive in winter and spring. It is planted by runners.

Yorkshire fog (*Holcus lanatus*) is a winter grass that has become naturalised in wet gullies. It is sometimes regarded as an aggressive unpalatable weed.

Prairie grass (*Bromus unioloides*) cv. Priebe is a vigorous and palatable winter grass best suited to land that has been growing vigorous pasture and has built up a mulch on the surface.

Annual ryegrass cv. Wimmera is suited to more marginal areas. It requires renovation every 1 or 2 years to stimulate growth, consequently it often becomes a weed in winter crops.

Legumes. Lotus major (*Lotus pedunculatus*) is an excellent summer legume for marshy areas. Seed is oversown along the edges of swamps at 0·5 to 2 kg/ha.

A similar species (*L. hispidus*) is naturalised on well drained orchard country at The Summit and is highly productive. It is killed by heavy frosts but the hayed off material provides good grazing.

Strawberry clover (*Trifolium fragiferum*) is a winter legume that sometimes grows well along the edges of swamps.

Rose clover (*T. Hirtum* cvv. Hykon, Sirint, Kondinin), is an annual winter legume which seeds heavily. It is slow to establish but is showing some promise in the marginal clover rainfall zone.

Kenya white clover (*T. semipilosum*) is under trial as an alternative to white clover in marginal rainfall areas.

Ball clover (*T. glomeratum*) is an annual which occurs naturally in some areas and is very useful during favourable late winter-spring seasons. A light rate (1 kg/ha) could be included in mixtures.

Pasture Nutrition

D.P.I. and C.S.I.R.O. trials as well as commercial experience on the Granite Belt show that the major fertilizer requirements for lucerne are phosphorus, calcium and sulphur. Clover gives major responses to phosphorus and sulphur and sometimes a fair response to calcium, copper and potassium.

Phosphorus. The optimum superphosphate rate for lucerne has been shown as 500 kg/ha at planting with annual applications of 180 kg/ha. An alternative programme of 250 kg/ha at sowing and in each subsequent year supports an equally persistent but less productive pasture.

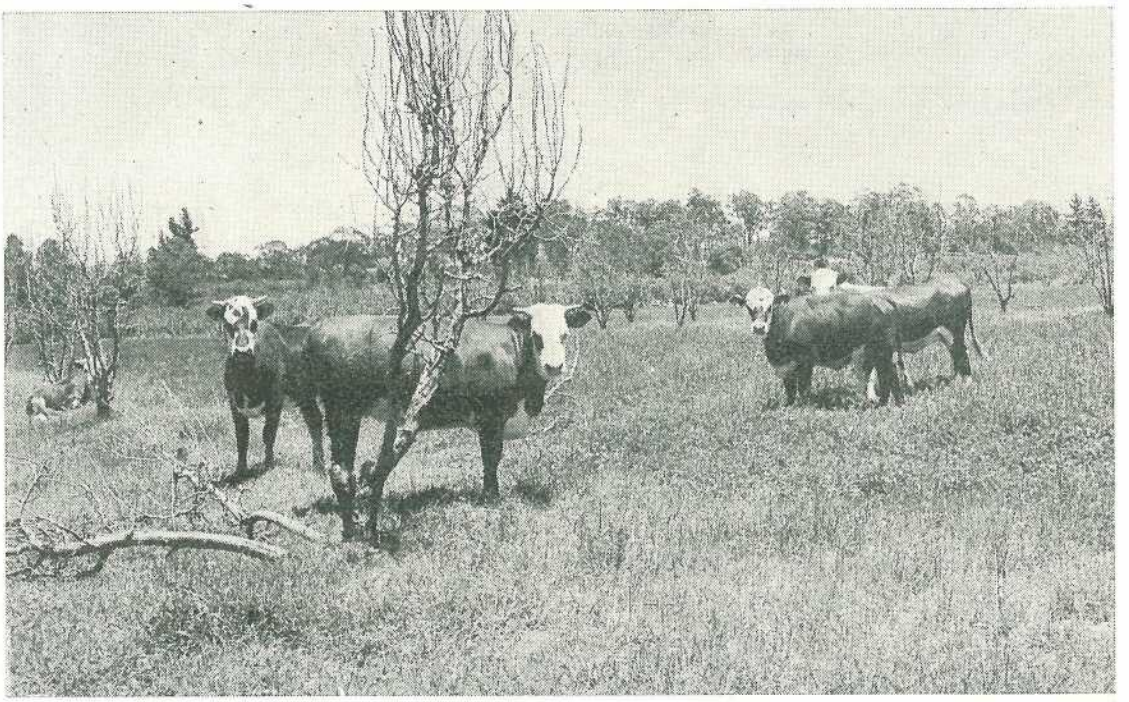
Clover requirement is probably similar to that of lucerne but periods of deficiency do not have the same permanent adverse effect, therefore fertilizer programmes can be more flexible. It is usual to apply a total of 750 kg/ha within the first three years to create a 'phosphorus bank'. Some good clover pastures have been established with annual applications of 125 kg/ha but these pastures take several years to become fully productive.

Molybdenum responses have not been demonstrated in the field but this element is essential for effective legume growth and is therefore included as a low cost precaution. It is applied in the superphosphate or with lime pellets on seed. Repeat applications are required every 5 to 6 years.

Agricultural lime increases the life and productivity of lucerne by supplying calcium and reducing soil acidity. When applied broadcast before sowing, rates of 1 to 2 tonnes/ha are usual. An alternative method is to sow lucerne with a seed drill and apply lime at 250 kg/ha down the same tubes as the lucerne seed. Clover based pastures have a lower lime requirement than lucerne but broadcast applications of 250 to 500 kg/ha are sometimes required.

Nitrogen response is normal in grasses but because of the high cost it is restricted to strategic situations such as grass stimulation during the first year. It can be applied by top dressing the pasture during spring with ammonium nitrate at 100 kg/ha, urea at 74 kg/ha, or ammonium sulphate at 155 kg/ha.

Potassium is commonly deficient on old cultivations and occasionally on new ground. Responses may take 8 to 12 months to become obvious. Potassium applications may be required at about 4-year intervals. Suggested



Pasture established in disused orchard at The Summit.

trial rate is 60 to 125 kg/ha of muriate of potash.

Sulphur is present as a bonus in superphosphate (10%) and ammonium sulphate (24%). Sulphur-fortified superphosphate 26% sulphur) and dump gypsum (16% sulphur) are cheaper forms of sulphur but at present are available only in bulk. They should only be used as a source of sulphur when the soil phosphorus level is raised to about 35 p.p.m. through using ordinary superphosphate. Lucerne in the drier areas requires about 10 kg/ha of sulphur each year, but both clover and lucerne in the higher rainfall areas may require 25 kg/ha.

TABLE 4

GENERAL FERTILIZER RECOMMENDATIONS

Type of Pasture	At Sowing	Annual Maintenance
Lucerne	Mo12 Super—500 kg/ha	Super—180 kg/ha
	or Mo24 Super—250 kg/ha	Super—250 kg/ha
	Agricultural Lime—250 kg/ha if drilled with seed,	Not usual
	or Broadcast 1 000–2 000 kg/ha ..	Not usual
White Clover—Temperate Grass Mixture	Mo12 Super—500 kg/ha	Super 250 kg/ha until clover is satisfactory, then reduce to 125 kg/ha
	or Mo24 Super—250 kg/ha	
	Ammonium Nitrate (optional—see notes) —100 kg/ha	Ammonium Nitrate (see notes)—100 kg/ha
White Clover (Oversown)	Mo24 Super—250 kg/ha	Super 250 kg/ha. Reduce to 125 kg/ha when clover growth satisfactory
	Repeat Sowing—Super 125 kg/ha	
All Pastures	Muriate of Potash—125 kg/ha (Sometimes required on old cultivations—see notes)	Expect repeat applications about 4 years apart

Super = Standard superphosphate (9·6% P).
Mo Super = Molybdenised superphosphate.

Soil Analysis

Soil analysis indicates some fertilizer requirements but it is not a precise guide.

Results of soil analysis performed by the Department of Primary Industries are interpreted for Granite Belt pastures as follows:—

PHOSPHORUS (*Dilute Acid Extractable Test*)

Soil Phosphorus (p.p.m.P)	Recommended Rate of Superphosphate at Planting
Below 15—Low	500 kg/ha
15 to 35—Moderate ..	250 to 500 kg/ha
Above 35—High	125 kg/ha

Potassium

Replaceable Potassium (m.e.% K)	Muriate of Potash at 125 kg/ha
Below 0·15 m.e.% K (60 ppm)—very low	Fertilize at planting
0·15 to 0·20 m.e.%K (60–80 ppm)—low	Apply trial strips at planting

p.H (*Reaction, acidity or alkalinity*)

Below 5·0. very strongly acid—unsuitable for lucerne.
5·0 to 5·5, strongly acid—doubtful for lucerne.
Above 5·5, higher reactions are increasingly suitable for lucerne.

Advice on soil sampling procedure should be sought from the Department of Primary Industries, or commercial firms that are involved with soil testing.

Land Preparation

Timber treatment

The most common approach is to clear all timber except for shelter strips. Advocates of this method contend that it reduces the problem of timber seedling regeneration. The alternative is to retain a parkland appearance with up to 25 trees/ha. There are examples of good pasture under both methods. Local experience with timber and soil types may be the best guide. The stringybarks, New England blackbutt and manna gum appear to present fewer seedling problems than peppermint, most gums and box trees.

Mechanical clearing is usual on arable land. Most areas are bulldozed but pulling is used to some extent. Timber is sometimes poisoned one to two years before it is cleared. On non arable land it is usual to ringbark the large trees and poison the small ones (mainly with "Tordon" products). However, some species such as New England peppermint tend to sucker after ringbarking and these should be poisoned irrespective of size. Total ringbarking is used for some paddocks but there is danger of severe regrowth after this treatment.

Ringbarking is usually cheaper than poisoning for the initial treatment but higher costs for follow up treatments make it more expensive as a long term control.

Seedbed Preparation

Pastures on the Granite Belt need a firm shallow seedbed with ample soil moisture. The required seedbed is easily prepared on most soils but it is difficult to make the coarse sands sufficiently firm. These may require several shallow workings and rolling or trampling with sheep.

Two or three cultivations are sufficient on most new land but more and deeper cultivation is necessary on old paddocks where perennial weeds are established. Sod seeding with a seed-box mounted on a chisel plough, and sowing after a single cultivation, have both been used successfully in native pasture. However, the seedbeds which receive only minimum preparation are more dependent upon rain for emergence than the better prepared seedbeds.

Before clover is oversown into native pasture green trees and shrubs must be controlled to allow good pasture growth. Bracken fern (*Pteridium aquilinum*) and blady grass (*Imperata cylindrica*) patches can be tolerated because clover will establish in these patches.

The most suitable conditions for oversown clover require a moderate cover of dry grass, good soil moisture and early winter sowing.

Planting Time

Suitable planting times are as follows:—

Lucerne—Late March to early May.

Clover-Temperate Grass—(*a*) Late March to late May. (b) Late July-August.

Oversown Clover—Late April, May, June.

[*Note.* Lucerne is sometimes planted in late winter or spring but it is subject to severe weed competition. Clover and temperate grass may be sown in late July and August but the earlier planting is preferred.]

Sowing Methods

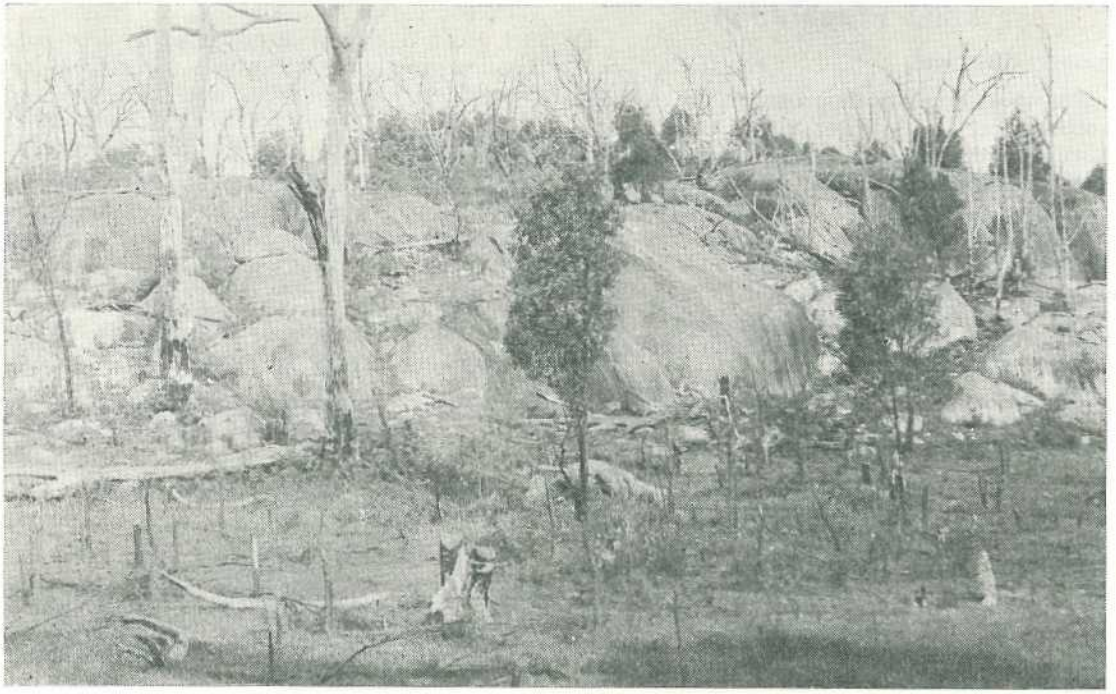
On cultivated seedbeds drill clover and grass seed 1 to 2 cm deep; lucerne may be sown to 3 cm. Follow sowing with light harrows. Alternatively seed may be broadcast and then covered by harrows.

Shallow sowing into a moist seedbed allows pasture seed to germinate but rain after sowing improves emergence. Rolling after sowing also improves emergence. It is more difficult to firm the soil after sod seeding and therefore emergence is less reliable.

Cover Crops

Cover crops give the young pasture some protection against heavy frost and provide a useful light grazing before the pasture becomes productive. A disadvantage is competition to the young pasture if dry weather follows sowing. Cover crops appear acceptable with autumn sown pasture but should not be used with spring sowing. Some precautions must be taken if they are used:—

- sow the cover crop (oats, barley or wheat) at less than 20 kg/ha. Golden Tares and field peas are not recommended because of their smothering effect.



Steep rocky land cleared for pasture in high rainfall country at Eukey.

- do not increase sowing depth of the pasture to suit the cover crop; either sow the cover crop separately to the pasture or at the pasture sowing depth.

Pasture Management

Grazing

Ideally, grazing of young pasture should be withheld until the pasture has flowered. If early grazing is necessary the pasture should be fed off quickly and the stock removed. If possible use cattle rather than sheep for this grazing.

Oversown clover emerges better if stock are allowed access after sowing; but once the animals begin to graze the clover selectively they should be removed until it seeds.

Established Pasture

With mixed pasture grazing objectives are: high production, provision of quality feed at strategic periods and reduction of bloat risk. Once a vigorous sward is established the pasture is improved by heavy grazing. This treatment creates a plant nutrient and organic matter cycle.

Young pastures are usually clover dominant but become grass dominant if well grazed. Older pastures fluctuate between grass and clover dominance. The ideal pasture is slightly grass dominant.

Nitrogenous fertilizer promotes grass dominance in young pastures but experience on the New England Tableland in New South Wales showed that these pastures reverted to clover dominance immediately applications of nitrogenous fertilizer ceased. It appears that the clover dominance phase cannot be bypassed but the pasture must be encouraged to pass through it quickly.

Intensive rotational grazing does not improve clover pasture production over the semi-open paddock system. Subdivision need only be sufficient to allow easy property management and periodic spelling for the improved pasture.

Spelling is required mainly to allow some paddocks to enter winter with a good pasture cover. These pastures provide a winter pasture reserve and they make more regrowth during the cold weather than low grazed pastures; they are also valuable during spring because the older clover and heavier grass cover reduce the risk of bloat.

Lucerne survives best where it is rotationally grazed and spelled 4 to 6 weeks between grazings. Lucerne produces a valuable green pick during winter and after showers in drought periods. Grazing at this stage should not harm the pasture provided stock are removed once it is eaten off. Rapid wilting due to moisture stress in hot weather may cause lucerne leaf to fall. These wilted pastures should be grazed quickly before the feed is wasted.

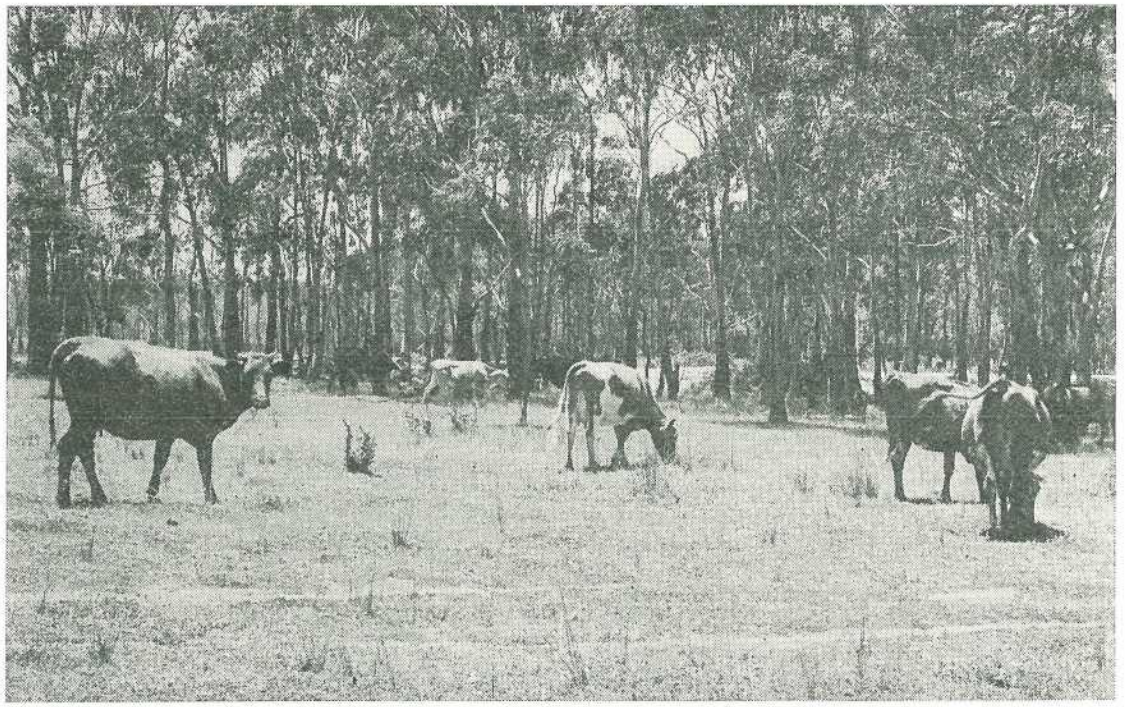
Maintenance Fertilizer—Time of Application

Clover based pastures should be top dressed in mid summer to promote autumn growth; winter applications promote a strong growth in spring and early summer when there is less likelihood of a feed shortage. Because the main production from lucerne is during spring and summer it is best top-dressed during winter.

Some growers fertilize only half their pasture each year using double the normal rate; this reduces clover dominance on the unfertilized area. However, it is a less efficient method of using fertilizer and it should not be used for mixed pastures before they reach the grass dominant phase.

Pasture Renovation

The response from renovation is usually due either to improvement in moisture penetration or a release of sulphur for plant use. Moisture penetration is generally no problem on Granite Belt pastures and sulphur is best applied through the fertilizer programme. Therefore pasture renovation has little value in this area.



Native pasture on flat, range top land at The Summit.

Cattle grazing on lablab at Dalveen.

Burning

Burning has a limited role in controlling tree and shrub seedlings in native pasture and as an aid to clearing for introduced pasture. Apart from these situations it is a damaging practice on granite soils which require a full ground cover and the development of organic matter at the surface before becoming fully productive. There are also some shrubs and trees that are encouraged rather than controlled by burning.

Rabbits and other Fauna

Unless rabbits are controlled, pasture improvement is difficult and sometimes worthless. Small pasture plantings are also subject to concentrated attacks from other animals such as wallabies and hares. Some protection for these areas is necessary. This problem is less acute in larger development projects. Control measures include poisoning, rabbit proof fencing and elimination of natural harbours such as dense undergrowth and blackberry patches.

Pasture Development Costs

(as at June 1974)

Clearing and Timber Treatment

	Approximate Cost $/ha
(a) Clear, burn, one cultivation on—	
(i) Green timber	65 to 150
(ii) Rung country (fairly clear of regrowth)	30 to 50
(b) Timber and Shrub poisoning—	
(i) Green timber plus shrubs (especially wattle)	20 to 35
(ii) Light timber and shrubs	15 to 20
(c) Ringbarking—	
(i) Initial treatment	10 to 18
(ii) First suckering	5 to 8
(iii) Second suckering	2 to 4
Total	.. $17 to $30/ha

Pasture Establishment—Total Seed and Fertilizer Costs

Oversown clover	$32/ha
Mixture 1 (clover, fescue, rye grass) ..	$46/ha
Mixture 5 (Lucerne)	$39/ha
Mixture 3 (Full mixture)	$57/ha

NOTE.—All costs assume Mo12 super is used at 500 kg/ha. If 250 kg Mo 24 super is used reduce costs by $13/ha.

Total Development Costs. Total land clearing and pasture sowing costs vary from $36/ha for oversown clover on clean rung country to $207/ha for the complete pasture mixture on land cleared of thick green timber.

Annual Grazing Crops

Annual grazing crops have a role as a phase of pasture development and are the basis of grazing programmes in regions where pastures are least successful. Oats is the most important crop and is used on most properties. The most successful summer crops are the legumes lablab bean and cowpeas and the non-leguminous millets.

Table 5 shows a simplified annual grazing and planting programme. Minor crops are disregarded and sowing times for major crops are generalised.

TABLE 5

SOWING AND GRAZING SCHEDULE

Period	Crop Sowing	Grazing Available
January–February	Late maturing oats and turnips (start late January)	Siberian millet, cowpeas
March–April ..	Early-med. maturing oats and turnips, Tares, barley	Lablab bean, cowpeas
May–July ..	Rye, barley, tares	Oats, turnips, rye
August–September	Late maturing oats for spring (not common practice)	Oats, rye, barley, turnips, Tares
October	Millet (Japanese, Siberian)	Oats, Japanese, Millet, tares
December ..	Lablab bean (early December cowpeas) ..	Japanese millet, Siberian millet/oats and tares

Winter Crops

Oats

Early maturing varieties: Bentland. Orient warrants trial sowings. Midseason varieties: Cooba, Camellia, Fulghum, Fulmark.

Late maturing varieties: Algerian, Camellia. Acacia warrants trial sowings.

Choice of Variety.—Aim to have oats ready for grazing before the onset of severe frosts because growth is very slow during the cold weather. The early varieties are useful because of their quick growth if sowing is delayed. Ideally they should be rotationally grazed to produce full winter grazing but this does not suit normal management practice on the Granite Belt.

The mid season and late varieties are satisfactory under the normal continuous grazing system. Algerian, which makes slow initial growth, should not be sown after early March. Camellia can be used either for early sowing or mid season (March) sowing. Sowing rate is 40 to 75 kg/ha.

Cereal Rye

Rye grows better than other crops during the very cold weather and tolerates lower soil nitrogen levels than oats. It is useful for quick feed during winter but it matures rapidly and becomes unpalatable early in spring. The preferred variety is Black Winter and the sowing rate is 50 to 75 kg/ha.

Barley

Winter growth rates and maturity are intermediate to cereal rye and oats. Principal use is for quick feed from late sowings. The preferred varieties are Black and Clipper, sown at 40–60 kg/ha.

Vetch—(Vicia sativa) cv. *Golden Tares*

Limited experience shows it to be highly productive during spring and early summer. It is the most promising annual winter legume available for the Granite Belt. Sow in mixtures with oats at 15 kg/ha from March to July. Inoculate seed with commercial inoculant "E".

Field peas

These produce a good bulk of high protein feed. Stock may reject them initially but accept them more readily than they do in other Queensland districts. The most suitable situation appears to be as a mixture with mid season (March sown) oats. Sow at 22 kg/ha with oats or at 65 kg/ha alone. Field peas should not be grown on the same land each year, because of the risk of disease. The usual variety is Dun and Derrimut is worth a trial.

Lupins

These are the most productive winter legumes for acid soils. However, they are readily attacked by native fauna and growth is often severely checked. Cultivars are Uniwhite, Uniharvest and Unicrop. New Zealand Blue lupins, which are used as orchard cover crops, are very bitter and are unsuitable for grazing.

Lupins should not be grown regularly on the same land because of disease. There is a risk of stock poisoning (lupinosis) from grazing dry lupin stubble.

The sowing rate is 56–67 kg/ha when grown alone and 28 kg/ha when sown in a mixture with a cereal. Use strain W.U. 425 inoculum.

Turnip

This is an excellent 'stand-over' crop particularly for breeding ewes. Sheep graze tops and tubers very efficiently but a tine cultivation after grazing exposes any remaining tubers. Grazing should be withheld until it is intended to feed the crop off completely. After eating the leaves sheep then scoop out the top of the tuber; wet weather following this stage of grazing causes tubers to rot.

Varieties are: late maturing—Green Globe (13–16 weeks maturity): medium maturity—Mammoth Purple Top (12 weeks): early maturity—York Globe (9–10 weeks).

Sowing Times are: late maturing—late Jan–Feb: early maturing—March. The sowing rate is 1 to 1·5 kg/ha.

Sowing Method: plant 2–3 cm deep in a firm seedbed. Roll after sowing if the seedbed is loose.

Lablab bean (Lablab purpureus) cv. *Rongai*

This produces a heavy bulk of high protein feed in late summer and autumn and fills the feed gap between natural pasture and oat grazings. The sowing rate is 17–34 kg/ha, depending upon seed price. Heavy rates provide earlier grazing.

Cowpeas

These give a similar performance to lablab bean but are faster and less productive. They are also subject to collapse from disease (*Phytopthora* stem rot). The recommended variety is Caloona (the other varieties are more liable to *Phytopthora* rot). The sowing rate is 17–28 kg/ha.

Millets (Japanese and Siberian)

Millets are earlier maturing and generally more productive than alternative non-leguminous summer crops. Japanese is the earliest and is the most popular variety. Siberian may take 3 to 4 weeks longer before it is ready for grazing but gives a longer grazing season.

The sowing rate is 8 to 10 kg/ha and the crop is suited to mixture with cowpeas but not lablab bean.

Forage Sorghums and Bulrush Millet

If adequately fertilized, these will provide grazing for a longer period than the millets. The main forage types and examples of some varieties are:—

- Sweet sorghum—cv. Sugardrip.
- Bulrush millet—cvv. Katherine Pearl, Ingrid Pearl, Tamworth.
- Sorghum-Sudan crosses—various trade names used.
- Sudan Grass—cvv. Piper, Sweet.

Sowing time is October-November and the sowing rates are—8 kg/ha (alone) and 4 kg/ha in mixture with legume.

Sudan grass lacks the potential yield of the sorghum hybrids and bulrush millet but under conventional fertilizer management production is comparable. Sudan grass may be used in lablab bean and cowpea mixtures for mid and late summer grazing.

Sweet sorghum, bulrush millet and the various sorghum hybrids produce a heavy bulk of summer feed in favourable seasons if heavily fertilized. They have the reputation of

being hard on granite soils, with the result that succeeding crops grow poorly. Sweet sorghum is commonly used in other districts as winter stand-over feed rather than for summer forage.

These summer forage crops have a restricted role on the Granite Belt because their major production period coincides with the peak production period of natural pasture.

Sorghum and sudan species are dangerous to stock at some growth stages especially in regrowth following drought or frosting.

Grazing Crop Fertilizer

Superphosphate is required by all crops. Rates required range from 125 to 375 kg/ha depending upon the phosphorus level of the soil.

Nitrogenous fertilizer is recommended at 50 to 70 kg of nitrogen/ha at sowing; repeat applications at similar rates may be required between grazings. On some of the heavier soils oats and millets produce reasonably without nitrogenous fertilizer for the first one or two crops.

Do not apply nitrogenous fertilizer down the same planting tube as the seeds. All legume seed must be *inoculated*. Molybdenised forms of superphosphate should be used for legume crops and turnips when the land has not been fertilized with molybdenum during the previous 5 to 8 years.

Crop Rotation

Legumes on the Granite Belt do not build up nitrogen in the soil for following crops but crop rotation is still desirable. Constant cropping with the same legume allows soil borne diseases to build up. A rotation to use different legumes and to include non-leguminous crops is necessary.

Repeat sowings of lupins, field peas or cowpeas should not be made on the same land within 3 years. Lablab bean and tares may tolerate repeat sowings but there is some risk.

Feeding Systems

Open grazing is usual, and is satisfactory on properties that are suitably subdivided, but strip grazing with electric fencing would allow more efficient use of feed.

Green lot feeding gains more from the available feed than other systems, but it is not used on the Granite Belt because of high labour and machinery requirements.

MORE THAN YOU NEED?

IF you find yourself with unwanted pesticide, either in the original container or in a spray vat, you should try to offer this material to a responsible person who may have need of it.

If this is not practicable, dilute the pesticide to spraying strength. Select a disposal pit at least 18 inches deep and spread a bag of lime over the bottom. Pour the diluted pesticide into the pit and allow it to soak in. Then cover with several inches of soil.

Do not take unwanted pesticide to an incinerator.

By courtesy Agricultural and Veterinary Chemicals Association.

The Prolapsed Vagina

by J. SHIELD, Veterinary Officer.

PROLAPSE of the vagina is one of the most distressing conditions that commonly affect cows. The sight of an afflicted cow generally results in an urgent call for veterinary assistance.

As the condition is not well understood, this article is designed to explain what happens when a cow prolapses her vagina, the cause of the condition, and some possible remedies.

Once the prolapse has occurred, the displaced tissue becomes congested and filled with fluid. This is caused by interference with the blood circulation within it. Sunburn, fly

what actually happens . . .

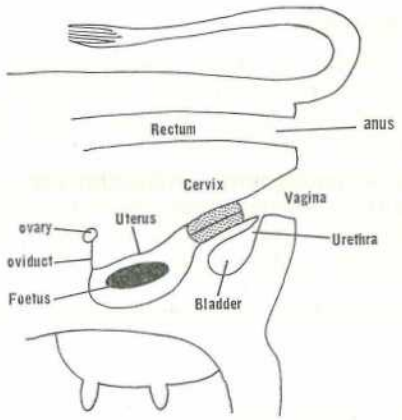


FIG. 1

Fig. 1 shows the normal pregnant condition. The cervix is closed, and this muscular tube seals off the uterus from the vagina. The cervix dilates when the cow is about to calve.

Fig. 2 shows a prolapse of the vagina. The wall of this organ has been extruded through the lips of the vulva.

Fig. 3. This relatively simple condition may be complicated by prolapse of the cervix and the bladder.

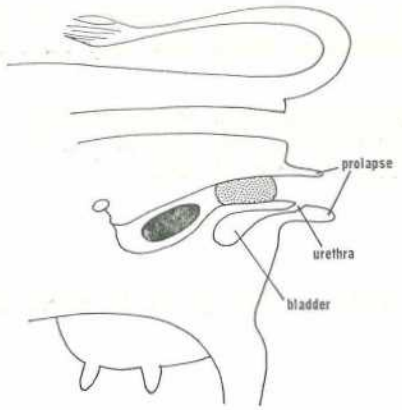


FIG. 2

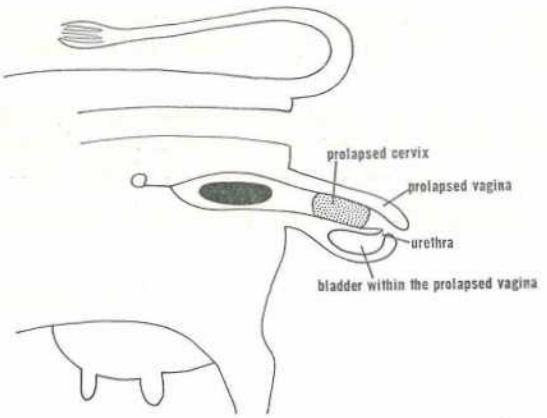


FIG. 3

strike, abrasion by the tail and other objects, and contamination by faeces soon turn the prolapse into a highly offensive mass.

At the same time the cow becomes frightened and may become aggressive.

Later she may succumb to blood poisoning.

Causes

There are various causes of this condition. Probably the most important factor is the relaxation of the ligaments that hold the reproductive tract in place in the abdomen. This relaxation is thought to be due to hormones produced during pregnancy. Thus most vaginal prolapses occur in pregnant cows, especially in cows that have had previous calves, resulting in some stretching of the ligaments.

Other factors that contribute to the incidence of prolapses are:—

- anthing that causes an *increase in pressure* in the abdomen or pelvis. This could include constipation and the bulk of the foetus itself or tumor of the cervix. Irritation or injury, such as when the vagina has been lacerated or become inflamed, is another cause.
- there may be an *inherited-tendency* to prolapse in some lines of cattle.

Treatment

Some cases can be treated by the owner but most require veterinary attention.

In either case, the first requirement is to thoroughly clean the prolapsed vagina. This is best done while the cow is standing in a bail or crush. Tie the tail aside and thoroughly wash the prolapse with water and antiseptic. If possible, immerse the organ in a bucket of water, held under the vulva. A running hose can also be used. Warm water used in the first stages will help soften the invariably hard, dried faeces; cold water will then help to reduce the swelling in the prolapse and the consequent bulk to be replaced. Once softened, faeces and other debris can be removed by gentle scrubbing.

As it may require a great deal of soaking and scrubbing to clean the prolapse, this could well occupy the time until the vet arrives.

If veterinary assistance is unavailable, the prolapse can sometimes be repaired simply, by manipulating the organ back through the opening of the vulva. The cow will frequently make this impossible by straining against the efforts of the operator.

Once the vagina has been returned to its normal position, the lips of the vulva should be sutured together to prevent a recurrence of the prolapse. The sutures must naturally be removed before calving.

If straining prevents replacement of the prolapse, a "last-resort" possibility is a tracheotomy, which involves cutting a hole in the trachea or windpipe. It is then impossible for the patient to build up sufficient pressure in the abdominal cavity to strain effectively.

For this operation, the cow's head is extended to its maximum extent (preferably with the cow lying on its back); the cartilage rings of the trachea can be felt close under the skin on the midline; a quick cut with a sharp blade will easily penetrate through the skin and trachea.

Where the bladder is involved in the prolapse, it may have to be drained or surgically replaced.

Once recovered, the affected cow is not necessarily prone to a recurrence later in pregnancy or at calving, but consideration should be given to culling her for slaughter because of the risk of prolapses in future pregnancies and the risk of her offspring inheriting this dangerous tendency.

Often a prolapse of the rectum is seen concurrent with a prolapsed vagina.

Macadamia

Summary of Insect Control Recommendations

prepared by Entomology Branch Officers

The following tabulation summarises the recommended pest controls for macadamias in Queensland. The insects referred to are a few of the many species (approximately 150) recorded damaging macadamias. There are also many parasitic and predatory insects; these effect considerable control over the pest species. Insecticide usage should be minimized to conserve these beneficial insects. Growers therefore need to understand their pest situations and to apply insecticide sprays only at the recommended rates and only when the pest incidence is such that spraying is warranted. Further details on identification and control of pests listed, where necessary, should be sought from extension officers of the Department of Primary Industries.

