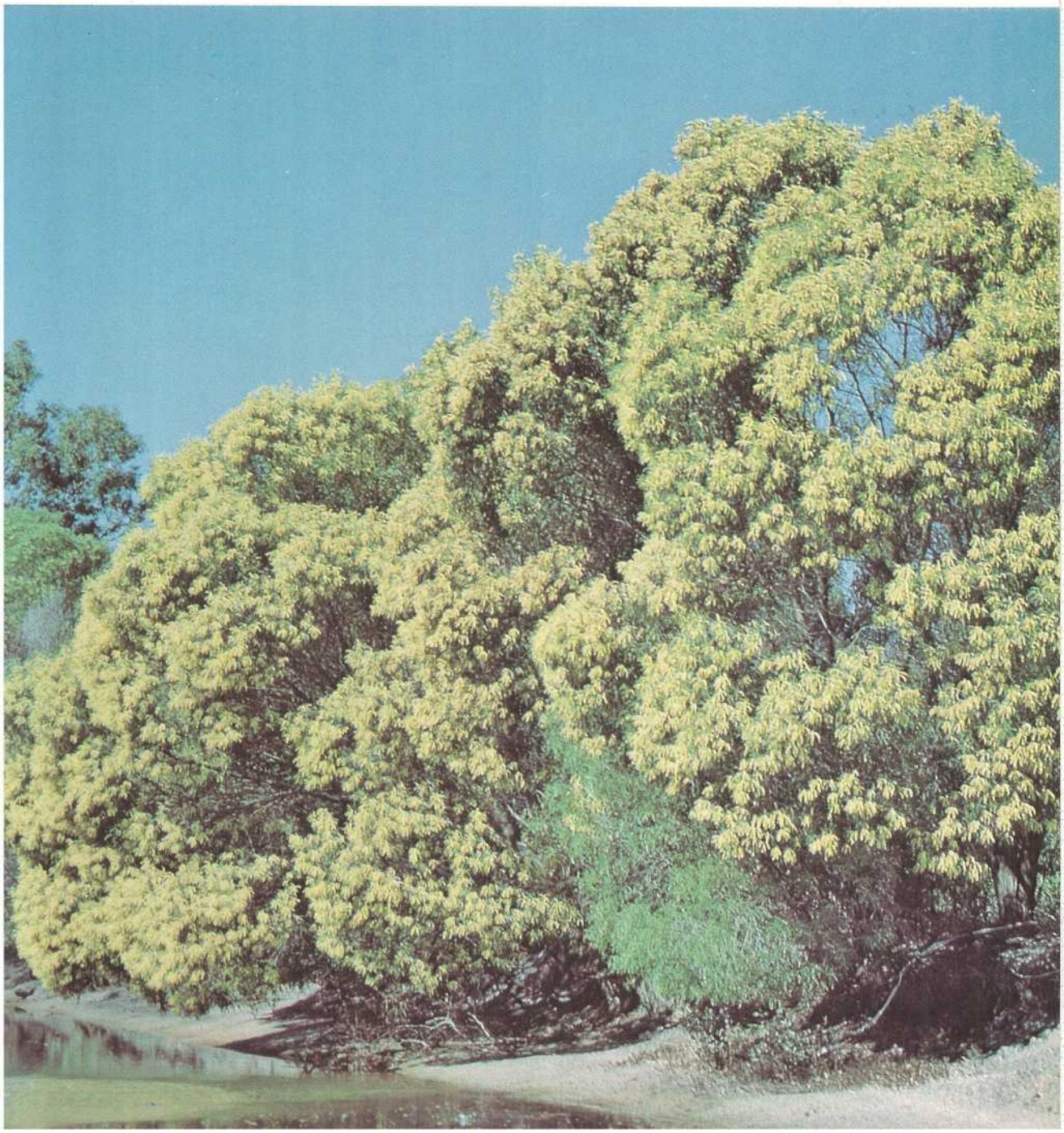
Queensland
AGRICULTURAL JOURNAL

July–August, 1979. Vol. 105, No. 4



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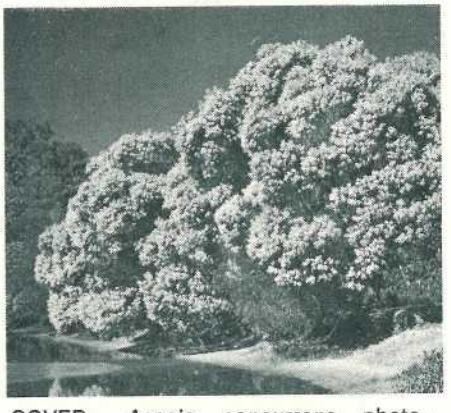

COVER. *Acacia concurrens* photographed at Bribie Island. See 'Wattles in South-east Queensland-flowers in spikes' in this issue. Photograph by Dr. S. L. Everist.

QUEENSLAND AGRICULTURAL JOURNAL

Vol. 105 No. 4 July–August 1979

Editor—P. R. Lee

Contents

The *Queensland Agricultural Journal* is published every second month by the Department of Primary Industries, Mineral House, George Street, Brisbane, Queensland, 4000. Telephone 224 0414.

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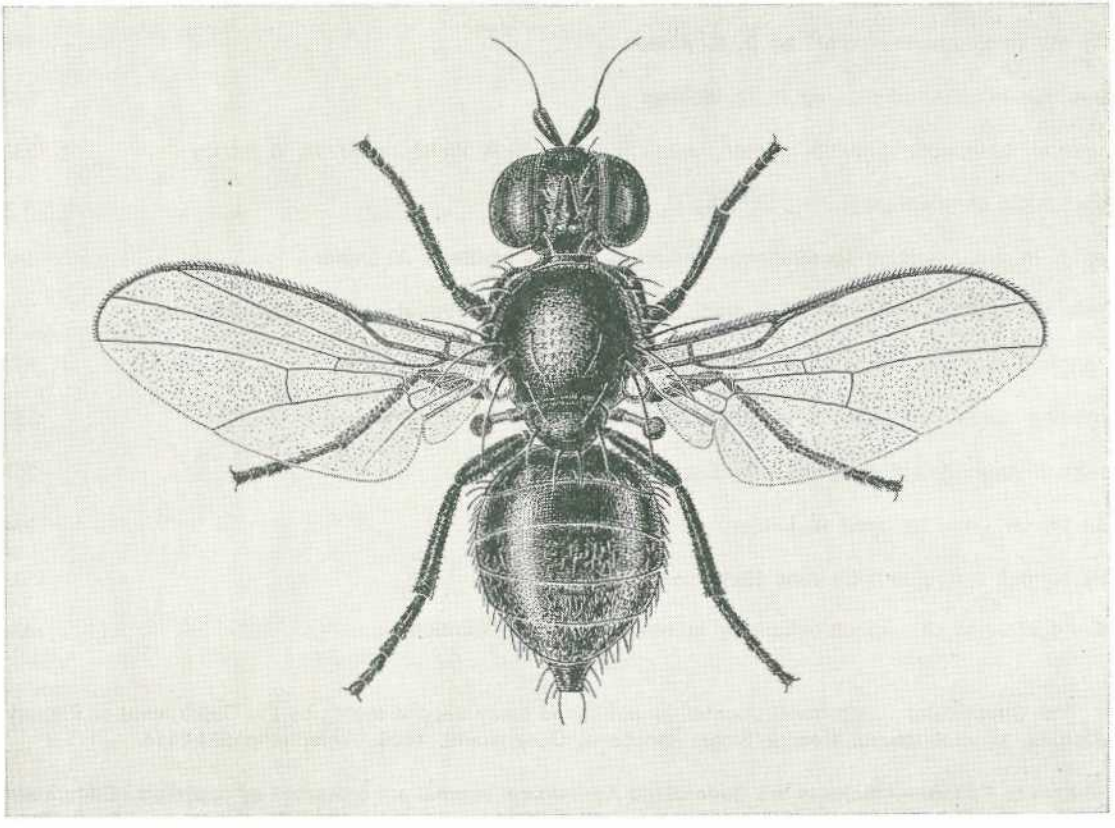
Insects and navy beans

by J. W. Turner, Entomology Branch

WHEN an insect feeds on a plant it may reduce the vigour of the plant through removal of sap or reduction of the leaf area.

Whether this in turn reduces the plant yield depends on the severity of the damage and the ability of the plant to compensate for the damage.

Even plant death cannot be treated as a complete loss. Plants growing in a crop are competitive and the reduction in growth or death of one will allow others to compensate through increased growth. Thus the insect-plant interaction is complex and all insect damage does not produce a consequent reduction in yield.



Beanfly adult.

Navy beans are grown for use in canning and the final return is dependant on both the quantity and quality of the yield. Insect attack on the pod has this dual effect on yield and causes the major losses suffered by this crop.

A wide range of insects are seen in navy bean crops. While some of these are pests, many feed on nectar and pollen while others feed on decaying organic matter in the soil or are parasites or predators of pests. It is essential to recognise the pest species.

Pest species

Beanfly

In the major navy bean producing areas in inland Queensland, there is a low survival of beanfly across the winter period. This combined with the paucity of hosts before bean planting commences means that few beanflies are present to infest young plants. The populations sometimes build up during the growth of the crop.

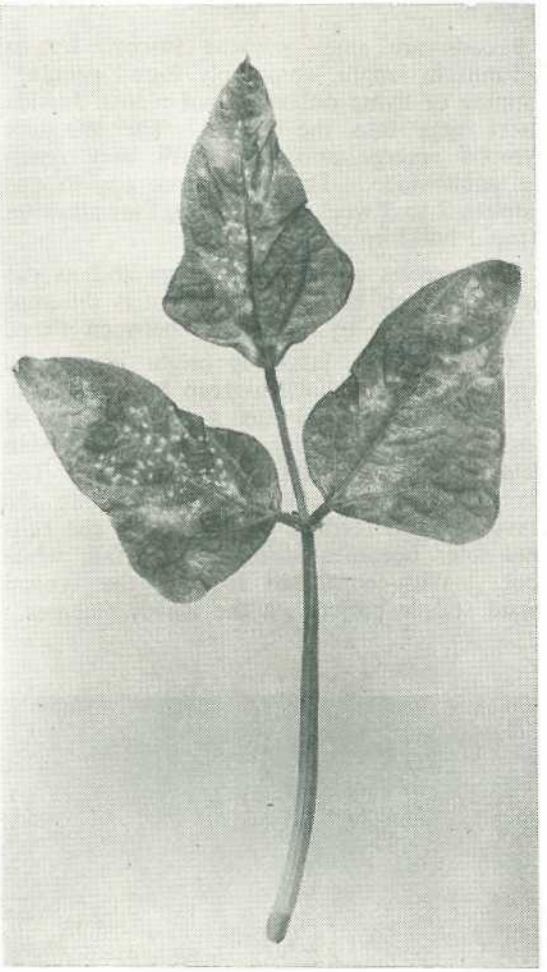
The adult beanflies are 2·5 mm long, shiny black with a pointed abdomen and are found moving actively on or around the plants. The female inserts its egg into the bean leaf. The presence of beanfly may be detected by holding the leaves up to the light and looking for the clear spots at egg laying sites. The egg develops into a maggot which feeds within the leaf, petiole and stem as it tunnels towards the base of the plant. When fully grown, the larva forms white to brown pupal cases 2·5 mm long under the bark or in cracks in the bark.

A severe attack on young plants may cause the plant to wilt and die. As the plant grows, its tolerance to damage increases so that in larger plants the bases of the petioles may be enlarged, the bark may be cracked and the vigour and structural strength of the plant reduced. These weakened plants may lodge or break off during windy periods.

Mites

Adult mites are up to 0·5 mm in length and their spider-like appearance can just be distinguished without the aid of a hand lens. Damage is seen as a mottling in the leaf colour with a yellowing of severely affected leaves. Leaf fall may result from severe or sustained attack. The mites feed and breed on the lower surface of the leaf with the life cycle being completed in about 11 days in summer. Mites attack a wide range of cultivated and weed hosts and are able to migrate during the early juvenile stage by drifting on air currents.

The rapid build up in population which occurs during periods of hot, dry weather is accentuated when broad spectrum insecticides destroy predators. Mites are not a problem in most inland navy bean growing areas except for areas such as the Lockyer Valley where climatic factors and cropping patterns increase their prevalence.



Beanfly oviposition punctures in a leaf.

Jassids

Jassids are small sucking insects, up to 2·5 mm in length, commonly found running, hopping or flying on or around plants. Jassids insert eggs into the plant. The wingless nymphs emerge and feed until they reach the adult stage. The cycle from egg to egg requires 2 to 3 weeks in summer, thus allowing a rapid build up in numbers.

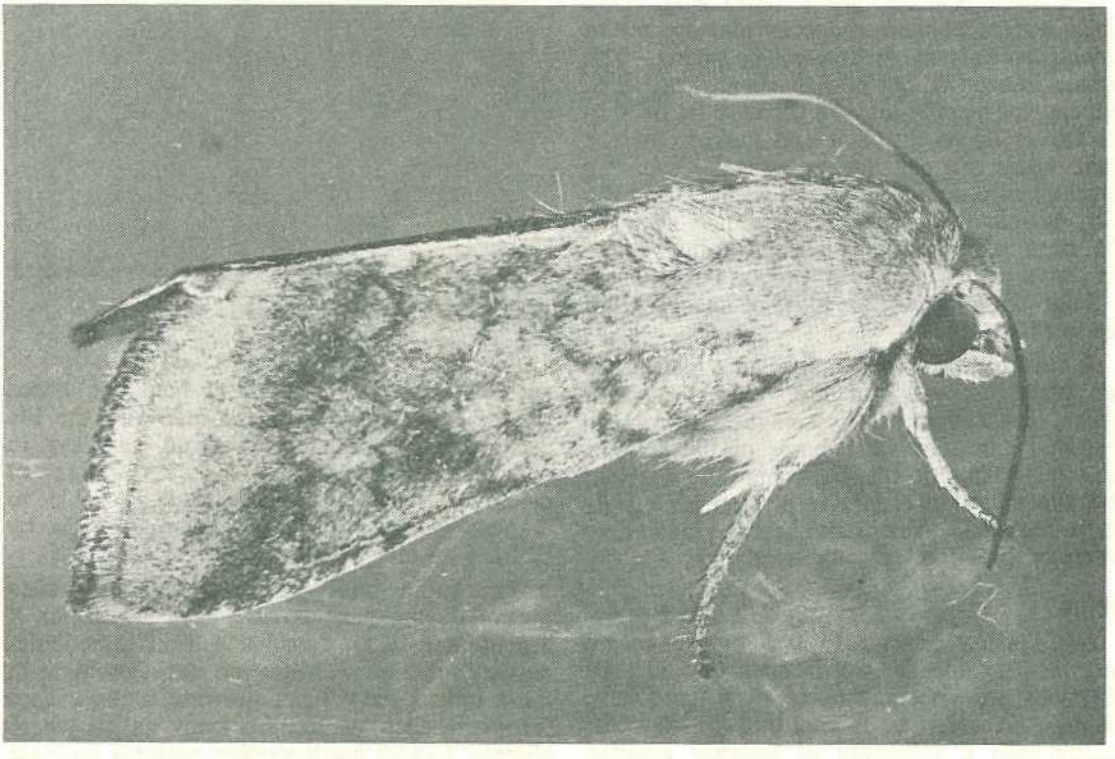
Two species attack navy beans and as the nature of their effect on the plant is different it is important to distinguish between them.

The vegetable jassid is bright green and larger than the yellowish-green lucerne jassid. The vegetable jassid has a wider range of hosts and is normally present in the bean fields earlier than the lucerne jassid. The vegetable jassid feeds from the cells in the leaves. Each feeding puncture kills the cells and later becomes visible as a small, white spot. With continued feeding, the typical jassid stipple pattern on the leaves emerges.