Description and Life History	Seasonal Incidence	Damage	Pest Status	Control
PREDOMINANTLY FLOWER PESTS **Macadamia flower caterpillar**—*Homoeosoma vagella* The adult, a small grey moth, lays tiny white eggs on flower racemes. As incubation proceeds the eggs turn a yellowish colour. Larvae tunnel into the buds, feed on the floral parts, and web silken shelters as they move between buds. Full grown larvae are striped green, brown or grey in colour and up to 12 mm long. Larvae usually leave the racemes and pupate in debris on the ground or in sheltered sites on the tree. The duration of the life cycle varies from 23 days in summer to over 8 weeks in winter	Moth activity is greatest during late winter and spring, coinciding with the main flowering period. Timing and severity of infestations vary in different seasons and localities	The young larvae destroy individual flower buds and as larvae grow the raceme is festooned with webbed frass and other debris. Flowers may be completely destroyed thus preventing nut set	Usually an important pest except in some elevated areas	trichlorphon or endosulfan 0·05%. One to three applications may be needed during August–September depending on the time and severity of infestation and time of flowering. Spray when bees are least active. In some seasons spraying is not necessary
Hairy line blue butterfly—*Erysichton lineata lineata* The larvae of a number of lycaenid butterflies attack the buds of macadamia racemes. The light green to pinkish slug like larva of the hairy line blue is one of the most common. The eggs are white, spherical, slightly flattened and finely sculptured. These are laid anywhere on the raceme. The larva is difficult to find because it is similar in colour to the raceme on which it is feeding	Heaviest infestations normally occur on autumn and winter flowers	The larva moves from bud to bud and eats out the floral parts leaving a neat round hole in the bulbous end of the bud	A minor pest. Rarely important enough to warrant specific control	*
Macadamia lace bug—*Ulonemia* sp. This is a tiny elongate sucking insect. The adult is light to dark brown and 3–4 mm long. The younger stages or nymphs are oval in shape and vary in colour from yellowish to pink. Colonies of nymphs and adults feed on racemes or young shoots	Heavy infestations may at times coincide with the main flowering	Feeding by the bugs progressively kills the buds or flowers on a raceme	A minor pest. Most severe infestations noted on the Blackall Range in closely planted stands of macadamia	*

Black citrus aphid—*Toxoptera aurantii* Adults are black, soft bodied insects about 2 mm long. The aphids accumulate in colonies of winged and wingless adults and immature forms on young foliage and flower racemes	Multiply on growth flushes and flower racemes in winter and spring. Heavy infestations are uncommon	The aphids feed by sucking sap causing death of buds and distortion of young leaves. Heavy infestations may reduce nut set	A minor pest. Rarely important enough to warrant specific control	demeton–S–methyl 0·025% Parasites and predators usually effect satisfactory control
PREDOMINANTLY NUT PESTS **Fruit-spotting bug**—*Amblypelta nitida* The pale green adult bug is slender, elongate, up to 12 mm long and 4 mm wide. Pale green eggs are placed singly in the vicinity of young nuts. The bug passes through 5 nymphal stages. These are pear shaped and wingless and are greenish to greenish-orange with dark red to black legs and antennae. A prominent feature of nymphs is the flattened oval second last segment of the antennae. The duration from egg to adult in summer is 34–38 days	Adult bugs may overwinter on macadamia and become active in early spring. Three generations may be passed through in a year. Migration from alternative hosts also occurs during spring and summer. Most severe damage occurs from November to January	Feeding by nymphs and adults results in serious premature nut fall or malformation of kernels. Damaged nuts when sectioned show cell breakdown and brown lesions on husk and shell and jellying or discolouration of the kernels	A very important pest in South-East Queensland	trichlorphon or endosulfan 0·05%. Two applications 3–4 weeks apart in late October–November, and further sprays if necessary. Earlier spraying may be needed if macadamia flower caterpillar sprays are not applied
Banana Spotting bug—*Amblypelta lutescens lutescens* This insect is similar to the fruit-spotting bug; but the head, antennae (except for the second last flattened segment) and legs are red and the upper part of the abdomen orange red in the 2nd–5th nymphal stages. Duration of the life cycle is a little longer than fruit-spotting bug	As for fruit-spotting bug	Damage to nuts is similar to fruit-spotting bug. This species also causes splitting or death of young shoots by its feeding	A very important pest in central and northern coastal areas. There is some over-lapping with fruit-spotting bug	As for fruit-spotting bug
Macadamia nut borer—*Cryptophlebia ombrodelta* The reddish brown female has a wing span up to 25 mm and a body length up to 12 mm. A distinctive feature is the black wedge shaped mark on the hind margin of the forewing. The male is smaller, paler in colour; its markings are less defined and its hind legs are noticeably furry. The scale like eggs are laid on the surface of the husk; young larvae tunnel into the nut. Full grown larvae are up to 20 mm long, pinkish in colour with dark greenish spots. Pupation often occurs at the feeding site in the nut. The duration of the life cycle in summer is about 5 weeks	The insect can be active in macadamia plantings throughout the year. Most severe damage occurs during December to February	Crop loss is caused by direct feeding on the kernel and subsequent invasion by secondary organisms, and by premature nut fall resulting from husk damage. Husk damage to mature nuts may also reduce quality	A very important pest, though patchy in its distribution	carbaryl 0·1% or endosulfan 0·05%. Repeated applications every 2–3 weeks may be needed during the December–February period. Effective control is most difficult if prolonged wet season rains occur

Description and Life History	Seasonal Incidence	Damage	Pest Status	Control
Yellow peach moth—*Dichocrocis punctiferalis*				
The pinkish larva resembles that of the macadamia nut borer, but grows slightly larger and the dark spots on the body are larger and more oval. The life cycle may be completed in about 4 weeks in summer	Occurs sporadically usually in summer	The insect has preference for nuts in clusters and causes similar damage to the macadamia nut borer	Usually of minor importance. Specific control rarely required	†
PREDOMINANTLY FOLIAGE PESTS				
Macadamia felted coccid—*Eriococcus ironsidei*				
All above ground parts of macadamia are infested; but the scale prefers shaded and sheltered parts of the tree. The adult female (about 1 mm long) is enclosed in a white to yellowish felted sac. The winged adult male emerges from a smaller white elongate ridged covering. Eggs are laid within the covering of the female. Crawlers hatch and spread over the plant. Females tend to settle on leaf mid-ribs, or in crevices at leaf axils, or in the bark. Males outnumber females and settle more indiscriminantly under leaves or on branches. During warm weather the life cycle may be completed within 6 weeks	The insect appears to breed continuously and there are several overlapping generations a year	It causes distortion stunting and even death of young shoots, flowers and young nuts. Older leaves show noticeable yellow spotting at the points of infestation. Branch die-back occurs where infestations are severe	Potentially a very important pest	White oil or summer oil 1 : 100, or maldison 0·1% diazinon or methidathion 0·05%. Repeat oil applications can cause phytotoxicity. Spraying must be thorough. Repeat applications may be necessary at 4–5 week intervals. Prevent entry into new plantings by using clean scion wood and nursery stock. Natural enemies satisfactorily control the scale in some plantations
Macadamia leaf-miner—*Acrocercops chionosema*				
The adult is a small moth with brown and white barred wings. Tiny glistening transparent eggs are laid on the surfaces of tender young foliage. Larvae mine under the leaf cuticle at first forming linear meandering mines. Within a few days the mine is enlarged forming a blister like blotch on the leaf. Full grown larvae are red striped and 6–7 mm long. These leave the mines and pupate in ground debris or other sheltered sites The complete life cycle takes about 3 weeks in summer and 6–7 weeks in winter	The insect breeds continuously throughout the year. Severe damage occurs when high populations coincide with major growth flushes in spring and summer. Winter infestations can also be important on young trees	Damage is confined to flush growth. Young leaves may be covered on both surfaces with blotch mining. This results in the tree having a ragged fire scorched appearance. Successive flushes may be destroyed stunting growth and reducing vigour	An important pest in elevated areas such as the Blackall Range	Sprays of azinphos-ethyl 0·025%–0·05%. The higher concentration is used if a heavy infestation is involved. During peak summer activity spray applications may be needed every 2–3 weeks

Macadmia twig girdler—*Neodrepta luteotactella* The adult, a satiny white moth, lays eggs on foliage or nuts and is attracted to old damaged sites. The young larva is light-brown and motley striped; when full grown it is mottled brown with black spots and about 20 mm long. While feeding larvae construct protective webbed shelters which become cluttered with frass and other debris. The full grown larva spins a tightly woven silken cocoon and usually pupates at the feeding site. The duration of the life cycle is quite variable and is known to take from 3–5 months	The insect is active throughout the year. Generations overlap. The moths are least active during the winter months July and August	The larva feeds on leaves and girdles young branches causing die-back. Severe infestations may completely defoliate young trees. In bearing trees the larva also tunnel into the nuts	The twig girdler is most important as a foliage pest on young or backward trees	†Spraying needs to be done thoroughly and one or two applications a year may be needed on young trees
Monolepta beetle—*Monolepta australis* The beetles are about 6 mm long and 3 mm wide, light-yellow with a light cherry coloured band across the wing covers and a pair of similarly coloured spots on the back towards the end of the body	Infestations are usually sporadic and patchy and may occur in winter, spring or summer	Beetles may be attracted to flowers during full bloom and severe damage occurs when there is a heavy infestation. New growth flushes are also destroyed at times	A minor pest, occasionally important	Carbaryl 0·1%, trichlorphon 0·1% or endosulfan 0·05%. Carbaryl should not be used on flowers as it is very toxic to honey bees. A follow up spray may be needed if reinfestation occurs
Orange fruit borer—*Isotenes miserana* The adult moth is light-grey with a wing span of up to 20 mm. Mature larvae are up to 24 mm long, brown with two longitudinal brown stripes and a dark head capsule	The insect is active on macadamias throughout the year	Larvae damage young shoots, rolling up young leaves. It feeds on flower buds or newly set nuts and may tunnel into larger nuts	Minor importance. Control may be required on nursery trees	†
Macadamia cup moth—*Comana fasciata* The larva is oval, flattish green and slug like. It has a prominent mid-dorsal yellow stripe which resembles the mid-vein of a leaf. The full grown larva is up to 3·5 cm long and 2 cm wide. Pupation usually occurs in the "cup-like" coccoon in debris at the base of the tree	Heaviest infestations occur on macadamias in summer and autumn	Larvae feed mainly on mature leaves. During heavy infestations young trees can be completely defoliated	Usually of minor importance, but can require specific control on young trees	†

* Chemicals recommended for the macadamia flower caterpillar will control these pests if such treatments are specifically required.

† Chemicals recommended for macadamia nut borer will control these pests if such treatments are specifically required.

QUANTITY OF MATERIAL PER 100 LITRES OR 100 GALLONS TO OBTAIN RECOMMENDED SPRAY CONCENTRATION

Material (common name)	Percentage Concentration Active Constituent	Strength of Product (no particular brand is favoured)	Quantity per	
			100 litres	100 gallons
Azinphos ethyl	0·05	40% emulsifiable concentrate	125 ml	1 pt
	0·025		62 ml	10 fl oz
	0·05	44% emulsifiable concentrate	114 ml	18 fl oz
	0·025		57 ml	9 fl oz
Carbaryl	0·1	80% wettable powder	125 g	1 lb 4 oz
		50% emulsifiable concentrate	200 ml	1 pt 12 fl oz
Demeton-S-methyl .. .	0·025	25% emulsifiable concentrate	100 ml	16 fl oz
Diazinon	0·05	80% emulsifiable concentrate	62 ml	10 fl oz
Endosulfan	0·05	35% emulsifiable concentrate	142 ml	23 fl oz
Maldison	0·1	50% emulsifiable concentrate	200 ml	1 pt 12 fl oz
		25% emulsifiable concentrate	400 ml	3 pt 4 fl oz
Methidathion	0·05	40% emulsifiable concentrate	125 ml	1 pt
Trichlorphon	0·05	62·5% emulsifiable concentrate ..	80 ml	13 fl oz
		80% wettable powder	62·5 g	10 oz

LARGE CONTAINERS A PROBLEM?

BEFORE you dispose of large containers which have held pesticides, check for remains of any material in the container. Empty this into a pit on the container site in a place where contamination of water sources will not occur. Remember to double rinse the containers with water after emptying.

Do not convert empty drums into livestock feed troughs, water storage containers or raft floats. They could be sources of food or water contamination.

Dispose of large metal drums (e.g. 50 to 250 litres) in one of these ways. (Do not forget to double rinse them before return.)

- Return them to the supplier.
- Sell them to a firm dealing in used drums or barrels that is equipped to neutralise the toxicity of adhering materials. Contact your pesticide dealer for the names and addresses of such firms in your state.
- Take them to a sanitary land fill type of dump. Inform the operator of the dump that the drums contain residues of poisonous materials. Warn him that poisonous vapours may be produced if the containers are burned. Before leaving, remove lids or bungs from the containers; chop holes in the containers with a sharpened pickaxe to prevent re-use. Make sure the site cannot contaminate a water supply.
- If none of the preceding disposal means are available to you, find a private disposal site of the type above which you will use only for empty containers and unwanted pesticides. Correct site selection is most important. Before leaving, again ensure lids or bungs are removed from the containers and chop holes in them with a pickaxe to avoid re-use.

By courtesy Agricultural and Veterinary Chemicals Association.

Pests of Potatoes

THE potato crop is susceptible to attack from a number of insect pests. To avoid unnecessary expenditure on pest control and yet provide adequate crop protection, it is essential that the farmer recognises the particular insect pests and appreciates the extent of the damage they may cause.

by P. D. ROSSITER,
Entomology Branch.

Above: Boom spray typical of the machines used to apply insecticides to potatoes.

THE potato moth is undoubtedly the most commonly occurring and the most destructive to potato crops in Queensland.

Others which warrant discussion include aphids, leaf eating ladybird beetles, jassids, field crickets and mole crickets.

The Potato Moth

The adult is an inconspicuous greyish-brown moth with a wingspan of 12 mm. During the day the moth shelters under soil clods, among leaves and in debris. Greatest activity occurs at or near dusk and when infestations are heavy moths may be readily seen flying among the plants.

The eggs, which take approximately five days to hatch, are laid on the undersurface of the leaf or on the eye of the tuber. On hatching, the young larvae immediately enter either the leaf or the tuber.

Larvae vary in colour from greenish when feeding in the leaves to pinkish when feeding in the tubers. After feeding for about 2 weeks they are fully developed, at a length of about 12 mm, and leave their feeding places in search of pupation sites such as old or dead leaves, under clods of soil, on tubers or bags in which potatoes have been stored. Moths emerge approximately one week later.

Under warm conditions, the life-cycle may be completed in less than four weeks resulting in a number of generations during summer. The insect's growth rate is much slower during cooler periods.

Damage

The pest is most active during the warmer period of the year. Consequently, the spring crops are attacked regularly and it would be rare for control measures not to be required. Crops from the autumn plantings usually escape serious attack.

Tubers held in storage after harvest may be subjected to continued infestation.

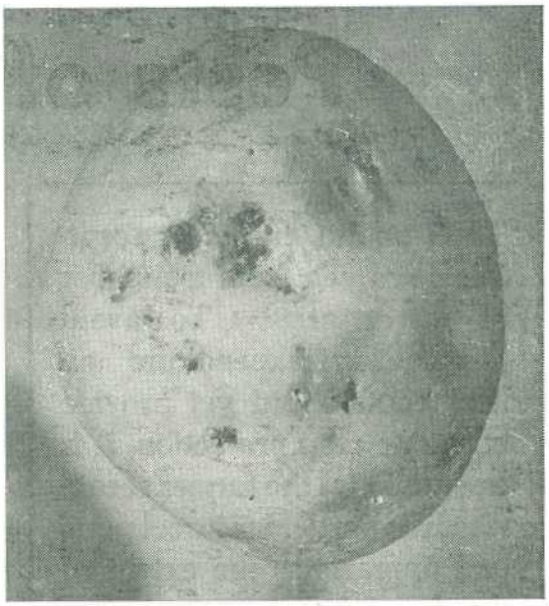
The first indication of attack in the leaves is the appearance of fine colourless channels within the leaf tissue. The larvae may eat out virtually all the internal tissue leaving only the upper and lower leaf surfaces and may involve a large proportion of the leaves.

Larvae may enter the stem at the growing point or leaf axils resulting in terminal collapse and stunting of top growth. Severe attacks, with the combination of both leaf and terminal injury, will result in unproductive plants.

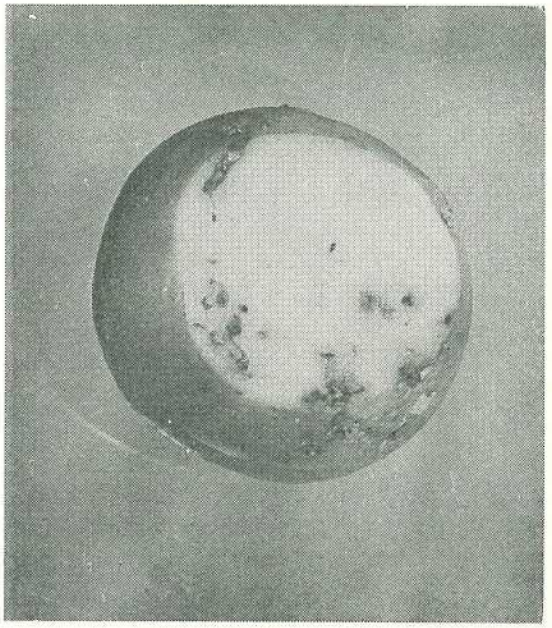
An accumulation of frass at the eyes of a tuber may be the only external evidence that it is infested with potato moth larvae. The internal tunnelling may be observed after cutting. Only exposed tubers are subject to attack in the field. A number of conditions, including cracking of drying soils and the development of tubers near the soil surface, may provide access for the pest. Tubers left on the soil surface after harvest are readily infested.

Field control

The reduction of pest breeding sites in the field will assist in minimising infestations in the crop.



Frass at the eyes of a tuber indicating infestation by potato moth larvae.



Tuber cut to illustrate typical potato moth damage.

Particular attention should be given to the clean-up or burial of crop residues immediately after harvest. Volunteer potato plants and some related Solanaceous weeds provide ideal breeding sites for potato moth and should be eradicated.

It is preferable that other crops, such as tomatoes and tobacco, which are also attacked by this pest, are not grown adjacent to the potato crop. Unfortunately, the normal farm practice of growing a series of plantings is highly favourable to the development of infestations.

The application of insecticide sprays does not necessarily provide adequate protection against infestations of tubers. As only exposed tubers can be attacked, the best protection is afforded by keeping them covered with soil. After most of the tubers are formed, but before they have developed sufficiently to crack the soil, the soil should be hilled up and around the bases of the plants. The usual time to start hilling is shortly after the crop has flowered. The hills should be maintained until harvest. The judicious use of irrigation will assist in preventing soil cracking.

Top growth infestations are important only to the extent to which reduction in effective leaf area reduces potential yield. Relatively slight infestations which do not keep pace with plant growth do not warrant control.

The application of insecticide sprays is the usual method of controlling established infestations in the top growth. For most effective results, the sprays should cover as much of the plant surface as possible.

The recommended insecticides are azinphos ethyl, used at the rate of 560 gm of the active constituent per hectare, chlorfenvinphos at 275 gm or methamidophos at 1 100 gm. When applied as high volume sprays these insecticides should be used at 0·05%, 0·025% and 0·1% respectively.

The decision to spray should be based on an observed increase in the number of small leaf mines and the consideration that young larvae are easier to kill with insecticides than older larvae. Irrespective of the efficiency of the control being obtained, re-infestation requiring further spray application, may occur within two weeks.

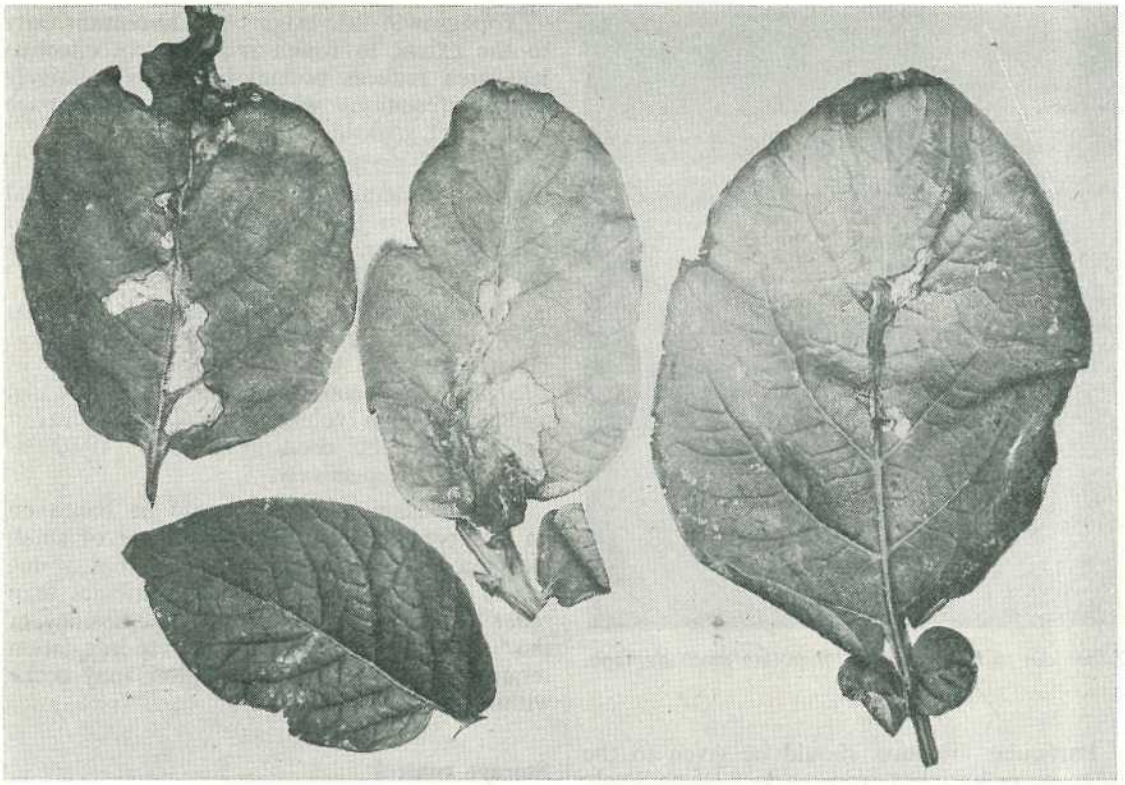
Storage control

Harvesting of potatoes should not be delayed after the tubers have reached maturity because any delay must increase the likelihood of field infestation. After lifting, the crop should be removed from the field as soon as possible to avoid attentions of any moths in the area which may lay eggs on the freshly-dug potatoes.

Fresh, clean tubers are most acceptable for human consumption. Where sufficient attention has been given to potato moth control, immediate marketing may be undertaken without further attention to pest control. If, on the other hand, the tubers are to be held on the farm for use as seed or for sale at a later date, then it is essential to prevent infestation.

Preparation of the storage area, particularly with regard to the removal of debris and previous crop residues that may harbour the potato moth, will assist in minimising attack on stored tubers. Only sound, uninfested tubers should be held in storage.

The potato moth and its larva cannot survive constant exposure to cool temperatures. The storage of tubers in refrigerated cool stores, not only prevents infestation, but arrests and



Typical potato moth damage to potato leaves.

virtually eliminates any infestations which may have been overlooked at the start of storage.

The alternative to cool storage is the use of insecticide dust treatment. Suitable products for this purpose are derris dust, containing approximately 0·75% rotenone, or pyrethrum dust containing approximately 0·3 per cent pyrethrins. Either dust should be used at the rate of 250 grams per bag. Reasonably uniform dispersal of the insecticide on the tubers in the bag is essential, and this may be achieved by placing a proportional amount of the dust in the bottom of each tin used for picking up. This will ensure sufficient dispersal of the dust as the tubers are tipped into the bag.

Unlike cool storage, dust treatments will not arrest the development of insects included in the storage. Thus the exclusion of infested tubers is essential for satisfactory pest control.

Aphids

Aphids are oval shaped, soft bodied, sluggish insects which may be found in colonies on the underside of leaves. Most individuals are wingless although winged forms may also be present. The size of the fully grown insect may vary between 2 and 4 mm in length with the colours ranging from greenish-yellow to green.

The female aphid gives birth to living young. Populations may increase very rapidly in warm weather.

Damage

Aphids feed by sucking sap from the leaves. When the infestation is severe, this feeding may cause the leaves to curl downward, become yellow and die. Damage is most severe during periods of warm weather particularly if soil moisture is in short supply. Very

hot, dry weather, however, may greatly reduce the aphid population.

The ability of aphids to transmit virus diseases may be of some importance particularly in crops grown for seed production.

Control

In normal commercial crops, specific control of this pest is usually not required. Provision of adequate water by irrigation will reduce the effect of aphid feeding.

In addition, natural biological agents normally provide sufficient control. Included among these useful agents are the adults and larvae of aphid-eating ladybirds, hover fly maggots, and wasp parasites whose activity may be indicated by the presence of mummified aphids.

In the event of aphids causing significant crop damage and in the absence of natural controlling agents, rapid kills of the pest may be achieved with spray applications of either demeton-s-methyl at the rate of 275 grams of active constituent per hectare or methamidophos at the rate of 1 100 grams of active constituent per hectare. When applied as high volume sprays these insecticides should be used at 0·025% and 0·1% respectively. For maximum results, every effort should be made to ensure that the sprays reach the underside of the leaves.

Regular applications of these insecticides will ensure virtually aphid-free crops where this is important in seed production. However, in these circumstances, it may be more convenient to apply a systemic granular insecticide in the planting furrow. Disulfoton when used at the rate of 2–3 kilograms of active constituent per hectare will provide protection for from eight to twelve weeks.

Crickets

The mole cricket is a brown coloured, somewhat velvety looking insect which attains a length up to 40 mm. The forelegs are remarkably strong and adapted for burrowing, being broad and shovel-shaped. It spends most of its time burrowing in the soil but may come to to the surface at dusk, especially on warm evenings after rain. Usually the mole cricket is associated with moist soils near creek banks although any continuously moist soil could be attractive to them.

The field cricket which is darker in colour and measuring up to 30 mm in length is also capable of burrowing. However, it is not as strongly developed in the forelegs as the mole cricket and may spend more time above the surface. This cricket is commonly associated with pasture or lucerne crops and may invade potato crops from such areas or may attack potatoes planted into areas previously used for these purposes.

Damage

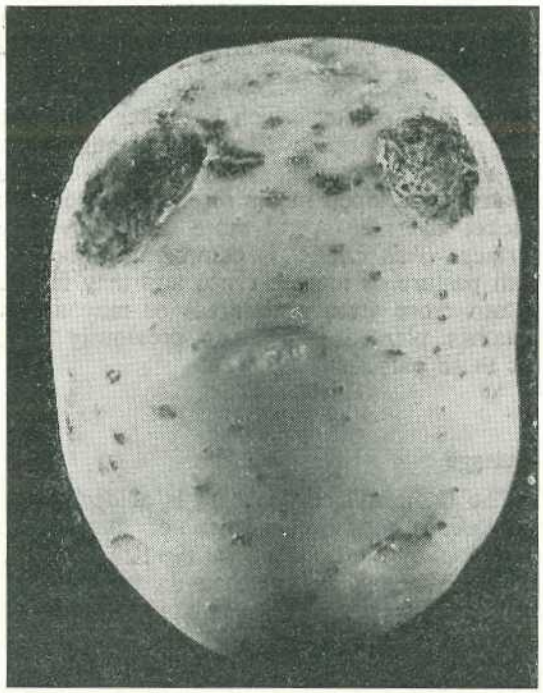
The damage from crickets is evidenced by excavations on the surface of the tuber. Occasionally the hole will go right through. It appears that the bulk of their damage is more accidental than deliberate in that they do not appear to seek out the potatoes particularly as food. The damage is the result of an accidental encounter as the insect burrows through the loose moist soil in the crop row.

Control

Investigations into control measures against these pests have not yet yielded satisfactory results. However, it is suggested that tubers should be harvested as soon as possible after maturity and that excessive water applications during the latter stages of growth should be avoided in areas known to be infested. The mole cricket, particularly, thrives in soil with moisture at or above field capacity and much of the damage from this pest appears to occur when tubers are held in the ground after maturity.

Jassids

These are greenish, torpedo-shaped insects measuring up to 4 mm in length. Eggs are laid in the tissues of stems and leaves and hatch in 10–12 days. The nymphs take 2–3 weeks to reach the adult stage. Populations increase rapidly with suitable conditions such as a dry summer-autumn period.



Excavations in the surface of a tuber caused by crickets.

Damage

The insect feeds by sucking sap from the leaves causing a series of small white dots or stipples.

Jassids rarely constitute a problem in well-grown crops. When present in large numbers, they may retard growth or accentuate the effect of other stress conditions.

Control

If control becomes necessary, dimethoate, used at 150 grams of active constituent per hectare, will provide adequate pest kills.

In crops grown for seed production, the use of disulfoton granules at the rate of 2–3 kilograms of active constituent per hectare applied at planting will provide protection for up to eight weeks.

Leaf-eating Ladybird

It is important to distinguish between the leaf-eating and the beneficial aphid-eating ladybirds. Characteristic of the former is the 24–28 conspicuous black spots on the wing covers.

The adult beetle is oval in shape, about 6 mm in length and yellowish brown in colour with the black spots on the wing covers. Its movements are rather sluggish and it does not fly readily.

The larvae measure up to 9 mm in length and are yellow in colour. The body is covered with dark, many-branched spines.

Damage

Leaf-eating ladybird may infest the plants at any stage of growth but are most common in the pre-flowering period. In general, adults will be found feeding on the upper surfaces and larvae on the lower surfaces of leaves. They eat the green tissue between the veins until only a thin film remains. In severe outbreaks the foliage may be completely destroyed and stems severely damaged.

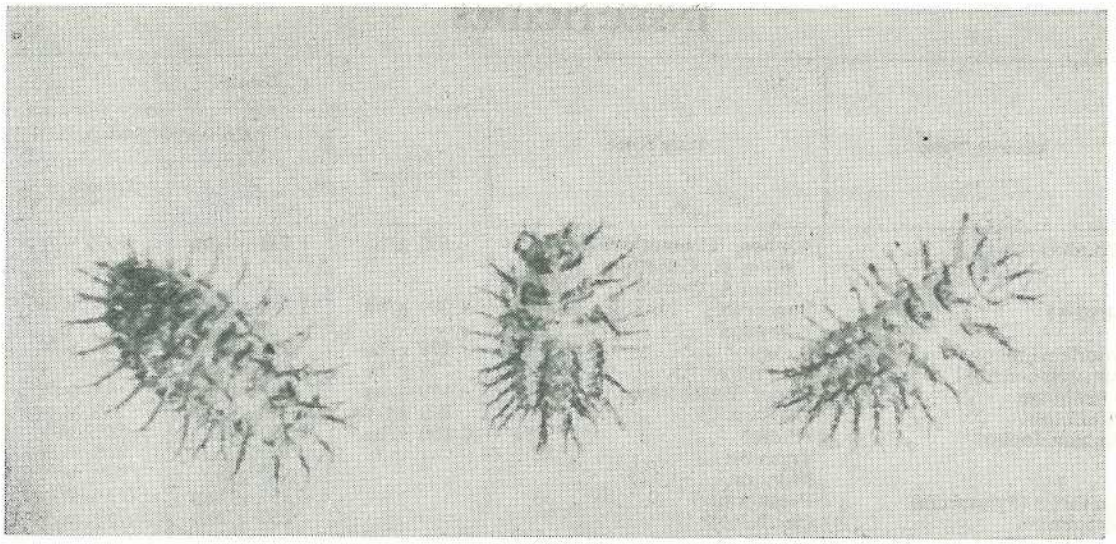
Control

Carbaryl, applied at the rate of 1 000 grams of the active constituent per hectare, or 0·1% when applied as a high volume spray will give effective control of these pests.

General Considerations

The potato moth is the most destructive pest of potatoes, particularly in spring crops. However, the incidence and the damaging effects of this pest, along with a number of other pests, may be minimised by strict attention to field hygiene and cultural control measures such as hilling and weed control.

Insecticides should be applied to the crop only when required to control a pest infestation. The application of insecticides on a routine basis is wasteful of materials and may not achieve the best control. Regular crop inspection will assist in determining the presence of the pest, the extent of damage and the effectiveness of natural controls. These factors should be considered before resorting to insecticides.



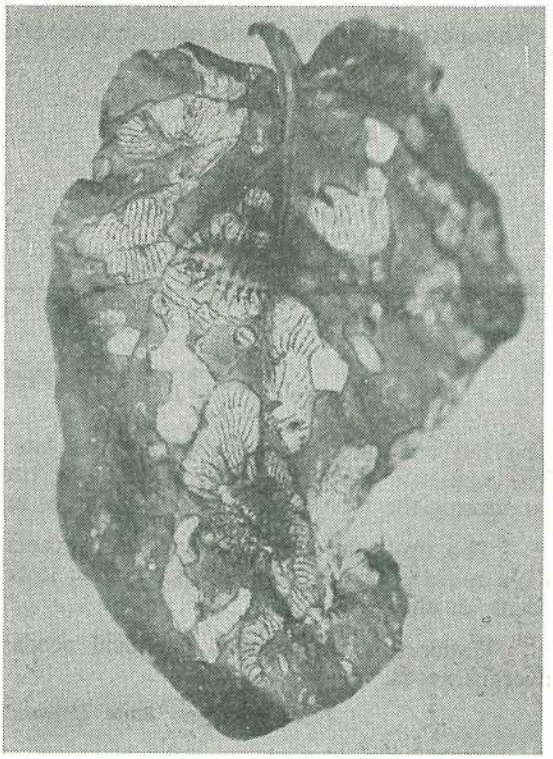
Larvae of leaf-eating ladybird.

When the application of insecticides becomes necessary, it is also essential that they be applied properly. For adequate control of most pests, thorough plant coverage with the spray is essential.

Boom sprayers have been used satisfactorily, providing attention has been given to the placement of nozzles. When the plants are small, adequate plant coverage may be achieved with a single nozzle over each row. In well-developed crops, the addition of inter-row droppers, with nozzles directed towards the sides of the plants, ensures maximum plant coverage and maximum pest control.

No definite directions can be given regarding spray output rate, pressure, or travelling speed to use as these characteristics may vary among different spray units. Experience with a particular sprayer will indicate the adjustments required. Most of these machines, however, provide an output in the range of 300–500 litres of spray per hectare. The use of cone type nozzles rather than the fan type, is to be preferred for insecticide applications.

The use of aircraft to apply spray to potatoes should be regarded as an emergency measure when the boom sprayer cannot cope.



Potato leaf with leaf-eating ladybird damage.

INSECTICIDES

Common Name	Trade Name	Dosage		
		Active Constituent	Commercial Product	
			—	Strength of Product
Azinphos ethyl	Azphos, Chemothion 40, Cothion E, Gusathion A, Kilathion A, Q-thion	560 g/ha	1 400 ml/ha	40% w/v
Carbaryl	Bugmaster, Hi-Kil, Septene, Zevilon	1 000 g/ha	1 250 g/ha	80% w/w
Chlorfenvinphos	Birlane	275 g/ha	550 ml/ha	50% w/v
Demeton-s-methyl .. .	Metasystox (i)	275 g/ha	1 100 ml/ha	25% w/v
Dimethoate	Rogor, Perfekthion .. .	150 g/ha	500 ml/ha	30% w/v
Disulfoton	Disyston	2–3 kg/ha	20–30 kg/ha	10% w/w
Methamidophos	Nitofol	1 100 g/ha	1 900 g/ha	58% w/v
	Tamaron		3 800 g/ha	29% w/v
	Monitor		3 800 g/ha	29% w/v
Pyrethrins (Pyrethrum) ..	Pybuthrin		250 g/bag	0·3% w/w
Rotenone	Derris		250 g/bag	0·75% w/w

Trade names which include the common names are not shown. The trade names listed 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.

The more important potato pests in Queensland are:—

Potato Moth	*Phthorimaea operculella* (Zel.)
Aphids	*Macrosiphum euphorbiae* (Thomas) *Myzus persicae* (Sulzer)
Field Cricket	*Teleogryllus sp.*
Mole Cricket	*Gryllotalpa sp.*
Jassids	*Austroasca viridigrisea* (Paoli)
Leaf-eating Ladybird	*Henosepilachna vigintioctopunctata* (F.)

Keeping track of weather

ENGINEERS have teamed with entomologists and other scientists to improve pest management. The engineers have developed a system of trained observers and electronic devices for closely monitoring the weather, insects and diseases in orchards.

This up-to-the-minute information reveals the best times for chemical applications. Sprays do a more effective job and represent a lower cost—both to the environment and in money spent for chemicals.

Under this new system, chemical needs are based on actual conditions rather than on average needs.

From Michigan State University Agricultural Experiment Station Research Report.

Radical Mulesing Pays

by R. J. ANSON and P. S. BEASLEY

Wrinkly-breeched sheep are struck more often than plain-breeched sheep by the primary green blowfly *Lucilia cuprina*. They require regular jetting with insecticides and frequent crutching because the breech region of these sheep is most prone to soiling by urine and faeces which set up inflammatory skin conditions resulting in odours most attractive to sheep blowflies.

Radical mulesing of wrinkly sheep reduces their susceptibility to breech strike and increases general productivity of the animal.

The benefits of radical mulesing were shown in a trial conducted at "Maxvale" in the Charleville district of south-west Queesland for 12 months from August 1960 to compare the incidence of flystrike, wool production and reproductive performance in radically mulesed and unmulesed sheep.

During the trial in which a heavy fly wave occurred in the autumn of 1961 fewer mulesed sheep were struck and production from mulesed sheep was higher than from unmulesed.

One hundred one-and-a-half year old maiden ewes off-shears were chosen at random from a flock of 1 200. They were classified according to their breech type and susceptibility to flystrike into the following:—

Breech Type	Susceptibility	No. of Sheep
Lightly wrinkled	Low	44
Moderately wrinkled	Moderate	34
Highly wrinkled	High	22

The trial started on 19 August 1960 and concluded after shearing in August 1961. Ewes were weighed and half of each class radically mulesed. The other half was left unmulesed as controls.

Ewes were run together as one flock for the duration of the trial and joined for eight weeks from 4 April 1961.

Mulesing technique

The radical Mules operation was performed by removing a strip of skin from the sides of the bare area of the crutch and completely removing the wool-bearing skin of the tail.

Healing time

Wounds of the lightly wrinkled sheep healed within 24 days, moderately wrinkled within 30 days and highly wrinkled in 32 to 40 days.

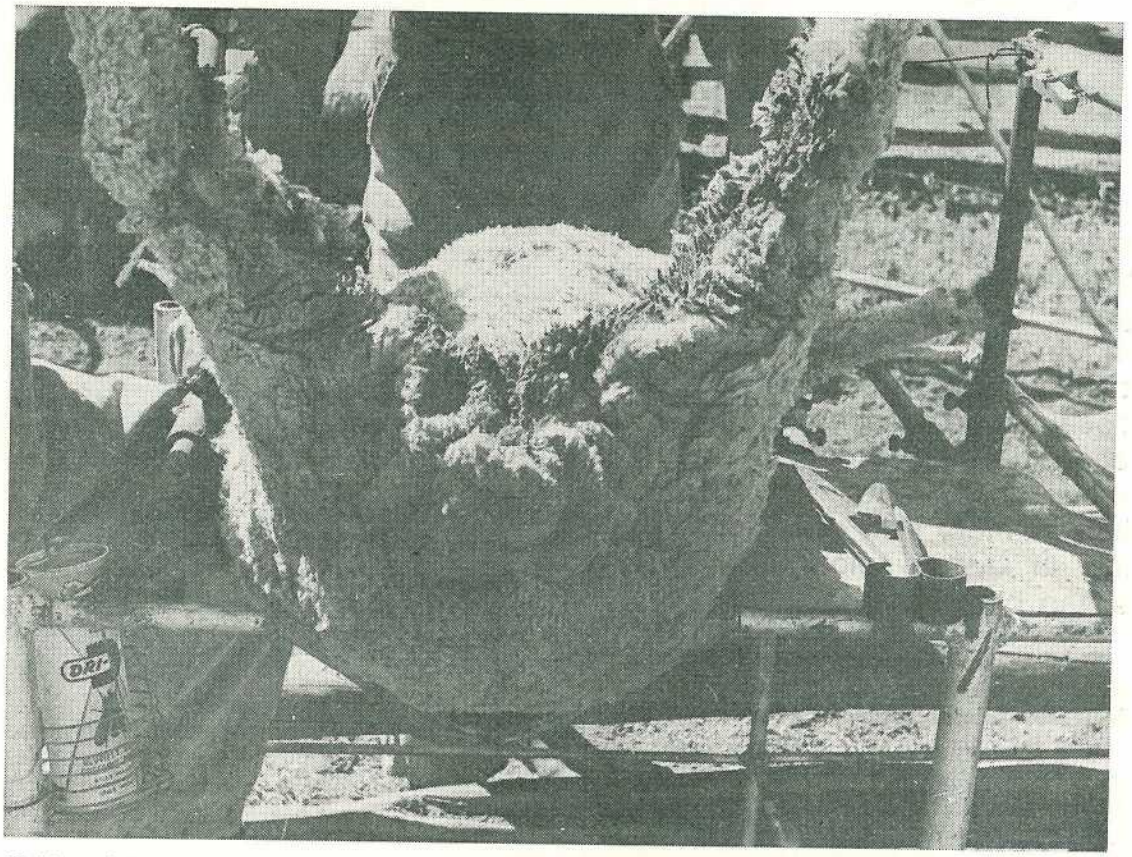
Body weight

Only the highly wrinkled mulesed sheep lost weight after the operation. Average body weights at the commencement of the trial and 32 days later are shown in Table 1.

TABLE 1

AVERAGE BODY WEIGHTS (kg)

Date	Lightly Wrinkled		Moderately Wrinkled		Highly Wrinkled	
	Mulesed	Unmulesed	Mulesed	Unmulesed	Mulesed	Unmulesed
19–8–60	39·9	39·8	37·1	36·7	35·6	33·1
20–9–60	40·3	40·5	37·1	37·1	34·6	34·2
Change in Body Weight ..	+0·4	+0·7	..	+0·4	−1·0	+1·1



Highly wrinkled breech. Unmulesed sheep in this class are subjected to 90% of flystrike.

Weather Conditions During Trial

During the trial records were kept of rainfall, temperature and humidity readings. These are shown in Table 2.

TABLE 2

RAINFALL, TEMPERATURE AND HUMIDITY (9.00 A.M. READINGS)

Month	Rainfall (mm)	Number Falls	Temperature		Humidity %
			Max. °C	Min. °C	
1960—					
October	25·4	6	22·2	15·6	44
November	41·6	3	20·0	15·6	39
December	39·2	6	23·9	18·9	49
1961—					
January	76·2	3	23·9	18·3	50
February	53·9	6	23·9	19·4	59
March	57·1	4	23·3	20·0	55
April	77·2	5	22·8	18·3	60
May	15·0	2	19·4	15·0	64
June	16·3	2	10·0	4·4	73
July	28·0	3	8·9	4·4	68
August	6·35	2	11·1	7·2	55

Number and percentage of Breech Strikes

It was observed that greatest activity by *L. cuprina* occurred when temperatures were above 20°C (range 20°C to 24°C) and the weather was showery and sultry with intermittent sunshine.

With the onset of cooler weather, and because sheep were crutched in May, blowfly strike during the winter was negligible. Results are shown in Table 3.

Throughout the trial unmulsed sheep were struck more than mulesed. The unmulesed lightly wrinkled sheep experienced greater strikes than the radically mulesed highly wrinkled sheep.

TABLE 3

NUMBER AND PERCENTAGE OF BREECH STRIKES

Date	Lightly Wrinkled		Moderately Wrinkled		Highly Wrinkled	
	Mulesed	Unmulesed	Mulesed	Unmulesed	Mulesed	Unmulesed
1960—						
October	..	..	..	..	..	4 (36%)
November	..	..	..	1 (6%)	..	3 (27%)
December	..	..	..	..	..	2 (18%)
1961—						
January	..	..	..	2 (12%)	..	6 (54%)
February	..	5 (23%)	..	2 (12%)	..	2 (18%)
March	..	2 (9%)	..	6 (35%)	2 (18%)	8 (73%)
April	..	4 (18%)	..	9 (53%)	2 (18%)	10 (91%)
May	..	..	..	..	..	..
June	..	..	..	..	..	..
July	..	..	..	..	..	..
August	..	..	..	..	..	..

Reproductive performance

Table 4 shows the reproductive performance, while Table 5 shows the effect of multiple strikes on lambing performance.

The fertility of struck ewes is lower than those unstruck, and the number of lambs marked is higher in unstruck ewes, as ewes severely struck often fail to mother their lambs.

TABLE 4

REPRODUCTIVE PERFORMANCE

—	Lightly Wrinkled		Moderately Wrinkled		Highly Wrinkled	
	Mulesed	Unmulesed	Mulesed	Unmulesed	Mulesed	Unmulesed
Lambing %	95·4	90·9	82·4	58·8	72·7	..