The lucerne jassid which feeds in the sap conducting system of the plant does not produce obvious stippling but injects more toxic substances into the plant than does the vegetable jassid. It also blocks the sap flow in the leaves. Thus the lucerne jassid has a more severe effect on the plant than the vegetable jassid.

Corn ear worm

The caterpillars of this species, which grow to 50 mm in length, vary widely in body colour and intensity of markings. The colours are usually a combination of green, buff, reddish-brown and black. Larval feeding occurs on the leaves but is concentrated mainly on the developing pods. Following pupation in the soil, the stout-bodied, strong-flying adult moth with a wing span of 35 mm emerges. The forewings are reddish to buff-coloured while the hind wings are creamy-yellow with large, marginal, smoky areas.



Corn ear worm moth.

Dome-shaped, pearly-white eggs are laid by the moths on terminals and leaves. The egg darkens as the embryo develops. The life cycle in summer takes from 5 to 7 weeks and as the bulk of egg laying occurs after flowering commences usually only one generation of the insect is passed in any navy bean crop.

The corn ear worm has a wide range of hosts allowing an early multiplication which is followed by breeding in maize, sorghum, soybean and cotton crops. The moths migrate from these crops to navy beans.

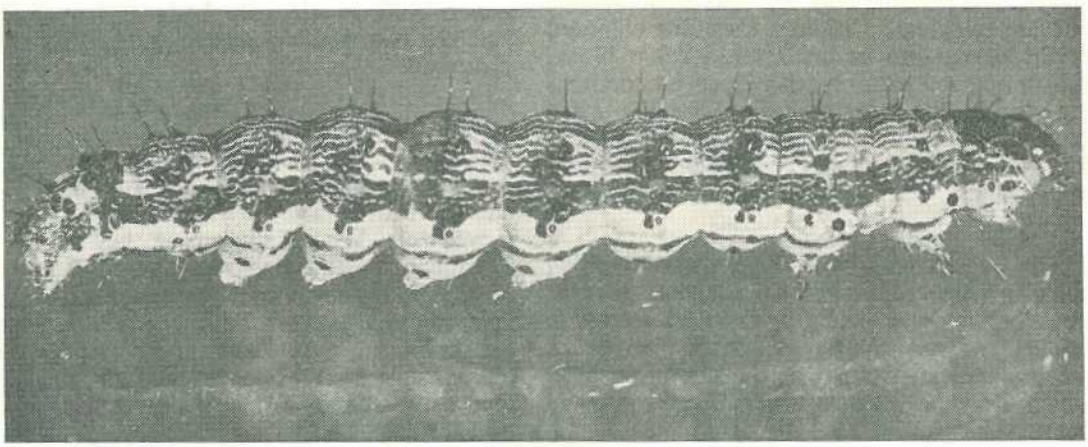
Bean pod borer

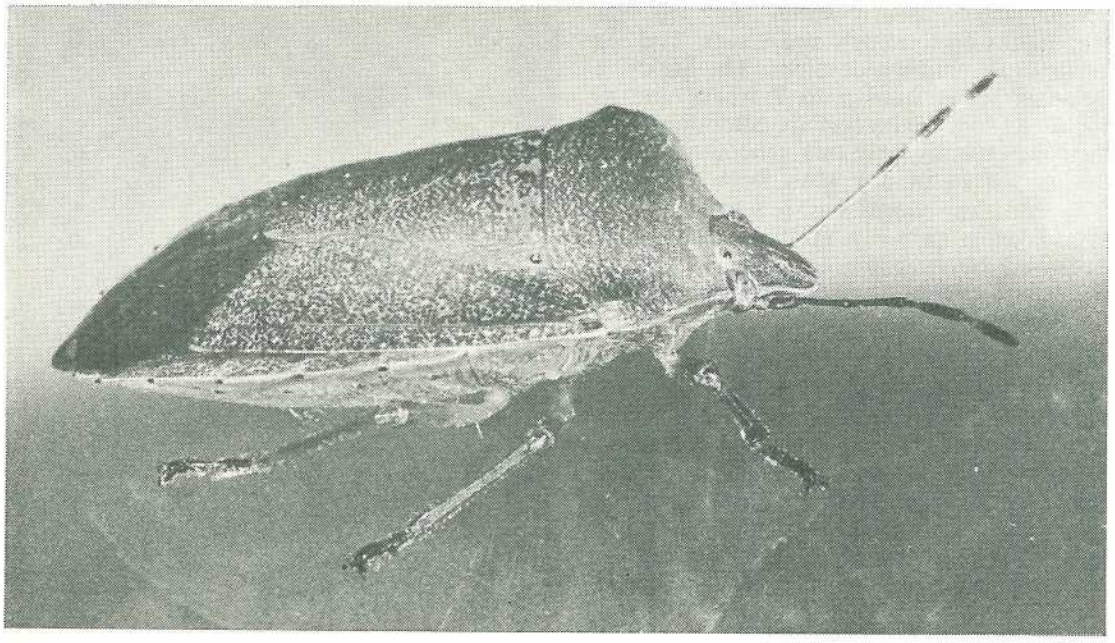
Bean pod borer moths invade the navy bean crop at the commencement of budding and the larvae feed in the flowers and developing pods. The flowers and pods are bound together by the frass-covered web produced by the larvae. The larvae which are 18 mm in length when fully grown are yellowish-green with several rows of dark spots along the sides of the body.

The forewings of the moths are yellowish-brown with several translucent spots while the hind wings are mostly free of scales except for the brownish fringes. The moth has a wing span of 25 mm shelters in plants during the day. Navy beans are one of the less preferred hosts of this species, but occasional outbreaks occur and economic loss can result.

ABOVE. Corn ear worm eggs.

BELOW. Corn ear worm larva.





Green vegetable bug.

Green vegetable bug

The adult green vegetable bug is shield-shaped, about 15 mm in length and coloured light green. The female deposits rafts of 20 to 150 eggs on the lower surfaces of the leaves. The juvenile bugs are also shield-shaped but are wingless. Initially they are coloured bright orange-brown but later develop black, yellow and red patterns with green predominating during the later stages. The life cycle occupies about 5 weeks in summer with both juvenile and adult stages feeding on the developing seeds.

The bugs have a wide range of hosts which allow multiplication through several generations before navy beans become an attractive host at pod set. Sunflower and soybean crops are a significant source of the migrating bugs which frequently cause severe losses in navy beans.

It should be noted that while a number of other shield bugs have been recorded feeding on navy beans, the green vegetable bug is the only one which occurs in sufficient numbers to cause loss. Pod-sucking bugs occasionally cause economic loss. These are predominantly brown with an elongate body and long legs, and are very active—running and flying when disturbed.

Loopers

These moth caterpillars are foliage feeders and are characterized by their looping form of movement. When fully grown they are about 38 mm in length. Both the plain green larvae of the green looper and the green larvae with light-coloured stripes of the soybean looper are found in navy bean crops. They feed on pods as well as leaves and on occasions may cause economic loss mainly through their pod feeding.

Lucerne seed web-moth

This insect is a severe pest of peanuts and soybeans in some of the navy bean growing areas. While it is hosted by navy beans to date it has not significantly reduced yields. The larvae tunnel into pods shortly after hatching, making early detection difficult and feed internally for most of the life cycle. The pink larvae may bind pods together with dung-covered webbing.

When is damage occurring?

Beanfly has the potential to kill bean plants especially during the seedling stage. An evenly distributed 25% reduction of a good plant stand during this stage will not reduce yield. The crop becomes more sensitive to plant loss from the flowering stage onward.

Later beanfly attacks also consume part of the plant's reserves and reduce the plant vigour. The wetter coastal regions where beanfly damage is severe are not suited to navy bean production. In the inland areas where beanfly numbers are lower at planting time, regular examinations for egg laying should be made. If one or more larval tunnels are found per small seedling, the crop should be sprayed and this should be followed by at least two more sprays at weekly intervals.

These sprays are rarely required. By this time, bean plants should be able to withstand any beanfly populations likely to be experienced. Beanfly populations will develop in many crops during the post flowering period and while damage is obvious and weakened plants may be broken off by wind it is not economic to attempt to control beanfly at this time.