TABLE 5

EFFECT OF MULTIPLE STRIKES ON LAMBING PERFORMANCE

Number of Strikes	No. of Ewes	Percentage Wet
Not struck	60	95·0
Struck once	24	66·7
Struck twice	5	20·0
Struck three times	7	..
Struck four times	4	..

Moreover, lactation is quickly suppressed which accounts for the greater percentage of dry ewes observed in struck sheep at marking time.

Wool production

Wool production was higher in the mulesed sheep than in the unmulesed. The figures are shown in Table 6.

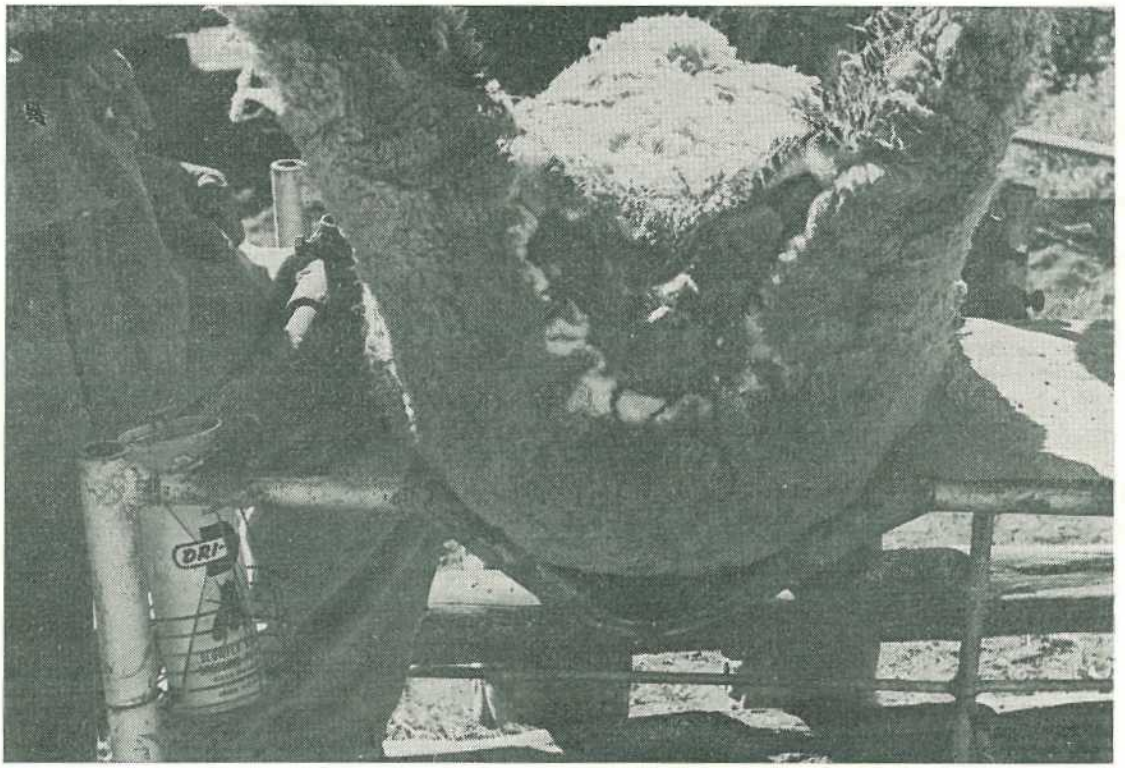
TABLE 6

WOOL PRODUCTION

	Lightly Wrinkled		Moderately Wrinkled		Highly Wrinkled	
	Mulesed	Unmulesed	Mulesed	Unmulesed	Mulesed	Unmulesed
Average Wool Production (kg)	4·6	4·5	4·5	4·4	4·3	3·8

When efficiently carried out on grown sheep the radical Mules operation reduces the wrinkled sheep's predisposition to fly strike to at least that of sheep with a completed plain breech.

The operation gives a high degree of protection, even in a severe fly wave, reducing the number of strikes in sheep, lowering the costs of blowfly control, and minimising loss of wool and lambs.



Showing the severe form of radical mules necessary on a highly wrinkled breech. Healing of wounds takes 32 to 40 days. Mulesed sheep in this class are subjected to 18% of strike.

WHEAT

Wheat Board Officers examine a crop of "Oxley", grown for seed increase, Jondaryan area.

Latest recommendations and research findings concerning Queensland's major grain crop.

A Q.A.J. Special feature prepared by W. BOTT and N. J. DOUGLAS, Agriculture Branch.

WHEAT is Queensland's major grain crop, with an annual production that has risen steadily to reach a peak of more than one million tonnes in 1968–69.

Since then a succession of unfavourable seasons has sharply reduced production during the last five seasons. Consequently imposition of delivery quotas in 1969–70 had little effect on subsequent production as quotas have not yet been filled because of poor seasons.

As wheat is a winter growing crop and Queensland has a summer dominant rainfall, production is restricted to southern and central parts of the State in the 575 to 700 mm rainfall zones.

In the early years of the wheat industry, the chief producing centres were those on the eastern Darling Downs served by the main railway line from Toowoomba to Warwick.

During the 1930's the main production emphasis swung northwards to the open plains from Jondaryan and Bongeen to Dalby and Jimbour.

Still more recently, the brigalow plains extending from Jandowae westwards to Brigalow and Chinchilla have been brought under the crop.

In the post-war years, wheat growing gradually extended westward to all the brigalow areas served by rail.

It increased rapidly with centres such as Tara, Meandarra, Wandoan, Drillham, Goondiwindi, Dulacca and Wallumbilla linking the two established wheat-growing districts of the Darling Downs and the Maranoa, where wheat has been grown since 1882. For many years, the area devoted to this crop fluctuated very little, but recently a rapid increase has occurred.

In the Capricornia region, wheat in the Biloela, Theodore, Emerald and Clermont districts is often grown as a minor part of the overall farming operation. While the rainfall total at these centres are similar to those of the Darling Downs, its distribution is more erratic. The evaporation rate, too, is much higher and so the risks attending crop production are correspondingly greater.

In favourable years, however, excellent yields of good-quality grain have been recorded, and the area devoted to wheat is considerable.

While these districts contain a large additional area of potential wheat growing land, they cannot be regarded generally as safe areas for grain production alone.

The southern brigalow country, that is from Tara to Goondiwindi, seems to hold the key to expansion of the wheat industry in Queensland. This is made up of large areas of fertile brigalow country suitable for wheat growing on a reasonably sure basis.

The area under wheat in Queensland fluctuates from season to season. These fluctuations are caused by seasonal conditions and the relative profitability of wheat with other grain crops, wool and beef.

Table I shows the wheat area and production from main districts in Queensland for the last 8 years.

The long term average yield of wheat in Queensland is about 1 400 kg per ha.

Where satisfactory moisture is available, wheat can be grown successfully in Queensland on most types of soil ranging from light loams to the red scrub soils of the South Burnett to heavy black-clay soils typical of the Darling Downs. While the lighter-textured soils may have definite advantages in certain seasons, it is on the heavier soils that the bulk of the State's crop is produced. These soils produce more consistent yields.

TABLE 1
SEASON, AREA AND PRODUCTION

District	1965–66		1966–67		1967–68		1968–69		1969–70		1970–71		1971–72		1972–73	
	ha '000	tonnes '000	ha '000	tonnes '000	ha '000	tonnes '000	ha '000	tonnes '000	ha '000	tonnes '000	ha '000	tonnes '000	ha '000	tonnes '000	ha '000	tonnes '000
Dalby	111·0	194·9	130·4	287·4	127·0	194·2	121·2	200·9	62·5	47·0	20·3	15·0	91·1	173·3	85·9	108·8
Western Downs	78·6	72·6	112·3	208·9	140·4	151·5	183·2	322·4	119·5	107·6	18·2	10·6	148·0	201·5	125·6	129·4
Northern Downs	27·0	42·7	29·4	62·0	28·5	42·8	30·1	50·8	16·5	12·6	12·9	10·3	19·8	31·1	4·9	4·3
Central Downs	34·9	49·4	62·9	124·7	68·0	97·2	69·0	126·5	39·1	36·8	12·5	15·4	52·5	96·6	22·2	21·7
Southern Downs	8·2	9·9	12·7	22·6	11·8	13·8	10·1	16·9	5·4	5·3	0·6	0·8	6·4	10·1	0·7	0·7
South west Downs	8·9	3·7	53·1	88·7	67·2	64·4	105·9	136·5	120·5	119·2	57·8	49·9	105·1	107·3	62·0	51·8
Central Highlands	19·2	14·7	10·5	16·0	32·9	36·3	59·2	92·5	..	..	..	..	22·5	21·5	9·2	8·1
Dawson–Callide	19·7	16·8	41·4	70·9	53·0	73·5	69·0	119·5	8·8	5·0	1·1	1·8	15·7	20·2	27·5	27·6
Maranoa	6·5	2·1	22·1	32·4	22·8	17·0	34·2	49·3	15·9	12·0	2·6	1·0	24·0	27·6	5·5	3·5
Other districts	7·3	12·5	11·1	19·2	10·1	12·7	11·5	19·3	4·6	5·8	0·5	0·7	3·5	4·2	2·2	2·8
Totals	321·9	419·6	486·5	933·3	562·0	691·4	693·7	1 135·0	393·3	352·0	127·0	105·9	488·9	689·5	345·9	359·2

Which variety?

In the early days of wheat growing in the State a steady and continuous change in the varieties holding premier position took place.

MORE recently, however, there has been a dramatic increase in the rate of change as plant breeders strive to replace older varieties as they succumb to rust.

The table below shows the rise and fall in popularity of a number of varieties during the last eight years.

Many hundreds of varieties from many parts of the world have been tried by research workers and farmers under field conditions during the history of the industry here.

It became evident, however, that the varieties offering best prospects of a successful grain crop were early maturing varieties and preferably those with a light foliage and stemmy, rather than leafy, appearance.

TABLE II

Year	Wheat Varieties ('000 ha)				
	Spica	Mendos	Gamut	Timgalen	Gatcher
1965–66	128	73	2	..	..
1966–67	125	171	45	..	..
1967–68	94	228	160	3	..
1968–69	87	284	158	74	..
1969–70	67	230	112	145	0·15
1970–71	24	92	45	65	4
1971–72	59	152	103	109	74
1972–73	43	107	84	87	146

The early maturing habit conferred a certain drought resistance since varieties of this type required less moisture per unit of grain yield than did the types maturing later.

This characteristic was especially important in the earlier days of the industry before the short or summer fallow was as efficiently practised as it is today.

Another major advantage of the early maturing varieties was that they were, in most seasons, able to mature their crop before rusts became prevalent enough to threaten yields seriously. Such varieties, while certainly not rust resisting, were frequently rust escaping.

The breeding programme, begun by the late R. E. Soutter before the beginning of the century and continued by him until his retirement in 1948, had as its major objectives drought resistance, high bread-quality, rust resistance and general adaptation to local conditions.

Considerable success was achieved in all but the third objective within a period of 25 years. Stem rust resistance was not successfully introduced into commercial varieties until fairly recently, mainly because no suitable rust-resisting parents were available.

For a number of years, more than 80 per cent of the State's wheat acreage was occupied by Queensland-bred varieties, but this percentage fell sharply with the recent release from New South Wales of a succession of varieties resistant to stem rust.

It is evident that, as new rust resistant varieties become available from the plant breeder, these will dominate the field until such time as they too are made valueless by the appearance of new and more virulent races of rust.

Brief descriptions of the more important varieties grown in Queensland are given. The varieties are listed alphabetically.

Gamut

Gamut was named by the University of Sydney in 1965 as a main-season variety combining at least four resistances to stem rust.

It is fairly quick maturing and grows fairly tall with thick straw. The ears bear tip-awns a little shorter than those of the parent, Gamenya, and show a slight tendency to shatter. The grain is slightly rough with a low grain weight but with very satisfactory bread-flour quality.

The area of Gamut rose rapidly during the first three seasons in cultivation, but it has since declined on account of low grain weight particularly under more marginal conditions. It is still a useful variety although its stem rust resistance became less effective during the 1973 season.

Gatcher

Gatcher is a Gabo-derivative and was released by the University of Sydney in 1969.

It is quick maturing, and suitable for main-season planting. It has performed well to date in all districts except the Central and Northern Downs where some disappointing results have been obtained with poor growth under stress conditions.

It is a medium-tall variety with fairly long straw and erect bearded heads. The grain is large, and of good weight and has somewhat superior baking quality to Mendos.

Gatcher has shown some evidence of susceptibility to loose smut but is resistant to current races of stem rust and flag smut and is increasing in popularity.

Mr. V. Hetherington, Kokotunga, examining a crop of Gamut.

Hopps

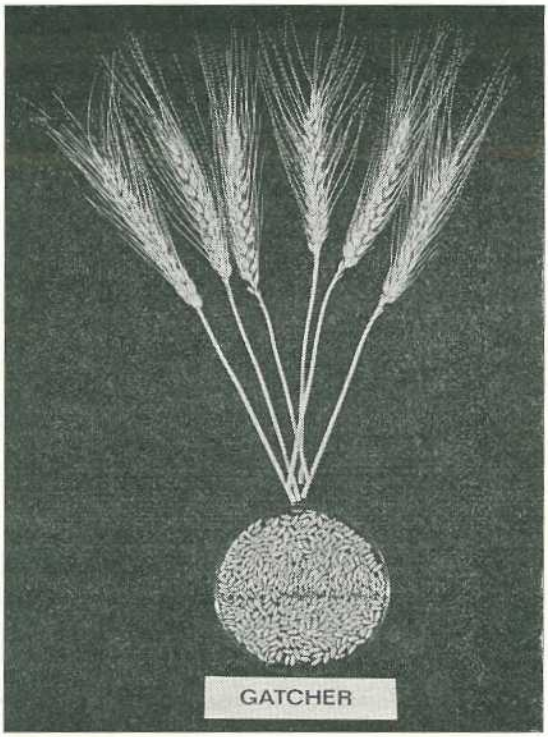
The variety Hopps was named and released by the then Queensland Department of Agriculture and Stock in 1959.

It is fairly drought tolerant, medium-slow in maturity and of average height with fine, willowy straw. The ears are tapered and fully awned.

The chaff is downy and white in colour, although the awns may sometimes be fairly dark. The grain is midsize, attractive, light amber in colour and is distinctly tapered towards the brush end.

Hopps produces a fairly well-balanced flour of medium-strong quality, but is not eligible for prime hard classification.

The variety though no longer completely resistant to stem rust appears to possess "field resistance" and is still used for early planting as a dual purpose crop. It responds well to grazing and a good tillering capacity enables it to go on to produce useful yields of grain.



Mendos

Mendos was released in 1964 by the University of Sydney.

Mendos is fairly quick maturing with short, fairly strong straw. The ears are white, slightly tapered and bear strong tip-awns. The grain is slightly rough with moderate hectolitre weight and fairly satisfactory flour quality.

The variety was immediately popular with growers in Queensland and displaced Spica as the leading variety within 3 years of its release.

However, stem rust strains capable of attacking Mendos appeared in 1968, rendering it unreliable under conditions suitable for stem rust.

Mendos is still a favourite variety in grazing areas as more recent releases are fully awned and are less suitable for grazing off in dry seasons.

Stem rust resistant varieties should be planted wherever practicable in place of Mendos.

Oxley

Oxley is a new variety named in 1974 by the University of Queensland and the Queensland Department of Primary Industries.

It is of mid-season maturity, although somewhat earlier than Festiguay. It is a fully awned variety, of medium height and free threshing. The grain has a high test weight, is free milling and of good baking quality. It has given consistently high yields relative to Tarsa and for that reason, tends to have slightly lower protein contents.

Oxley was released as a stem rust resistant replacement for Tarsa. Since then new field races of rust have been identified which attack Oxley. Although it is expected to play a useful roll in the short term, its replacement with fully resistant mid-season varieties has become necessary.

Spica

Spica was named by the then Queensland Department of Agriculture and Stock in 1952 and within two years became the leading variety in this State.

It then declined in popularity but later regained favour and is still grown to some extent. The variety is quick-maturing, medium-tall and has a pale yellow straw of satisfactory strength.

The ears are awned, creamy-white in colour, mid-size, tapered and slightly curved.

The chaff is smooth and slightly adherent making the variety difficult to thresh under some conditions, but preventing loss of grain by shattering of the heads. The grain is large, mostly lopsided at the back, white in colour and semi-translucent. It yields flour of excellent baking quality.

Spica is resistant to flag smut, shows some tolerance to stem rust and because of its early maturing habit, its hardiness and high yielding characteristic is still recommended in many districts including the Maranoa and Central Highlands.

Tarsa

Tarsa was released by the Department of Agriculture, New South Wales in 1971.

Tarsa tillers well and produces erect partly-bearded heads on fairly tall straw. The grain is fairly small but it is attractive with high weight and good baking quality.

It is resistant to flag smut and may be suitable as a dual purpose or grain variety. Tarsa is no longer resistant to current races of stem rust and severe damage could occur in a season favourable to the disease. Cultivation of Tarsa could not be recommended once a suitable alternative mid-season variety becomes available.

Timgalen

Timgalen was released by the University of Sydney in 1967 and is still a leading variety in Queensland.

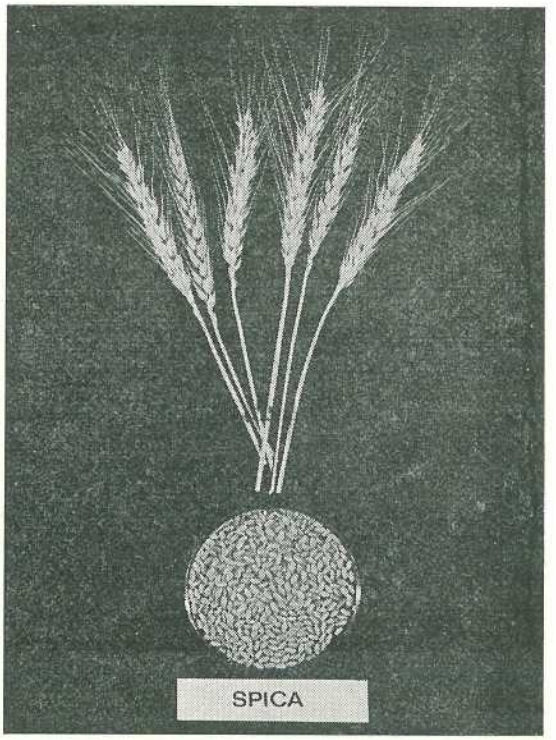
It is a medium height variety of high tillering capacity. It is fairly quick maturing and suitable for main season plantings.

The ears are somewhat small and fully awned. The grain is small, of reasonable weight and high protein percentage.

Under favourable conditions, it is capable of giving very high yields and generally it has given good overall performance.

It has resistance to all current races of stem rust and flag smut.

Because of its high tillering capacity and small grain size, seeding rate of Timgalen is often reduced slightly.



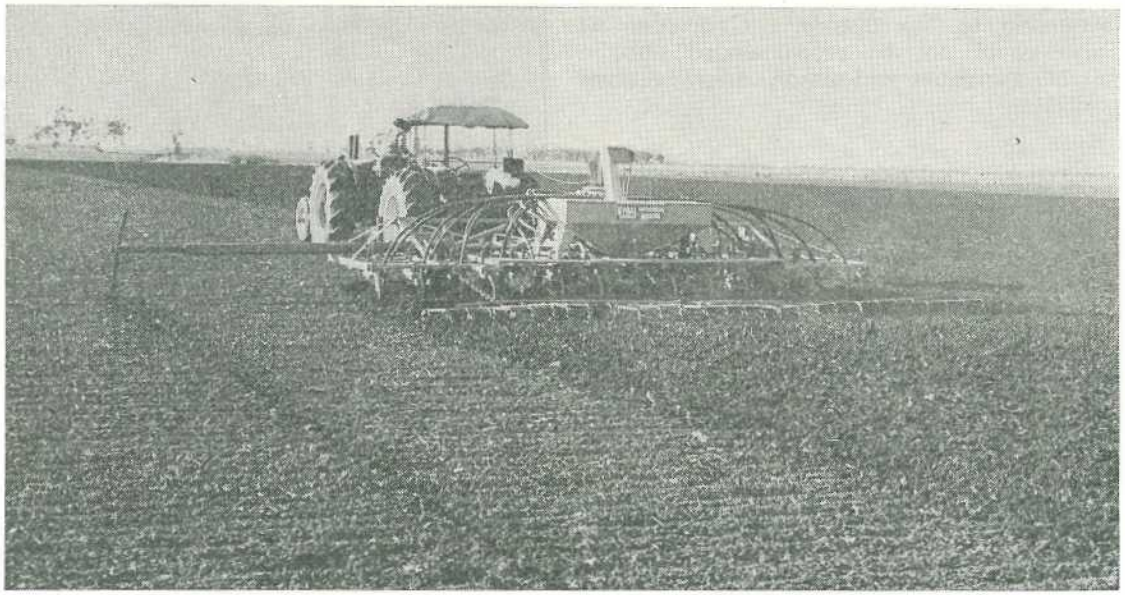
The Cropping System

Traditionally, Queensland's wheat crop has been grown on a continual cropping basis. The land has been fallowed for 6 or 7 months during the summer to build up soil moisture. This system is still being practised by many wheatgrowers.

On the Darling Downs, many wheat growers have diversified recently into summer grain production such as grain sorghum, sunflowers and soybeans. Where summer crops are included in the cropping system, fallow periods are sometimes 18 months long.

In the western and northern areas, with their less reliable rainfall, wheatgrowers have diversified into beef cattle and sheep as well as summer grains. The cropping frequently in these areas is less consistent and fallow periods are variable.

Sowing the crop



Planting wheat with a combine manufactured in Dalby area.

WHEAT in Queensland is almost universally drill-planted at 18 cm row spacing by means of the standard grain drills of varying width.

The "combine" or cultivator-drill is standard sowing equipment although seed boxes mounted on either scarifiers or disc ploughs are used in some areas. All are dual-purpose machines which allow the farmer, in one operation, to give the land its last working and to sow the seed with the soil still in the best possible condition to ensure germination. Modifications now have been made to some planting machinery, including press wheels to improve seed-soil contact and moisture-seeking devices to enable planting to be made through layers of dry soil.

Sowing techniques vary little with soil type. However on very heavy soils, rolling after sowing often increases emergence. 5 to 8 cm is the most favourable sowing depth and reduced emergence usually results from plantings deeper than 12 cm.

Dry sowing is not recommended. Any advantages that may be gained through the

earlier germination of seed so sown may be more than offset by the incidence of seed spoilage and weed growth.

Time of sowing

The most favourable sowing time for wheat is May and June. Earlier sowings of quick-maturing varieties run a considerable risk of being frosted later in the season. If planting rains do not occur by the end of June, the planting period can be extended to early August in southern Queensland and to mid-July in central Queensland with some loss of yield. Long-season, dual-purpose wheats should be sown early in the season—in April and May.

The prescribed minimum germination standard is 80 per cent., while 95 per cent. germination can be expected from grain taken from a well-grown crop matured and harvested under good conditions.

Rates of sowing

The most satisfactory planting rate depends on seasonal conditions, variety and time of sowing and will vary from one district to another.

The seeding rate generally lies between 20 and 50 kg/ha.

Where grain has been stored for some time or subjected to weathering or insect attack, its germination should be checked before planting. Where the germination percentage falls below 80, the sowing rate should be increased to compensate for the faulty seed.

Selection and distribution of seed wheat

The State Wheat Board operates a seed wheat scheme which provides growers with a ready reliable source of all approved varieties.

The Queensland Wheat Variety Committee, consisting of the members of the State Wheat Board and representatives from the Australian Wheat Board, the Department of Primary Industries (including the Queensland Wheat Research Institute) and the Flour Millers' Association recommends to the State Wheat Board which varieties should be eligible for quality premiums each season. It also recommends the quantities of varieties to be grown for seed each season.

New varieties and selected seed of existing varieties are produced as an adjunct to the plant breeding work of the Department of Primary Industries and more recently the University of Queensland. These are handed over to the Board from when the varieties are ready for release.

Specialist officers of the Board supervise further increase on selected farms until sufficient seed is available for general release. After this stage, any grower may make application to the Board to have his crop inspected as a potential seed crop. These crops are inspected and if considered suitable, part or all of the crop would be set aside for seed. These seed lots are segregated and delivered to appropriate depots with all facilities for grading and seed treatment. A special premium is paid to growers who carry out multiplication of seed of selected new varieties.

The seed production scheme is working very satisfactorily. Seed lines have attained a high standard of varietal purity, and freedom from disease and weed contamination.

Varietal purity is important and the main sources of contamination are from machinery used for harvesting, grading and planting. In keeping varietal purity on the farm, the header is the most difficult machine to clean down completely. When changing from one variety to another, the best procedure is to discard the first bin of the new variety.

Fertilizers

Up to 10 years ago, it was considered that most of the wheat soils in Queensland did not require fertilizer to improve the growth of wheat crops. Superphosphate was used on areas of lighter soil in parts of the Darling Downs and even on some areas of the heavier clay soils, but generally the use of fertilizer was unknown to the wheat farmer.

FIELD experiments begun by the Department in 1954 and continued up to the present time have shown conclusively the need for the use of fertilizer on many of the State's wheat soils.

The main elements found to be deficient are nitrogen and phosphorus. The possibility of zinc disorders must be considered, especially after long fallows on alkaline black soils.

While some information is available on sulphur deficiency, it has not yet shown up as a problem in commercial wheat crops. Copper deficiency has also been reported from isolated areas of the Western Downs brigalow region.

Fertilizer requirements are specific to individual farm situations and advice should be sought so that fertilizer recommendations can be made on a farm or paddock basis.

Department research has shown that about 50% of wheat soils are low in phosphorus. Phosphorus deficiencies in the past have been corrected by using standard superphosphate.

Applying anhydrous ammonia on a Dalby wheat farm.

Now more concentrated forms are available but these fertilizers contain little sulphur.

Nitrogenous fertilizers are used mainly on the Darling Downs. Two commercial fertilizers are widely used: anhydrous ammonia and urea. On the basis of nitrogen content, both are equally effective. The cost per unit of nitrogen does vary between types.

The cheaper form, ammonia, has so far been restricted to the Central and Southern Downs where volume sales justify the cost of the distribution facilities. Ammonium nitrate is recommended for topdressing established crops when nitrogen deficiency appears.

Other areas will respond in certain seasons to applications of nitrogen. Increased yields will depend largely on available soil moisture. In view of this, nitrogenous fertilizers are not at present applied in these areas as a general practice.

LAND PREPARATION

IT is only possible to cover basic principles of land preparation because wheat is grown in such a range of soil and climatic environments under various cropping systems using different management practices.

Following the harvest of the preceding crop, and throughout the fallow, the land should be cultivated only when weed growth becomes a problem, unless the surface has set hard and requires breaking to allow rainfall entry. If the soil is cracked, cultivation should be delayed to retain the cracks in an open condition where they are effective in allowing storage of high intensity rain. While the cracks remain, the soil is basically dry and weed growth will be slow and evaporative losses low.

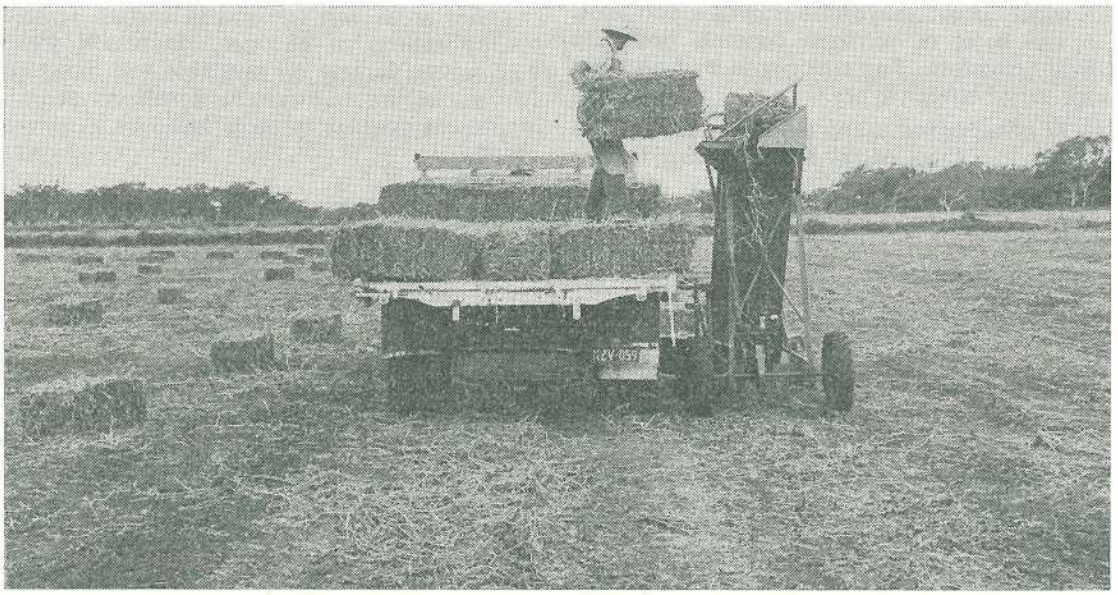
The implement used for the first cultivation will depend on what is available and the cropping system being used. Should the farmer be aiming for the immediate sowing of another crop, the cultivation will be designed to give weed control and prepare a seedbed. However, generally a longer fallow will be planned, in which case a rough surface should be produced. Disc ploughs are often used for the first cultivation.

Crop residues should be retained and a cultivation implement used which will handle them. Slashing of the stubble will facilitate easier handling. Burning of residues should be avoided but may be necessary in such emergency situations as where the build up of disease organisms has been known to occur.

Tyned implements such as scarifers are widely used for these cultivations. These implements effectively control most weeds yet produce minimal stubble breakdown and surface disturbance.

The depth of cultivation should be slowly reduced over the fallow from approximately 10 cm for the initial rough tillage to about 5 cm for the seedbed. Unfortunately most planting combines in common use require a fine, stubble free, seedbed for effective sowing of the crop. This means the land is in a highly erodible state during seed preparation and early crop growth. This problem can be overcome by using press wheel drills or modified combines with stubble clearance.

Wheat for grazing or hay



Making hay from frost-damaged wheat at Broadwater.

WHILE wheat is grown mainly for its grain, large areas are used annually for grazing and also a very small area is grown for hay.

Much of the area used for grazing is probably planted for grain production and eventually fed off as a result of a feed shortage on the farm, or a decision that the grain crop would probably fail on account of dry weather. Failed crops of the awned varieties are unattractive to livestock and these crops should be grazed before the head appears.

In the western areas dual-purpose wheats such as Tarsa can be sown in March-April and provide useful grazing in June and July. Livestock should be removed by mid July if these crops are to produce satisfactory grain yields.

Where wheat is cut for hay, best results are obtained by cutting during the early heading period, not later than a week after flowering. Well-formed grain in wheaten chaff generally indicates that the material has passed its most nutritious stage. A grain content in wheaten chaff also invites destruction by mice and other vermin.

Crops may be cut with a mower or forage harvester, allowed to cure in the swath, and baled.

As in making other types of hay, it is essential that the material should carry no free moisture when it is baled or stacked.

Excess moisture will cause over-heating in a large stack of any type, and has frequently resulted in fire and complete loss through spontaneous combustion.

Only experience can provide a guide as to the correct stage at which to bale loose hay. With wheat, however, the best criterion is the drying out and shrinkage of the upper nodes, or joints, of the straw.

Insect pests on Wheat in Queensland

SEVERAL insect and related pests are associated with the production of wheat in Queensland.

Although serious and widespread losses occur in some areas each season, insect pests are not usually considered to be major limiting factors in the production of wheat.

Armyworms

Armyworms are one of the most common of the insects which attack wheat in Queensland. Almost invariably each season, some part of the cereal-producing areas of the State are infested, with crop losses occurring in either seedlings during autumn or in more mature plants during spring. Armyworms show a preference for barley, but when pest numbers are high, significant losses occur also in wheat. The moth is fawn to brownish color with a wing span of 40 mm and is usually active only at night.

When fully grown, the grubs vary in colour from green to black, with two distinctive green longitudinal stripes on each side of the body. They may measure up to 50 mm in length. Depending upon the species present, feeding may occur during the day or night. However, when populations are really high, feeding will occur during both day and night, irrespective of the pest species. The grubs are fully grown in 4–5 weeks. The chances of re-infestation following treatments are very low.

Two distinct types of armyworms attack may occur. The more spectacular infestation develops when the caterpillars occur in countless numbers and move into a crop on a definite "front", eating all the plants as they advance. The more common type of infestation, however, is a lighter but more general distribution of larvae over a paddock. Such an infestation follows from a wide dispersal of moths and consequent scattered egg laying. Highly significant crop losses often occur under these conditions before the grower realizes that the pests are present.

Control. DDT. is the most effective insecticide for armyworm control and applications by means of a ground operated boom or from an aeroplane are usually employed. DDT. should be applied at 550 g of active constituent per ha (2·2 litres of 25% product per ha) when infestation is widespread over a crop, but when the pests are moving as an "army", treatment of a broad strip over and in advance of the infestation is sufficient to bring the pests under control.

Should wheat stubbles be intended as a fodder crop for grazing in the post-harvest period, the use of DDT. is banned and the alternative insecticide, trichlorphon at 550 g per ha, (700 g of 80% dispersable powder or 925 ml of 60% emulsifiable concentrate per ha) is recommended. Although results with this material may be slightly less effective than with DDT., it has the major advantage that grazing may be carried out without fear of residue problems after only 2 days from treatment.

Cutworms

The name cutworm is derived from the main habit of these pests in cutting through the stem of young plants near ground level. Affected plants fall over and die and reductions in seedling stands may result from this type of feeding. In more established crops, however, injury is largely confined to the leaf flag, with the result that damage to the crop is much less severe. The larva is grey-green to dark brown, soft bodied up to 40 mm in length. The moth is dark greyish in colour with a wing span of 40 mm.

The life cycle of the pests may be completed within 7 to 8 weeks but, during the cooler months, as long as 15 weeks may be required. Where frosts are severe, only the pupal or resting stage is able to survive the winter.

DDT. at 550 g active constituent per ha (2·2 litres of 25% product per ha) as for armyworms will give satisfartory control but the comments on DDT. residues and withholding periods are equally applicable in this situation. When an alternative chemical is required, trichlorphon, again at 550 g active constituent per ha (700 g of 80% dispersable powder per ha or 925 ml of 60% emulsifiable concentrate per ha) is recommended.

Locusts

The hoppers and fliers of several species of locust and grasshoppers may attack wheat crops at any stage of growth and if large numbers of these insects appear, fields of wheat may be completely destroyed.

The commonly encountered species are the Australian Plague Locust (mainly in southern regions), and the spur throated and the migratory locusts (mainly in Central Queensland regions).

Isolated specimens of locusts are encountered virtually every season but such non-swarming individuals are of no importance. Invasion of cropping areas by small swarms may result in plant defoliation. But, under plague conditions, large swarms moving into crops from surrounding areas of pasture can result in complete crop loss.

In western areas, the pests may be abundant following a succession of dry seasons. When swarms are known to be present, growers are advised to watch for the pests in areas adjacent to their cereal production paddocks. If the swarms are composed of hoppers which are the immature wingless stages, good control is relatively easy to obtain, but after the pests have reached the adult flying stage, control is much more difficult.

Control. Locust invasions may be checked by spraying over and around the swarms with maldison at 425 g of active constituent per ha (425 ml 103% emulsifiable concentrate per ha). To avoid residues in animal or crop produce, grazing or harvesting should be withheld for 7 days after treatment.

Blue Oat Mite

The blue oat mite, as the name implies, is a pest more commonly encountered on oats but may attack wheat.

The blue oat mite is purplish blue in colour with a red spot on upper surface. The legs and mouth of the pest are bright red. The length is 0·8 mm.

Damage by the blue oat mite is virtually confined to seedling crops and is most common in late planted stands which germinate and begin to grow under dry, cold conditions.

Feeding by the mites causes a silvery or greyish appearance on the leaves and, when feeding is intense, the entire leaf area may present a bleached appearance.

Control of blue oat mite may be obtained rapidly and effectively by spraying with either azinphos-ethyl or methidathion at 35 g of active constituent per ha (90 ml of 40% product per ha). To avoid the possibility of residues in produce, grazing or harvesting should be withheld for 7 days after the application of either of these insecticides.

Brown Wheat Mite

The brown wheat mite is often confused with the blue oat mite. The adult of the brown wheat mite is quite small, about the size of a small pin head, and not more than one-third the size of the blue oat mite. The mite is brown and the front pair of legs of the wheat mite is distinctly longer than the remaining legs.

The brown wheat mite is essentially a dry weather pest. Feeding on seedling grain crops causes a fine mottling of the leaves. Persistant populations cause stunting and reduction of tillering. Seedling stands may be eliminated by excessive populations coupled with poor growing conditions.

Dimethoate is recommended for control of the brown wheat mite, and the dosage is 35 g of active constituent per ha (120 ml of 30% product per ha).

Pest kills without good subsequent growing conditions are unlikely to result in significant plant recovery.

Ants

Ant damage can be a serious limiting factor in crop establishment and, in recent years, losses have occurred particularly on the Darling Downs and Central Highlands in the heavier black soils. Although several species may be involved, they are all small and brownish coloured.

As the ants attack only the seed and not the young plants, every technique which will promote rapid germination will minimize ant damage. For example, rolling to compact the soil around the seed and thus ensure the most favourable conditions for germination, should be carried out in all soils where rolling is an acceptable practice. Treatment of this nature is sufficient to ensure an adequate stand of plants when pest populations are not excessively high.

Insecticide treatment, however, will give control when required. Lindane powder or dust formulation containing 20% of active constituent should be mixed with the seed immediately before sowing at 2 g per kilogram. It is essential to plant the seed immediately after the insecticide is added as prolonged contact between high content lindane dusts or powders and the seed may cause severe seedling growth malformations.

Chemical treatment should be applied only when a pre-plant search reveals that ants are prevalent in the soil. All seed which is treated and not sown should be destroyed. On no account can it be fed to domestic animals as such a procedure may result in undesirable residues in the animal products.

False Wireworm

False wireworms cause sporadic damage in wheat every season. Occasionally infestations are sufficiently widespread to make replanting of affected paddocks necessary. The false wireworms are easily recognized in the field as being shiny wire-like pale to reddish-brown coloured "worms" or larvae with a quite hard body. Fully grown, they measure up to 50 mm in length.

The adult stage of the false wireworm is a rather small dull coloured beetle which can be easily overlooked in searching for soil pests.

Observations indicate that the insects are most commonly encountered in the lighter of the black soils of the Queensland grain areas.

Control. Trial data on the control of false wireworms are not yet complete. However, preliminary evidence indicates that lindane mixed with sufficient inert material to give even dispersal and applied as an in-furrow treatment at planting will give control of the pests. The insecticide should be used at not more than 280 g of active constituent (gamma isomer) per ha (1·4 kilogram of 20% product per ha or 350 g of 80% dispersable powder per ha) when crops are planted at the usual 18 cm drill width. However, where wider row spacings are employed proportionately less should be used.

Thrips

Thrips and aphids are often encountered but they are not considered to be economic pests.

General considerations

Pest control in wheat crops is not normally an annually recurring problem but rather one which requires attention in the occasional season. When control measures are necessary, it is often essential for them to be applied quickly and effectively to ensure that losses are kept to a minimum. It is, therefore, essential that the grower is aware of the problems which may be encountered. He must be able to identify the pests that are present so that the appropriate action can be taken as soon as possible.

Weeds and their control

Good weed control is vital if you want a good crop. This article gives guidelines on how to control most of the major weed pests of wheat crops.

WILD OATS is the worst weed of the Queensland wheat crop and causes significant economic losses.

It is a significant problem in those winter cereal growing areas in southern Queensland where winter fallowing between crops is rarely practised.

The weed reduces farmer income both through reduced cereal yields and through dockage for impurities in the grain.

In Queensland there are two species of wild oats: *Avena ludoviciana* and *Avena fatua*. *Avena ludoviciana* produces two or three seeds which stick together to form a seed group. *Avena fatua* produces double or triple seeds which fall apart when ripe.

Wild oats is a significant problem owing to insufficient winter fallows in many management systems, the dormant nature of the seed and the unpredictability of potential infestations.

Wild oats germinate mainly during cold, wet periods in winter with the peak germination occurring from early May to late October. The time of emergence is important if summer cropping is considered as a control measure. Summer crops should not be planted earlier than November on infested ground as early sowings may result in dirty crops.

The reserve of wild oats seeds in the soil germinates at a variable rate, some seeds germinating almost immediately, others remaining dormant for some years. Winter fallowing must be continued beyond one season to exhaust seed reserves effectively and reduce wild oat populations.

When a pasture phase is used to reduce the wild oat population the area should remain in pasture for three or preferably four years. However, on areas that are summer-cropped and winter-fallowed the period out of winter crops does not need to be as long because winter cultivations speed up wild oat seed germination. Two or preferably three years out of winter crop is generally effective if wild oats plants are not allowed to seed.

Basically, the wild oat situation is one of increasing weed infestation during the winter crop phase and decreasing infestation during the summer crop phase of the rotation.

Because winter crops have generally been the more profitable in Southern Queensland, the basic objective in control is to extend the winter crop phase by restraining wild oat build-up and keeping the summer phase to a minimum by rapidly reducing the potential wild oat population.

In recent years some areas in the Eastern Darling Downs and more northern cereal growing areas have found summer cropping to be more profitable. In these areas wild oats are less of a problem.

Under continued winter cropping light infestations of wild oats build-up rapidly. A single wild oat plant produces up to 400 seeds. Infestations of 350 plants per square metre may build up with only 4 to 5 years continual winter cropping. Infestations of this level may reduce cereal yields to one half that of clean paddocks.

The rate of wild oat increase during winter cropping is restricted by measures such as chemical control, delayed planting, careful cultivation before planting, and in paddocks with light infestations, by hand-pulling. Avadex B.W. (tri-allate), has proved most useful in assisting with wild oat control but has never replaced sound farming practice.

Rather than rely on the inherent wild oat population for feed, commercial oats may be planted into an infected paddock. This gives good control provided grazing management is strict and severe. The paddock should be ploughed in before the wild oats set seed.

Control of other weeds

Other than wild oats, the main weeds in the State's wheat crop are turnip weed, mustards, wild radish, Hexham scent, climbing buckwheat, New Zealand spinach, Mexican poppy and Spiny emex.

Turnip Weed, Wild Radish and Mustards

The mustards (*Sisymbrium* spp.) and turnip weed (*Rapistrum rugosum*) have yellow flowers, while wild radish (*Raphanus raphanistrum*) has almost white flowers with purple veins in the petals. These weeds are distinctive, and in favourable seasons cover whole paddocks, roadsides and stock routes as well as infested wheatfields. They belong to the well-known cabbage and turnip family.

These plants are particularly susceptible to even light applications of hormone herbicides. Their destruction in cereal crops is simple and they should no longer appear as weed pests in wheatfields.

Experience has shown that turnip weed can be killed at all stages of growth, but generally the most effective treatment is that given when the plants are young and leafy.

When turnip weed is growing vigorously and the plants are young, 380 g acid equivalent per ha of MCPA or 2,4–D are generally regarded as sufficient for control, irrespective of the volume of water used.

Wild radish and mustards are more difficult to handle and 550 g of acid equivalent per ha are required.

Treatment costs, such as labour, fuel and plant depreciation, are relatively light as under normal working conditions it should be possible to cover up to 8 ha an hour with a spray of moderate size attached to a motor truck.

Hexham scent

Hexham scent (*Melilotus indica*) belongs to the same group as the sweet or Bokhara clovers and possesses the strong sweet smell which is characteristic of this group. It is an annual weed which is very prevalent in certain wheat cultivations, and is also widespread along railway enclosures and roadsides through the Darling Downs. Its growing period is much the same as that of wheat, and the presence of harvested pods or seeds in wheat gives the grain the characteristic scent of the weed.

Grain so tainted is not acceptable for milling, as the taint is carried through to the flour and eventually to the bread or other end products.

As with other winter weeds, control can be easily effected by using the long fallow or introducing summer cropping for a season or two. Where it is intended to continue growing wheat in an infested area, control may be obtained by spraying the wheat crop with 2,4–D at the rate of 850 g acid equivalent to the ha plus additional wetter.

At this strength Hexham scent may not be killed. but its growth will be so retarded that it will no longer be capable of competing with the wheat crop.

Climbing buckwheat or Black bindweed

Climbing buckwheat or black bindweed (*Polygonum convolvulus*), a climbing weed with a small, black, angular seed is a serious and widespread pest of the older cultivated areas of the Darling Downs.

The use of 2,4–D as previously recommended is not entirely satisfactory, compared with more recent herbicides as Tordon 50D* and bromoxynil. Advice on control measures should be sought from local agricultural advisory officers.

* Registered trade mark.

New Zealand Spinach

New Zealand Spinach (*Tetragonia tetragonioides*) grows in wheat as a robust, upright, fleshy and profusely branched annual. The leaves are triangular-ovate in shape and thick with a silvery surface.

It is a native of Australia and occurs in most brigalow country. When the country is cleared and cultivated it can become a serious weed problem in wheat by virtue of its competitive growth, and the fleshy leaves and stems can present severe harvesting difficulties.

Major problems can occur especially in early plantings when rains closely follow planting and stimulate a heavy weed germination. Chemical control with Tordon 50D* or bromoxynil can be most effective on young plants provided growth conditions are good at time of application. Applications under conditions of low temperatures or moisture stress can be ineffective.

Diquat, applied shortly prior to harvest, can be used as a desiccant to assist in a crop salvage operation.

Mexican poppy

Mexican poppy (*Argemone ochrobuca*) is an annual introduced species which grows up to one metre in height. The leaves are bluish-green or greyish-green and blotched with white. The flowers are very pale yellow or cream. The oblong seed capsule is spiny and contains numerous small round brown seeds which are shed through an opening at the apex. The seed is harmful to animals and poultry and is a prohibited impurity in wheat seed.

Control of this weed in wheat can be achieved by adequate crop competition and the use of chemicals. Experimental work has shown that increasing the sowing rates of wheat results in decreased density and vigour of the weed. Seedlings and young rosettes in wheat may be controlled by spraying the crop with 2,4–D amine at 850 g of the acid equivalent to the ha.

Crop salvage

In very wet pre-harvest periods a number of broadleaf weeds e.g. New Zealand Spinach and climbing buckwheat can grow up rapidly within the crop and provide an extremely serious harvest problem.

This type of problem is effectively handled by the use of Diquat (Reglone) used at the rate of 1 400 ml to 2 100 ml per ha costing approximately $13 per ha. It is essential that adequate wetting agent be included in the spray mixture. A non-ionic wetting agent should be included at the rate of one part in 600 for ground equipment.

For best results the chemical is applied in the late afternoon. Diquat is a contact chemical therefore regrowth may subsequently occur and it is recommended that limited areas should be treated at any one time. Only mature crops should be treated.

A cheaper but slower form of crop salvage is to spray with 4 500 ml of 2,4–D amine 50 per ha. It will take about 14 days to give a good knock down with the serious disadvantage that grasses are not affected. It may be applied from the soft-dough grain stage onwards.

* Registered trade mark.

Brucellosis – what and why?

The prospect of export markets discriminating against meat and dairy products from non-tested sources has forced a decision by the Australian Government to embark on a National Brucellosis Eradication Programme. Because of the disease's importance to human and animal health, most advanced countries have done so.

What effect does Brucellosis have on cattle?

Brucella abortus multiplies rapidly on the membranes surrounding the unborn calf and eventually prevents nutrients passing across these membranes. The calf usually dies and is commonly aborted at about the 7th month. The afterbirth is often retained causing a subsequent infertility.

How does Brucellosis spread?

Discharges from an infected womb contaminate pastures and water. *Brucella abortus* is however susceptible to direct sunlight.

Brucella abortus thrives in womb and udder tissue. Milk is also a source of infection to other cows via the teat during milking and to humans. Contaminated tails also spread infection.

Bulls rarely spread infection during mating.

What effect does Brucellosis have on humans?

Brucellosis can be a severe disease of humans causing a recurrent fever not unlike influenza. There may also be serious complications.

How is Brucellosis Diagnosed?

Tests for antibodies can be applied to blood and milk, while the organism can be isolated from a freshly aborted foetus.

While these tests are generally reliable they occasionally miss the odd 'carrier' which fails to react. Repeat testing is necessary to detect 'silent carriers'. Indirect tests are also adopted.

Can Brucellosis exist unrecognised in a herd?

Yes – Some cows exposed to infection fail to abort despite invasion of the womb.

However outbreaks of abortion are not uncommon and a high percentage of pregnancies may end in abortion of a dead foetus or the birth of a live but weak calf.

How long does a cow remain infected?

In most cases cows remain 'lifetime carriers', although they usually calve normally.

However, at each calving an infected cow is a 'spreader' of infection, despite a normal birth.

Once infected, the cow usually remains a 'carrier'.

It is the need to sacrifice this type of animal in an eradication programme that makes brucellosis eradication so costly and disrupting to production.

Can Brucellosis in cattle be cured?

No! There are no drugs which will deal with this disease in cattle.

Role of vaccination

Outbreaks of Brucellosis are controlled by the use of vaccines.

Vaccines are also used in chronically infected herds to immunise replacements as they are reared. This is an essential step in eradication in these herds as a test and slaughter programme would be too costly to embark upon initially.

Two vaccines are available, Strain 19, a living vaccine, which is limited by regulation to calves 3 months – 6 months. Strain 45/20, a killed vaccine, which is used in cattle over six months.

Strain 19 vaccine can be administered legally only by veterinarians as the vaccine is capable of causing undulant fever. Strain 45/20 may be used only under direction of the Divisional Veterinary Officer.

Why the age limit on the use of Strain 19 vaccine?

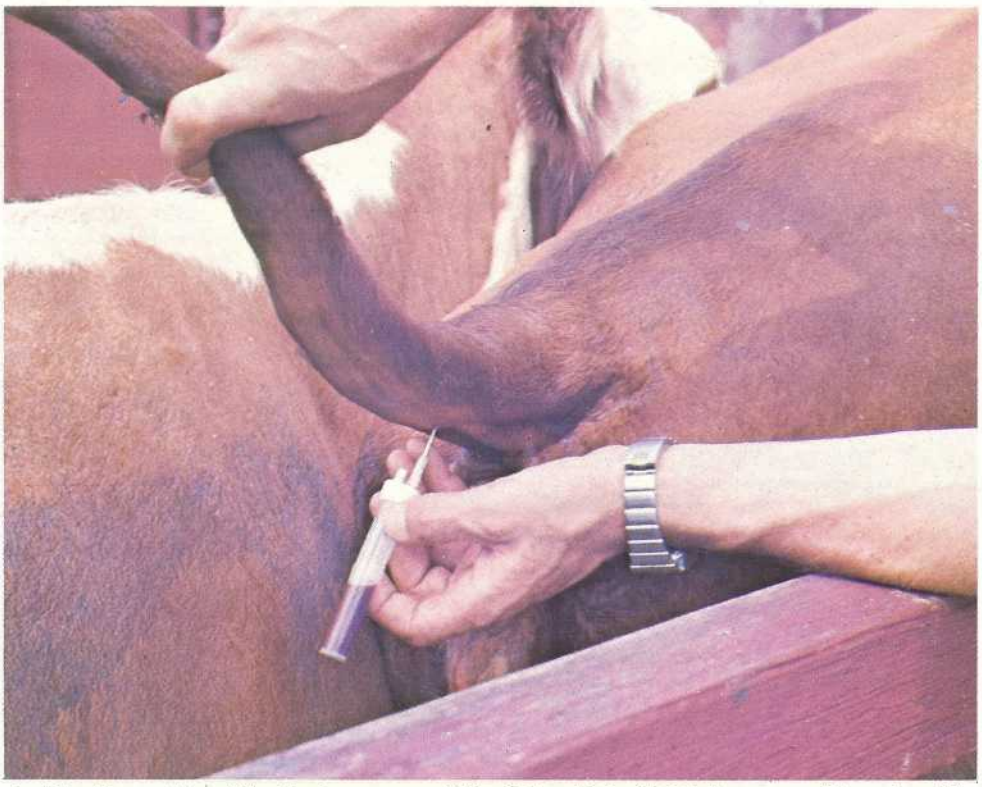
Some antibodies tend to persist when Strain 19 vaccine is used over six months of age and therefore may complicate subsequent blood testing.

How effective is vaccination?

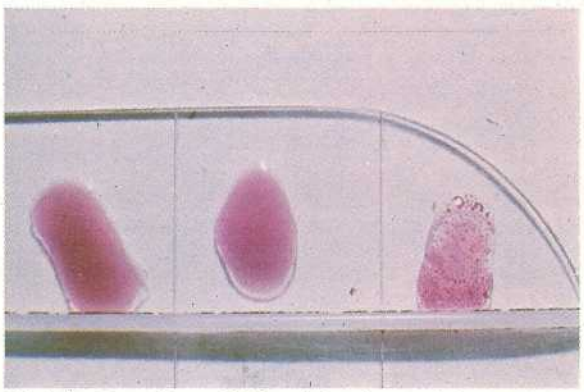
Brucella vaccines give cattle a high level of protection. However no vaccine is 100% effective and the degree of protection afforded by brucella vaccines is influenced by the amount of contamination or challenge in the environment. Vaccination does not always prevent infection, but does markedly reduce the abortion rate.

Compiled by I.D. Wells. Veterinary Services Branch.

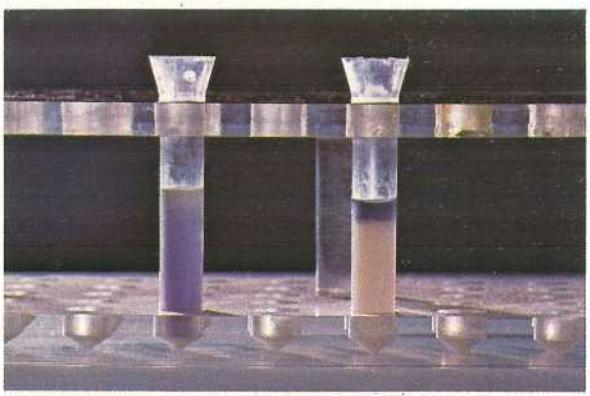
the tests are simple



1. Bleeding cattle while dipping causes little delay. Note that tails are readily accessible between the rails of the crush.



2. The Rose Bengal Plate Test is used for rapid screening of blood tests.



3. The milk ring test is used with vat samples for detecting infected herds.

Brucellosis

The choice is yours

This

Or

This

Does Strain 45/20 cause reactions to blood tests?

Normally strain 45/20 vaccine does not complicate routine testing for the presence of Brucella antibodies, after an interval of 12 months.

This vaccine is therefore used to protect cattle over six months of age where there is evidence of infection in the herd.

When is Strain 45/20 vaccine used?

1. In adult cattle in the face of an outbreak.
2. When calves cannot be vaccinated within the age limit set for Strain 19 vaccine.
3. When special testing for sale to particular markets is required.

When is Strain 19 used?

For routine immunisation of calves because:

1. Only one dose is required to afford protection against the effect of brucellosis.
2. It is cheaper, i.e., two to three doses of Strain 45/20 are required to give the same protection as a single dose of Strain 19.

How is eradication to be achieved?

By the testing of cattle and the disposal of reactors. This will be organised and funded on a sharing basis through a National Brucellosis Eradication Committee comprising representatives of each state and the Australian Departments of Health and Agriculture.

What steps are being taken now?

The first phase is fact finding and disease containment.

Field surveys by random testing of blood and milk samples are being undertaken in all States. In Queensland up to 80% of dairy herds in some areas are infected.

In beef cattle the prevalence ranges from 25% of infected herds in coastal areas to almost 100% of breeding herds in the far western areas.

Breeders are also being blood tested at meatworks. The adoption of compulsory identification of sale cattle is important for the success of this project.

Vaccination

Infected herds not undergoing a vaccination programme are being identified. In some dairying areas compulsory vaccination may be necessary.

In the extension of this phase, controls are operating in some areas in Queensland on stock movement both out of infected herds and between areas.

To achieve a movement control system area surveying is necessary to classify herds into three categories namely – 3. infected; 2. non surveyed but with no clinical history of infection; 1. clean herds (by survey).

When is the 'slaughter out phase' to start?

This depends upon:

1. A suitable avenue for economic disposal of reactors at meatworks.
2. A compulsory scheme.
3. A predominance of herds where the infection is of a low order.

What is required of the producer?

1. The presentation of animals for testing on request.
2. The collection of milk samples on request.
3. The provision of functional yard and crush facilities, in a good state of repair, suitable for working cattle. Remember that tail bleeding is done through the rails. Blood is collected either by needle or from a nick made with a small blade. Given reasonable facilities a two man team usually collects about one hundred samples per hour.
4. Good hygiene is most important. Aborting cows should be isolated until disposal or at least until they have 'cleaned up'. Aborted foetuses and afterbirth should deeply buried or burned.

Diseases of Wheat

Wheat diseases discussed in this article are stem rust, leaf rust, bunt, loose smut, flag smut, powdery mildew, crown rot, common root rot, take-all, glume blotch, and black point.

Stem rust

The name stem rust is quite descriptive of the disease, the stem and sometimes the leaves of the affected plant being covered with reddish-brown, powdery pustules which resemble rust spots on iron. These are in reality clusters of fungous spores which are formed below the epidermis and which subsequently burst through to the surface.

These spores are formed in countless numbers, and carried about by wind and so serve to spread the disease within and between crops.

Given dry weather during the ripening period, stem rust is usually not serious. If, on the other hand, the early spring months are warm and moist, rust may spread with great rapidity.

When a rust attack is early and severe, the fungus causes the plant to lose moisture excessively. The grain becomes light in weight and shrivelled and there may be a reduction in quality. Late crops are particularly liable to rust infection and late planting rains or a long cold winter accordingly favour stem rust development.

The only practical means of combating rust is the use of rust resistant varieties. The stem rust fungus, however, occurs as a number of different strains and the appearance of a new strain may adversely affect the degree of resistance previously displayed by a variety.

Growers should obtain recommendations for rust-resistant varieties each season from their local extension officers. Careful attention should also be paid to the elimination of out-of-season wheat and barley plants. These can act as important sources of infection.

Leaf rust

Leaf rust is not as spectacular as stem rust but can still cause considerable yield loss. Varieties exhibiting leaf rust resistance should be preferred when available, however, no current commercial variety is completely resistant in the field.

Bunt or Stinking smut

Although few growers of today are familiar with bunt or stinking smut, any relaxation in seed treatment practices could result in its reappearance in economic proportions.

Bunt appears in mature ears where, in place of each grain, a black, evil-smelling mass of fungous spores is found compacted closely together to form a bunt ball.

If a single bunt ball was crushed it could contain sufficient spores to contaminate every grain in a bushel of seed wheat.

The spores adhering to the grain germinate at the same time as the seed and infect the young seedling before it shows above ground. The fungus then grows up inside the developing wheat plant, finally replacing the normal grain with a mass of spores.

Bunt can easily be controlled by treating the seed with a fungicide prior to planting. The mercurial fungicides and hexachlorbenzene are no longer available. Seed should be treated with Le-San-ELL* at the rate of 100 g per 50 kg of seed.

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* Registered trade mark.

Loose smut

Loose or flying smut makes its appearance at flowering time. Instead of the hard, compact bunt balls found in stinking smut infection, a loose powdery mass of fungous spores is formed in the head. These spores are readily blown or washed away, leaving a bare ragged stalk.

The fungus is transmitted within the wheat grain and so remains unaffected by the usual seed treatment methods. The most economical way to control loose smut is to select seed from a crop free of loose smut. Seed treatment with the new systemic fungicide, oxycarboxin at 100 g per 50 kg seed will also control seed borne infection, but because of its cost is generally used only for treating foundation seed of individual varieties.

Flag smut

A wheat plant affected with flag smut remains stunted and deformed and usually fails to develop ears. The flag becomes twisted and wound about itself in a characteristic manner and develops narrow, greyish lines running up the leaf.

These lines eventually burst, disclosing a powdery mass of dark smut spores which may contaminate the grain during harvesting operations or may be liberated in the soil, where they will be a danger to the next crop. The use of resistant varieties such as Timgalen and Gatcher is the best means of controlling seed and soil-borne flag smut.

Present day commercial varieties vary in susceptibility and the most susceptible variety is Gamut which should be avoided on contaminated land.

Powdery mildew

Powdery mildew is caused by a fungus which forms greyish-white, powdery patches on the lower leaves of the plant generally around flowering time.

Though this fungus is conspicuous and may cause a yellowing and drying off of the lower leaves, it is not usually responsible for losses and no control measures are warranted.

Glume blotch

This disease is characterised by a purple-brown discoloration on the glumes or stem of the plant. While the disease is not particularly prominent, effect on crop yield can be considerable. The disease is rarely present at damaging levels and is more prevalent in mild, moist seasons.

Black point

This condition is caused by several fungi which are very commonly found on dead cereals and grasses. Wet periods early in the grain development period enable colonisation of the grain with the resulting dark discoloration at harvest. This detracts from the appearance of the grain sample and the grain may be down-graded. No economic control for black point is available at present.

Crown rot

Crown rot is caused by a fungus which, as the name suggests, attacks the basal portions of the stem and crown causing these to decay and turn brown.

If conditions are moist, this reddish-coloured fungus is readily visible on the stem base when the lower leaf sheaths are peeled away. The fungus may also be seen on the stem nodes and, in rare cases, may be associated with a blighting of the heads after flowering. It should not be confused with a pinkish-purple colour in the actual leaf sheaths which is caused by an unimportant soil-borne fungus.

Crown rot is noticed most conspicuously in the late heading stage when affected plants can be identified by heads which appear to ripen prematurely. According to the severity of the attack, the grain may either shrivel or even fail to develop.

In addition to wheat, crown rot also attacks barley, canary seed and oats, and a number of common grass species.

It is most severe on heavy soil types. On such soils, crop losses as high as 70 per cent have been recorded.

As the crown rot fungus may live over in the soil from season to season, and can be transmitted on the seed, attention to certain cultural practices is necessary to minimize crop infection.

It is therefore recommended that growers:

- Rotate infected areas with resistant summer grain crops such as sorghum, legume or sunflowers or winter crops such as linseed and safflower for two or three seasons.
- Prepare the seed bed early to ensure a quicker breakdown of crop residues.
- On land where the problem is consistently present, avoid more susceptible varieties such as Spica and Gamut.

Common root rot

Common root rot is a widespread problem affecting the underground portion of the stem, the lower internodes of the stem, and sometimes the roots. It can be recognized by the deep brown or almost black colour of affected tissues.

It is difficult to estimate the economic losses associated with this disease but as it is widespread it could well be considerable.

The crop rotation recommended for crown rot should be effective against common root rot.

There are no highly resistant varieties available, but Timgalen should be avoided in problem areas because of its high susceptibility.

Take-all

This disease known as "take-all" is common in southern Australia but is rarely severe in Queensland.

It is characterized by a black discoloration of the roots and lower stem tissue often referred to as a "stocking". Affected plants often die before heading, but more commonly produce dead heads as with crown rot. Crop rotation is advocated as the way of controlling this problem. Oats, being resistant to take-all, can be used in such a rotation.

Other root rots

Basal rot is another soil-borne disease which causes rotting of the stem base. It is caused by a fungus which is common to most soils. Discoloration of the stem base is not normally as intense as that of crown rot and often has the appearance of brown streaks. The disease can cause the production of "deadheads" and pinched grain.

In addition, root lesion nematode, stunt nematode and *Pythium* spp. have been found associated with unthrifty plants.

BULK HANDLING

VIRTUALLY the whole of the Queensland crop is now bulk-handled. Besides speeding up the harvesting operation this innovation has taken much of the hard work out of grain-growing.

Bulk-handling coupled with high capacity harvesters have made it physically impossible to deliver all wheat directly from header to depot. Some on-farm storage, even of a temporary nature, is therefore essential for the economic operation of bulk-handling equipment.

Costs and Returns

The simplest way of examining crop profitability is by comparing gross margins. The Gross Margin (G.M.) is gross return less variable costs (growing, harvesting and selling expenses). The G.M. measures the contribution of the crop to fixed costs (rates, depreciation, permanent labour etc.) and to profit.

The calculation below is an example only, as a guide to those who wish to work out the G.M. applicable to their particular circumstances. Instead of gross price, on-farm price (gross price less freight and levies) is used, so that variable costs include only growing and harvesting expenses. Since a G.M. has little meaning on its own, costs and returns for barley are also shown for comparison purposes.

EXPLANATION OF ASSUMPTIONS

Yields are statistical averages for Darling Downs, adjusted for increasing productivity over the last 30 years. (It is interesting to note that barley yields have been increasing approximately twice as fast as wheat yields).

Prices for the 1973–74 season are high, but must decrease eventually, because of the expected world-wide production response to the high prices, especially if there is a return to good seasons. A range of three prices is used for each crop.

Plant Operating Cost: Fuel and oil, repairs and maintenance for tractors, implements, header, and grain handling equipment.

Seed: Rate—45 kg/ha both crops. Price partly depends on price of crop.

Fertilizer: Because yields are statistical averages applying mainly to unfertilized areas, no fertilizer costs are shown. Suitable rates would be 90 kg/ha urea for wheat and 56 kg/ha for barley. Superphosphate is recommended for some areas, depending on soil analyses.

Weedicide: 350 ml Tordon 50 D ® and 350 ml 2, 4-D per ha (boomspray). Assume no Avadex required.

Insecticide: Barley ⅔ kg/ha Trichlorphon aerially applied, one year in three.

TABLE V

GROSS MARGIN PER HECTARE: WHEAT AND BARLEY

	Wheat			Barley		
On-farm Price—$/tonne	40·00	48·00	66·00	35·00	48·00	62·00
Yield —tonnes/ha	1·61	1·61	1·61	1·68	1·68	1·68
On-Farm Return $/ha ..	64·40	77·30	106·70	58·80	80·60	104·20
Variable Costs ($/ha)—						
Plant Operating Costs ..	7·20	7·20	7·20	7·20	7·20	7·20
Seed	3·60	4·00	4·40	3·60	4·00	4·50
Fertilizer	..	..	..	..	..	..
Weedicide	2·00	2·00	2·00	2·00	2·00	2·00
Insecticide	..	..	..	1·10	1·10	1·10
Aerial Spraying	..	..	..	1·70	1·70	1·70
Contract Harvesting ..	..	..	..	..	..	..
Casual Labour	..	..	..	..	..	..
Total	12·80	13·20	13·60	15·60	16·00	16·50
Gross Margin/ha ..	51·60	64·10	93·10	43·20	64·60	87·70

Aerial Spraying: $5/ha rate decreases as area increases, and will vary for different localities.

Other: If header not owned, contract harvesting charge should be included. Assume no casual labour required.

This example illustrates how to compare crop on the basis of returns. Which crop is most profitable depends on the wheat/barley price ratio and also on relative yields. Where relative crop productivity is not the same as that indicated by the Darling Downs yields used here, the comparison could give quite different results.

HARVESTING

THE main wheat crop is ready for harvesting from October to the end of December.

The risks of severe loss through hail and thunderstorms in Queensland wheat-growing districts are very real during the normal harvesting period. At the same time, the State Wheat Board cannot accept grain with a moisture content in excess of 12 per cent., so before commencing the general harvest, growers must be sure that the grain moisture will not exceed this limit.

Also it is not safe to store grain containing more than 12 per cent. moisture.

Accuracy can be attained by using calibrated moisture meters. The Marconi moisture meter is the instrument in most general use in Queensland. It is a simple, reliable portable unit.

However, individual or group ownership of Marconi moisture meters, although ideal from many points of view, is not necessary, as the Board has moisture testing facilities which are available to growers at all times at all bulk depots.

The modern header-harvester which cuts, threshes and cleans the grain in one operation, is a remarkably efficient machine. It has proved itself able to handle expeditiously, and with little loss of grain, crops which are weedy, badly lodged or poorly anchored in moist soil.

Many makes of machines, all eminently suited to Queensland conditions, are readily available. The swath cut by such machines ranges up to 7·3 m.

Badly lodged and tangled crops, which were once written off as almost total failures, may now be harvested with little or no grain loss.

Header harvesters can be classified according to power source and also by the type of harvesting front attached.

The older-type P.T.O.-operated drawn headers have largely given way to the self propelled headers in the main grain-growing areas.

The through-put of these latter machines can be much higher than that of a drawn header of similar comb width. As the Queensland crop is harvested from October to December when the threat of thunderstorms and hail is very real the value of high capacity harvesting machinery becomes apparent.

The main two types of header front are the Australian or closed (comb) front and the open (reel) front. The advantages of the former type is that when erect, even crops are harvested, the ratio of grain to straw passing through the machine is higher than with the open front machine. However, the open front is more popular on the Downs because of the wider range of crops successfully harvested and its superior performance under difficult crop conditions.

Grain storage

After the harvest, correct storage is important. In the silo, certain storage problems may develop if the grain is not clean, dry and free of insect eggs.

GRAIN is a living organism that breathes very slowly, breaking down starches into water and carbon dioxide and producing slight heat in the process.

At a grain moisture content safe for storage this heat production is negligible. Below 12 per cent. moisture content, clean insect-free grain generally stores safely. At a moisture content above 15 per cent., heat production is considerable. Grain stored between 12 per cent. and 15 per cent. moisture heats slowly and the germ may be destroyed if grain in this moisture range is stored for long periods.

Above:—Filling mobile temporary storage units.

The moisture content of grain is not stable but varies according to the amount of moisture in the air surrounding it. Variation in the moisture content of the grain occurs more readily near its exposed surfaces than deep in the bulk.

In the absence of forced ventilation, however, air movement in a grain bulk is exceedingly slow and the trapped air develops a moisture content in equilibrium with the grain.

The cooler and drier grain goes into bulk storage, the better are the chances of safe storage. If this situation cannot be achieved, the grain should be artificially dried.

Grain drying

The moisture content of the grain when stored is of critical importance to its safe storage. In order to avoid losses due to excessive moisture content, drying by artificial means can be an economic solution.

By drying, grains can not only be stored with more confidence, but the harvesting period may be varied and retarded and field losses reduced since harvesting can be carried out when the grain moisture content is higher than would normally be acceptable.

Drying methods

There are three major methods of drying with forced air:

- Natural drying using unheated air, when the relative humidity of the atmosphere is suitable.
- Drying using supplementary heat to raise the temperature of the drying air by approximately 5–8°C above atmospheric temperature and thus reduce air relative humidity.
- Heated air drying where the temperatures of large volumes of drying air are heated to 40°C or more.

The selection of the method used must be based upon a number of factors including drying rate required, capital and running costs involved.

Grain stored on farms

Sound measures to control grain storage insects on farms are essential, both to reduce losses in farm-stored grain and to allow the farmer to present grain which is completely insect free to the bulk-handling authorities.

Many overseas markets demand a complete ban of insects in grain. The gradual emergence of maldison-resistant strains of insects indicates that increased attention to the problem will be required to maintain existing standards.

Control measures generally required on grain farms may be grouped into three categories:

- good handling and storage procedures.
- application of protectant insecticides.
- fumigation of infested grain.

Basic Handling and Storage

Farm hygiene

Infestation of newly harvested grain usually results from contamination with infested grain present in harvesting and handling machinery and in storage facilities.

Removal of all grain residues is essential and this requires scrupulous attention to hygiene.

Harvesting machinery is generally difficult to clean. After harvest, the machinery should be run for 2 minutes with any inspection covers open and then cleaned manually or with compressed air if available. Maldison dust as specified below should then be added, while the machine is running, to coat inaccessible parts.

Before harvesting commences for the new season, the machine should be run for a further 2 minutes to remove excess maldison residues. Grain augers must be cleaned, and bins for storage or transport should receive particular attention to ensure removal of grain lodged in corners and in sliding shutter doors. Residues in planting equipment and any other machinery stored nearby must not be overlooked.

All grain spillages near machinery or storage sheds should be removed promptly as a regular practice. Grain lodged in the fabric of the building or under it should be removed as storages are emptied. The long-term solution lies in the introduction of machinery and storages which facilitate cleaning. These requirements should be a prime consideration whenever new structures or equipment are being planned.

Grains for stockfeed or poultry feed are often infested, and grain for seed can also carry infestations. These should be stored in containers suitable for fumigation or placed in buildings separated from grain handling machinery or stored grain intended for later delivery to bulk-handling authorities.

New bags are obviously desirable to avoid insect infestation and all second-hand bags must be disinfected before use. The most satisfactory procedure is to use one of the fumigation treatments described below:

Moisture content

Grain of high moisture content is much more subject to insect infestation than is grain of low moisture content and the breakdown of insecticides is much more rapid with high moisture content. For these reasons, only grain of low moisture content should be stored.

If weather conditions at harvest time prevent this, then artificial drying should be considered. The maximum recommended moisture content is 12% for wheat and most other grains except maize which has a limit of 14%. Although grains at these respective moisture contents are accepted, every endeavour should be made to ensure a lower level of moisture whenever possible.

Weatherproofing of storage facilities is a basic requirement. Leaks in storage results in the formation of hot spots through the action of moulds and insects in wet grain.

Temperature

Insects develop much more rapidly at warm temperatures than at cool ones. Whenever practicable, storage bins should be protected from the heating effects of direct sunlight and due allowance should be made for cool ventilation.

Insecticides

Insecticides can do no more than supplement the basic farm hygiene programme. An over-riding consideration in their use must be the safety of residues in the grain.

TABLE 3

INSECTICIDE TREATMENTS FOR STORED GRAIN

Circumstances	Treatment	Application Rate
All grain to be stored more than 6 weeks before delivery to bulk-handling authorities	Mix together premium grade maldison 1·4% spray (dilute 103% w/v 1 part in 71)	850 ml per tonne
As above but spray equipment not available	Mix together maldison 1% dust	1 kg per tonne
At 2-month intervals during storage ..	Surface treat grain with premium grade maldison 2·5% spray *or* Surface treat grain with maldison dust 1%	50 ml per m^2 150 gm per m^2
Moth infestation likely; storage moderately airtight	Dichlorvos slow release strips placed in airspace above grain	1 strip per 28 m^3
Moth infestation present during storage ..	Surface treat grain with premium grade dichlorvos 0·5% spray	50 ml per m^2
Live insects present in newly harvested grain for immediate delivery to bulk-handling authority *or* Grain rejected because of insect infestation and fumigation undesirable or impracticable *or* Maldison-resistant insects present and fumigation undesirable or impracticable *or* Moth infestation present prior to delivery to bulk-handling authority	Mix together premium grade dichlorvos 0·7% spray (dilute 114% w/v concentrate 1 in 159)	850 ml per tonne

It is essential that only approved materials are used and then only at the dosages recommended.

Maldison and dichlorvos are the only materials recommended for direct admixture with grain. In general, maldison should give several months' protection while dichlorvos is active for only a few days. Grain should not be used within 14 days of treatment with maldison or within 7 days of treatment with dichlorvos. Details of the recommended treatments are given in Table 3.

Buildings and storage facilities generally require treatment soon after emptying and again before filling. Recommended treatments are given in Table 4.

TABLE 4

PESTICIDE TREATMENTS TO DISINFECT GRAIN STORAGE BUILDINGS AND EQUIPMENT

Location	Circumstances	Treatment	Application Rate
Surfaces of bins and machinery in contact with grain	General preventive treatment, except as below	Maldison 2·5% spray ..	50 ml per m²
	Spraying not practicable ..	Maldison 1% dust	Lightly cover all surfaces
	Grain infesting moths present	Maldison 2·5% plus dichlorvos 0·5% spray	50 ml per m²
	Maldison resistant insects present	Maldison 2·5% plus dichlorvos	50 ml per m²
Surfaces not in contact with grain	General preventive treatment, except as below	Maldison 2·5% spray ..	50 ml per m²
	Grain infesting moths present	Maldison 2·5% + lindane 1·0% spray	50 ml per m²
	Maldison resistant insects present	Fenitrothion 1·0% spray	50 ml per m²

Fumigation

Should infestation become evident during storage, fumigation is the preferred treatment. Within prescribed limits, fumigants penetrate the grain bulks in the gas phase and kill insects where they are. It is essential for the commodity to be placed in a gas-tight situation during fumigation. The grain should be in either a sealed metal container or fumigation chamber or it should be covered with impervious plastic sheeting.

Serious losses of gas occur through cracks in wooden floors so, if prolonged storage is expected in these situations, it is wise to place plastic sheeting under the grain during intake to avoid the necessity for moving it at a later stage.

Either methyl bromide or phosphine fumigation is recommended. Both materials are highly toxic and methyl bromide should be used only by trained operators. Phosphine is safe to use in practice since it generates slowly from the action of moisture in the air on the specially formulated aluminium phosphide tablets.

Placement of the tablets must be completed and the operators must leave the affected area within 4 hours of commencement. Phosphine is highly inflammable so every care must be taken to avoid ignition.

Dosage rates are as follows: methly bromide, 32 gm per cubic metre for 24 hours; phosphine, 6 tablets or pellets of Gastoxin or Phostoxin per tonne for 5 days.

Grain that has been fumigated with methyl bromide should not be handled until declared safe by a trained operator. Grain fumigated with phosphine should be aired for 5 days before handling. As methyl bromide fumigation can reduce germination, its use for seed grain or malting barley is not recommended.

Getting the crop to market

The Queensland State Wheat Board was established as a statutory marketing authority in 1920 to market wheat crops on behalf of Queensland farmers.

The Board continued to operate in this role until 1939, when under National Security Regulations the Australian Wheat Board was established by the Commonwealth Government as the marketing authority for Australian wheat.

Following World War II Wheat Industry Stabilization legislation was enacted and the Australian Wheat Board was appointed and has continued to be the marketing authority for Australian wheat. The State Wheat Board has continued to act as a handling authority on behalf of the Australian Wheat Board in Queensland.

The State Wheat Board comprises the Director of Marketing, Department of Primary Industries and seven grower members elected by wheat growers. The Minister for Primary Industries appoints the Chairman of the Board.

It is responsible for the intake, storage and handling of the wheat crop. In addition, the State Wheat Board, acting on behalf of other marketing authorities, also receives and stores barley, grain sorghum and the oil seed crops such as sunflower, soybeans and safflower.

The Board operates 75 country depots and grain export terminals at Brisbane and Gladstone. The overall capacity of bulk storage facilities at country centres is 1 163 000 tonnes; the capacity of the Pinkenba terminal is 66 000 tonnes and the Gladstone terminal 31 000 tonnes.

All seed is delivered in bulk. The storages comprise mainly multi-bin vertical concrete silos, steel vertical bins and horizontal storages constructed of tubular steel and corrugated iron.

Grain protein

Queensland has the reputation of producing high protein wheat. The State average sample generally fluctuates between 12 and 14 per cent. Growers receive a premium based on the protein content of their Prime Hard deliveries. The premium may be as high as $7.50 per tonne. Grain protein is dependent upon available soil nitrogen and yield produced.

As continuous wheat cropping steadily eats into the soil's nitrogen reserve, it follows that under such a cropping system soil nitrogen is eventually seriously depleted and a decline in grain protein is inevitable unless corrective measures are taken.

Such a decline is more rapid in some soils than in others. In virgin brigalow country, for example, grain protein levels of 17 to 18 per cent. are not uncommon, but in unfertilized cultivations more than 25 years old, figures in excess of 13 per cent. would be quite unusual.

The decline on the open downs soils, although evident, is less spectacular. The regular use of lucerne or a lucerne-based pasture as a rotation with wheat is an effective but not generally practised method of maintaining the soil nitrogen status. Experience has repeatedly indicated the superiority of lucerne as a protein-building rotation component.

Investigations have shown that nitrogenous fertilizers are effective in increasing both grain yield and protein content in many areas.

Mottling

Mottling is the occurrence in individual grains of both vitreous and opaque sections. The degree to which it occurs is influenced by protein content, pre-harvest drying conditions and variety.

Mottling seldom occurs in grain above 13·0% protein but may be completely absent from grain as low as 10·5% protein.

Work conducted from the Queensland Wheat Research Institute has shown mottling to be an excellent indicator of potential yield response to added nitrogen fertilizers although lack of mottling is not necessarily a sign of soil nitrogen adequacy. The addition of adequate amounts of nitrogen fertilizers eleminates mottling by increasing the protein content of the grain.

Wheat quotas

The wheat delivery quota system was introduced in 1969 to curtail production by restricting the quantity of wheat which could be delivered to the Board for an immediate first advance.