Leaf-feeding insects reduce the phytosynthetic area of plants. If the area removed exceeds a critical point, the plants' ability to manufacture food from sunlight will be reduced. Damage may also increase water loss. No direct data is available on the ability of navy bean plants to tolerate defoliation but it can be expected from experience with other plants that up to 25% leaf loss during the pre-flowering stage will not reduce yield given vigorous plants and adequate moisture. With the commencement of flowering, up to 10% leaf loss may be tolerated under good growing conditions.

During the pod-filling stage, plants are very sensitive to defoliation and the removal of 5% of leaves from vigorous navy beans will cause a significant economic loss. Defoliation does not reduce yield if it occurs after the bean seeds are fully expanded. Less vigorous plants will have a lower ability to compensate for damage.

Damage to terminals should be considered separately as the effect comes from stunting and excessive branching rather than the removal of photosynthetic area. No terminal damage should be tolerated in the pre-flowering stage. After pod set, terminal damage becomes less significant and by the stage when seeds are fully expanded may actually increase yields.

Although mites are leaf feeders their interaction with the plants differ from that of chewing insects. Mites feed on the sap of the plant and in the process inject saliva. The chemicals contained in the saliva affect the metabolism and growth-promoting substances present in the plant. When plants are actively growing in the pre-flowering stage up to four mites per cm^2 do not reduce yield while ten mites per cm^2 inhibit growth and yield. Plants are more sensitive to mites during the period from pod-setting until the seeds are fully expanded.

Once the plant canopy has met across the inter-row space, mite control becomes more difficult. Early application of miticides is advisable if mite populations are detected and seem likely to reach high levels before the seed is fully expanded. Because of the difficulty in achieving adequate cover, sprays applied as the mite population approaches the economic injury level are less reliable in preventing losses. If mite populations reach high levels after seeds are fully expanded, no action should be taken as the defoliation will not affect yield.

Vegetable jassids do not appear to inject toxins into the plant along with saliva during feeding. The removal of sap and the reduction in photosynthetic area by jassid stipple can reduce yield. Navy bean plants are tolerant of this damage and control of vegetable jassid is not warranted until jassid stipple is clearly visible when standing in the field.

The lucerne jassid injects toxins while feeding but does not stipple, as it feeds mostly in the leaf veins. Far fewer of these jassids are required to cause injury. If kicking the plants raises noticeable numbers of these jassids (20 or more jassids per large plant) then spraying is warranted.

Vigorous navy bean plants produce many more flowers than are required for the number of pods which can be matured. Experimental removal of 90% of the flowers and buds did not reduce the yield. Attack by corn ear worm during the flowering stage can be tolerated by the plant providing the flower removal is not excessive and providing the poplation is controlled before the larvae become large and severely damage developing pods.

Bean thrips feed inside flowers from the time they can first gain entry and may cause shedding if there are more than six thrips per flower. Populations of this level during the early flowering stage period justify spraying but once the crop has been set the thrips in late flowers are of little significance. Damage caused to the tiny bean pods enclosed in the flowers leads to later distortion of the pods, a factor of little consequence in navy beans.

When seeds are damaged the resources of the plant are redirected and the remaining seeds often grow larger so that the final yield may remain unchanged. The ability of the plant to compensate for seed damage is greatest during the early pod-setting stage and decreases as seeds mature, reaching zero when seeds are fully expanded. Vigorous plants compensate most efficiently so all agronomic factors including available moisture affect the outcome.

The degree to which a seed is damaged is also significant as slightly damaged large seeds will continue to develop. These utilize plant resources and prevent the compensation which can occur if a small seed is aborted following damage. This gradation in effect can be seen with green vegetable bugs sucking on seeds. Young seeds are aborted while part-grown seeds are shrivelled. Fully-expanded seeds exhibit a black spot in a depressed area at the puncture point.

Any bug-damaged seed will be rejected during grading but the larger seeds potentially represent a greater loss as less compensation can occur. Green vegetable bugs are one of the most significant factors in loss of quality. Control is warranted when an average of 1 adult or juvenile bug is found per 5 m of row. As the distribution of bugs is extremely patchy, close surveillance of crops must be maintained.

The bulk of corn ear worm eggs are laid in the crops during the flowering stage with the peak of egg laying coinciding with the peak of the flowering. In rare instances, a significant population of larger larvae are present at flowering, having fed on the leaves and buds. These present a major hazard.

Larvae consume relatively small amount of food before they reach a length of 10 mm. As it takes about 10 days from egg laying to reach this stage, most crops have reached the late flowering stage before significant damage occurs. The recommended management plan for corn ear worm is to monitor the crop from bud set onwards for larvae and damage. The strategy adopted in chemical control will depend upon the type of chemical being used. If using methomyl which has a short residual life, the application of the first spray should be delayed as late into the flowering stage as possible to obtain an effect on the maximum number of larvae. The extent of the delay will depend upon the number of larvae present and the amount of damage to the plants.

Larvae surviving the first spray and from later egg layings may necessitate the application of a second spray after the end of the flowering period. Fenvalerate has reasonable residual activity under good conditions. If economically significant numbers of small larvae are detected then spraying should commence. Delaying the application until mid-flowering will have the potential advantage of providing corn ear worm protection for the crop with one spray.

The plants are less able to compensate for corn ear worm damage as the size of the pods increase. The plants have great tolerance during the flowering and small pod stage. When fully expanded pods are damaged they are normally carried through to harvest and during a wet harvest allow staining of undamaged seed in the pod. As the size of the seed increases, the ability of the plants to compensate decreases, until it ceases when seeds are fully expanded.

When using methomyl, control of corn ear worm in navy bean crops is warranted when vigorous shaking of plants dislodges one larvae per 2 to 3 metres of well-grown navy bean plants. Fenvalerate, however, is applied against smaller stages and shaking should be replaced by careful searching of the plant for larvae and eggs when this chemical is used.

Bean pod borer moths lay eggs from very early in the flowering period of the crop. After feeding on the flowers, the larvae tunnel in the pods and are very difficult to contact with insecticides. The larvae, however, damage far fewer pods and seeds than corn ear worms and at least three larvae per metre of row is required to justify control measures. These control measures must be applied earlier in the flowering period than those for corn ear worm, at a time when pod borer larvae are difficult to detect.

Looper larvae are far larger than the other two species but consume more leaves than pods. Control of the pest is warranted when one larvae is found per metre of row of well-grown navy beans following vigorous shaking.

Control measures

Surveillance for insect pests during crop growth is the key to efficient management of pests. The main flowering period of navy beans is 7 to 9 weeks after planting in a well-grown, early-planted crop and 6 to 8 weeks in a late planted crop. Harvesting normally begins at 16 weeks after planting in an early-planted crop. The crop is susceptible to insect damage for the whole of this period.

During the pre-flowering stage, jassids and loopers should be monitored on a weekly basis by shaking plants and observing the insects and by monitoring the damage. Leaves should be examined for beanfly. Insects have a greater potential for damage at the post-flowering stage and twice-weekly examinations of the crop are essential. Plants should be shaken to dislodge corn ear worm, loopers, jassids and green vegetable bugs. Flowers and pods should be examined for the webbing of bean pod borer.

Insect distribution in crops is often patchy and at least five sites should be inspected in every 20 ha. The sites chosen should be distributed through the field and not concentrated on the edges. At each site, at least 5 m should be examined for all pests and 20 m, for green vegetable bug. A large proportion of bugs move to the top of the canopy and 'bask' in the sunlight between 8 and 10 a.m. Observations during this period are recommended to save time in looking very critically into plant canopy.

The most efficient application of insecticides during the seedling stage can be achieved by mounting a hollow cone nozzle on a boom spray over each row. Furthermore, considerable savings can be involved as the rate of chemical application can be reduced proportionate to the reduced area of coverage. Boom sprays fitted with additional nozzles and preferably with some mounted on droppers are efficient applicators until coverage of the inter-row space or plant height results in plant damage.

During later growth, ground applications can only be made by using a medium clearance spray rig with guards to minimize damage from the passage of wheels and droppers. Even with this specialized equipment some plant damage will result. The likely losses will vary with the amount of entwinement across rows, damage to plants by beanfly and the presence of vines in the crop.