Under legislation the Wheat Delivery Quota Committee was appointed to determine quotas and hear reviews. A Wheat Delivery Quota Appeal Tribunal was appointed for the purpose of hearing appeals lodged by growers in respect to decisions made by the Wheat Delivery Quota Committee.

The 1969 basic quotas were calculated in four categories The categories were as follows:

No. 1 *Category*—Growers who delivered to the Board each year from 1966–1968

No. 2 *Category*—Growers who delivered to the Board 2 years from 1966–1968

No. 3 *Category*—Growers who delivered to the Board 1 year from 1966–1968

No. 4 *Category*—Growers who had financially committed themselves to planting wheat crop in 1969.

Subsequent quotas have been determined on a percentage of the basic 1969 quota. Percentages vary according to the categories.

Queensland State quota

Queensland was allocated the following quotas:

1969–70—31 million bushels (0·8 million tonnes)

1970–71—36 million bushels (1 million tonnes)

1971–72—38 million bushels (1 million tonnes)

1972–73—38 million bushels (1 million tonnes)

1973–74—43·2 million bushels (1·2 million tonnes)

Wheat delivery quotas were issued to Queensland growers in accordance with the Act. However, because of difficult seasons the State quotas have never been filled so there have been no restrictions on wheat intake to date.

Grading and Classification

As from the 1973–74 season wheat will be classified as follows:

F.A.Q.

F.A.Q. classification is to include any registered or approved variety of wheat except Durum wheat, red wheat and soft white wheat.

- The wheat must weigh not less than 74 kg/hl on the Franklin Chondrometer.
- It must be sound, mature wheat and contain not more than a reasonable quantity of whiteheads, chaff, straw, etc, no more than 5% by volume of unmillable material, i.e. inert matter, damaged or pinched grains and foreign matter, including weed seeds up to the limits set down below, but no more than 1% by volume of small foreign seeds.
- It must contain no more than 20 foreign seeds per pint sample (metric equivalent not decided on at time of writing), i.e. barley oats, wild oats, buckwheat, Durum wheat, grain sorghum, linseed or safflower seed, and no more than one large foreign seed per one pint sample, i.e saffron thistle, variegated thistle, spiny emex (double gee), New Zealand spinach, sunflower, soybean or maize seeds.

- It excludes sprouted grain and must contain no more than 10% of grain affected by weather stain or blackpoint or more than 1% of grain dry-green and/or frost affected.
- It excludes musty wheat, wheat with Hexham scent, *Datura* spp. or Mexican poppy seeds, cotton seed, stones or soil and grain pickled with any chemical compound.
- It must be entirely free from live insects and the moisture content must not exceed 12%.

Prime Hard Classification

The Prime Hard classification is to be restricted to approved varieties. The classification will exclude Durum wheat, red wheat and soft white wheats.

- The wheat must be up to F.A.Q. specification in all respects.
- It must contain no more than 10% mottled grains.
- It must contain no more than moderate bleaching.
- It must not contain budded grains, i.e. where the germ end of the kernel has swollen to a budded condition.

Hard No. 2 Classification

This classification is to be restricted to approved hard varieties. The classification would exclude Durum wheat, red wheat and soft white wheat.

- The wheat must be up to the F.A.Q. specification in all respects.
- It excludes sprouted grain but would permit wheat in a budded condition and bleached grains.
- It must contain not more than 25% mottled grains.

Hard No. 3 Classification

This classification is to apply to deliveries up to the Hard No. 2 specification except it would permit:

- Deliveries with a minimum weight of 71 kg/hl.
- 20% grain in a sprouted condition.
- Up to 7·5% unmillable material.

Off-Grade Classification

Wheat which is merchantable but for one or more reasons does not qualify for the Prime Hard, Hard No. 2, F.A.Q. or Hard No. 3 classification and is regarded as off-grade. Acceptance of off-grade wheat is subject to assessment of the appropriate dockage. There is a nil tolerance regarding objectionable foreign matter such as Mexican poppy, Datura stramonium, ball smut, lucerne pellets and wheat pickled with any chemical compound.

Growers tendering wheat containing live insects, objectionable foreign matter and excessive unmillable material will be requested to clean the wheat and re-tender.

Moisture content must not exceed 12%.

Wheat research in Queensland

The Queensland wheat industry has become very soundly based technologically in the past 15 years. It is not mere coincidence that in the same period there has been a considerable increase in agricultural research servicing the industry.

IN the case of wheat, farmers have shown a very responsible attitude towards research. It is largely due to farmers interest that the Queensland Wheat Research Institute was established at Toowoomba in 1962.

Although most of the Institute's funds are provided from wheat levies, the Commonwealth Government and the State Department of Primary Industries, wheat farmers have contributed generously to the voluntary levy which is currently 11 cents per tonne of wheat delivered. Funds from this levy have been used to provide large items of equipment which have added much to the efficiency of the Institute and to the output of research findings. Farmers have had a large say in the research undertaken at the Institute because they are strongly represented on the Queensland Wheat Industry Research Committee.

The Institute is not the only establishment which concentrates on wheat research. Hermitage and Biloela Research Stations, the Entomology Research Laboratory, Indooroopilly, and the Warwick and Toowoomba D.P.I. staff have large programmes and are making impressive contributions. Nevertheless the Queensland Wheat Research Institute and its staff of 50 have the major responsibility. Some of its major achievements in the eleven years since its inception include:

- Development of commercial soil test recommendations for phosphorus, nitrogen, zinc and copper. More than 200 trials were used to develop the P and N soil tests. Commercial fertilizer companies were actively associated at the Institute with the nitrogen studies.
- Successful calibration of grain moisture meters for various crops.
- Solving of the zinc deficiency problem associated with the "long fallow disorder".
- Clarification of the nitrogen loss situation in the black earth soils.
- Development of the concept of maximizing rainfall utilization by opportunity cropping, from fallow moisture accumulation and crop sequence studies.
- Identification of potential nutrient deficiencies in Queensland cereal soils.
- Development of the pre-sowing drought hardening technique which can result in marked increases in grain yield under certain moisture stress conditions.

In addition our comprehension of air-borne and soil-borne disease problems, the wheat plant's reaction to water stress, wheat quality issues, wild oat control, contributions which soil microbes can make to the nitrogen nutrition of the wheat plant, land preparation strategies and techniques, and general wheat agronomy has been improved by continuing Institute effort.

Plant breeding deserves special mention. The Institute has two plant breeding programmes. Dr. Syme's University of Queensland programme was commenced while Dr. Syme worked at the Agricultural Research Institute, Wagga Wagga.

Already one variety Condor, which was selected and tested in Queensland has been registered and released by the New South Wales Department of Agriculture. The variety succumbed to stem rust otherwise it would almost certainly have been released here for it had a marked yield advantage over current commercial varieties.

Oxley is a recently released variety which was bred at the Institute. Other promising cross-breds are being tested currently in the Department's Regional Variety Testing Programme.

In the Department's Institute breeding programme commenced in 1967 a wide range of genetic material from all over the world has been crossed with adapted commercial varieties. To date over one thousand such crosses have been made. Thousands of lines developed from these crosses have been tested and selections made mainly on the basis of yield, quality and rust resistance. A number of these selections have reached an advanced stage of breeding and have given very promising results in strain trials.

The Department's Institute breeding programme is integrated with that undertaken at Hermitage Research Station where Spica was bred. Two specific projects in the latter programme are:

- Back-cross programme for common root rot resistance in collaboration with Institute pathologists.
- A study of the influence of rate of maturity on yield in Queensland wheat areas.

Pre-sowing drought hardening of wheat

A treatment whereby wheat grains are subjected to a severe water stress before sowing has been studied and is currently being adapted for commercial operation.

Trials to study the effect of this drought-hardened seed on wheat yields have been conducted throughout the wheat growing regions of Queensland. The results of these trials have shown that the treatment had little effect in environments where there was more than one severe stress and the control yield was less than 1·7 t/ha. The plants from drought-hardened seed had a mean yield increased of 12% over the control.

The best responses to the treatment occur when the first severe drought stress occurs at a sensitive stage of wheat development and is subsequently relieved by further good rains.

Opportunity cropping

The system known as opportunity cropping is based on the fact that once a heavy clay-soil profile has some depth of wet soil, it will be more difficult to increase the depth of wetting. If the fallow continues, the possibility of erosion is increased. It is likely that little advantage will be gained increasing stored soil water while part of the storage may be lost by evaporation.

For the soil type represented in Figure 1, the efficiency of storage decreased after the soil was wet to 60 cm, therefore the possibility of growing a crop should be investigated at that stage. Such a crop, if established, would also rely on the receipt of some rainfall during the growing season.

Thus the system depends heavily on the circumstances of each situation and is therefore very flexible with no hard and fast rules being laid down.

Its successful adoption requires a high level of managerial skill by the farmer. He has to be familiar with the characteristics and depth of soil over his farm. He is also required to make decisions on when to sow, based on the amount of water stored in the soil at a particular time and the probability of receiving growing-season rainfall. He also has to decide what crop and variety to sow and the seeding rate and fertilizer to use.

Fortunately for wheat, most of the answers to these questions are available as a result of both practical experience and research conducted over the years. Because of the complexity of the situation, these answers are not discussed here but may be obtained from the Department of Primary Industries.

This system is applicable to all wheat growing areas of the State, but the degree of application will vary with the soil-climatic

environment. It has found most acceptance on the eastern Darling Downs where shallow sloping soils limit the depth of wetting attainable and the high erosion potential under fallow encourages the adoption of the system which maximizes the vegetative cover of the soil surface.

A further advantage of this flexible fallowing system is that it should reduce the number of cases of "long fallow" disorder. With greater acceptance of this system of fallowing the number of long fallows should be reduced markedly.

Wheat fallow management trials

From the oft-debated question of whether to burn or retain stubble has stemmed the two fallow management experiments currently being conducted at the Hermitage Research Station.

The first experiment was set down on flat ground, for it was an accepted fact that stubble retention was imperative on sloping land. It followed a crop of wheat in 1968.

The four main fallow treatments involved in the experiment, which in 1973 was planted to its fifth wheat crop are:

- stubble burnt and mechanical cultivation,
- stubble retained and mechanical cultivation,
- stubble burnt and chemical weed control,
- stubble retained and chemical weed control.

Each of these is associated with three rates of nitrogen applied at sowing time 0, 50 and 100 kg/ha, making a total of 12 treatments.

Apart from other observations, sampling is undertaken for soil moisture and nitrate nitrogen.

To date, the stubble retained-chemical fallowed treatments have been outstanding in regard to moisture accumulation during the fallow period. Their superiority in this aspect has been reflected in either vegetative growth or grain yield in two out of the four seasons.

Another aspect favouring these treatments is that all could have been sown in June. However, planting was delayed because of the other mechanically-cultivated treatments until planting rains occurred. For example, in 1970, sowing was not undertaken until September. It should be borne in mind that this experiment is located on a heavy black earth soil.

The second experiment is confined to one crop of wheat on a given site, that is, the sites are varied in an attempt to compare treatment responses in different textured soils within the black earth series.

There are six main treatments in this experiment and these are split to include two rates of nitrogen applied as urea at sowing (nil and 100 kg/ha).

The treatments are:

- stubble burnt and mechanical cultivation
- stubble retained and mechanical cultivation
- stubble retained and zero tillage
- stubble retained until February then burnt and mechanical cultivation
- stubble retained until February then mechanical cultivation
- stubble retained sweep plough used for cultivation during the fallow period.

Sampling for soil moisture and nitrate nitrogen is undertaken on four occasions—after harvest of the bulk wheat crop, mid-February, mid-April and pre-sowing, the aim being to check the actual moisture and available nitrogen status of the fallow at these times.

This experiment was initiated in 1971; results to hand for these two crops have not shown great treatment differences in these two seasons.

Fallowing... how efficient is it?

Recent research has resulted in a critical appraisal of our traditional fallow system.

RECENT research on the cracking clay soils, which account for most of the State's wheat lands, has shown that only a small fraction of rain falling during a fallow actually enters the soil and is stored.

Severe water erosion of these soils, particularly on the sloping country, has occurred during fallow periods when the soil surface was relatively unprotected by vegetative cover.

The accumulation of available nitrogen during a summer fallow, usually resulting in increased wheat yields, occurs at the expense of the soil organic nitrogen reserves. Thus the practice of indiscriminate fallowing helps the long-term nitrogen fertility decline of our soils, encourages soil erosion, while it achieves very inefficiently its primary purpose of storing incident rainfall. These factors, together with other economic considerations, have resulted in a critical appraisal of our traditional fallow system.

The efficiency with which a fallow stores rainfall depends on the following points rather than the length of the fallow.

- The soil characteristics, land slope and the moisture status at the start of the fallow.
- The amount, intensity and distribution of rainfall received during the fallow.
- The evaporation that occurs.

The very feature of the heavier clay soils that makes them suitable for wheat growing, that is their ability to store approximately 15 to 20 mm available water per 10 cm depth, reduces the efficiency with which they store rainfall. This is because most falls of rain up to about 40 mm simply wet the surface cultivated zone and are subsequently lost by evaporation with no increase in stored soil water.

Further, these soils, when wet, have extremely low infiltration rates, making any increase in the depth of wet soil difficult to achieve, and surface run-off of rainfall quite common. Subsequent losses of stored soil water from wet profiles by evaporation during dry periods are significant.

The effects of these factors can be seen in Figure 1 which presents the results of some research done at the Queensland Wheat Research Institute. Note the rapid increase in stored soil water which occurred over the first 3 months of the fallow, where 33% of the rain was stored, primarily through large cracks remaining after the preceding crop. Subsequent build up of stored soil water was slow, particularly during the final 12 months where only 4% of incident rainfall was stored.

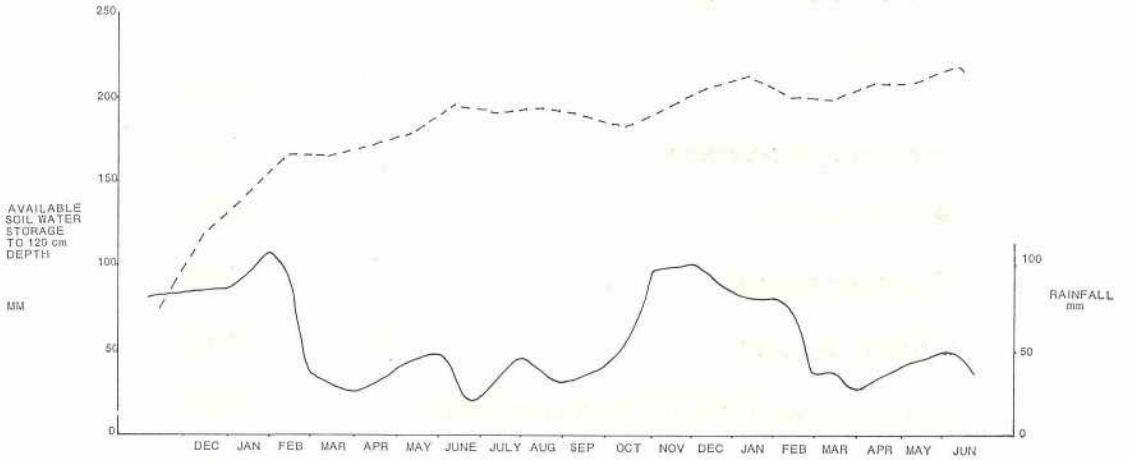
It can be seen from the figure that for the years sampled, the winter planting rains and the high mid-summer falls increased storage, while the spring and late summer rain was not effective. It is important to note that, even after 19 months fallow the soil was not fully wet and could have held another 50 mm water.

The efficiency with which a fallow stores rainfall can be increased and the erosion potential reduced in two inter-related ways:—

- By adopting management practices that protect the soil surface, reduce surface run-off and reduce evaporative losses during the fallow. These include mulching of crop stubbles, contour ploughing, leaving the soil surface in a rough condition as long as possible, only cultivating to control weeds, strip cropping and where necessary, construction of contour banks and grassed waterways.
- By adopting a flexible approach to the cropping system, by which fallow duration depends more on seasonal conditions

experienced than on any fixed cropping pattern. This should aim at minimizing the time under fallow.

Implementation of these measures will ensure the most efficient use of rainfall during a fallow. This will give an increased number of crops and/or increased crop yields. Either way, vegetative protection of the soil surface is increased, and this ensures maximum erosion protection and economic returns.



INSURANCE

As far as fire insurance is concerned, growers have the option of insuring their crop with the State Wheat Board or they may elect to insure with any insurance company. The majority of growers take out such insurance.

Private insurance companies give fire cover from the period of time from when the crop comes in head until the 31st January the following year.

At the time of writing, the insurance premium rate is $1.71 per $1 000 worth of crop. Discount on this rate can be obtained from several insurance companies. Fire cover is immediate except when the state of fire emergency exists and in these circumstances there is a 48 hour delay before acceptance.

The risk of severe loss through hail and storm damage in Queensland wheat growing districts is very real during the harvest period from October to December.

The State Wheat Board operates a compulsory co-operative hail insurance scheme which ensures that all wheat growers who complete the necessary return are automatically insured against crop loss through hail damage. This scheme is financed by means of a levy on all wheat harvested.

ACKNOWLEDGEMENTS

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M. Bengston, Entomology Branch—Control of Insect Pests of Grain Stored on Farms.

R. D. Berndt, Q.W.R.I.—Fallowing efficiency and Opportunity Cropping.

O. Cartledge, formerly Q.W.R.I.—Wild Oats.

J. Harbison, Q.W.R.I.—Wheat Research in Queensland.

J. W. Littler, Agriculture Branch—Wheat Fallow Management Trials.

J. M. T. Marley, Agriculture Branch—Control of Weeds Other Than Wild Oats.

T. Passlow, Entomology Branch—Insect Pests of Wheat in Queensland.

D. Rosser, Agriculture Branch—Varieties.

G. Wildermuth and R. G. Rees, Q.W.R.I.—Wheat Diseases.

D. R. Woodruff, Q.W.R.I.—Pre-sowing drought Hardening of Wheat.

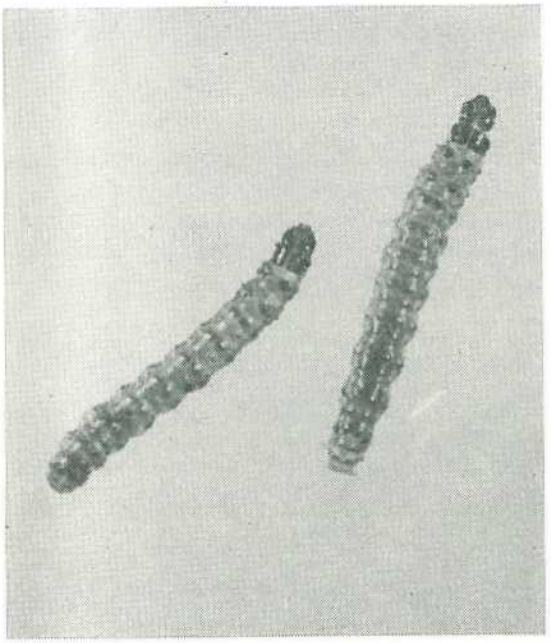
The assistance, help and contributions of these and other Departmental officers is gratefully acknowledged.

Special mention must also be made of the assistance of the State Wheat Board.

Wheat—Guide to Contents

Banana Scab Moth in North Queensland

by B. A. FRANZMANN, Entomologist.



Larvae of the banana scab moth.

THE most troublesome insect pest of bananas in north Queensland is the banana scab moth (*Nacoleia octasema* (Meyr.)). Its damage appears without warning and it is very difficult to control.

In Australia the scab moth occurs only in north Queensland banana plantations. It has not been found south of Cardwell.

Appearance

The adult scab moth is a small drab moth predominantly light brown in colour with a few dark spots on the wings, and a conspicuous band of shiny silver scales along the top of the abdomen. The adult is rarely seen in the field during the day and it is not attracted to light at night.

The eggs are very small and are generally laid in clusters of about 5–30. They are oval and flat and on the plant have the appearance of a cluster of small shiny overlapping scales. About a day before they hatch the black heads of the larvae can be clearly seen inside the eggs.

The larvae are yellow, red or blackish depending on the colour of the food upon which they are feeding. When fully grown they measure approximately 25 mm.

The pupa is brown to black. Pupation can occur on the bunch in a cell of silk and frass but more often occurs in old leaves and trash around the pseudostem.

Life history and habits

Eggs are laid near, or on the outside of, the emerging bunch. Egg laying starts as soon as the tip of the bunch appears in the throat of the plant and generally has stopped by the time the bunch has lost its first bract. The interval between these two growth stages may be as short as nine days under conditions of good growth. During most of the year in north Queensland, eggs take 3–4 days to hatch, though they do take some days longer during cool weather.

As soon as the larvae hatch they make their way to the young fruit wrapped in its protecting bracts.

The newly hatched larvae are very small and they can readily move down the bunch through the spaces between the fingers and bunch stalk. Young larvae may thus be found feeding throughout the bunch while the bunch is still in a vertical position. Larvae generally feed on a hand until its covering bract falls.

Once this has occurred they usually move to the next sheltered hand down the bunch. This lifting and falling of bracts and movement of larvae is a regular process until all the bracts have fallen from the fruit.

The larvae then feed on the male flowers or between the fingers in a sheltered position. Generally soon after the fingers are exposed, feeding ceases and the larvae move to a suitable site to pupate. In all, the larvae feed for two to three weeks with a large increase in the area of skin eaten towards the end of the larval period.

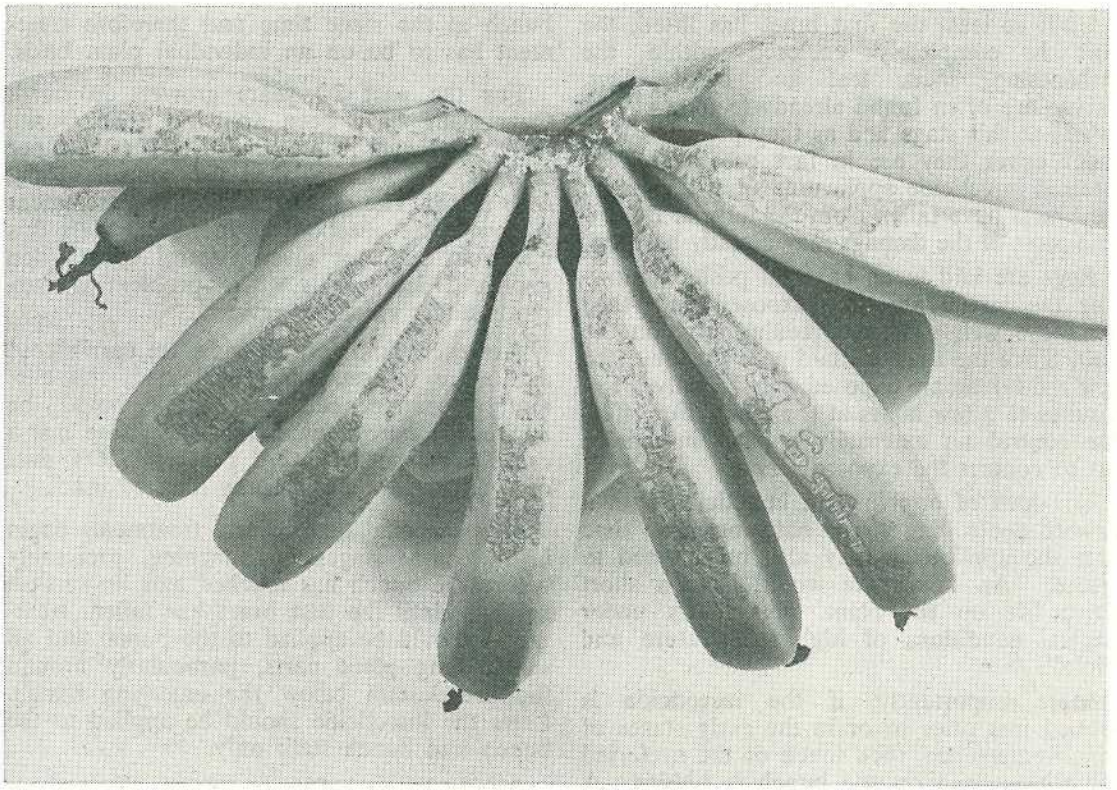
The pupal period lasts for just over a week at the end of which the adults emerge.

Mating generally takes place on the first night after emergence and egg laying commences on the next night. Adults live for about nine days.

Nature of damage

Feeding by larvae on the skin of the immature fruit causes surface scars or scabs. Larvae very rarely penetrate through the skin of the fruit and thus the fruit appearance only is affected. This unsightly appearance precludes the production of high quality fruit and results in downgrading of fruit at markets.

Scab moth damage on young fruit.



Old scab moth damage on mature fruit.

The fruit surface closest to the bunch stalk is the area generally damaged by the larvae. This surface becomes the outer curve after the fingers turn up and this is where the main damage is seen on maturing fruit. Areas between fingers may also be damaged, but very rarely is damage seen on the inner curve.

Depending on the number of larvae which feed on the bunch, damage can vary over the whole range from very light where no economic damage has occurred to so heavy that the bunch is not worth harvesting.

Damage can occur during any season though it is generally heaviest during late summer and autumn. During cold winters in all north Queensland banana areas, scab moth numbers are reduced to negligible proportions.

Hosts

Alternative hosts of the scab moth in north Queensland are wild bananas and species of *Pandanus* or screw palms. On *Pandanus* only the flowers are attacked. The screw palms therefore can only serve as a host during the summer when flowers are present.

Parasites

Seven species of parasites have been recorded from the scab moth in Queensland. Detailed sampling has revealed that they occur in very low numbers and have a negligible effect on scab moth numbers in commercial plantations.

Control

The scab moth is very difficult to control with insecticides. Recent studies carried out by the Department in north Queensland provide ample evidence to show that the real problem of control is the difficulty of applying insecticides to the larvae or the larval habitat once the larvae have reached the fruit.

Until at least the first bract has lifted, the fruit is completely enclosed within the ensheathing, spade leaf and basal bract. Larvae are often found already feeding on the fingers at this stage and as they prefer to feed under cover they are in fact protected from external insecticide application until almost all the bracts have fallen from the fingers. By this time most of the damage may already be done.

Eggs are laid in an exposed position, however the larvae are only exposed until they reach the well protected feeding sites on the fruit. Since the eggs are laid near the fruit, the time the larvae are exposed may be only a few minutes to a few hours at the most. For effective control an externally applied insecticide has to contact the exposed larvae.

The idea of applying an insecticide with a view to controlling larvae hatching some time after the application may also be doomed to failure. An insecticide would have a short active life on the plant, particularly under tropical conditions of high temperature and rainfall.

More importantly, if the insecticide is applied just prior to or in the early stages of bunch emergence, then much of the preferred oviposition area on the bunch is hidden. A matter of a week later the bunch is fully exposed. Egg laying sites, which were not contacted by the insecticide treatment, are then fully exposed.

To further add to the problem of the insecticidal control, plants in an area do not all bunch at the same time and therefore treatment has to be on an individual plant basis.

For the past 20 years growers in north Queensland have been applying a composite DDT (2·0 per cent) and BHC (0·26 per cent gamma isomer) dust for control of the scab moth. The effectiveness of this treatment is now being questioned. In recent trials this treatment has not given control even when applied twice weekly. The problem is currently under extensive review.

However, until further trials are carried out and more information is obtained, the currently recommended treatment should be applied. Where banana rust thrips are not a cause for concern, a 2·0 per cent DDT dust or 0·1 per cent DDT spray may be used.

It is essential that control treatments begin in the early stages of bunching, preferably before the bunch has reached half its vertical height. Until the first bract has fallen, treatments should be applied to the bunch and all surrounding plant parts, particularly around the pseudostem below the emerging bunch. Later the insecticide should be applied to the bunch and bunch stalk only.

Lifting bracts before treatment will increase the chance of the insecticide contacting the larva and enhance control. During continuous wet weather, twice weekly applications may be necessary. Treatments are unnecessary and wasteful after the bracts have fallen and all the fingers are exposed.

SMALL pesticide containers represent the majority of such containers to be disposed of in Australia, and care should be taken as far as their disposal is concerned.

They should be disposed of either at a public dump or buried at least 18 inches deep at a private disposal site.

First remove the caps or lid, punch holes in metal containers, crush glass containers.

Do not make rafts from them and contaminate waterways, and do not convert them into feed containers.

By courtesy Agricultural and Veterinary Chemicals Association.

Fan-Flowers of S. E. Queensland

Although in Australia the greatest number of species is found in Western Australia, three very attractive fan-flowers occur in south-eastern Queensland.

In 1771 Carl Linnaeus, the Swedish botanist, published the name *Scaevola,* describing the genus to which the wild flowers we know as fan-flowers belong.

The name is the diminutive form of *scaeva* meaning "the left-handed one" and alludes to the appearance of the corolla, which somewhat resembles an open hand with the fingers spread wide.

Fan-flowers can be prostrate spreading herbs or larger undershrubs or shrubs. As a general rule they have alternate leaves with entire margins, but in some species the margins are toothed. The flowers are solitary and axillary. They consist of five sepals, five petals and five free stamens. These are all developed on the top of the ovary which is then said to be inferior. The calyx tube is joined to the outer wall of the ovary.

The corolla is irregular in shape, with the tube split open to the base on the upper side, and the nearly equal lobes spreading out like the fingers on a hand. Each petal has a flat central band which ends in a point and this band is bordered by membranous coloured wings. The free stamens surround the style which ends in the very distinctive feature of the family Goodeniaceae to which these plants belong.

This is called the indusium or pollen cup. It is a membranous cup-shaped dilation at the top of the style and surrounds the stigma.

In the bud stage the staminal filaments are as long as the style and the anthers are spread out around the indusium and slightly above it. As the anthers dehisc, the pollen is shed into the open cup.

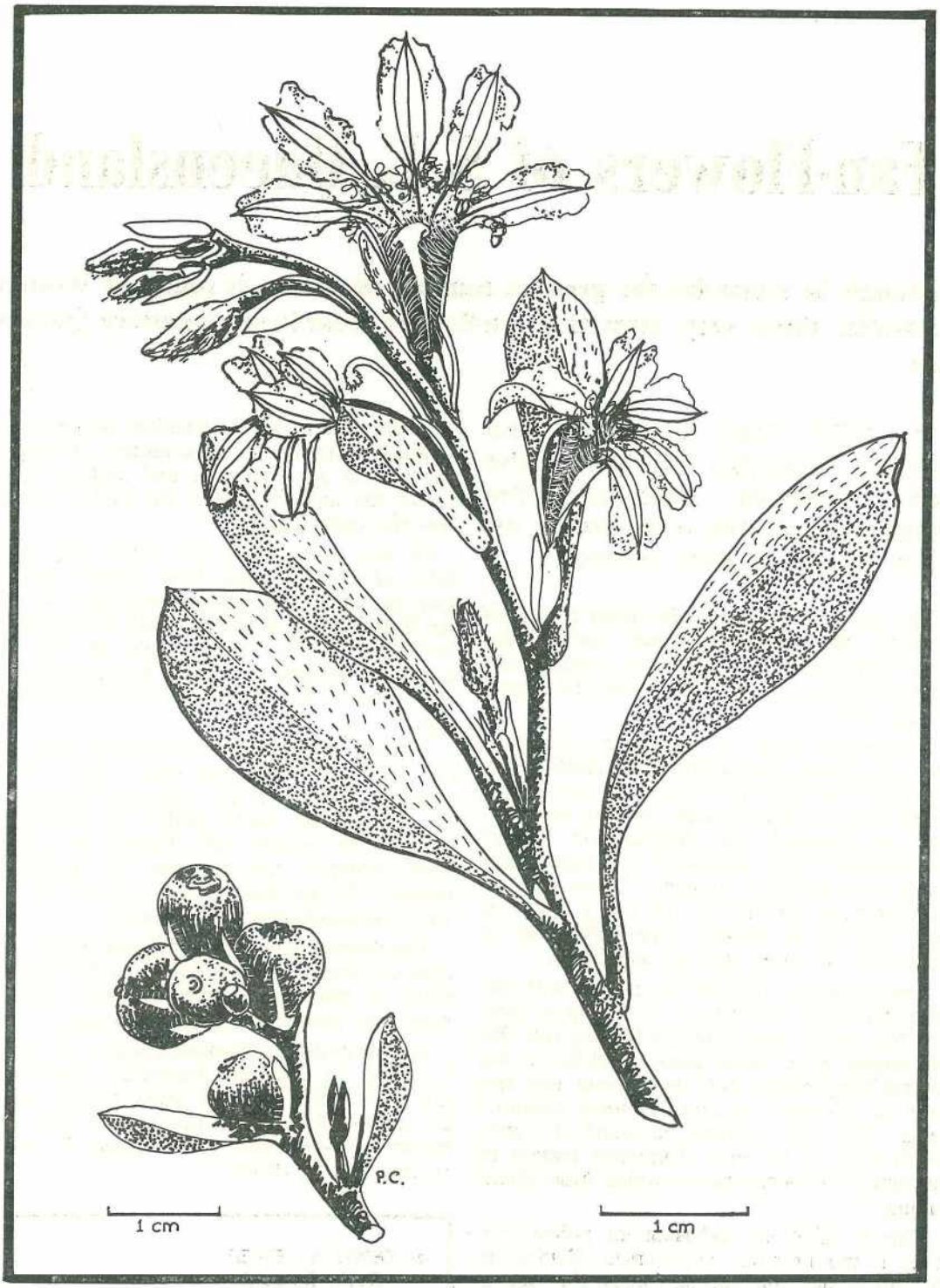
In less than a day the upper and lower sides of the indusium have closed together and the style has bent downwards, so that the flattened cup is at the mouth of the almost horizontal flower. The margin of the cup is densely fringed with short hairs which collect some of the pollen as it is shed into the cup.

Visiting insects come in contact with the cup and dust themselves with a little of the powdery pollen. As the stigmatic lobes grow up in the cup more pollen is forced out through the narrow slit. Finally the stigma itself emerges and receives the pollen of younger flowers from insect visitors. In this way cross-pollination is achieved.

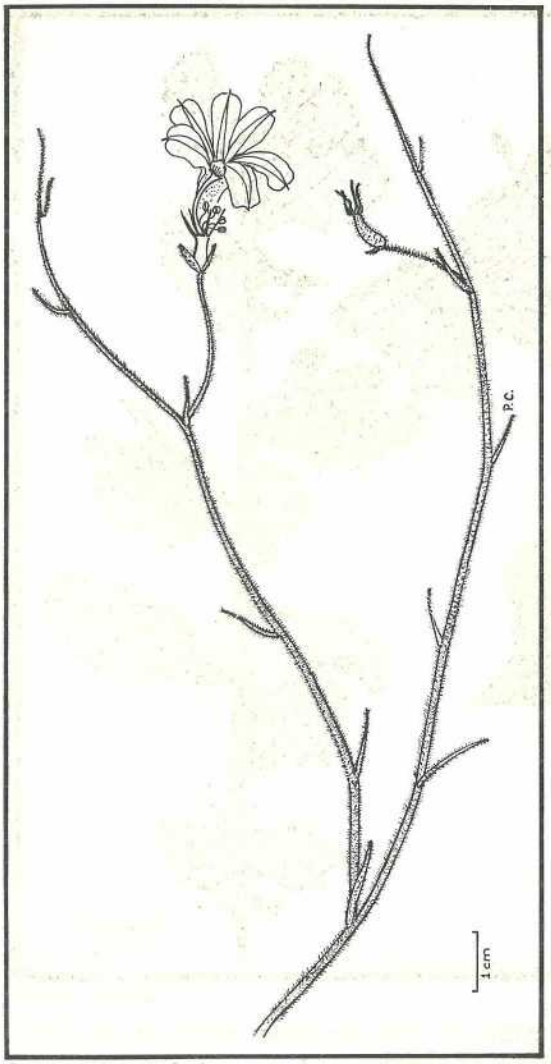
Fan-flowers can have flowers which are light or deep blue, pale violet or rich purple, white or pink. In Western Australia there is even one fan-flower which is orange.

In Australia the greatest number of species is found in Western Australia. Fan-flowers are also found in other parts of the world. In south-eastern Queensland there are three fan-flowers—*Scaevola calendulacea, S. ramossissima* and *S. albida*

by BERYL A. LEBLER,
Senior Botanist.



Scaevola calendulacea.



Scaevola ramosissima.

Scented Fan-flower

(*Scaevola calendulacea*)

The Latin suffix *acea* indicates resemblence and in this species the shape of the leaves was thought to resemble those of Calendula, a favourite spring annual in many home gardens both here and in England.

DISTINGUISHING CHARACTERS. This is the only fan-flower which grows on the coastal sand dunes, often forming dense mats. The fleshy leaves, large bright blue flowers and succulent fruits, together with the habitat, clearly distinguish this plant.

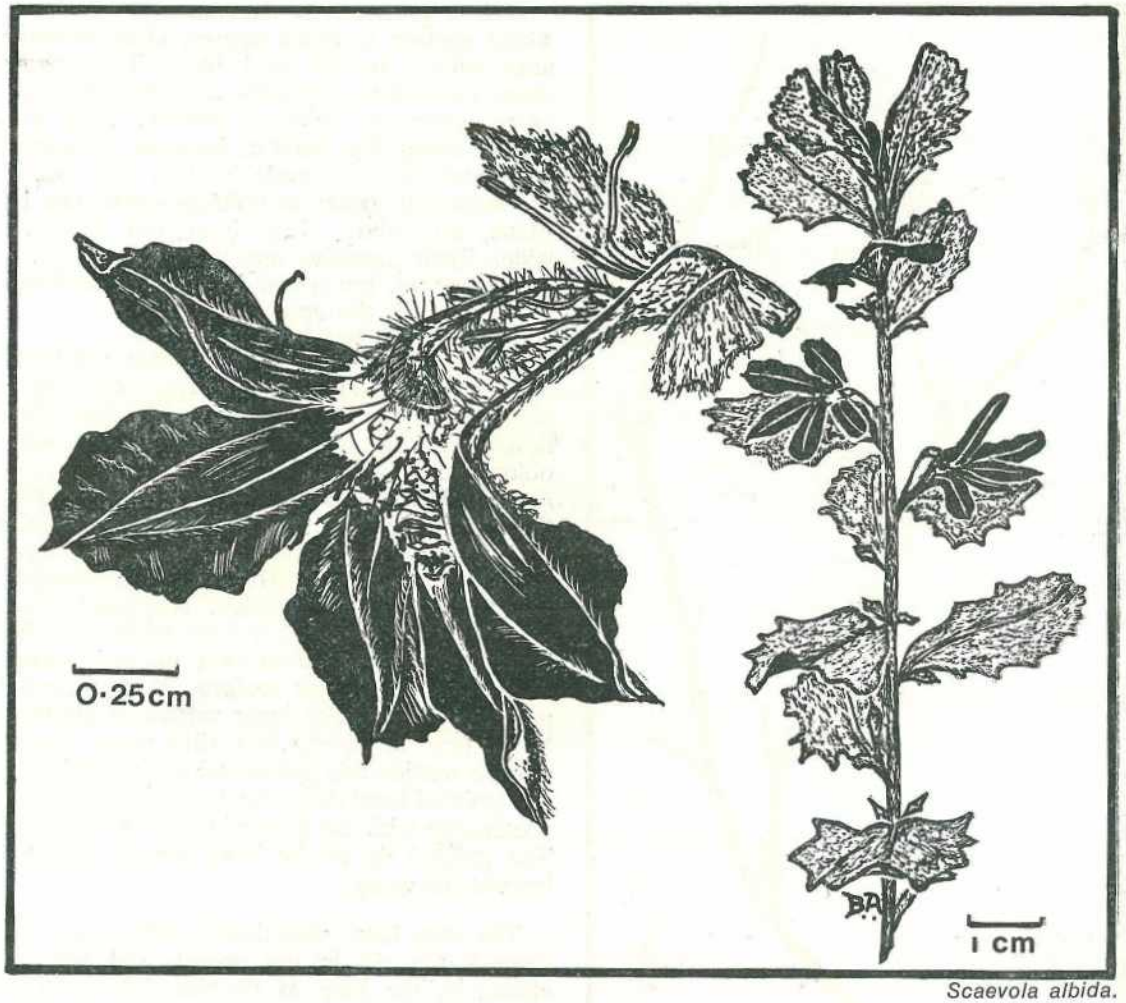
It is a prostrate or decumbent undershrub which sprawls in dense masses, often forming large patches on the sand dunes. The woody stems are slightly succulent and the yellowish-green leaves are thick in texture. They are spaced along the stem at intervals of about 2 cm and curve upwards from it. The leaves are decurrent, ovate to oblong—spathulate in shape, and about 5 cm long and 1·85 cm wide. Their margins are recurved, and are usually entire, but a few teeth are sometimes found towards the apex.

Very fine, short white hairs are scattered on the young stems and leaves, particularly along the leaf margins. The sessile bright blue flowers form terminal interrupted spikes, with oblong-linear green bracts, subtending each flower. These bracts are shorter than the flowers. The green adnate calyx tube ends in five, blunt-tipped sepals which are fringed with short white hairs. The petals are arranged in a fan about 1·5 cm wide. The outer lobes are 1·25 cm long, and 0·5 cm wide, and the inner three lobes are as long but are wider. Both inner and outer surfaces of the corolla tube are yellow. The inner surface is covered by a fuzz of short, fine silky erect hairs. On the outside this yellow colour is continued in a pointed band down the centre of the petals, contrasting with the blue wings on either side. The pointed tip of the band projects slightly beyond the wings.

The very hairy blue-tinged style curves up through the slit in the corolla and reaches almost to the base of the free lobes. The collapsed indusium curves abruptly in towards the corolla tube. The stamens at this stage of the flower development are only half the length of the style and spread out around its base. A dense fringe of short stiff white hairs covers the lip of the indusium. The flowers have a fairly strong sweet perfume. The shiny globular succulent fruits are rich deep purple and are 1·85 cm in diameter. The top of the fruit is indented in a shallow, circular hollow, surrounded by the remnants of the calyx, still fringed with sparse hairs.

FLOWERING TIME. Throughout the year except in the hottest summer months.

HABITAT. On coastal sand dunes.



Scaevola albida.

DISTRIBUTION. Along the coast, from South Australia to as far north in Queensland as Curtis Island.

GENERAL REMARKS. This plant has been used successfully as a ground cover plant in some home gardens. Good drainage and deep sandy soil are necessary to develop the thick mat-like cover found in the natural state.

Hairy Fan-flower or Purple Fan-flower

(*Scaevola ramosissima*)

The Latin adjective *ramosissima* meaning very much branched chosen as the specific epithet for this fan-flower refers to the plant's habit of growth.

DISTINGUISHING CHARACTERS. The strangling wiry and hispid stems with scattered long narrow leaves and rich purple flowers differentiate this plant readily from the other fan-flowers in south-eastern Queensland.

It is a more or less sprawling herb with very straggling branches which can be up to 1 m long. Some plants have numerous semi-erect branches from the base. The leaves are few and sessile. They are dark green and can be as long as 6 cm and as wide as 0·5 cm at the middle, tapering to both ends. A few small teeth can sometimes be found on the margins near the leaf tip.

All parts of the plant except the corolla wings are sparsely covered with short, stiff, spreading hairs. Short slender branches arise from the leaf axils towards the ends of the branches, with one showy flower at the end of each branch.

These flowers are purple or violet, 2·5 cm long and as wide. On each side of the ovary at its base is a linear bract. The linear sepals are 0·8 cm long and spread widely with the five petals at the end of the corolla tube spreading like a fan. A sparse cover of spreading white hairs is found on the outside of the corolla tube and the central bands down each petal. The inside of the tube is tinged with yellow and is thickly covered with short hairs. Five short stamens surround the base of the style which arches up over the corolla tube. The upper third of the style is sprinkled with long white hairs, which are denser on the upper part of the indusium. A white patch about 0·3 cm long extends along the inner surface of the central petal from the level of the end of the indusium. The fruit is oblong and succulent.

FLOWERING TIME. Spring to late summer.

HABITAT. In open eucalypt forests on sandy soils or in heavy soils on sandstone ridges.

DISTRIBUTION. From Victoria to as far north as the Blackdown Tableland in central Queensland.

Small-fruited Fan-flower

(*Scaevola albida*)

The Latin adjective *albida* means somewhat white to whitish. In 1794 this plant was described from a dried specimen collected at Port Jackson and sent to London. It would therefore seem the colour could have faded from the flowers or was such a pale blue compared to the rich purple fan-flowers previously seen for the plant to merit the choice of this name.

DISTINGUISHING CHARACTERS. The arrangement of the flowers in terminal interrupted leafy spikes, and the shape of the coarsely-toothed leaves distinguish this fan-flower from the others in south-eastern Queensland.

DESCRIPTION. It is a perennial herb which is very rarely erect. Usually it is procumbent, diffuse or ascending. Erect firm green stems rise from the procumbent main stem. These are usually no more than 30 cm high, and when viewed against the light appear "fuzzy". Examination under magnification reveals minute white hairs scattered over the surface. These make the leaf surface rough to the touch.

On the main stems the leaves can be 6 cm long and 4·5 cm wide. On the erect stems they are rarely more than 2·5 cm long and as wide. On the erect stems the short pedicels lie close to the stem with the lamina spreading out on the leaves at the base of the stem and curving upwards on those higher up. The pedicels gradually widen into the lamina.

The flowers are solitary and in the axils of the upper leaves which are much smaller and different in shape. They are sessile between two small green leafy bracteoles. The calyx consists of five very tiny rounded lobes which, without magnification, cannot be distinguished from the ovary. The lavender-blue corolla is just over cm long and almost 3 cm across and is sweetly perfumed.

Short white hairs curving upwards cover the outside of the corolla tube and extend along the central pointed band in the petals. The inner surface of the corolla tube is greenish-yellow and covered with long erect hairs which extend up along the margins of the lobes. The upper part of the style, immediately beneath the indusium is covered with spreading white hairs tinged with purple. These surround the indusium which is glabrous except for the dense fringe of short hairs on the lip.

FLOWERING TIME. Throughout the year except during winter.

HABITAT. In open eucalypt forest on ridges or rocky slopes, often in mountainous areas.

DISTRIBUTION. It grows in South Australia and the eastern states to as far north in Queensland as Mt. Coolum and as far west as about Mitchell.

RING SELLING... a cause of bruising?

RING Selling or, drafting stock into a special sale ring for auction, often after weighing, as against selling from pens is becoming increasingly popular with cattlemen. It is frequently stated that ring selling contributes substantially to the problem of bruising in Australia.

There is some evidence[1] to suggest that ring selling, as opposed to pen selling, causes an increase in the prevalence of bruising but detailed figures are not available.

One abattoir in Queensland includes on its kill sheets information on the number and size of bruises trimmed from all carcasses. This abattoir, a medium sized country abattoir, purchases cattle from both ring selling and pen selling saleyards.

The bruise data recorded on the kill sheets was analysed statistically to determine the significance of differences in bruise prevalence and severity for cattle purchased from these two sources. This report presents an analysis of the data of 1,200 cattle slaughtered at this abattoir.

This abattoir obtains cattle from many sources. However a significant percentage of all cattle slaughtered would be purchased from either a particular ring selling saleyards (Saleyards R) or a particular pen selling saleyards (Saleyards P).

Saleyards R is approximately 5 kilometres from the abattoir while Saleyards P is approximately 300 kilometres from the abattoir. Cattle from Saleyards P normally travel to the works by rail transport.

The same type of cattle are purchased at each saleyard—the typical animal being a 2–3 year old steer of carcass weight 225–300 kg.

The animals included in this retrospective survey were all slaughtered at the abattoir during the period February–June 1974. In some cases animals from the two different sources were killed at the works on the same day. The survey covers 600 animals purchased from each of the two saleyards.

The works carcass grader makes an estimate of the surface area of the bruise and places it into one of three depth categories—superficial, deep or very deep.

RESULTS

Table 1 shows the bruise incidence (the percentage of cattle with at least one bruise) and the bruise severity (the mean bruise area per carcass side) for the two saleyards.

The results show clearly that cattle from saleyards R had considerably more superficial and deep bruises than cattle from Saleyards P. However for the category of very deep bruises cattle from saleyards P had considerably more bruises than saleyards R cattle.

by W. R. RAMSAY, C.S.I.R.O. and F. D. SHAW, Slaughtering and Meat Inspection Branch.

TABLE I

BRUISE PREVALENCE AND BRUISE SEVERITY FOR RING SELLING AND PEN SELLING SALEYARDS

	Bruise Prevalence (Percentage of Cattle with at Least One Bruise)		Bruise Severity (Mean Bruise Area per Carcass Side—Sq. Cm)	
	Ring Selling	Pen Selling	Ring Selling	Pen Selling
Superficial Bruises	16·3%	8·0%	161·4	51·7
Deep Bruises	24·2%	16·2%	258·7	150·3
Very Deep Bruises	4·0%	13·7%	14·2	59·7

N.B. For Both Bruise Prevalence and Bruise Severity for Each Class of Bruise the Differences are highly significant ($P < 0.001$)

It has been shown that the presence of horns on cattle leads to an increase in the amount of carcass bruising[2]. Therefore if saleyards R normally had a particularly high percentage of polled cattle for sale it could be expected that bruising from these yards would be less than from other saleyards.

On four different occasions a count was made of the number of horned and polled cattle at these two saleyards. At saleyards R approximately 50% of cattle were polled and 50% horned while at saleyards P approximately 33% were polled while 67% were horned. Thus it could be expected that cattle from Saleyards P would have more bruising than cattle from Saleyards R.

The fact that the reverse was the case for superficial and deep bruises suggests that the Saleyards R cattle may be being bruised during the actual sales. The reason for the high incidence of very deep bruises for the saleyards P cattle is not clear. It is possible that many of these bruises occur during transportation from the saleyards to the abattoir.

It should be noted that the total economic loss due to bruising may be similar for the two saleyards as considerable carcass mutilation may occur when very deep bruises are removed. However, it would appear that the procedure of ring selling of cattle leads to an increase in the number of superficial and deep bruises.

REFERENCES

1 Anon. (1972)—"1971 Bruising Survey Report" Victorian Meatworks Association, Melbourne.

2 Meischke, H.R.C., Ramsay, W. R. and Shaw, F.D. (1974).

Sewage irrigates crops

INITIAL forage plots are being irrigated with chlorinated sewage from the City of East Lansing, U.S.A.

Crop scientists are closely evaluating the ecological effects of this waste disposal technique.

Areas of concern include potential effects on the soil, ground water supplies, nutritional quality of the crop, and any possibility of toxic reactions in livestock.

From Michigan State University Agricultural Experiment Station Research Report.

REPORT ON BOAR PERFORMANCE

The following boars were approved during March, 1975. Average boars score 50 points for Economy and 50 points for Carcase. Point Scores can be compared only with those of boars of the same breed.

Large White Boars

Breeder	Ear No	QAR No	Point Score		
			Economy of Production	Carcase Quality	Total
N. J. Cotter, P.O. Box 23, Goomeri, 4601	Sire: Sedgenhoe Major Morgan Imp. Dam: Olaroy Pride 146				
	271	658	61	61	122
	272	659	93	59	152
K. and J. Mathiesen, Naiken Stud, Box 138, Gayndah, 4625	Sire: Moorilla King David 601 Dam: Moorilla Mona Lisa 5386				
	764	648	90	46	136
	Sire: Colley Champion Turk 5 Dam: Naiken Flavia 123				
	781	662	70	51	121
A. B. and B. D. Robin, Blaxland Stud Piggery, M.S. 1889, Dalby, 4405	Sire: Wodalla Caesar 242 Dam: Bettafield Countess 2798				
	96	663	60	60	120

Landrace Boars

L. A. Peters, M.S. 1974, Bongeen, 4356	Sire: Moonlight Rainlover 631 Dam: Moonlight Doris 526				
	850	646	49	76	125
A. B. and B. D. Robin, Blaxland Stud Piggery, M.S. 1889, Dalby, 4405	Sire: Caminda Rainlover 582 QAR 599 Dam: Glen Farm Marilyn 212				
	199	665	105	55	160
	200	666	61	45	106
L. B. and L. J. Trout, M.S. 757, Kingaroy, 4610	Sire: Lynangra Rainlover 789 Dam: Caminda Fairy 58				
	1,358	660	75	36	111
	1,360	661	98	39	137
	Sire: Balgowrie Royal Promise 330 QAR 612 Dam: Caminda Bessie 14				
	1,377	664	87	65	152

MAKUENI

a new guinea grass for North Queensland

by C. H. MIDDLETON and T. H. McCOSKER, Agriculture Branch.

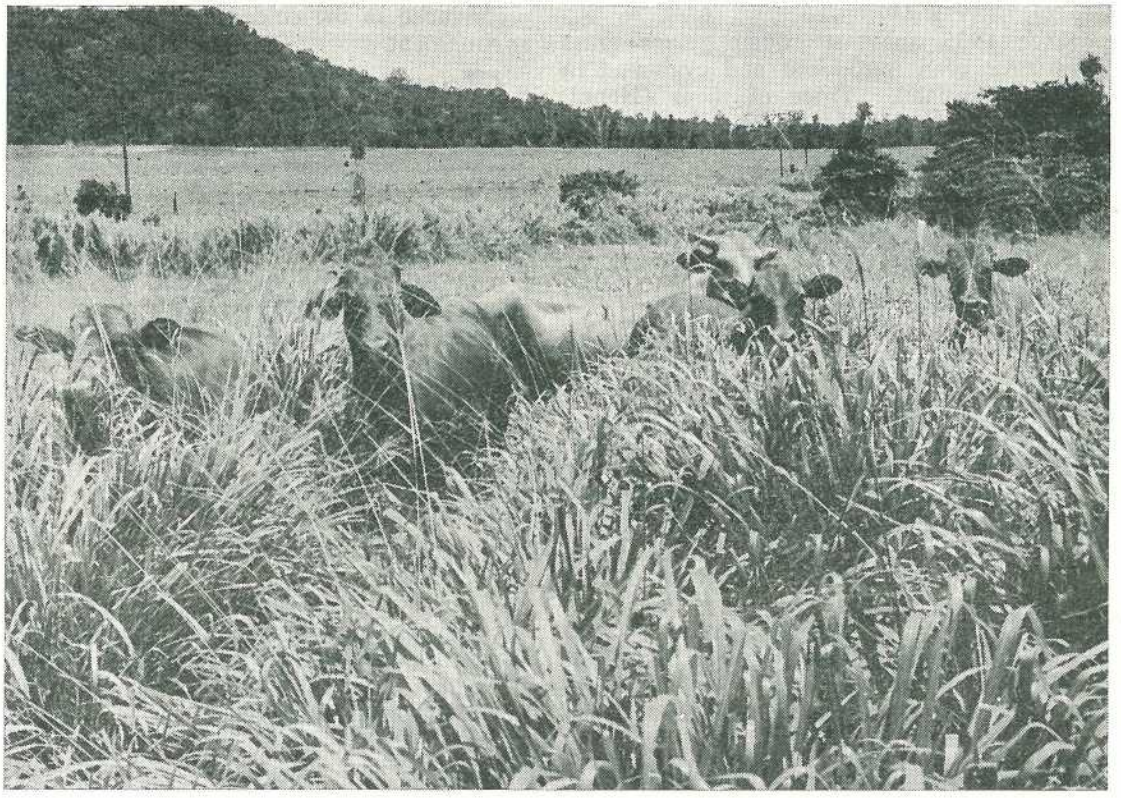
IN July 1974 a new cultivar of guinea grass called Makueni was released for commercial use in Australia.

It was introduced from Kenya in 1965 and subsequently tested in northern Queensland where it has given better cool season growth than other guinea grasses.

Makueni is recommended as an alternative to these on the wet coastal lowlands and adjacent highlands of tropical far northern Queensland.

Guinea grass (*Panicum maximum*), a native of Africa, is widespread throughout the humid tropics and subtropics of the world. It arrived in Australia before 1900 and soon began to spread along the coastal areas of Queensland.

Below: A mature stand of Makueni under grazing at Utchee Creek. Note the drooping growth habit.



Problems in collecting good quality seed limited its early use and it was not until after cattle fattening started on the coast in the mid 1930s that the real value of guinea was recognized.

At this time investigations were started on the property of Mr. Brice Henry (Tully) and the South Johnstone Research Station to find grasses better suited to the environment than molasses grass (*Melinis minutiflora*) and para grass (*Brachiaria mutica*).

Common guinea grass immediately came to notice and its subsequent success was evidenced by its widespread use on the well drained soils. Today, common guinea remains one of the major grasses used for cattle fattening in the wet tropical regions.

Better varieties needed

Common guinea grass has two main weaknesses:

- the bulk of its growth occurs in summer;
- in recent years commercial common guinea grass seed has become increasingly contaminated with less desirable types such as coarse guinea.

Since 1935 about 46 other guinea grass lines have been introduced and evaluated in north Queensland. Three of these (Hamil, Coloniao and Embu) found limited use. More recently (1965) a number of guinea grasses were introduced from East Africa jointly by Dr. B. Grof (formerly of the South Johnstone Research Station) and Mr. J. Redrup (formerly of Andersons Seeds Ltd.).

Some of these, including Makueni, originated in the relatively cool highland areas of Kenya. Intensive evaluation of these introductions in northern Queensland since 1965 led to the release of Makueni for commercial use.

Appearance

Makueni is easily distinguished from other guinea grasses because the whole plant is covered with dense, whitish, soft hairs giving it a soft furry feel. Since the outer seed coat is also hairy it is easy, with the help of a magnifying glass, to distinguish Makueni seed from that of other guinea grasses. However, it is not so easy to distinguish Makueni seed from seed of green panic (*P. maximum* var. *trichoglume* cv. Petrie), which is also hairy. These two can only be positively separated after germination of the seed.

Makueni is an erect, tufted cultivar of medium height. The leaf canopy is less erect than that of all other cultivars except Embu, a creeping type. Table 1 summarises the botanical features which distinguish the main guinea grasses in use in north Queensland.

Makueni is slightly larger in growth form than common guinea but much smaller than the giant types, Hamil, Coloniao and coarse guinea. The leaves are longer and wider than those of common guinea and this, together with the drooping nature of the leaf canopy, makes the plant look more leafy than it actually is. In fact, the proportion of leaf to stem in Makueni is no different from that of common guinea of similar age.

Advantages

Experiments in northern Queensland have shown that the main advantage of Makueni is better cool season growth than other cultivars, particularly the giant types. Superiority over common guinea during winter is more pronounced in the colder Atherton Tableland environment.

Like common guinea, Makueni is capable of extremely high dry matter production. In one year (1973–74) at South Johnstone it produced more than 60 tonne/ha when 300 kg/ha of nitrogen was applied (Table 2).

Makueni appears to be very similar to common guinea in most other performance features. It responds readily to nitrogen fertilizer on nitrogen deficient soils. It combines well with a number of tropical legumes including centro (*Centrosema pubescens*), stylo (*Stylosanthes guyanensis*) puero (*Pueraria phaseoloides*) and glycine (*Glycine wightii*).

The quality of common and Makueni guinea appears similar in that both are relatively high in crude protein content and dry matter digestibility when young and leafy, but decline rapidly with age (Table 3).

Preliminary results from grazing experiments have shown that Makueni is readily grazed by cattle and capable of giving liveweight gains of up to 0·8 kg/animal/day, equivalent to those from common guinea.

TABLE 1

BOTANICAL DIFFERENCES BETWEEN SIX GUINEA GRASSES OF NORTH QUEENSLAND

ATTRIBUTE	COMMON	MAKUENI	HAMIL	COLONIAO	"COARSE"	EMBU
Growth form ..	Medium height (1·8–2·0 m), erect canopy, fine stems	Medium height (1·8–2·4 m) leaves less erect than others. Moderately coarse stems	Giant robust type, thick stems. Height 3·0–3·5 m	Giant robust type, thick fleshy stems. Height 2·5–3·0 m	Giant, robust, thick woody stems. Height 2·5–3·0 m	Semi-erect, rambling habit, roots freely from nodes, produces aerial roots from lower nodes. Height 1·0–1·5 m
Leaves—						
Colour ..	Green	Light green	Dark green	Distinctive blue-green	Dark green	Light green/green
Length ..	70–80 cm	80–90 cm	70–80 cm	80–90 cm	80–90 cm	20–30 cm
Width	15–18 mm	18–22 mm	24–26 mm	25–30 mm	25–30 mm	12–16 mm
Blade hairs ..	Sparsely hairy upper surface—few on lower surface	Densely soft hairs both surfaces, hairs whitish. Much more hairy than all others	Sparsely hairy on upper surface	Nil	Sparse to moderately dense stiff short hairs giving rough feel to the leaf	Occasional short hairs on leaf surfaces
Sheath hairs ..	Moderately hairy on outside surface, density increasing towards node	Densely hairy, increasing in length towards node. Hairs on both surfaces of sheath	Sparsely hairy, increasing in density on sheaths towards base of plant	Glabrous except for few short hairs on sheath margin toward sheath/blade junction	Moderately dense long stiff brittle hairs on outside surface increasing in density towards the blade/leaf junction. Sheath painful to handle	Sparse short hairs on lower outside of sheath near the node junction
Exposed stem hairs	Nil	Moderately dense particularly on lower side of nodes	Nil	Nil	Nil	Occasional hairs on lower internodes
Panicle (seed head)—						
Size ..	15–40 cm long 12–30 cm wide	15–40 cm long 12–30 cm wide	20–60 cm long 15–40 cm wide	20–50 cm long 15–30 cm wide	20–60 cm long 15–40 cm wide	15–20 cm long 12–15 cm wide
Colour ..	Green	Green with purplish tinge	Dark green	Dark green	Distinctive dark brown	Green
Spikelet (seed)—						
Outer glume hairs	Nil	Densely hairy	Nil	Nil	Nil	Nil

TABLE 2

DRY MATTER YIELD (TONNE/HA) OF FIVE TROPICAL GRASSES BETWEEN APRIL, 1973 AND MARCH, 1974 AT SOUTH JOHNSTONE

(Sampled at 3, 6 and 12 Week Intervals)

Grass	Sampling Interval*		
	3 weeks	6 weeks	12 weeks
Pangola	13·0	20·8	24·6
Signal	22·3	30·0	52·4
Setaria splendida	20·6	33·2	62·5
Common guinea	22·7	35·0	62·4
Makueni guinea	23·3	36·3	62·5

*Grasses cut 10 cm above ground.

Makueni and the legume puero (Pueraria phaseoloides).

TABLE 3

THE EFFECT OF AGE ON % LEAF, % CRUDE PROTEIN AND % DRY MATTER DIGESTIBILITY OF COMMON AND MAKUENI GUINEA GRASSES

Attribute	Common Guinea			Makueni Guinea		
	3 weeks	6 weeks	12 weeks	3 weeks	6 weeks	12 weeks
Proportion of leaf in total dry matter yield (%)	85·7	72·3	50·0	89·1	75·6	49·0
Crude protein content of leaf plus stem (%)	15·5	11·5	7·9	16·4	10·7	7·6
Dry matter digestibility (%)—						
Leaf	71	68	N.A.	71	65	N.A.
Stem	68	64	N.A.	67	60	N.A.

N.A. = not analysed.

Establishment and management

Evidence to date suggests that there is no major difference between common guinea and Makueni either in establishment or management. However, since Makueni has not been with us for long differences may appear in the future. Like all tufted guinea grasses, it becomes coarse, stemmy and unattractive to stock with maturity. This is likely to happen during the wet summer months unless the grazing pressure is greatly increased.

General planting and management details for the guinea grasses have been outlined in detail by J. K. Teitzel and others in the April, May and June, 1974, issues of the *Queensland Agricultural Journal*. These should be consulted.

Experience indicates that Makueni is best suited to the deep, friable rain-forest soils. It is currently recommended for use on any soil where common guinea is suited. This includes the well drained soils of the coastal lowlands north of Ingham and the adjacent Atherton Tableland.

While Makueni is an acceptable alternative to common guinea, difficulty can be expected if one attempts to replace an old guinea grass pasture with Makueni. This arises from the dense regeneration of seedlings from the old pasture. Makueni is therefore best planted on new areas. If planting into old guinea grass paddocks is unavoidable, prepare the seedbed sufficiently to remove most guinea grass seedlings.

Seed

Makueni guinea grass is similar to common guinea as a seed producer and has some prospect of producing more than one crop annually in some circumstances. Since seed production areas are already in existence, limited supplies should be available in early 1975 with larger quantities becoming available from mid 1975 onwards.

EMPTY CONTAINERS

BEFORE disposing of any empty pesticide containers, ensure that they are rinsed at least twice with water, and that the rinsing water is preferably added to the spray tank to avoid waste of pesticide and money.

Double rinsing will remove the greatest portion of the container's contents.

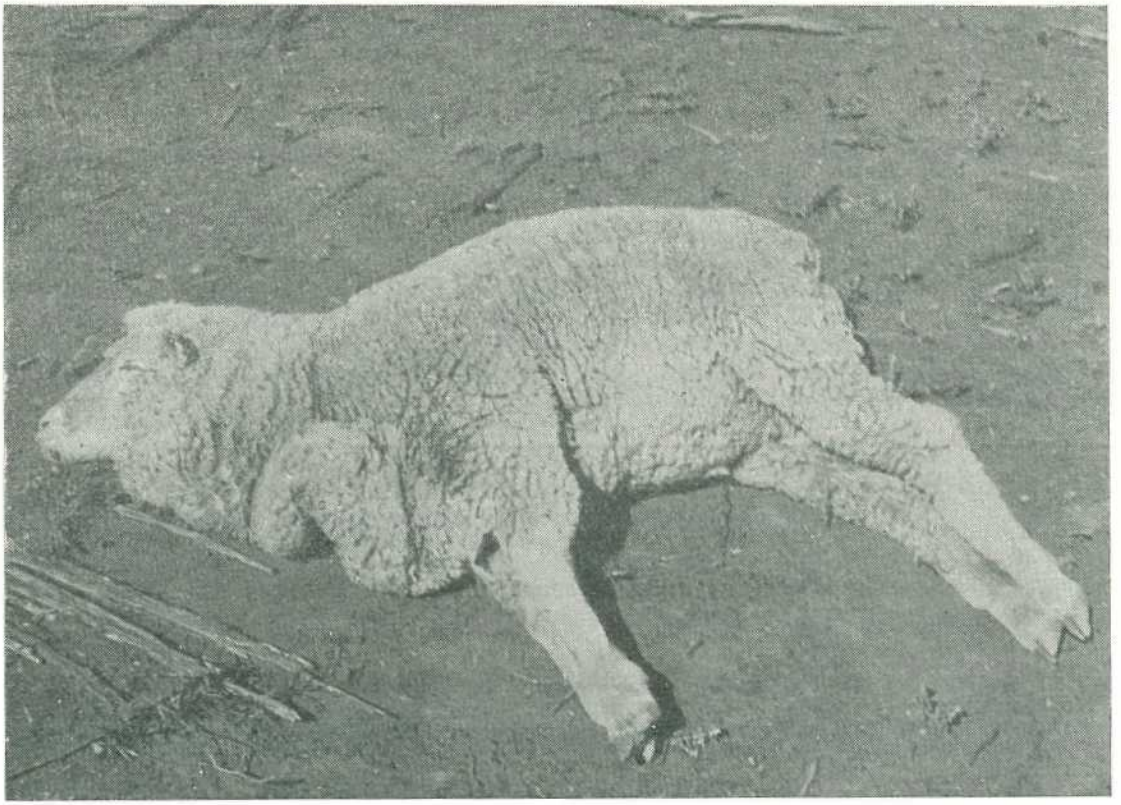
By courtesy Agricultural and Veterinary Chemicals Association.

Tetanus in Sheep

by R. T. F. ARMSTRONG,
Sheep and Wool Branch.

TETANUS is a disease which affects man and animals. The horse, sheep, and goat are more susceptible to the disease than the other domestic animals.

In sheep, the disease commonly occurs after operations where the skin is cut or broken. These include mulesing, lambmarking, shearing, and crutching. The use of rubber rings at lambmarking can be particularly hazardous as the dead and dying tissue under the ring provides an ideal medium for the growth of the causal organism. Cases have also been reported after sheep heavily infected with grass seed have been dipped.



Tetanus is caused by a germ *Clostridium tetani,* a bacteria which, unlike many bacteria, does not spread through the body. This germ remains at the site of infection while a poison it produces circulates in the blood stream. This poison, called a toxin, affects the nervous system.

The first sign of a tetanus outbreak usually noticed is a few dead sheep lying in the paddock four of five days after one of the above operations. These deaths can and often do continue up until the 21st day. As well as the dead sheep, some sheep can be observed lying on their side with their heads and legs stretched out. Affected sheep, especially if disturbed by noise or touched, suffer from muscle spasms or "tetanic fits". Stiffness as shown by a stilted gait can be seen in early cases.

The eye is often covered by the third eyelid. In many cases the jaws will be difficult to open and from this the old name of "lockjaw" was derived.

On post-mortem examination no abnormalities other than the wound containing the site of infection are found. Sometimes the wound is so small that it cannot be found.

Treatment

In most instances sheep are not treated for tetanus. If treatment is attempted the aims are:

- Eliminate the causitive organisms by opening up the wound to remove all dead tissue and giving antibiotic drugs.
- Neutralise the effect of the circulating toxin by giving large doses of tetanus antitoxin (10 000 to 20 000 units).
- Relax the muscle spasms (tetany) and keep them relaxed by the use of tranquilizers until the toxin is neutralised or eliminated from the animal.

Those measures should be carried out under veterinary supervision. Also it is recommended that the animals under treatment be housed in a quiet, dark, well bedded shed or stable.

As this treatment is costly, it is usual for all animals showing advanced symptoms to be humanely destroyed. In some outbreaks no further treatment of exposed but unaffected animals is attempted but in others the animals not showing symptoms are given a dose of not less than 500 units of tetanus antitoxin. When the tetanus antitoxin is given further deaths should be minimised.

Prevention

Whereas tetanus is difficult to treat it is simple to prevent. Prevention techniques include husbandry measures and immunization by the use of hyperimmune serums and/or vaccines.

The husbandry measures are essential and include:

- The use of clean sterilized instruments. All boilable instruments should be boiled for at least 15 min. and the remainder sterilized in a suitable disinfectant prior to use. During use, *all* instruments should be continually dipped in disinfectant solutions. Any instrument which is dropped should be cleaned and disinfected before use.
- Where possible, operations which incorporate intentional cutting of the skin such as mulesing and lambmarking, should be carried out in temporary yards erected on a grassy area.
- If old yards are used they should be watered regularly to reduce the dust menace. Shearing sheds should be thoroughly washed and the shearing board scrubbed and disinfected.
- The animals should be returned to the open paddocks as quickly as possible.
- Dips should be frequently cleansed and only clean wash used.

Along with these husbandry measures some form of immunization is desirable. This type of protection can be either temporary or long-term.

Temporary Immunity

Immunity which lasts for only a short time can be given by using hyperimmune serum—tetanus antitoxin. An injection of tetanus antitoxin will give the sheep protection within 3 to 4 hours and will last for 21 days. This protection therefore covers the period of risk if given at the same time as an operation is carried out. If a longer period of protection is desired further doses at three week intervals are required or the sheep should be vaccinated to give a long term immunity.

The dose rates of tetanus antitoxin recommended are:

- Adult sheep—not less than 500 units
- Lambs—not less than 100 units
- Young lambs can also gain temporary immunity through the colostrum provided the ewe has been vaccinated recently to give her a long term immunity.

Long Term Immunity

Long term immunity is developed by the use of tetanus toxoid. To gain maximum benefit from the use of this vaccine three doses are recommended. The second dose is given 4 to 6 weeks after the first and the third approximately 12 months later.

Tetanus toxoid can be purchased as a vaccine by itself or in a combination vaccine. In the combined vaccine it is mixed with toxoids of closely related organisms which produce such diseases as blackleg, enterotoxaemia, etc. Where protection is required for these associated diseases as well, combined vaccines are very useful as a time and cost saver. (Combined vaccines cost per dose is similar to that of toxoid alone.) The vaccination programme does not alter when these combined vaccines are used.

It should be noted that both tetanus antitoxin and tetanus toxoid can be injected into the one animal simultaneously at different injection sites without loss of effectiveness. In giving these, separate syringes and needles MUST BE USED and not interchanged.

With this technique the animal gains immediate protection and as this wanes the active immunity is developing and extends the period of protection.

Recommended Vaccination Programmes

A great variety of vaccination programmes has been developed over the years and the following are some of those which have been found to be effective:

- At lambmarking the first dose of tetanus toxoid and a dose of tetanus antitoxin are injected at different sites. At weaning (or earlier if feasible) the second dose of tetanus toxoid is given. The third dose is given 12 months later whilst some other operation is being conducted, for example, shearing, crutching. The toxoid can be either as tetanus toxoid alone or combined vaccine.
- The second programme is similar to the previous one except that at lambmarking tetanus antitoxin is not given. This strategy is undertaken in areas where the risk of infection is minimised by the use of temporary yards and the other husbandry techniques listed earlier.
- In some areas of very high risk a basic programme as outlined in the first programme is used but the ewes are given a booster dose of tetanus toxoid about one month prior to lambing. This ensures an increase in antibodies in the ewe's bloodstream and colostrum or first milk. The lamb on suckling the mother and obtaining the colostrum gains a high degree of protection.
- Some owners are in areas of very low risk and they feel that vaccination for long term immunity is not warranted. These owners then only vaccinate the sheep at times of high risk with tetanus antitoxin. Lambmarking and mulesing are two occasions when this is undertaken. This programme is not recommended if more than one or two doses of tetanus antitoxin have to be given as it is cheaper to use tetanus toxoid and produce a long term immunity.
- Where the risk is low but the owner desires to prolong the protection period obtained from the use of tetanus antitoxin only one injection of toxoid is given at the same time as the antitoxin is injected. The use of separate syringes and needles as indicated in the section under long term immunity must be observed.

Enough?

Too much?

Too dear?

When it comes to costing protein and phosphorous supplements, graziers must be able to get clear answers to these vital questions. This feature, prepared by L. A. Warrell, Agricultural Chemistry Branch and A. J. Boorman, Beef Cattle Husbandry Branch, provides basic information needed to find the answers.

Costing protein and phosphorus supplements for beef cattle

THE final choice of a supplement should be based on the cost per unit of protein and/or phosphorus fed. First, however, the manager must be satisfied that the licks from which he makes his final choice will give his cattle the quantity of nutrients they need.

Managers can determine whether or not their cattle are receiving sufficient supplement from Tables I and II. However it should be remembered that any one commercial lick will seldom supply sufficient of both protein and phosphorus to meet animal needs. The tables show the number of blocks or packs of lick 100 head must consume weekly.

If the cattle are consuming more licks than indicated by either Table I or II, some is being wasted. If they eat too little the cattle will not respond as well as they should and the results may not justify the cost.

How cattle accept a lick depends on their appetite for salt or phosphorus, whether or not they like molasses or grain, and some other factors such as previous experience with licks.

In assessing potentially useful licks it is also necessary to consider labour and other property resources. This will determine whether or not licks should be mixed on the property, mixed to specification by a feed merchant or whether a commercial supplement should be used. Generally home made licks are cheapest and most effective but only the station manager can assess the reliability of his labour and the other factors involved.

Once assured that his cattle will accept the licks on his short list and that they can be handled by his labour and other resources, then and only then should a manager consider cost.

Calculating Costs

Two simple calculators and an equally simple table (Table III) have been developed to assist in calculating the cost of a feeding programme. The calculators give the cost of feeding 100 head of cattle for one week when they are fed the quantities of protein and phosphorus recommended in Tables I and II.

The first step in calculating the cost of a supplement is to determine the per cent. of protein or phosphorus. With proprietary lines this can be read from the label but with home-made supplements it has to be worked out. (See section Calculating % Protein and Phosphorus).

Next, if the landed cost per tonne is not known calculate it from Table III.

Example

Assume that F.O.R. or F.O.B. cost per pack (block or bag) is $13.75 and that the pack weight is 50 kg.

Divide the cost per pack into tens and units e.g. $10 + $3 + $0·70c + 0·05c = $13.75.

From Table III read off the cost per tonne in the 50 kg block column as follows:—

$10	=	$200.00
$3	=	$60.00
0·70c	=	$14.00
0·05c	=	$1.00
		$275.00

To the cost per tonne F.O.R. add the cost of freight e.g. $56 Landed cost on the property then becomes: $275 + $56 = $331 per tonne.

When home made licks are used an allowance must also be made for the cost of labour involved in mixing the licks and depreciation on mixing and feeding equipment.

Distribution costs will be similar for all types of lick except urea molasses.

Once the landed cost per tonne is determined turn to the protein cost calculator and run a finger down the left hand side of the page until the appropriate percentage of protein is reached, e.g. 68%. Then run a finger down the right hand side of the page until the appropriate cost per tonne is reached, $331. Place a ruler across the two points and read off the cost on the sloping line.

The cost is given as the cost of feeding 100 head of cattle for one week and is $51.00.

To calculate the cost of a phosphorus supplement, a similar procedure to that outlined above for protein is followed. With this calculator all costs are based on feeding 10 g of P per head per day. **Dry cattle such as weaners and steers etc. require 6 g daily while breeders require 8–10 g.** To obtain the cost of feeding 6 g read off the answer using the appropriate % P and cost per tonne and then multiply by 0·6.

Where the cost or percentage protein or phosphorus is too great or too small to fit on the scale of the respective calculators the following will allow their use.

If the cost is too great: divide by 2, 3, or 4 until the answer fits onto the scale. Divide % protein or phosphorus by the same figure and then read off the cost of feeding 100 head per week on the calculator in the usual way.

If the cost is too small: Multiply by 2, 3, or 4 until the answer fits onto the scale. Multiply the percent protein or phosphorus by the same figure and then read off cost of feeding 100 head per week in the usual way.

If the percent protein or phosphorus is too great: Divide the percent protein by 2. Divide the cost by 2. Read off the cost per 100 head per week in the usual way.

Budgeting

Having determined the cost of feeding 100 head of cattle for one week it is possible to obtain a rough estimate of the cost of the years' feeding programme. This is done as follows: divide the number of cattle to be fed by 100; multiply by the cost of feeding 100 head for one week; multiply by the number of weeks feeding e.g. if the cost of feeding 100 head for one week is $15 and 2,500 head are to be fed for 30 weeks then the cost of feeding for the whole period is

$$\frac{2{,}500}{100} \times 15 \times 30 = \$11{,}250.$$

This is only a rough estimate and there may be 5–7% inaccuracy depending upon how much care is exercised in reading the calculators.

Calculating Percentage Protein or Phosphorus

Calculating the percentage of protein in a home made lick will generally only involve licks containing urea or biuret but in some cases protein meals such as meat and bone meal, or linseed meal may also be involved.

Where grains are used as carriers or to attract cattle to the supplement, they will add to the protein value and this should therefore be included.

The crude protein and phosphorus values of some common foodstuffs are set out in Table IV.