Aerial application of insecticides during the seedling stage is more expensive than boom spraying over individual rows. Efficient control from aerial application can be achieved for most pests at all crop stages. Efficiency is reduced by dense foliage and control of mites, which inhabit the lower surface of the leaf. is often inefficient under these conditions. Green vegetable bug control may be improved by applying pesticides during the 'basking' period described earlier.

The following table gives the rate of active constituent of chemicals and product required for control of damaging populations of pests.

Pest	Chemical	Withholding Period	Grams of Active Ingredient	Amount of Product
Beanfly	diazinon	14	120/ha	150 ml of 800 g/L
	methomyl	1	22·5/100 L	100 ml of 225 g/L
	dimethoate	7	300/ha	1·1 L of 300 g/L
Mites	dicofol	7	600/ha	2·3 L of 250 g/L
	dimethoate	7	330/ha	1·1 L of 300 g/L
	propargite	7	30/100 L	100 g of 300 g/kg
Jassids	dimethoate	7	140/ha	450 mL of 300 g/L 350 mL of 400 g/L
Corn ear worm	methomyl	1	340–450/ha	1·5–2 L of 225 g/L
	fenvalerate	14	80–100/ha	400–500 ml of 200 g/L
Green vegetable bug	methomyl	1	340/ha	1·5 L of 225 g/L
	endosulphan	7	735/ha	2·1 L of 350 g/L
Loopers	methomyl	1	340/ha	1·5 L of 225 g/L
	fernvalerate	14	80–100/ha	400–500 mL of 200 g/L

Scientific names of insects mentioned in the text

Bean fly	*Ophiomyia phaseoli* (Tryon)
Mites	*Tetranychus* spp.
Lucerne jassid	*Austroasca alfalfae* (Evans)
Vegetable jassid	*A. viridigrisea* (Paoli)
Corn ear worm	*Heliothis armigera* (Hübner)
Bean pod borer	*Maruca testulalis* (Geyer)
Green vegetable bug	*Nezara viridula* (Linnaaus)
Pod sucking bugs	*Riptortus* spp.
Green looper	*Chrysodeixis eriosoma* (Doubleday)
Soybean looper	*Trichoplusia orichalcea* (Fabricius)
Lucerne seed web moths	*Etiella* spp.

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If possible, two months' notice should be given to ensure your Journal is sent to the correct address.

The Wacol bull motel

by J. W. Cooper, Dairy Cattle Husbandry Branch.

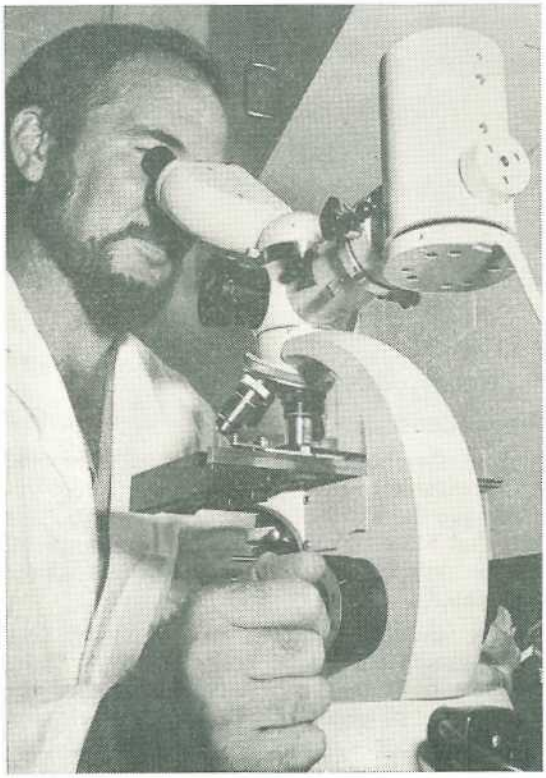
FOR the past 10 years, cattlemen throughout Queensland have utilized the custom collection service offered by the Wacol A.I. Centre.

In 1974, the unlicensed semen laboratory was put into operation. This centre was designed to provide an alternative service at the Wacol Herd Improvement Centre to the existing custom collection service. It operates along the lines of a bull 'motel', where any bull can be housed while semen is collected.

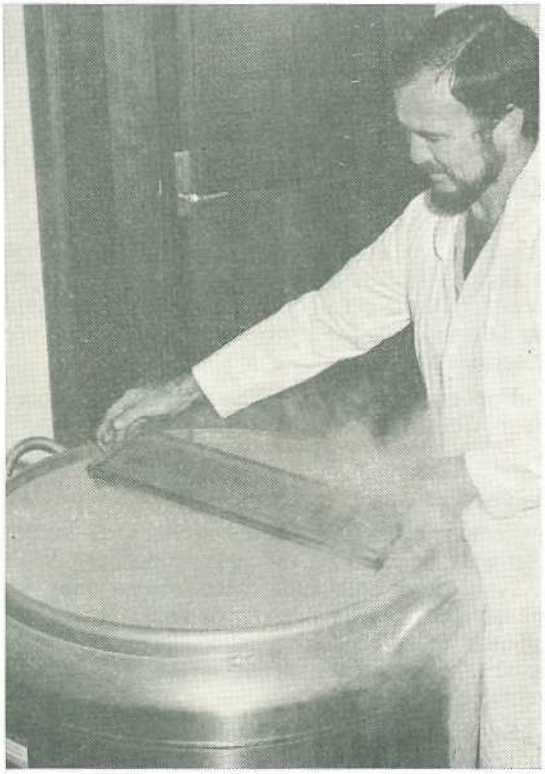
The motel

The services offered at Wacol are:

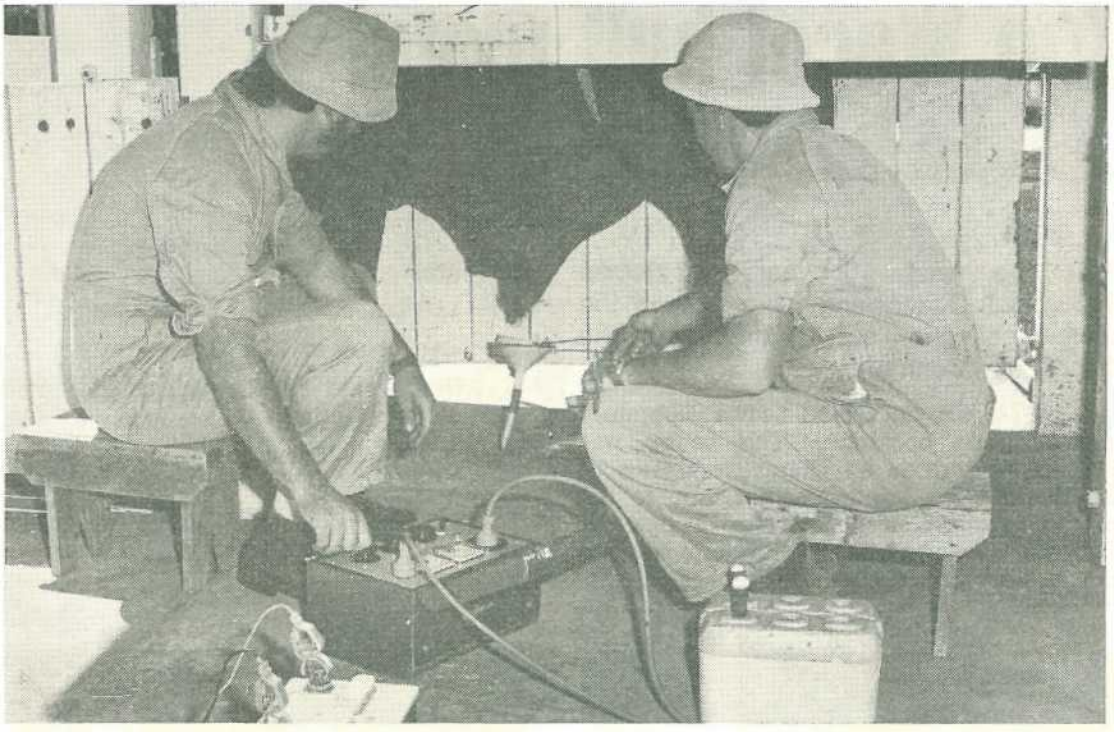
- Housing for up to 18 bulls.
- Veterinary care by the unlicensed semen laboratory veterinarians.
- Semen collection and processing by experienced staff.
- Semen storage and maintenance in owners' units or Wacol Centre liquid nitrogen containers.