Formulae for calculating the percentage protein in some home-made licks are as follows:—

Urea, Molasses

$$\frac{\%\ \text{Protein in urea (260)} \times \text{Weight of urea in lick}}{\text{Total weight of urea} + \text{molasses} + \text{water}}$$

Lick Containing Urea, Meatmeal, Grain, Salt and Sulphur

$$\frac{\%\ \text{Protein in Urea} \times \text{Weight Urea} + \%\ \text{Protein in Meatmeal} \times \text{Weight Meatmeal} + \%\ \text{Protein in Grain} \times \text{Weight Grain}}{\text{Total Weight of Urea} + \text{Meatmeal} + \text{Grain} + \text{Salt} + \text{Sulphur}}$$

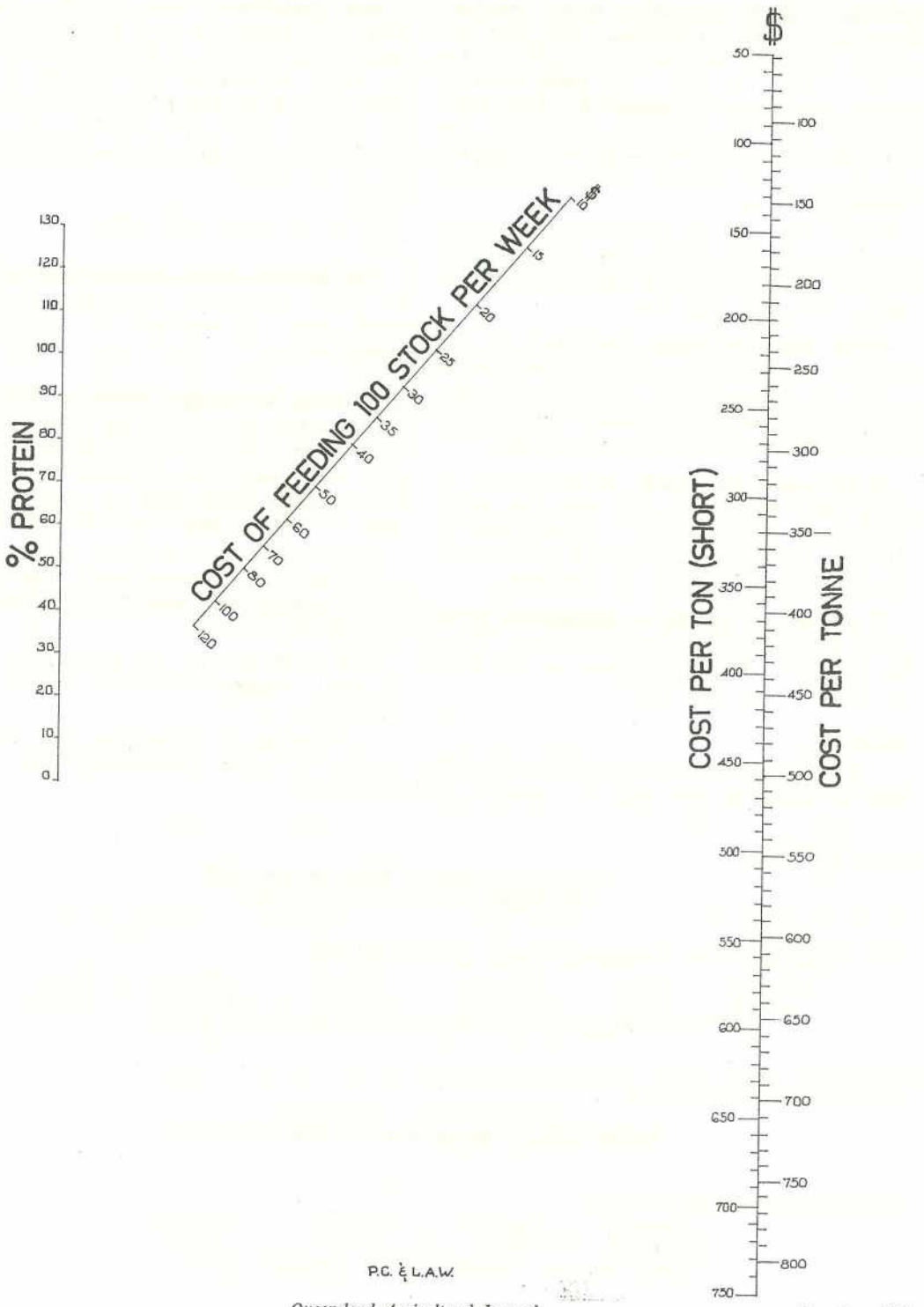
Urea, Salt and Sulphur Lick

$$\frac{\%\ \text{Protein in urea} \times \text{Weight urea}}{\text{Weight of urea} + \text{Weight of salt} + \text{Weight of Sulphur}}$$

Biuret, Grain and Sulphur Lick

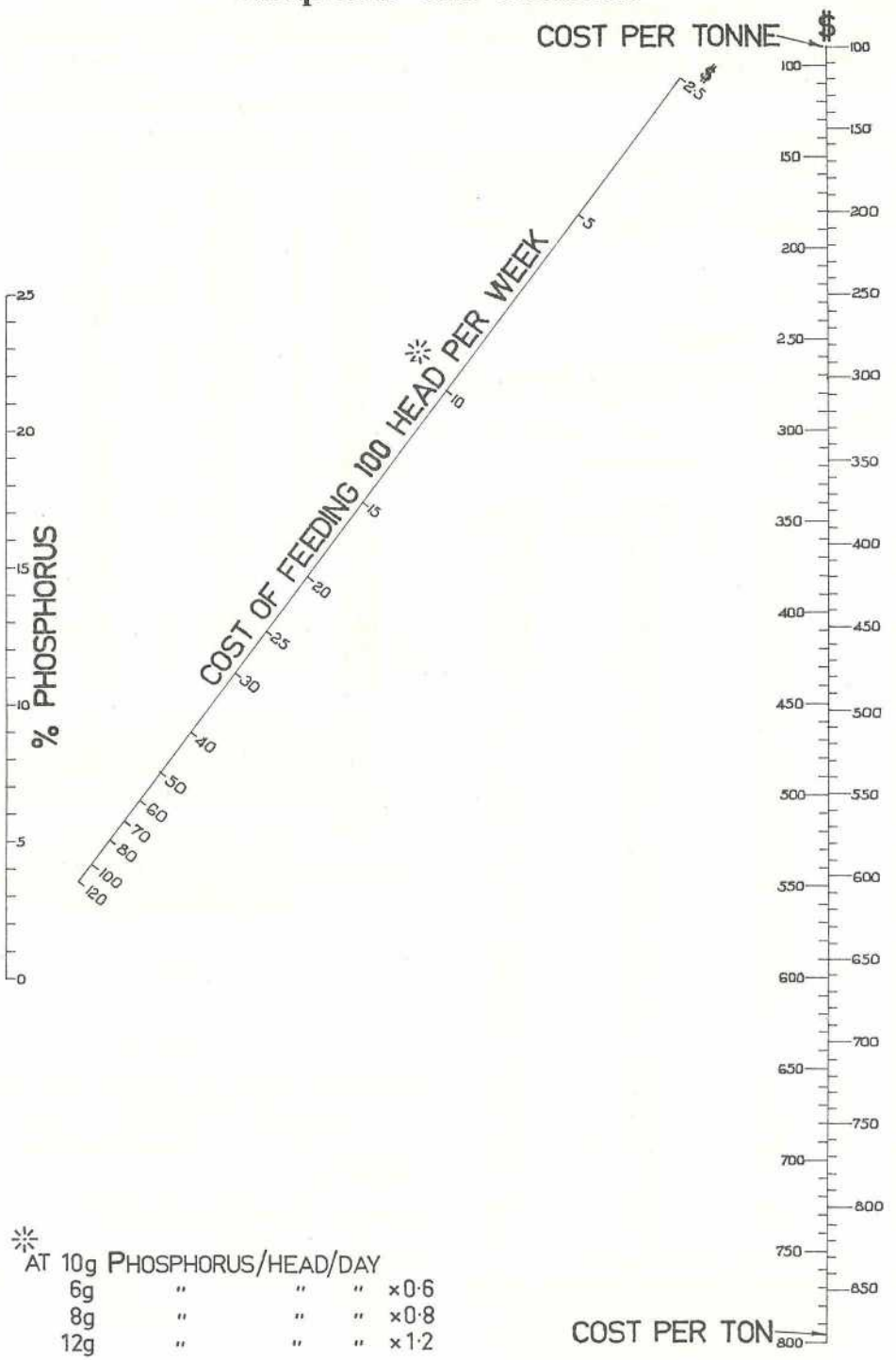
$$\frac{\%\ \text{Protein in Biuret (230)} \times \text{Weight of Biuret} + \%\ \text{Protein in Grain} \times \text{Weight of Grain}}{\text{Weight of Biuret} + \text{Weight of Grain} + \text{Weight of Sulphur}}$$

Protein Cost Calculator



P.C. & L.A.W.

Phosphorus Cost Calculator



AT 10g PHOSPHORUS/HEAD/DAY

6g	"	"	×0·6
8g	"	"	×0·8
12g	"	"	×1·2

P.C. & L.A.W.

Formulae for calculating the percentage of phosphorus in a lick are similar to those for calculating the percentage protein: i.e. sum of % phosphorus x weight of phosphorus source for all P sources divided by total weight of lick.

Acknowledgement

The assistance of Mr. Peter Cannell of the Irrigation and Water Supply Commission in drafting the calculators is greatly appreciated.

TABLE I

NO. OF BLOCKS 100 HEAD OF CATTLE REQUIRE PER WEEK TO OBTAIN ⅓ lb. (150 gms) OF PROTEIN EQUIVALENT DAILY

% Protein	Weight of Block		
	15 kg	*40 kg	†50 kg
8	87·5	32·8	26·3
10	70·0	26·3	21·0
12	58·3	21·9	17·5
14	50·0	18·8	15·0
16	43·8	16·4	13·1
18	38·9	14·6	11·7
20	35·0	13·1	10·5
22	31·8	11·9	9·5
24	29·2	10·9	8·8
26	26·9	10·1	8·1
28	25·0	9·4	7·5
30	23·3	8·8	7·0
32	21·9	8·2	6·6
34	20·6	7·7	6·2
36	19·4	7·3	5·8
38	18·4	6·9	5·6
40	17·5	6·6	5·3
45	15·6	5·8	4·7
50	14·0	5·3	4·2
55	12·7	4·8	3·8
60	11·7	4·4	3·5
65	10·8	4·0	3·2
70	10·0	3·8	3·0
75	9·3	3·5	2·8
80	8·8	3·3	2·6
85	8·2	3·1	2·5
90	7·8	2·9	2·3
95	7·4	2·8	2·2
100	7·0	2·6	2·1
105	6·7	2·5	2·0
110	6·4	2·4	1·9
115	6·1	2·3	1·83
120	5·8	2·2	1·75
125	5·6	2·1	1·68
130	5·4	2·0	1·62

* 20 kg Packs: Double the figure in the 40 kg column opposite the appropriate % protein to obtain the number of 20 kg packs 100 head require per week.

† 25 kg Packs: Double the figure in the 50 kg column opposite the appropriate % protein to obtain the number of 25 kg packs 100 head require per week.

TABLE II

NO. OF BLOCKS 100 HEAD OF CATTLE REQUIRE PER WEEK TO OBTAIN *10 g OF PHOSPHORUS DAILY

% Phosphorus	Weight of Block		
	15 kg	†40 kg	‡50 kg
1·3	35·9	13·5	10·8
1·5	31·1	11·7	9·3
1·7	27·5	10·3	8·2
1·9	24·6	9·2	7·4
2·1	22·2	8·3	6·7
2·4	19·4	7·3	5·8
2·7	17·3	6·5	5·2
3·0	15·6	5·8	4·7
3·3	14·1	5·3	4·2
3·6	13·0	4·9	3·9
4·0	11·7	4·4	3·5
4·4	10·6	4·0	3·2
4·8	9·7	3·6	2·9
5·2	9·0	3·4	2·7
5·6	8·3	3·1	2·5
6·0	7·8	2·9	2·3
7·0	6·7	2·5	2·0
8·0	5·8	2·2	1·8
9·0	5·2	1·9	1·6
10·0	4·6	1·8	1·4
12·0	3·9	1·5	1·2
14·0	3·3	1·3	1·0
16·0	2·9	1·1	0·9
18·0	2·6	1·0	0·8
20·0	2·3	0·9	0·7
22·0	2·1	0·8	0·64
24·0	1·9	0·7	0·58

* *To feed more or less than 10 g of P per 100 head per week:* To find the number of blocks required to feed 6 g of phosphorus, multiply the figure in the Weight of Block Column opposite the appropriate % Phosphorus by 0·6. To feed 8 g multiply by 0·8. To feed 9 g multiply by 0·9. To feed 12 g multiply by 1·2.

† 20 kg Packs: Double the figure in the 40 kg column opposite the appropriate % P to obtain the number of 20 kg packs 100 head require per week.

‡ 25 kg Packs: Double the figure in the 50 kg column opposite the appropriate % P to obtain the number of 25 kg packs 100 head require per week.

TABLE III

COST PER TONNE OF PROTEIN OR PHOSPHORUS SUPPLEMENT

Cost per Block or Bag	Weight of Block of Bag		
	15 kg	*40 kg	†50 kg
$	$	$	$
10.00	666.67	250.00	200.00
20.00	1,333.33	500.00	400.00
30.00	..	750.00	600.00
40.00	..	1,000.00	800.00
50.00	..	..	1,000.00

TABLE III—*continued*

COST PER TONNE OF PROTEIN OR PHOSPHORUS SUPPLEMENT—*continued*

Cost per Block or Bag	Weight of Block or Bag		
	15 kg	*40 kg	†50 kg
1.00	66.67	25.00	20.00
2.00	133.33	50.00	40.00
3.00	200.00	75.00	60.00
4.00	266.67	100.00	80.00
5.00	333.33	125.00	100.00
6.00	400.00	150.00	120.00
7.00	466.67	175.00	140.00
8.00	533.33	200.00	160.00
9.00	600.00	225.00	180.00
0.10	6.67	2.50	2.00
0.20	13.33	5.00	4.00
0.30	20.00	7.50	6.00
0.40	26.67	10.00	8.00
0.50	33.33	12.50	10.00
0.60	40.00	15.00	12.00
0.70	46.67	17.50	14.00
0.80	53.33	20.00	16.00
0.90	60.00	22.50	18.00
0.01	0.67	0.25	0.20
0.02	1.33	0.50	0.40
0.03	2.00	0.75	0.60
0.04	2.67	1.00	0.80
0.05	3.33	1.25	1.00
0.06	4.00	1.50	1.20
0.07	4.67	1.75	1.40
0.08	5.33	2.00	1.60
0.09	6.00	2.25	1.80

* 20 kg Packs: Multiply the price of 20 kg packs by 2 and then read the appropriate price per tonne from the 40 kg column.

† 25 kg Packs: Multiply the price of 25 kg packs by 2 and then read the appropriate price per tonne from the 50 kg column.

TABLE IV

PROTEIN AND PHOSPHORUS VALUES OF SOME FEEDS

Feedstuff	Crude Protein %	Phosphorus %
**Protein Rich Concentrates—*		
Biuret (KEDLOR 230, Biurol 230)	230 equiv.	..
Urea	260 equiv.	..
Grains—		
Maize	9	0·3
Grain Sorghum	10	0·3
Wheat	13	0·4
Barley	12	0·3
Oats	11	0·2
Grain By-products—		
Wheat Bran	15	1·0
Wheat Pollard	15	0·7
Phosphorus Rich Concentrates—		
Rock Phosphate (Christmas Island)	..	15·0
Rock Phosphate (Defluorinated)	..	20·0
Super King	..	20·7
M.A.P.	68	21·0
D.A.P.	..	20·0
Biophos	..	21·0
Bone flour (Calphos)	..	11·0
Tricalos	..	13·0
Tricaphos	..	18·0

* Meals which are by-products such as Meat and Bone Meal or Linseed Meal carry a label giving a guaranteed analysis from which the protein and Phosphorus contents may be read.

Disease protection for unborn calves

VETERINARY scientists have successfully prevented scours by injecting a vaccine into the amniotic fluid surrounding the calf foetus. Vaccine is injected through the flank of the pregnant cow, so no surgery is needed.

The calf receives the vaccine orally as it naturally swallows some of the amniotic fluid.

None of the calves have died after birth, even though scientists have subjected them to large doses of the scours-causing organism.

From Michigan State University Agricultural Experiment Station Research Report.

Wild Pigs are an increasing menace within the Pastoral and Agricultural areas of Australia.

They cause extensive damage to Crops, Fences, and Watering Facilities. Pigs compete with Livestock for Food. They are also carriers of a number of important Diseases of Cattle.

A cheap effective portable pig trap

by TREVOR K. FRASER,
formerly Beef Cattle Husbandry Branch.

PIGS are not native to Australia. They were apparently introduced with the First Fleet in 1788, and during the Gold Rush era. Many of these domestic pigs were probably left unattended; some of them escaped to become the foundation of a wild pig population.

Within Queensland wild pigs are found in most areas, congregating along water courses, in swamps and in rough or timbered country. They are mainly nocturnal; hiding under cover during the day, and appearing in the open during the late afternoon. Pigs are omnivorous (eat whatever is offering) and tend to concentrate where food is plentiful, particularly in ripening crops or the chance accumulation of carrion during droughts or after fires.

Water, an assured food supply, and cover in which to hide during the day, are the primary requirements of wild pigs.

Control

Several methods of control of wild pigs are available. Shooting, poisoning and fencing, although effective, can have specific limitations. Traps are possibly one of the most effective and economical methods for control, particularly in the more settled areas of Queensland.

Trapping

Traps have advantages over other methods, in that they are species-specific, thus causing no danger to other animals. They are cheap to construct, easy to site and maintain, and are permanently effective. Their success is dependent on the fact that pigs have regular habits, and tend to water at the same place.

When pigs are watering on bore drains, creeks or rivers, siting of the traps is more difficult. However a high proportion of pigs can be trapped in a short time where isolated tanks or dams are the only source of water.

Available designs for pig traps are many and varied. Mesh wheat silos with simple entrance gates to more complicated mesh covered box type traps have all been used with varying success.

Mr. George Schwennesen, a grazier from "Telgazlie", Surat, who has been trapping pigs on his property since 1965, has designed and built a trap which he feels has some advantage over others that he has used.

One advantage of the "Telgazlie" trap is that it can be dismantled, loaded onto a utility, transported to a new site, and reassembled in a short time by one man. More importantly it is effective. In the first few weeks of trapping, Mr. Schwennesen caught 250 pigs. Attracted to the traps by the strong odour of the bait (a carcase, or boiled or spoiled grain) pigs readily find the gate. Free feeding has not been necessary to tempt the pigs to enter.

Once the pigs are destroyed (shooting or stunning) the trap is easily turned onto one side, and the carcases loaded onto a vehicle for removal and destruction through burning or burial.

In 9 years of strategic trapping almost 2,000 pigs have been destroyed on "Telgazlie".

Making the Trap

MATERIALS

(a) *Black Pipe*

28 metres of 25 mm black pipe (92 ft. of 1″ pipe).

2·34 metres of 15 mm black pipe (7 ft. 8 ins. of ½″ pipe).

0·38 metres of 20 mm black pipe (15 ins. of ¾″ pipe).

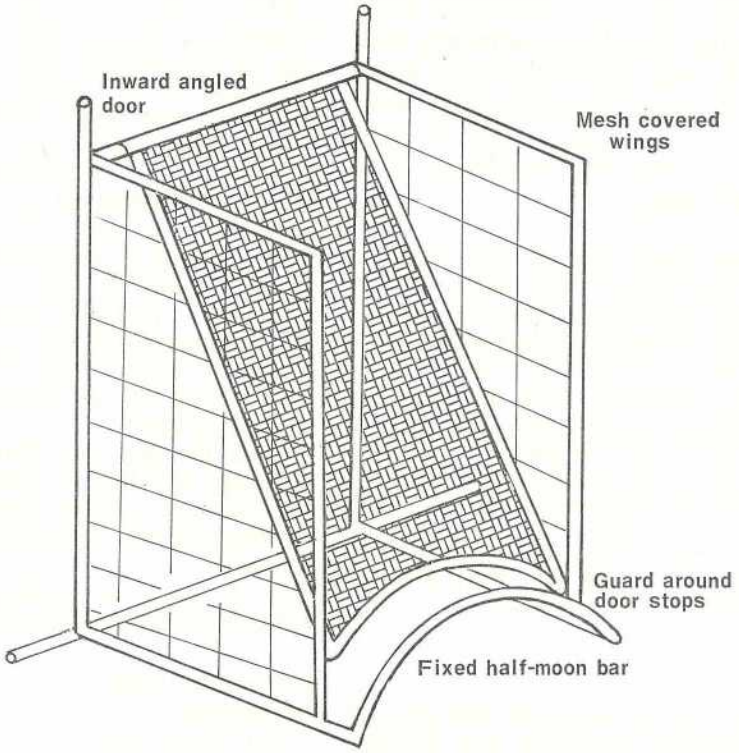
0·37 metres of 32 mm black pipe (14½ ins. of 1¼″ pipe).

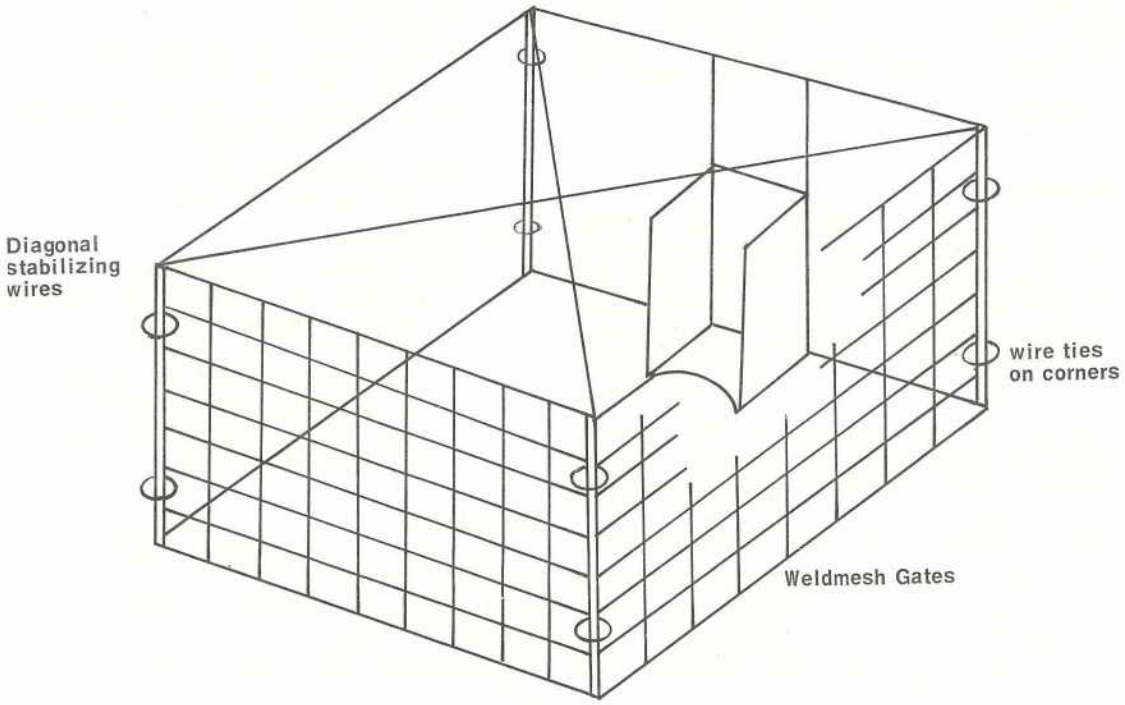
(b) *Weldmesh*

7·3 metres (x 1 metre wide) of 150 mm x 100 mm x 5·6 mm (which replaces 24 ft. x 3 ft. 4 ins. x 6″ x 3″ x 5 gauge). Much of this material would be available on the property, thereby reducing the cost. Existing steel gates could also be modified for use.

Construction

The trap is constructed using four—1·83 m x 1·07 m (6′ x 3′ 6″) pipe and weldmesh gates, wired together to form a square pen, and stabilised by two diagonal wires. An escape-proofed trap door is built into one side.


Inward angled door
Mesh covered wings
Guard around door stops
Fixed half-moon bar


Diagonal stabilizing wires
wire ties on corners
Weldmesh Gates

Each gate is of the same basic design. A 25 mm (1″) black pipe frame encloses a sheet of 150 mm x 100 mm x 5·6 mm (replaces 6″ x 3″ x 5 g) weldmesh. However one side has two vertical 25 mm (″) pipes, welded 38 cm (15″) apart to form the entrance to the trap. Between these pipes, and 60 cm (2 ft.) above the ground, is welded a 38 cm (15″) length of 20 mm (¾″) pipe with a free turning 32 mm (1¼″) pipe sleeve. Two parallel, mesh covered internal wings, 60 cm high x 30 cm wide, (2 ft. x 1 ft.) with 25 mm (1″) pipe frames, are welded to these vertical pipes at right angles to the side of the trap. The bottom of each wing extends 10 cm (4″) past the inside edge as part of the escape proofing (see later).

The inward angled door is 66 cm x 36 cm (26″ x 14″) and is chain mesh inside a 15 mm (½″) pipe frame, welded onto the 32 mm (1¼″) free turning pipe sleeve. The lower edge of the door is half moon shaped to suggest a possible opening, and to encourage pigs to lift the door by the usual up thrust of their snout. This curved bar is welded in the vertical position when the door is closed, with the top of the curve 15 cm (6″) above the ground. At the same level, and 10 cm (4″) directly in front is a second half moon bar, welded to the extensions left on the base of the wings. This second and fixed bar prevents the trapped pigs from lifting the door from the inside to escape.

Two crank shaped door stops 12 mm or ½″ steel rod are welded to the bottom outside edges of the door to prevent it closing beyond the inner edge of the wings. A rubber covering around the stops prevents excessive noise when the door closes. Small guards or loops are welded to the wings, so as to enclose the stops when the door is shut, as a final escape proofing measure.

Pigs are mobile animals, and effective long term control can only be achieved through the co-operation of property owners over a wide area. Without this co-operation it is unlikely that the pig population can be substantially reduced for any length of time on individual properties.

DO not burn containers which have held weedkillers such as 2, 4-D and its derivatives. When these herbicides volatize, the resulting vapour may damage nearby plants, crops and shrubbery. Also, herbicides or defoliants containing chlorates may explode when heated.

Dispose of these containers in this manner:

- Break glass containers and chop holes in the top, bottom and sides of metal containers so they cannot be re-used or collect water. A sharpened pickaxe is best for this purpose.
- Bury all weedkiller containers to a depth of 18 inches at a safe disposal site or take them to a dump where they will be covered with soil.

By courtesy Agricultural and Veterinary Chemicals Association.

"it seemed a good idea"

It is very easy for an adviser to feel that he knows what local dairy-farmers should be doing. It is then very difficult for him to understand why farmers do not make the changes suggested to them.

In many cases it is obvious that the simple communication of facts is not enough—the farmers must become involved in some way before they will adopt new techniques. This is especially so with a complex subject like dairy cow nutrition, which includes most facets of dairyfarm management.

Experience with the Wondai Dairyfarmers Discussion Group has shown that in some circumstances it is more successful to advise farmers as a group rather than as individuals. Cow nutrition has been successfully improved on the farms of discussion group members.

Starting the Group

There was nothing remarkable about the start of the Discussion Group—"it just seemed a good idea at the time". There were plenty of talks being given by Departmental Officers at Q.D.O. and other meetings. The local farmers had shown considerable interest in these talks. It seems a natural extension to form a discussion group.

In co-operation with the Wondai Q.D.O., the discussion group was formed in October, 1971. The first Chairman, Mr. Nev. Reinke, was also President of the Wondai Q.D.O. and a Director of the local Co-operative Dairy Association. Mr. Bill Bell, the first Secretary was Q.D.O. Secretary and a member of the Dairy Extension Advisory Committee. These office holders ensured that farmers and factory personnel were both informed and involved.

During the first year the meetings concentrated on an intensive nutrition programme. Since then, many other subjects have been discussed.

Group Success

The group's success can be assessed by the improved production results of members over the last few years. Thirty farmers who attended regularly during the first two years achieved the following improvement:—

Average production per farm 70–71: 7 812 lb.BF.

Average production per farm 72–73: 11 724 lb.BF.

This is a 50% increase in production. In comparison, the 104 other suppliers in the area had increased their production by only 11·5% over the same period, increasing from 6 927 lb.BF. in 70–71 to 7 988 lb.BF. in 72–73.

More recent results

During 1973–74 a large number of dairymen left the industry, including seven discussion group members.

Of the 23 members left, two did not attend any meetings in 1973–74.

The remaining 21 members had the following production figures:—

—	1970–71	1971–72	1972–73	1973–74
Average lb.BF. per farm	8 116	10 285	12 595	12 973

Thus production increased 55% during the first two years and 3% in the third year.

During the last year seasonal conditions limited production on all farms in the district.

Individual Members show big Benefits

Let's look at a few of the farmers in the Wondai Discussion Group.

by W. B. OLIVER, Dairy Field Services.

Mr. Cyril Schultz of Cushine (dryland farm) produced 7 400 lb. of butterfat in 1970–71, a cow average of 164 lb. of butterfat. The year ending 1974 saw Cyril's farm produce 19 526 lb. of butterfat with a herd average of 321 lb. of butterfat per cow.

"Preconditioning of dairy cows and feeding a balanced ration has paid off handsomely for me", said Cyril. "I was going broke fast until I realised that to correctly feed cows you needed a thorough understanding of nutrition. My herd is production recorded. I keep a close check on monthly production and alter concentrate feed rations in accordance with pasture and fodder crop quality."

Col. and Noela Ardrey at Hivesville, also a dryland farm, have lifted production from 5 700 lb. of butterfat in 1970–71 to 19 600 lb. in 1973–74. A better understanding of dairy cow nutrition has played a major role in this huge increase in production.

However, farm development with improved pastures has permitted a notable increase in herd size according to the Ardreys. The herd average is now 262 lb. of butterfat per cow.

John Evans from Cushnie has lifted his production from 7 800 lb. of butterfat in 1970–71 to 17 500 lb. in 1973–74.

"It's simply a matter of having good cows and feeding them a balanced ration", said John. "We dairymen were 10 years behind the pig growers in understanding nutrition. Thanks to the Wondai Discussion Group, we now know what protein and energy are and their importance in feeding cows. We know what the cow needs instead of the 'hit and miss' methods we were adopting previously".

Another farmer to show improvement is *Vince Lakin* at Mondure. He says the exchange of ideas and improved knowledge of nutrition has helped him lift production.

"I have installed a 7-stand Rotary dairy because with improved pasture and increased herd numbers, I see production increasing a lot more given average seasonal conditions", he said.

Vince lifted production from 8 600 lb. in 1970–71 to 17 242 lb. in 1973–74.

Why has this Discussion Group been so Effective?

Three factors appear to be involved in making the group effective.

Firstly, the activities of the group have always been well publicised before and after meetings. Notices with brief comments on speakers and subject matter are sent to farmers via cream and milk carriers. The local radio, including A.B.C. and local press publicise the meetings well ahead, then give follow up reports and summaries of the meetings.

Secondly, farm visits were made by dairy advisers and other D.P.I. staff to ensure each farmer understood points discussed at meetings and to help him use these ideas on his own farm where practical.

Thirdly, meetings are designed to be as effective as possible. A successful meeting involves:

- Active participation and involvement of all farmers in the meeting. This is achieved by presenting material that makes people talk. The meetings are broken into small groups for discussions, the group reports back to the speaker or panel of speakers.

  Questions which cannot be answered on the spot are dealt with by personal handouts at the next meeting.
- Speakers who concentrate on putting across a message and who have something worthwhile to say.
- Punctual starting and finishing times, 8.15 p.m. to 10.30 p.m.
- Tea and biscuits after the meeting for informal discussion.

The evening meetings are held bi-monthly and a small charge is levied to hire the hall.

Topics for discussion are chosen by the group. Although D.P.I. officers give guidelines and suggestions the group often chooses the guest speaker.

In a recent questionnaire the group unanimously voted to continue in 1975 with emphasis on the economics of dairyfarming.

I believe working with this group of farmers has achieved far better results than would have been obtained by individual farm visits alone. The key to success is the genuine 'farmer involvement' in the project.

Tuberculosis-Free Cattle Herds (As at 21 February, 1975)

ANGUS

Corden, E. B., Netherby, Warwick
Crothers, H. J. "Mooreenbah", Dirranbandi
Mayne, W. H. C. & Sons, "Gibraltar", Texas

A.I.S.

Cox, T. L. & L. M. J., Seafield Farm, Wallumbilla
Evans, E. G., Lauraven A.I.S. Stud, Maleny
Henry, Mrs. K. & Sons, "Tara", P.O. Box 4, Cambooya
H. M. State Prison Farm, Numinbah
Klein Bros., Kapleton A.I.S. Stud, Ma Ma Creek, via Grantham
Lawley, E. D. & Sons, Arley A.I.S. Stud, Maleny
Marquardt, C. R. & J. L., Cedar Valley A.I.S. Stud, Wondai
Martin, J. P. & R. J., Kentville, via Forest Hill
Middleton, C. W., Airton Vale, Cambooya
Mitchell and Mulcahy, Rosenthal
O'Sullivan, P. W., "Navleigh", M.S. 371, Greenmount
Pagel, E. E., and Hayes, E. M., Trafalgar Stud, Tarampa, via Lowood
Queensland Agricultural College, Lawes
Ross, W. & Co., M.S. 23, Rosewood
Schelbach, N. N. & Co., Allanview Stud, Warwick
Siebenhausen, J. & S. C., "Meniton", M.S. 195, Pittsworth
Thompson, W. H., "Alfa Vale", Nanango
Vohland, A. R., Bevallan, Stoneleigh, M.S. 150, Pittsworth
Weier, L. G., Prairie Plain A.I.S. Stud, M.S. 765, Allora

AYRSHIRE

Goddard, B., Inverell, Mt. Tyson, via Oakey
Scott, J. N. & Son, "Auchen Eden", Camp Mountain

BRAFORD

Bowden, W. H., "Brendale", South Pine Road, Strathpine
Thompson, M. A. K., "Glen Kyle", Buderim

FRIESIAN

Behrendorff, E. C. & N. G., Inavale Friesian Stud, M.S. 786, Boonah
Evans, P. J., M.S. 28, Dragon St., Warwick
Guppy, N. J. & H. M., Bli Bli Road, Nambour
Hickey, K. A. & M. R., Bunya
Lobley, N. E., "Neloby", Mt. Pleasant, via Dayboro
McWilliam, A. A., Oatlands Stud, M.S. 918, Toowoomba
Martin, R. J. and E. L., Kentville, via Forest Hill
Panzram, J. & K., Bienheim, via Laidley
Queensland Agricultural College, Lawes
Stumer, A. O., Brigalow, Boonah
Vonhoff, A. R. & D. G., M.S. 918, Toowoomba

GUERNSEY

Dionysius, R. L. & L., Warana Stud, M. S. 1796, Proston
Erbacher, J. P. & M. M., "Leafmore", Hodgsonvale
Hopper, G. T. & H. W., Ellendean Guernsey Stud, Maleny
Wilson, R. A. and M. R., "Okeden", Proston

HEREFORD

Hill, W. W. & P. C., "Mathalla", Dirranbandi
Panorama Stud Pty. Ltd., M.S. 765, Allora

JERSEY

Conochie, I. S., Brookland Jersey Stud, M.S. 461, Kalbar
H. M. Prison Farm, Capricornia Stud, P.M.B. 11, Rockhampton
H. M. State Farm, Palen Creek
Lau, J. F., "Rossallen", Goombungee, Toowoomba
McDonald, R. G., "Buffelvale", M.S. 807, Mundubbera
Paulger, S. & S. M., "Advale", Kenilworth
Postle, R. S. & G. C., "Yarallaside", Pittsworth
Queensland Agricultural College, Lawes
Snare, A. E. & Son, Laidley Park Stud, Laidley, 4341
Spressor, O. W., Carnation Jersey Stud, Mt. Walker Rd., Rosewood
Todd, J. R., Aberfoyle, Laravale, via Beaudesert
Vohland, A. R., Bevallan, Stoneleigh, M.S. 150, Pittsworth
Waite, H. M., M.S. 182, Laidley
Westbrook Training Centre, Westbrook

POLL HEREFORD

Anderson, J. H. & Sons, "Inverary", Yandilla
Christensen, B. L. & M. O., "Elavesor", Rosevale
Morris, H. J. & D. I., Gaiview Stud, Clifton
Nee Nee Pastoral Co., Dirranbandi, 4392
Stiller, N. L., "Vine Veil", Guluguba

POLL SHORTHORN

Leonard, W. & Sons, "Welltown", Goondiwindi
Pointon, R. B. & S. C., "Wywurri", M.S. 780, Kingaroy

BRAHMAN

Queensland Agricultural College, Lawes
The Cherokee Group Brahman Cattle Co., Tanby

SANTA GERTRUDIS

Barbara Plains Grazing Co., Barbara Plains, Wyandra
Central Estates, Comet Downs, Comet

SHORTHORN

Pointon, R. B. & S. C., "Wywurri", M.S. 780, Kingaroy

DROUGHTMASTER

University of Queensland, Veterinary School, St. Lucia

Self-oiling back-rubber for buffalo fly control

by B. A. ARTHUR, formerly Beef Cattle Husbandry Branch.

AN improved back-rubber to control buffalo fly in cattle has been built by Mr. Len Stolk, Manager of Scottish Australian property, 'Escott', Burketown.

It requires recharging only once every 6 to 8 weeks and most of the materials required for construction can be found on the property.

Buffalo flies are a problem in all Gulf Country beef herds, causing considerable irritation to all classes of stock. Because of large areas and large herds of cattle, stock cannot be mustered at short intervals for spraying or dipping. Moreover, buffalo fly infestations are generally worse during the wet season when stock cannot be handled and roads are impassable.

To overcome this problem 'Escott' station has begun building self-oiling back-rubbers in the paddocks. The old type of back-rubber needed fairly frequent recharging by pouring the insecticide-oil mixture over the sacking by hand.

Self-Oiling

Mr. Stolk has improved upon the original type and has designed a system where the back-rubbers are automatically oiled from a 200-litre (44-gal.) drum.

'This new device is simple to construct, reduces the need for frequent servicing during the wet season and ensures that the back-rubber is fully charged at all times', he said. 'Moreover, once the components are assembled, two men can build a unit in 2 hours.'

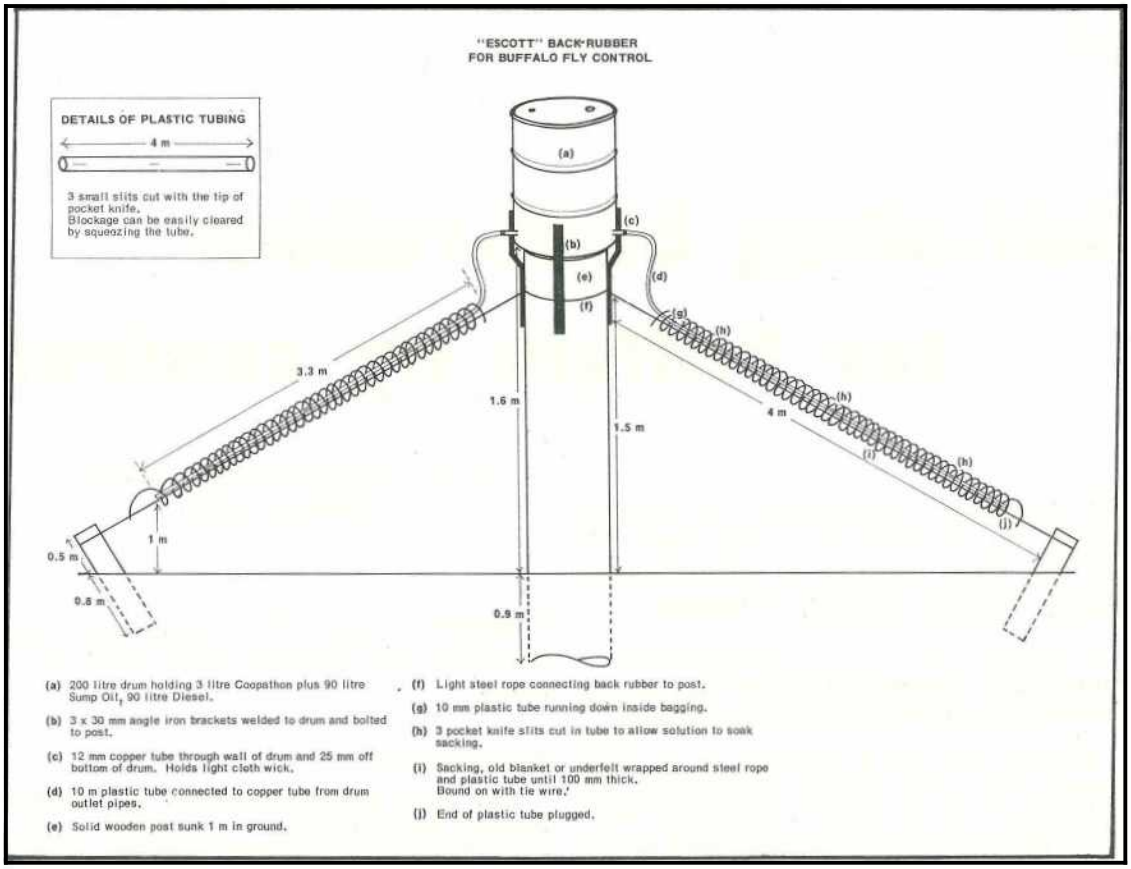
Construction

Mr. Stolk has experimented with several different designs and now has a reliable system made from easily-procurable materials, already available on most properties.

A 200-litre drum is mounted on top of a solid wooden post which is 1·6 m out of the ground. A sawn-off tree stump or a bore casing. is also suitable for mounting the drum. Two rubbers are serviced from a single drum reservoir. Two pieces of 5 m long light steel rope are attached to the main post and to the small posts on each side of the reservoir. This is shown in the diagram. This steel rope need not be tight.

Two pieces of 12 mm diameter copper tube, 50 mm long, are inserted through and brazed on to each side of the drum—one outlet for each rubber. These are placed 25 mm off the bottom of the drum to reduce clogging by any sludge.

A small piece of light cloth is inserted inside each outlet tube to act as a wick and filter, and to slow down rate of flow of solution out of the



The 'Escott' back-rubber for buffalo fly control.

drum. A small piece of fibreglass fly screen, rolled into a ball could be used instead of the cloth wick.

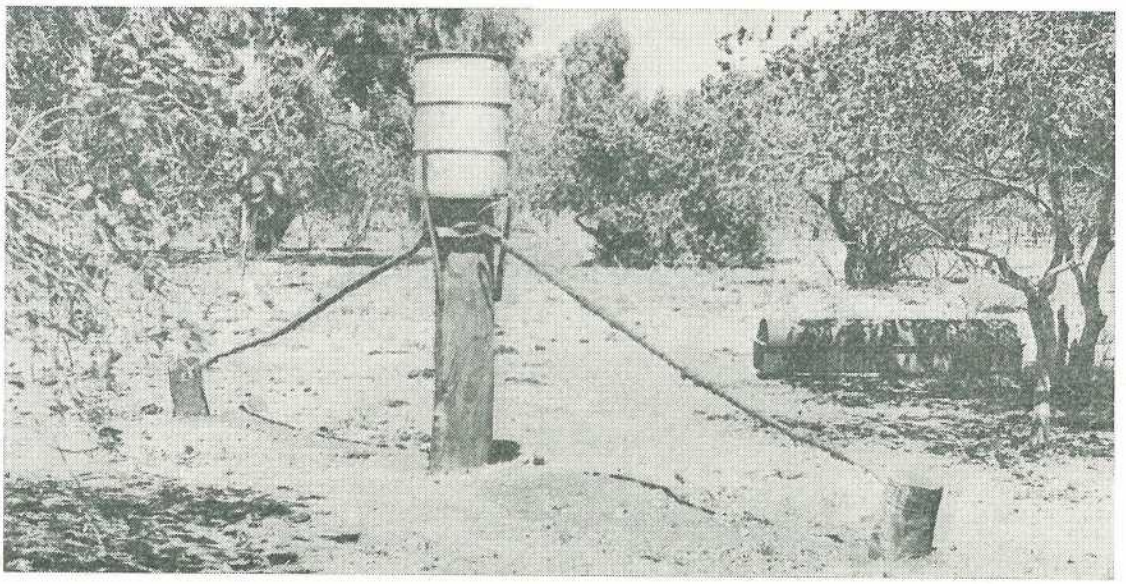
Reticulation tubes

Mr. Stolk originally used a long copper tube to reticulate the insecticide-oil mixture out of the drum and down inside the sacking. This copper tube had three small holes drilled in it to allow the solution to soak the sacking. This method was found to be fairly satisfactory but he experienced difficulty in regulating the rate of flow.

In construction of the latest model, he has used a piece of 4 m long 10 mm clear plastic hose to reticulate the mixture to each rubber. This plastic tube is connected directly to the outlet tubes on the 200-litre drum reservoir. This tube runs down the steel rope to within 0·5 m of the bottom post. Three small holes are made in the plastic tube using the tip of a pocket knife: one hole near the top, one in the centre and one near the bottom. The plastic tubing is tied loosely to the steel rope at 0·5 m intervals using tie wire, and the end blocked off.

Sacking

The plastic tubing, plus the steel rope, is then wrapped in old blanket which has been cut into 250 mm wide strips. These strips are wound around the steel rope and tubing until each back-rubber is about 100 mm thick. It is then bound with tie wire every 150 to 200 mm.

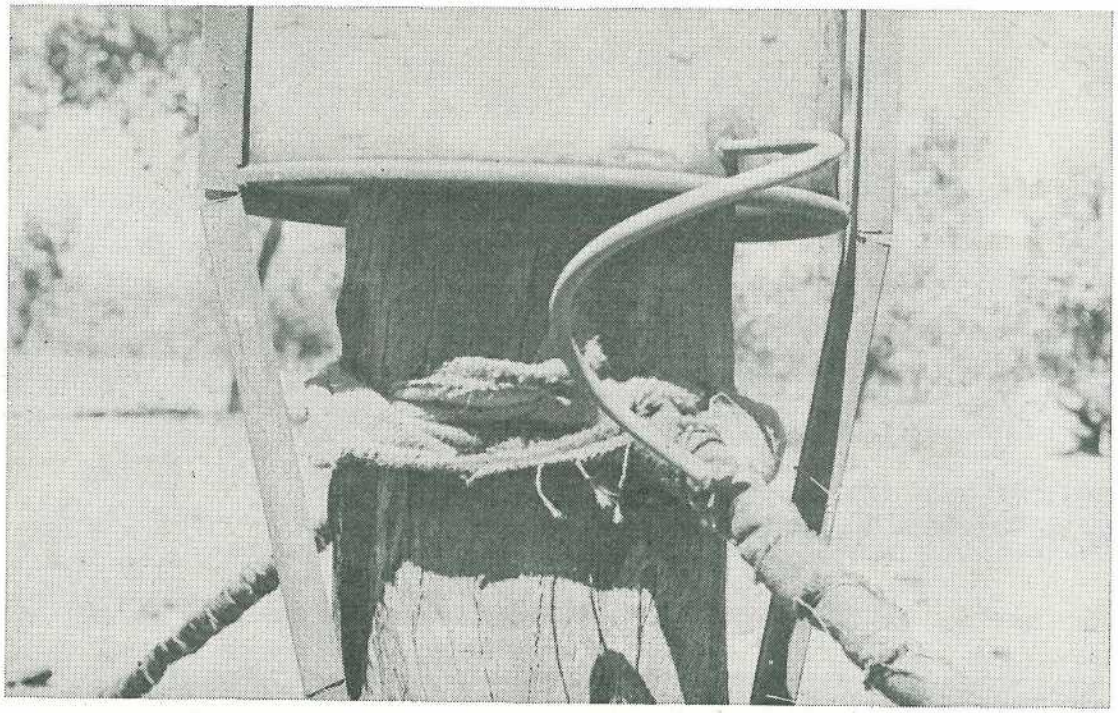


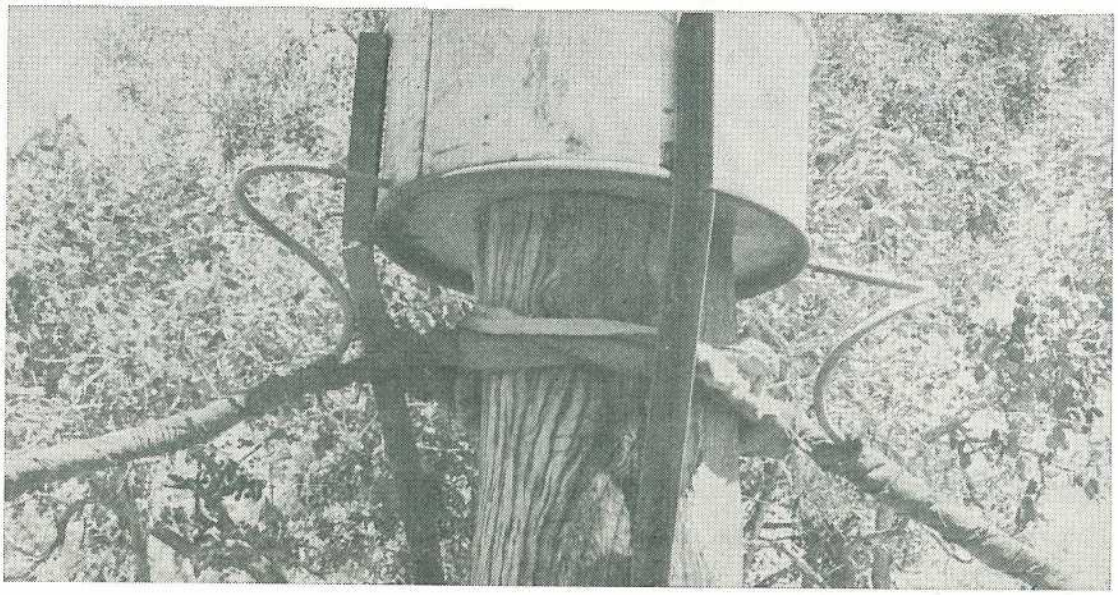
TOP. This simple device is sturdy and reliable and requires filling only once every 6 to 8 weeks.
BOTTOM. Back-rubbers are best placed near watering points or supplementary feeding sites. Stock began to use this one within 3 weeks of construction.

Medicament

Ethion (Coopathon*) can be used at a dilution rate of 1:60. It is desirable to use a mixture of equal parts of sump oil and diesel with this device so that the solution is of the correct viscosity for correct oiling of each back-rubber.

* Registered trade name.





TOP. A short piece of ½ in. copper tube is inserted through the wall of the drum, 1 in. from the bottom, and brazed on. This is connected to a long, clear, plastic tube running through the centre of the back-rubber to oil the sacking.

BOTTOM. Two back-rubbers can be worked from one 44-gal. drum reservoir.

Mr. Stolk also advises that a mixture containing sump oil will give greater protection to each animal because it tends to adhere to the coat longer than a mixture containing ethion plus diesel alone. The mixture used is 3 litres of Coopathon to 90 litres of sump oil and 90 litres of diesel oil.

Rate of flow

Once this device is in use, each back-rubber is automatically oiled as the mix slowly gravitates through the plastic tube and soaks the blanket through each small outlet hole.

On inspection, if part of the back-rubber is dry, one of the small knife holes may be blocked. It is a simple matter to give the back rubber a squeeze in the vicinity of the appropriate hole to free the blockage. This does not happen often, but even if one hole becomes blocked, there are two remaining holes on each rubber to continue the oiling process.

If one whole back-rubber is dry, this indicates a blockage at the drum outlet. The plastic tube is easily disconnected, the cloth wick pulled out and the obstruction will generally flush out. Replace wick and re-connect the plastic tube.

Site

Back-rubbers are best situated in areas where cattle congregate near watering or supplementary feeding points. At 'Escott', one of these units per watering point is used, and serves from 150 to 300 head depending on numbers in the paddock.

Mr. Stolk uses a small amount of molasses to encourage stock to use the rubber when it is first erected. During construction, he places an old truck or tractor tyre, cut in half, over the centre post to act as a feed trough. He advised that it has only been necessary to 'paint' molasses over the inside surface of the tyre to attract the cattle to the back-rubber but a small amount of molasses can be poured into the bottom.

Recharging the reservoir

The top of the drum is 2 m off the ground, and is best recharged by pumping a prepared solution from a delivery drum or tank mounted on the back of a truck.

Replacing sacking

Bags and hessian have also been tried as the padding for back-rubbers at 'Escott', but they have found old blankets to be a better absorbent material. Carpet underfelt is also a good material for this purpose.

Each back-rubber will probably require some attention after 12 months' use. As the absorbent material becomes worn, new material can be added over the old and tied on, but eventually all the sacking will require renewing.

Experience elsewhere has shown that the life of the absorbent material can be prolonged by a covering of nylon prawn netting.

Reliable

These self-oiling back-rubbers have been in use on 'Escott' since mid 1972, and have now been installed on several other properties in the Cloncurry district.

They have been found sturdy, cheap to construct, to require little maintenance if properly constructed and to need refilling only once every 6 to 8 weeks.

Brucellosis-Tested Swine Herds (As at 21 February, 1975)

BERKSHIRE

Clarke, E. J. & Son, "Kaloon Stud", Boonah
Cochrane, S., "Stanroy", Felton
Crawley, R. H., Rockthorpe, Linthorpe
H. M. State Farm, Numinbah
H. M. State Farm, Palen Creek
Handley, Est. J. L., "Meadow Vale", Lockyer
Handley, G. R., "Locklyn" Stud, Lockyer
Kimber, E. R., Tarella, M.S. 805, Mundubbera
Ludwig, A. L., "Beau View" Stud, Cryna, via Beaudesert
Neuendorf, W., M.S. 794, Kalbar
Queensland Agricultural College, Lawes
Research Station, Hermitage
Rosenblatt, G., Rosevilla Biloela
Westbrook Training Centre, Westbrook

LARGE WHITE

Ballon, E. E. & E. Maclagan
Barrier Reef Islands Pty. Ltd., Hayman Island
Batterham, P. & N., Raby Park, Inglewood
Beutel, G. R. and Son, Brookdale Stud, M.S. 786, Boonah
Bool, A. R. and B. E., Rossvale, Crow's Nest
Briskey, R. G. and M. J., Wallingford, Pittsworth
Brosnan, D. J., "Bettafield", Mt. Murchison, via Biloela
Cauley, J. R., M.S. 918, Toowoomba
Cauley, T. P., M.S. Jondaryan 444, Rosalie
Clegg, J. A. & M. A., "Karoma" Stud, Mundubbera
Coleman, C. J., Merriland Stud, Britannia Station, Charters Towers
Corney, F. D. and E. C. W., Pagel, Tara
Cotter, N. J., "Olaroy", Goomeri
Craig, K. F., "Echoes", Bancroft, via Monto
Crawford, B. P. & B. J., M.S. 757, Kingaroy
Department of Aboriginal and Island Affairs, Cherbourg
Diete, E., Ingoldsby, 4343
Duckett, R. and L. M., Fairview, Capella
Duncan, C. P., "Colley", Flagstone Creek, Helidon
Duncan, J. A. & B. L., Ma Ma Creek
Dunlop Meats Pty. Ltd., Coondulla, Robertson Pk., Murray Upper
Eagle, D. R. & J. A., "Walugra", 134 Hogg St., Toowoomba
Fisher, J. & L., Lyndhurst, Jimbour
Flegler, T. C., Wongabeena, Dalby
Fletcher, L., "Par-en-eri" Stud, M.S. 806, Mundubbera
Forster, I. S. & D. E., 112 Drayton Rd., Toowoomba
Fowler, K. J. & B. D., "Kenstan", M.S. 195, Pittsworth
Fowler, K. P., Northlea Stud Farm, 156 Hogg St., Wilsonton, T'ba
Franke, K. H. and B., "Delvue" Stud, Cawdor
Freeman, W. A., "Trevlac", Rosewood
French, A., "Wilston Park", Pittsworth
Gosdon, T. C. & E. A., "Naumai", Dalby
Graham, T., Dunleigh, Highfields
Grayson, D. G., Wodalla, Killarney
Harwood, L. B., Cobar, Tara
H. M. State Farm, Numinbah
Head, G. A., M.S. 825, Ipswich
Hinchcliffe, D. F. & R. K., "Oakview", Milman, 4702
Hockings, J. & M., "Quambi", Kumbarilla
Hudson, R. F. & V. D., "Rondel", Hogg St., Wilsonton, Toowoomba
Jones, K. B. & I. R., "Cefn" Stud, Clifton
Kajewski, C. & D. I., "Glenroy", Glencoe, via Toowoomba
Kanowski, A., "Exton", Pechey
Kimber, E. R., "Tarella", M.S. 805, Mundubbera
Kruger, V. F. & B. L., "Greyhurst", Goombungee
Kuhl, V. and C. A., "The Mounts", M.S. 222, Oakey
Le Gros, W., "Elourea Stud", Marburg
Little, R. S., P. M. & G. W., "Glengarry", Jimbour
Maranoa Stud Piggery, Mitchell
Marsden, M., "Fernflat" Canaga
Mathieson, K. N., "Iderway", Gayndah
Philip, R. J. and M. M., Boolarong Stud, Elimbah
Postle, R. S., G. C. & Son, "Yarallaside" Stud, Pittsworth
Queensland Agricultural College, Lawes
Quilter, P. E., Paga Paga Piggeries, Postman's Ridge
Radel, V. V., "Braedella" Stud, Coalstoun Lakes
Robin, A. B., Blaxland Rd., Dalby
Rosenblatt, G., Rosevilla, Biloela

LARGE WHITE—continued

Research Station, Biloela
Ruge, A. F. & V. M., "Alvir" Stud, Biggenden
Ruge, G. H. & I. E., "Al-Lester" Stud, Woowoonga, Biggenden
Sharp, D. W. & L. J., "Arolla", Lavelle, Q., 4357
Smyth, R., Barambah Rd., Goomeri
Ward, R. J., "The Plateau", Mulgildie
Whiteman, J. H. & A. B., Long's Bridge, via Warwick
Willdo Farming Co., Southbrook
Willet, L. J., "Wongalea", Irvingdale
Williamson, K., Cattermul Ave., Kalkie
Withcott Stud Piggery, Rowbotham St., Toowoomba
Wolfenden, C. B. & J., Rossmoya

TAMWORTH

Kanowski, S. E., Pinelands, via Crows Nest

WESSEX SADDLEBACK

Douglas, Mrs. W. S. & Son, "Greylight" Stud Goombungee
Smith, C. R. & Son, "Belton Park", Goombungee

LANDRACE

Ballon, E. E. & E., Maclagan
Barrier Reef Islands Pty. Ltd., Hayman Island
Batterham, P. & N., Raby Park, Inglewood
Bertolotti, F. E. J. & N. I., "Mascotte", Wallumbilla
Bool, R. A. and B. E., Rossvale, Crow's Nest
Brosnan, D. J., "Bettafield", Mt. Murchison, via Biloela
Cauley, J. R., M.S. 918, Toowoomba
Cauley, T. P., M.S. Jondaryan 444, Rosalie
Clegg, J. A. & M. A., "Karoma" Stud, Mundubbera
Coleman, C. J., Merriland Stud, Britannia Station, Charters Towers
Crawford, B. P. & B. J., M.S. 757, Kingaroy
Crowle, N. & D., Cooranga North, 4408
Diete, E., Ingoldsby, 4343
Duckett, R. and L. M., Fairview, Capella
Dunlop Meats Pty. Ltd., Coondulla, Robertson Pk., Murray Upper
Fisher, J. & L., Lyndhurst, Jimbour
Flegler, T. C., Wongabeena, Dalby
Fletcher, L., "Par-en-eri" Stud, M.S. 806, Mundubbera
Forster, I. S. & D. E., 112 Drayton Rd., Toowoomba
Fowler, K. J. & B. D., "Kenstan", M.S. 195, Pittsworth
Fowler, K. P., "Northlea", 156 Hogg St., Wilsonton, Toowoomba
Fowler, N. E. P. & M. P., c/- Kewpie Enterprises, Kingaroy
Gosdon, T. C. & E. A., "Naumai", Dalby
Graham, T., Dunleigh, Highfields, 4352
Grayson, D. G., "Wodalla", Killarney
Harwood, L. B., Cobar, Tara
Hinchcliffe, D. F. & R. K., "Oakview", Milman, via Rockhampton
Hockings, J. & M., "Quambi", Kumbarilla
Hudson, R. F. & V. D., "Rondel", Hogg St., Wilstonton, Toowoomba
Jones, K. B. & I. R., "Cefn" Stud, Clifton
Kajewski, C. & D. I., "Glenroy", Glencoe, via Toowoomba
Little, R. S., P. M. & G. W., "Glengarry", Jimbour
Maranoa Stud Piggery, Mitchell
Marsden, M. "Fernflat", Canaga
Marsh Pastoral Co., Brymaroo
Nielsen, L. R., "Sunny Hill", Ascot, via Greenmount
Peters, L. A., "Moonlight", Bongeen
Philip, R. J. and M. M., Boolarong Stud, Elimbah
Quilter, P. E., Paga Paga Piggeries, Postman's Ridge
Radel, R. M., Turua Stud, Biggenden
Robin, A. B., Blaxland Rd., Dalby
Rosenblatt, G., Rosevilla, Biloela
Ruge, A. F. & V. M., "Alvir", Biggenden
Sharp, D. W. & L. J., "Arolla", Lavelle, Q., 4357
Trout, L. B. and L. J., "Caminda", Crawford, Kingarov
Whiteman, J. H. & A. B., Long's Bridge, via Warwick
Willdo Farming Co., Southbrook
Willet, L. J., "Wongalea", Irvingdale
Williamson, K., Cattermul Ave., Kalkie

THE FARM FAMILY

In this issue, we present a special feature, prepared by Tess Mallos of the AUSTRALIAN MEAT BOARD on making the most of the present low beef prices.

BULK BEEF

A good buy for the budget conscious

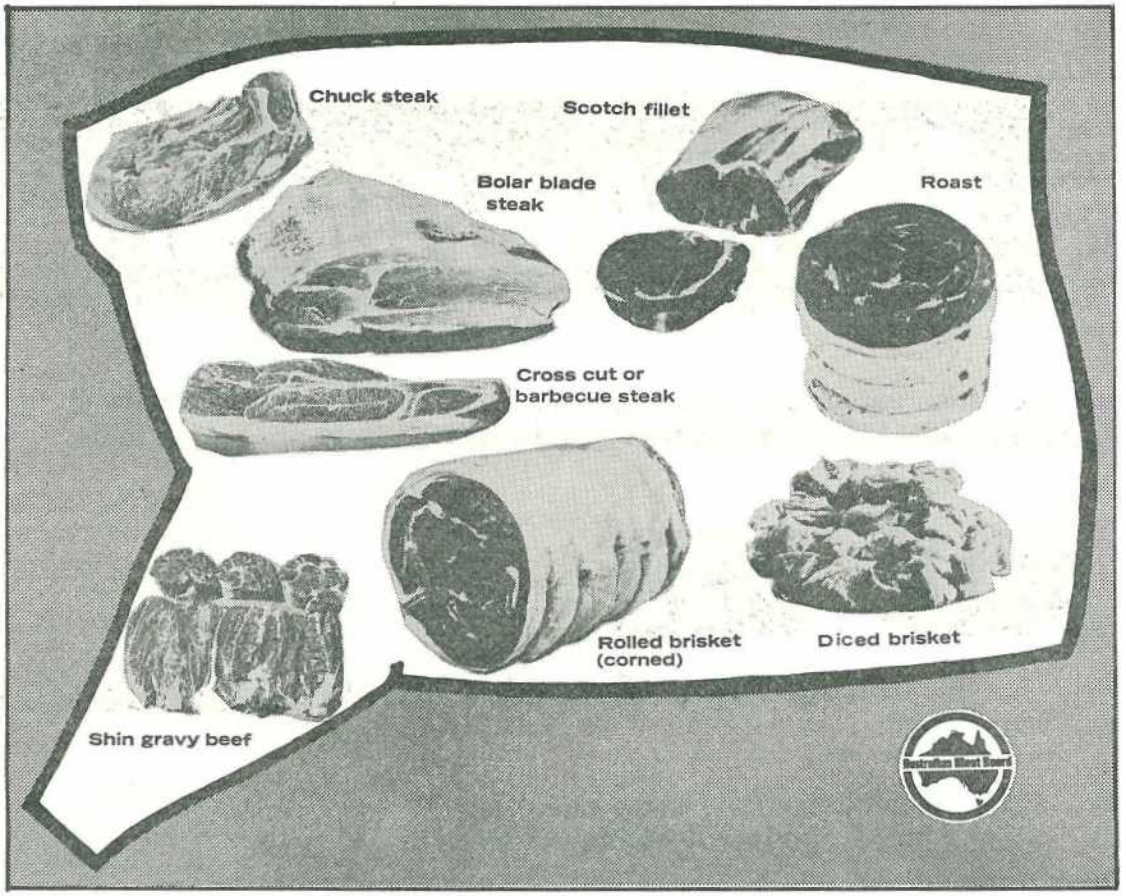
WITH the beef cattle population at an all-time high, Australian housewives are in the midst of a beef bonanza. Beef, relative to the cost of so many other foods, has really become an attractive buy. Beef prices are at their lowest for some years—a refreshing change when the food price index spirals upwards almost daily.

It is possible to offset other food price rises even more by buying beef in bulk—particularly forequarter beef—as it is in this area that the greatest savings on meat can be made.

Buying in bulk does not necessarily mean buying the whole forequarter—many meat retailers are bulk-packaging lots ranging from 1·5 kg (3 lb.) upwards and offering them at lower prices than for the same cut sold by the 500 g (1 lb.).

However if you can accommodate a forequarter in your freezer, these notes will show you that it is possible to get a maximum of 12 grill meals and 5 roasts, or a maximum of 7 roasts and pot roasts and 7 grill meals from a forequarter. To the grill meals may be added a number of hamburger meals made from the large quantity of mince the forequarter gives. Admittedly, a forequarter provides a lot of beef which is best suited for moist heat cookery methods, but by cooking these in bulk and freezing meal-sized portions they can be just as convenient as roasts or grills.

To give an idea of what quantities to expect, I bought a forequarter weighing 55·8 kg (123 lb.). The meal portions have been based on about 750g (1½ lb.) for grilling meats; 1 kg (2 lb.) for stewing and braising beef; 500g, 750g and 1 kg (1 lb., 1½ lb. and 2 lb.) portions for minced meat. Roasts and corned meat were divided into approximately 1·5kg (3 lb.) lots. These amounts are adequate for a family of 5.



Primal cuts, what Retail Cuts you can expect to get (and what meals you can plan)

SET OF RIBS

This cut can be divided in two convenient ways—

Method 1. The whole Scotch fillet (cube roll or rib eye) is removed in one piece—slice into steaks or cut into 2 roasts. Alternatively, a 1·5kg (3 lb.) piece can be cut off for roasting and the remainder sliced for 2 steak meals. The rest of the rib can then be filled with the roll blade and rolled into a rib roast—enough for 3 roasts. If there is a thick fat cover, have butcher trim some off before rolling.

Method 2. A standing rib roast of 2 or 3 ribs can be cut off from the set of ribs. Have the butcher oven-prepare it by sawing through the chine bone where it meets the rib bones. This section can also be removed from the bone and sliced into rib steaks (entrecote). The "Tail" section should be cut into short ribs (oven-braise these in a spicy sauce.) The rest of the ribs can have the Scotch fillet removed then filled and tied as a rolled rib roast, giving 2 roasts. Have the Scotch fillet sliced into steaks—2–3 meals.

BLADE

Method 1. The whole blade (minus the roll blade which is used in the rolled rib roast) can be cut into cross-cut or barbecue blade on a band saw (7 steak meals). More grilling

steak comes from the undercut blade—about 500g (1 lb.). Have butcher slice this—it is a good breakfast cut.

Method 2. Have the bolar blade cut off—this gives 2 roasts or pot roasts. The rest can then be removed from the blade bone and sliced into steaks across the grain for grilling (3 grills—marinate for extra flavour and tenderness) or if sliced with the grain, use for braising. The undercut blade gives another steak meal.

CHUCK

Method 1. Have chuck sliced for stews etc. (8–10 meals).

Method 2. Have butcher cut off tapered point of the primal cut (rib end) with rib bones intact. The ribs should then be sawn in 2 or 3 places and cut into meaty squares to give short ribs. (Yields 1·5kg or 3 lb.). The rest of the chuck can then be removed from the bone and sliced into steaks for stews etc.

Method 3. Have rib half of chuck rolled and tied for pot roasts (2 large ones). If the beef is yearling, these can be oven-roasted. The neck section is then sliced into steaks for stewing (4–5 meals).

SHIN

Slice and chop for stews, casseroles, brawn and meaty soups (3 meals).

BRISKET

Method 1. Defatted, boned, rolled and corned by butcher. Have it cut into meal-sized portions (about 6 pieces). Freeze raw, not cooked—it freezes well without loss of flavour.

Method 2. If corned brisket does not appeal, it is not advisable to have brisket cut into portions for pot roasts as there tends to be a lot of fat in this cut. Fatty meat should not be frozen for long periods as the flavour of the meat can be affected by the fat which oxidises during long-term freezer storage, giving meat a rancid flavour. If you like brisket pot-roasted, have one portion cut off and plan to use it as soon after purchase as possible. The remainder of the brisket can be boned, defatted and minced or diced for stews. Or have the whole brisket prepared in this way—it yielded 6·3kg (14 lb.) mince or stewing meat in my test run.

TRIMMINGS AND OFF-CUTS

These are minced—the test forequarter yielded 4·3kg (9½ lb.) mince. With the brisket the total mince weighed 10·6kg (23½ lb.).

Mince can be classed as a "convenience" meat cut. Shape some into patties (no need to add anything—they hold together very well when cooked from the frozen or partly thawed state). Place patties on a scone tray and leave in freezer long enough to freeze them. Remove immediately they are frozen (if you leave them in too long they will become "freezer burnt"), stack with waxed paper between each pattie, then wrap closely with high-density plastic wrap and seal. The rest of the mince should then be packed into plastic bags in meal-sized portions—amounts ranging from 500g (1 lb.) to 1kg (2 lb.) so that the quantities will suit a variety of recipes. Flatten the mince in the bag, pushing it into the corners. Tuck in and seal with masking tape, label with quantity and date. Done this way, mince thaws more rapidly than if packed into a thick mound.

A breakdown of the meals I obtained is rather complicated—many different results could have been achieved depending on how the forequarter was cut, but give an indication of the main meals one can expect, this list results from the way our test forequarter was broken down.

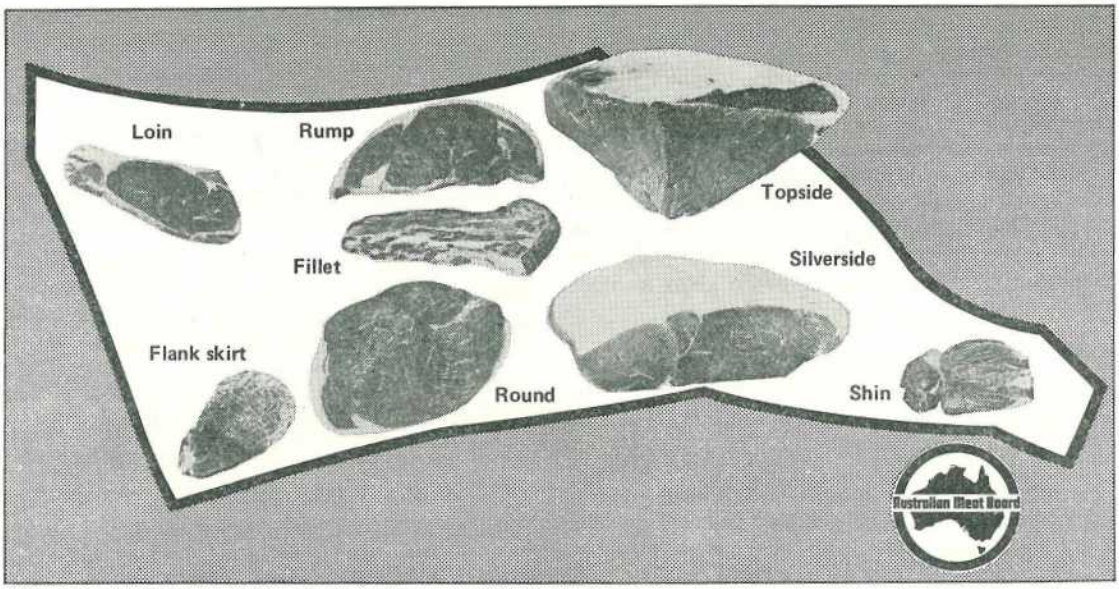
Set of Ribs—(Following Method 1) 3 rolled rib roasts and 4 steak meals.

Blade—(Following Method 2) 2 roasts or pot roasts and 3 steak meals.

Chuck—8 stews or casseroles, 1 braised short ribs.

Shin—3 stews, casseroles, brawns or soups.

Brisket—(Following Method 2). All boned and defatted for mince—added to mince from trimmings it gave 4 hamburger meals packed in lots of 10 patties, 4 meals using 500g (1 lb.) mince and 6 meals using 1kg (2 lb.) mince.



Total meals—(Family of 5)

Roasts and Pot Roasts	5
Grills including Hamburgers	11
Stews, braises, casseroles	12
Minced Meat Dishes	8

Total of 36 meals from 35kg (77½ lb.) meat.

Hindquarter Beef for Convenient Meals

Though you pay more for hindquarter beef, the percentage of convenient meat cuts—such as roasts and grills—is greater and this makes the hindquarter a very attractive buy for those who have little time for prolonged meal preparation.

The hindquarter tested for the purpose of this article weighed 79 kg. The meal portions have been based on 1 kg for grilling and braising meats, 500 g, 750 g and 1 kg portions for minced beef dishes. Roasts, pot-roasts and corned beef were divided into approximately 1·5 kg pieces. These amounts are adequate for a family of 5, with left-over roast and corned meat for salads and sandwiches.

How to order from the butcher

LOIN

Method 1. From this cut comes the popular Sirloin, T-Bone and Porterhouse steaks. They have a lot of bone so it is a good idea to have the butcher take the strip loin off the bone and slice in into steaks. This way there is no problem of padding bones to prevent wrapper tearing. Also it saves storage space and time in freezing. This method gives about 24 steaks, each weighing about 250 g.

Method 2. Have steaks cut on the bone, but pad bones well when wrapping. 24 steaks.

Method 3. Have a 2 kg wing rib removed and the remainder cut into steaks. 1 roast and about 18 steaks.

FILLET

Method 1. If you choose Method 1 for the Loin, then you will have a lovely long fillet. This makes an excellent roast for a special occasion dinner.

Method 2. Have a 1·5 kg piece of fillet cut from the thick end for a roast, the rest cut into steaks or cube it yourself for a Beef Fondue. Again you'll need a long fillet for this method. 1 roast, 1 steak or fondue meat.

Method 3. If you prefer the loin steaks with bone in, then you will have a short fillet. This can be left in the piece for a roast or sliced for steaks—enough for 1 meal.

RUMP

Method 1. The whole rump can be cut into steaks for grilling. 6 grills.

Method 2. Have first two-thirds of the rump sliced into steaks. Use remainder as a special roast. 4 grills and 1 roast.

ROUND

Method 1. The first 4–5 slices of round are good for grilling. Ask the butcher to keep them separate from the rest which is suitable for braises or casseroles. 3 grill meals and 5 braises etc.

Method 2. Have first 4 slices taken off for grilling, the remainder cut in half to give 2 roasts or pot roasts. 2 grills or 2 roasts or pot roasts.

TOPSIDE

This cut is a bit dry for the usual braises and for grilling but is excellent for Beef Olives and similar dishes and for roasting. Have butcher cut half of the topside thinly. Cut the remainder into 2 pieces—they will be about 2 kg each, but it is excellent roasted or pot roasted and the left-over meat is handy for salad meals and sandwiches. 4 meals Beef Olives or similar, 2 roasts or pot roasts, plus cold meat.

FLANK SKIRT

Only a small amount of this cut in a carcase —about 600 g—but it can be spread with a stuffing and rolled up for a small roast. This can also be used for a grill—score the fine membrane on each side in a diamond pattern and marinate in French dressing or a packaged salad dressing for 2 hours. Grill and slice with the knife at 45° angle to serve. Excellent for steak sandwiches. 1 roast or grill.

SILVERSIDE

Method 1. Have whole silverside corned and cut in portions to suit your family needs. If you freeze it raw, it should only be kept for 3 weeks—otherwise cook it all, cool, wrap and freeze in meal-sized portions in the piece, not sliced. If you like to serve it hot, put pieces in plastic containers and cover with cooking liquid. Leave 2·5 cm (1 inch) head space in container. It can then be re-heated in its own liquid. 5–6 corned beef meals, plus left-overs.

Method 2. Have half of the silverside cut into steaks for braising or have it minced. The remainder can be corned or cut into 2 roasts or pot roasts. 3 braises or minced beef dishes and 3 corned beef meals, roasts or pot roasts.

GRAVY BEEF

This should be removed from the bone and diced. Makes excellent casseroles, stews, brawns and soups. Two casseroles or stews or 1 brawn or soup.

TRIMMINGS AND OFF-CUTS

This is minced—specify whether you would like it fine, medium or coarse ground. The butcher will, no doubt, make some of it into sausages if you ask him. Shape some of the finely ground mince into hamburger patties and freeze. These can then be cooked straight from the freezer when required.

Our test hindquarter gave the following meals:

Total meals (For a family of five from 46 kg of beef—no bones.)	
Roasts and pot roasts	7
Corned beef	3
Grills, including hamburgers	15
Braises, casseroles, stews	11
Minced beef dishes	12
	48

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BUNT (OR STINKING SMUT)

Compiled by N.T. Vock, Plant Pathology Branch.

BUNT, caused by the fungi *Tilletia foetida* and *Tilletia caries*, is one of the oldest plant diseases known to man and was probably the first disease to be controlled by chemical means. It has not been a problem in Queensland for some years. This has been largely due to the very effective control by chemical seed treatments. Because of recent changes in the treatment of wheat seed, a close watch is being kept for any new outbreaks of the disease.

Bunt occurs only on wheat, but a similar disease known as covered smut affects barley and oats.

Symptoms

Bunt is not easily recognized in a field of wheat because diseased plants appear similar to healthy plants. Affected plants are however generally a little shorter, remain green longer, and the ears often show a bluish-green colour. Not all heads of a plant may be diseased and some may even be only partially affected.

When affected heads ripen, the hulls (or glumes) which normally surround the grain tend to gape open, revealing dark, round bodies known as bunt balls instead of sound healthy grains. These balls generally remain intact within the head, although they may be very brittle. The bunt balls contain masses of tiny fungal spores which completely replace the normal grain contents. When a bunt ball is crushed, a fine black powder is produced. This has a pronounced odour similar to that of decaying fish and is the reason why the disease is sometimes referred to as 'stinking smut'.

Spread

The disease arises from contamination of clean seed by spores of the bunt fungi. During harvesting, spores are released from the bunt balls and lodge in the groove and brush of healthy grain. Where a badly affected crop is harvested, the whole seed sample may have a greyish discoloration as well as a 'fishy' smell. If this seed is sown without treatment in cool, moist soil, the bunt spores germinate and enter the developing seedling before it emerges. Infected seedlings then grow normally until flowering, when a bunt ball forms instead of a healthy grain.

Control

Bunt can be effectively controlled by using fungicides as seed dressings. Despite the virtual absence of the disease in Queensland, growers are still advised to use treated grain. Bunt could well build up quickly if untreated grain was continually used. Unsown treated seed must not be fed to livestock or poultry or returned to the silo with freshly harvested grain. This is essential if the chemical residue problems in food products similar to those which have been evident in recent years are not to recur. Because some fungicides may adversely affect germination, treated grain held over from one season to the next should be tested for viability before sowing.

LOOSE SMUT

LOOSE smut, caused by the fungus *Ustilago nuda*, is generally a minor disease of wheat in Queensland but occasionally a serious outbreak occurs. If this happens, significant yield losses in the immediate crop may result, and if seed from this crop is sown, severely diseased crops could be produced in the following season.

The loose smut fungus of wheat does not attack other cereal crops.

Symptoms

No indication of the disease appears until the heads emerge. In contrast to bunt, loose smut is easily recognized because most of the head is replaced with masses of black spores. These spores readily blow away leaving a bare, ragged head stalk. Not all heads of a plant may be affected and often only partially-affected heads are seen.

Spread

Infection begins at flowering when spores are blown from diseased heads and land in the flowers of healthy heads. If conditions are suitable, the spores germinate and enter the seed in the very early stages of development. The fungus remains dormant inside the grain until the seed is sown. It becomes active again when the seed begins to germinate and then grows inside the plant until the head begins to form when it replaces the head with masses of spores.

Control

Loose smut is different from bunt in that the fungus is carried inside the seed. Most of the fungicides used to control bunt do not penetrate the seed or seedling and are therefore ineffective against loose smut. Until recently, hot water was the only effective seed treatment available for eliminating this fungus from wheat seed. The recently developed systemic fungicides such as carboxin can penetrate the seed and hence control loose smut. The high rate of application, and consequent cost required to achieve this purpose prevents the routine use of such materials at the present time. However, plant breeders and seed marketing authorities find them valuable in building up stocks of disease-free seed of new cultivars and older ones which have been troubled with loose smut in the past.

(Further information including recommended fungicides may be obtained from your nearest Plant Pathology Branch office or by writing to the Director, Plant Pathology Branch, Department of Primary Industries, Meiers Rd, Indooroopilly. Q. 4068.)

DISEASES OF WHEAT-1

BUNT. Diseased heads. Note the gaping and darkening of glumes (hulls) due to the bunt balls.

BUNT. Bunt balls (lower) removed from the heads at left compared with healthy grain.

LOOSE SMUT. Left: diseased heads. Right: healthy heads.