Experienced Wacol technician evaluating custom collected semen.



Freezing processed semen in Cassau straws.



Collecting semen from a Sahiwal bull.

Entry requirements

Should any stock owner decide to take advantage of this service, the bull must first undergo health tests to ensure no semen-transferable diseases are present. This should be done on the property by a private veterinarian.

For entry into the Wacol Herd Improvement Centre the health tests required are:

- Brucellosis
- Tuberculosis.

Semen processed at the unlicensed centre can only be used on owners' properties. With a syndicated bull, unlicensed semen may be transferred between part owners. It is an offence to sell or give away any unlicensed semen. Only semen produced at the licensed centre can be sold.

By comparison, the health tests for entry in the Wacol Licensed Centre are:

- Brucellosis
- Tuberculosis
- Vibriosis
- Trichomoniasis
- I.B.R.
- Johnes disease
- C.B.P.P.
- Q fever
- Leptospirosis.

Precautions

If a shareholder in a bull lives interstate, it is advisable to investigate the health requirements for the entry of unlicensed frozen semen into that State. Problems may be encountered in the transport and use of unlicensed semen interstate.

Care should be taken in estimating how much semen should be collected. By mating the best bulls to the best cows, some of the sons should be genetically superior to their sire. To make genetic progress, it would be then advisable to breed from these sons as soon as possible. Therefore, it is unwise to store large amounts of semen from the one sire.

Advantages

Some of the advantages of unlicensed semen production using facilities at Wacol are:

- The wider use of outstanding bulls in your herd.
- It is an alternative insurance scheme for valuable bulls. As an example, consider the cost of insuring a bull valued at $10 000 against injury or death. Premiums, at 10% of the bull's value, would be $1 000 annually. 500 doses of semen could be processed for less than this amount. Having this semen stored ensures that calves can still be sired, even after death of the bull.
- Convenience whereby a syndicate-owned bull may be used in several herds simultaneously. Most breed societies allow a maximum of four share holders per bull.
- If a veterinarian is unavailable or your facilities are unsuitable for semen collection on your property, the unlicensed centre provides both at Wacol.
- Bulls placed on the centre receive the best care and fodder and are handled by experienced technicians.

Costs

Costs applying to this service are quite reasonable. For successfully processed semen, a charge of $1.00 per dose applies. There is no charge if processing is not successful.

Agistment charges are $50.00 per month. If a bull stays for less than a month, a rate of $2.00 per day applies.

For cattlemen with their own units, Wacol will maintain them for $5.00 per month, plus liquid nitrogen used, at 50 cents per kilogram. Storage can also be arranged using Wacol Centre containers. The cost is $5.00 per semen location. One semen location holds 300 straws. For smaller quantities, the charge rate is 3 cents per dose per month, the minimum charge being $2.00 per month. Liquid nitrogen units are usually available for hire to transport semen from Wacol to your property at $3.00 per trip plus the cost of liquid nitrogen.

Any further information can be obtained by writing or calling direct to the Officer-in-Charge, Wacol A.B. Centre, Grindle Road, Wacol.

Tickicide Subsidy Scheme ends

THE Minister for Primary Industries, Mr V. B. Sullivan, has announced the termination (from June 30) of the State Government's tickicide subsidy scheme for cattle producers.

The scheme was introduced in October, 1975, to help the beef industry following a severe downturn in prices due to loss of export markets.

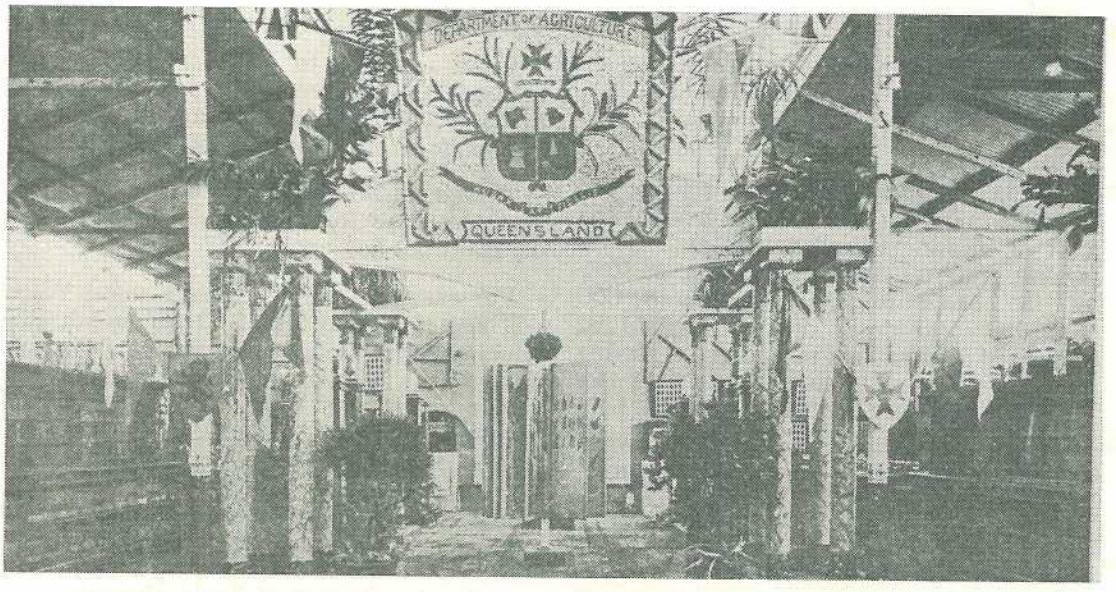
'The cost of this assistance to the Government has been slightly more than $4 million,' Mr Sullivan said.

'Following a recovery in prices for beef last year, State Cabinet decided in December to continue the subsidy but at half the previous rate to assist producers further until the return to reasonable price levels had been consolidated.

'There has been a marked improvement in the industry's situation in recent months and the industry is now on a sound footing.'

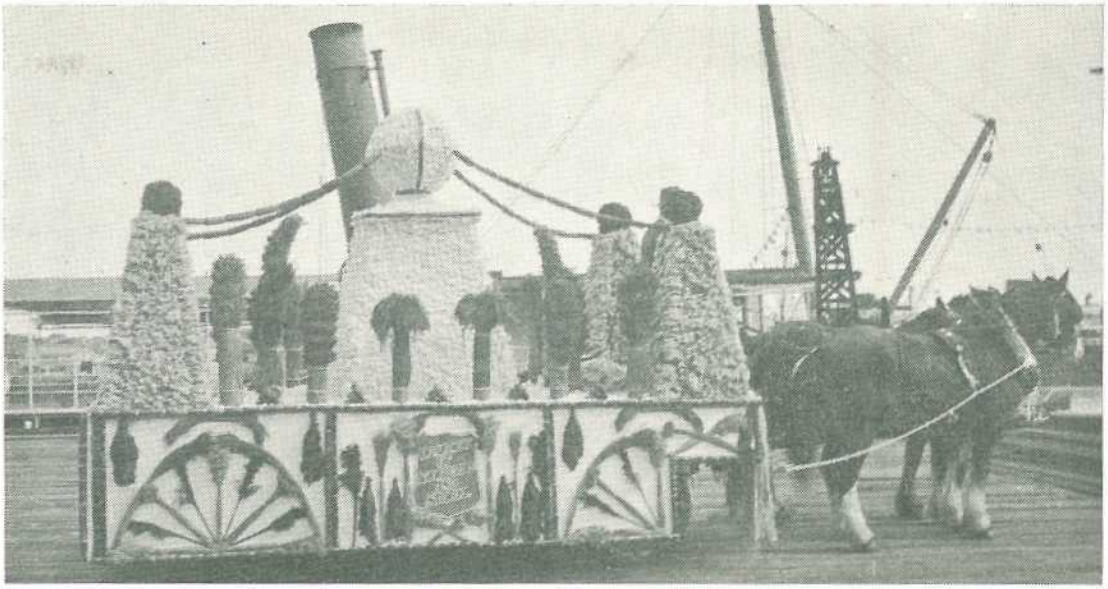
Mr Sullivan pointed out that considerable quantities of acaricides on which the subsidy had been paid still would be held by retailers.

They were required to pass on the benefit of this assistance to stockowners while those stocks remained.



D.P.I. displays reflect

Top. The Agriculture Department's 1897 International Exhibition display at Bowen Park. Above. A horse-drawn float outside the old university in 1920.



the changing times

HORSE-DRAWN trailers, cotton ships, plaster herefords, giant prawns and sophisticated audio-visual equipment have all been used at one time or another in D.P.I. displays.

No matter how diverse the materials used, the target of each exhibit has always been the same—to entertain as well as inform rural and urban Queenslanders.

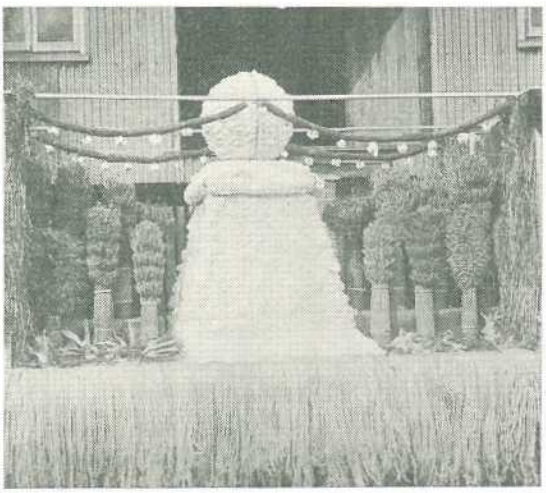
In the 1970s, a sophisticated public is demanding more sophisticated exhibits—exhibits that explain the importance of the continued growth of the State's primary industries.

The Department's 1979 R.N.A. exhibit will follow this theme. Some of the features of this year's show will include:

- A simulated trip in a helicopter used for mustering cattle.
- A display showing the steps from breeding and rearing calves through to the export market.
- A display on Queensland's poisonous plants.

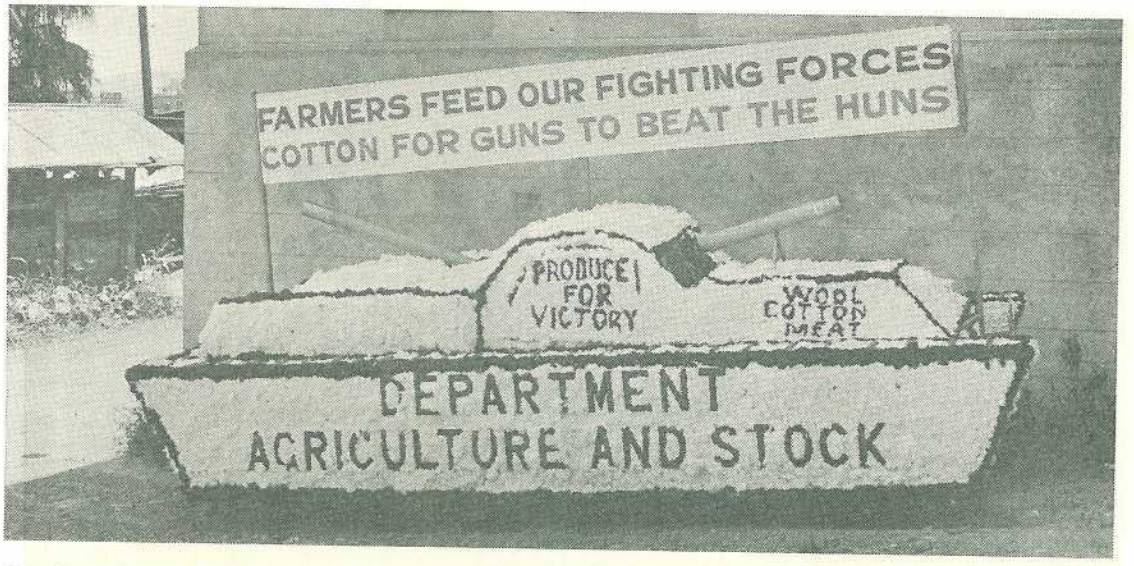
Specialist advice will be available from advisory officers who will be on duty throughout the show. Publications will also be distributed.

It promises to be the best show for 90 years!

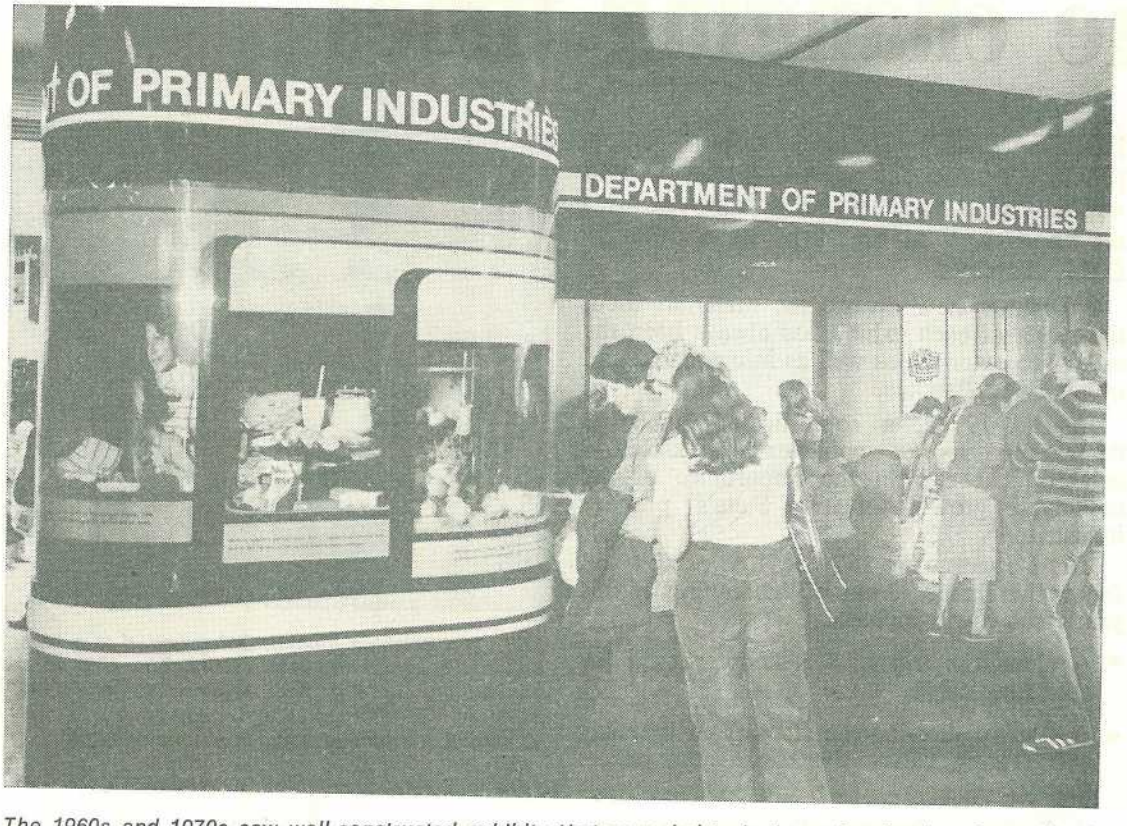


Top. The finishing touches being added to a horse-drawn display in the late 1920s. The ship in the background is the S.S. Otter—the Government yacht at the time.

Above. A produce display in the early 1930s.



The Department's float in the 1941 Liberty Week Procession.



The 1960s and 1970s saw well-constructed exhibits that appealed to both rural and urban Queenslanders.

Children still enjoy the opportunity to learn about Queensland's primary industries.

Specialist information on particular subjects is often available at the R.N.A. and some country shows.

The Department's school project material is always in demand.

75807—11

Queensland meat inspection

QUEENSLANDERS accept that their meat is safe to eat without question. It is, and we are fortunate—in many countries of the world the hygiene and quality of meat cannot go unquestioned.

The safety of our meat supply does not happen by chance—it is maintained by Queensland's meat inspectors. These skilled men work for the Department of Primary Industries' Slaughtering and Meat Inspection Branch (S.M.I.B. for short).

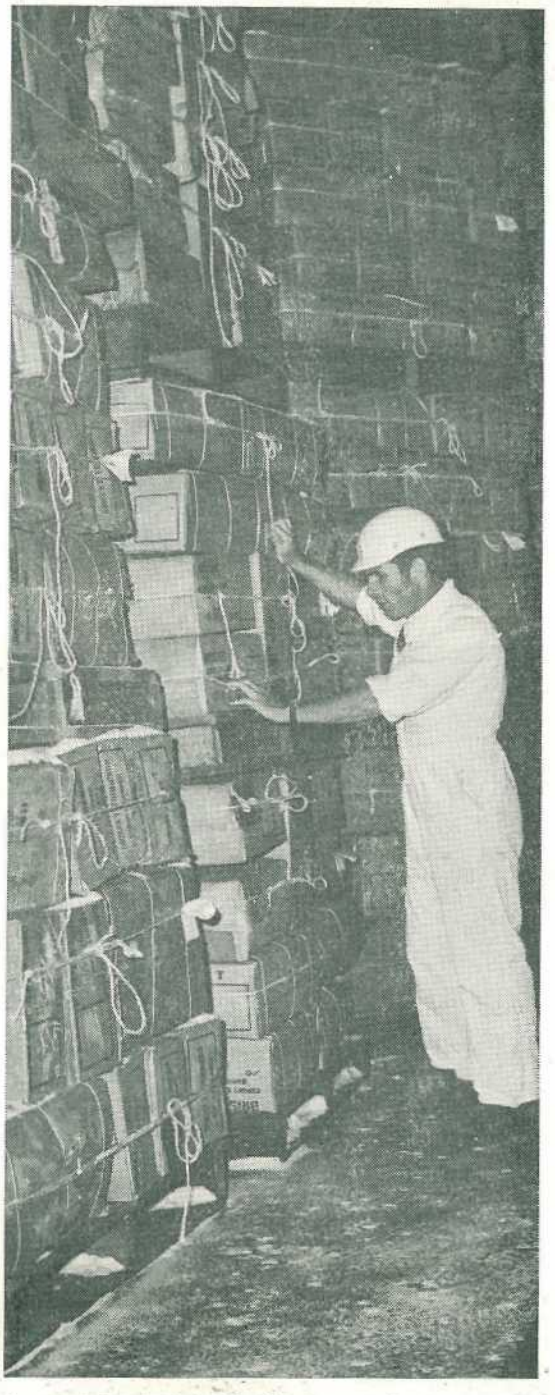
All meat, butchers' shops, abattoirs, smallgoods factories and vehicles for carrying meat are subject to inspection. Throughout the State, inspectors are stationed to work with the meat trade in maintaining the highest possible standards.

In parts of the State with small populations, itinerant inspectors move about the area, and a good standard of country slaughter-house has been achieved.

In major centres with large populations, inspectors are stationed at abattoirs and only meat from these or equivalent abattoirs can be sold.

When meat is brought into Queensland from other States it must be from abattoirs where the standard of facilities and inspection is equal to Queensland's own. The Director of

by W. R. Ramsay, Slaughtering and Meat Inspection Branch.



A meat inspector checking meat in cartons for damage.

Slaughtering and Meat Inspection Branch makes inspections to certify that this is so—as well as administering Slaughtering and Meat Inspection Branch's staff of four veterinarians, 150 inspectors and eight clerks.

Some areas of the State are served solely by meatworks operating for the export market. Throughout Queensland much of the meat prepared for export is marketed locally. In some export works, State Meat Inspectors share responsibility with their colleagues employed by the Commonwealth Department of Primary Industry (the authority for inspection of export meat).

Only animals which are healthy are allowed to be slaughtered. Diseased animals are condemned or sent away for treatment.

After animals are slaughtered and dressed, inspectors carry out a detailed examination of all organs and important lymph nodes. As a result, the diseases which can be transmitted from animals to man are eliminated. Such diseased material is condemned, heat treated and rendered into fertilizer or meat meal.

Detailed inspection

In dressing carcasses, there are many opportunities for dirt to be transferred from the animals hide etc. to the edible meat. Because of this, S.M.I.B. inspectors are careful to supervise the way the slaughtering is done. To help the industry, S.M.I.B. staff has developed techniques for hygenic slaughtering and has also prepared illustrative slides for industry use. These are borrowed frequently from as far away as New Zealand as well as other Australian States.

These efforts bring results. C.S.I.R.O. independently surveyed the bacterial status of carcass meat in Brisbane. To quote their 1975 report—"It was found that the surface bacterial populations on carcasses were generally very satisfactory". Queensland is the only State where the results of such scientific checking have been published.

When meat reaches the standard required it is branded with a red health stamp to indicate this. There are other red stamps used on meat (abattoir of origin, the 'lamb' stamp) but red is only used where the meat reaches the health requirements. So the presence of the red dye on meat shows that it is health approved.

General eating quality in beef is identified by blue marks under the free blue ribbon grading scheme supervised by S.M.I.B.

Beef of similar quality that has been tenderstretched or electrically stimulated is marked green. Genuine lot-feed beef is identified with a purple dye. These colour grading systems are voluntary. The colour marks are made with harmless dyes.

In Queensland, meat inspectors check right down the line until meat is delivered into the consumer's hands: even the production of edible fat for making margarine is supervised. Butchers' shops are checked regularly. Generally, the butcher and the inspector work well together. The butcher knows that the things the inspector is looking for to keep meat safe are the very things that ensure that the meat has a long shelf life which is good for the butcher's business.

Animal disease control

Some animal diseases—like brucellosis of cattle—can only be detected by routine blood sampling and testing.

The origin of these diseases and their extent needs to be recorded. S.M.I.B. staff carry out these responsibilities which are most important to the whole nation.

These various services and responsibilities constitute the practice of classical meat inspection but S.M.I.B.'s interests and responsibilities range beyond this.

Meat quality

For many years, S.M.I.B. has operated the voluntary blue ribbon grading scheme for beef, the only one of its kind in Australia. Recent modifications to the scheme have resulted in grading also identifying the yield of salable beef.

S.M.I.B. believes that it has a responsibility to promote quality in meat. For enhanced tenderness at insignificant cost the Branch has a project for encouraging the trade to use the tenderstretch process. Inspectors are prepared to work with butchers to demonstrate the technique.

Again on a voluntary basis, but involving 100% of the trade where applicable, S.M.I.B. inspectors check that lambs are indeed lambs and supervise the application of the 'Lamb' brand (red).

Poultry are not overlooked. As well as making routine visits to processing plants to check on health aspects, inspectors also check that excess water is not included with birds in the processing.

Education

S.M.I.B. officers are keenly interested in education activities:

- For consumer groups, inspectors frequently give talks and show films on meat quality and cooking.
- For butchering apprentices at the Food School, staff regularly participate in courses on meat hygiene.
- For the Correspondence School, the course notes and study material for the proposed new meat inspection course were prepared by S.M.I.B. officers.

Pet food

Some important animal human diseases have their origin in dogs. While it is undesirable to store pet food with human food this often occurs through ignorance or force of circumstance. Thus there are two basic reasons for the control S.M.I.B. exercises over pet food knackeries, shops, kangaroo depots and the like.

Agricultural shows

Inspectors are sometimes called on to demonstrate meat cutting. Because of their knowledge and position of impartiality they are often invited to judge carcass competitions.

S.M.I.B. favours Australia-wide uniformity in judging techniques and a scientific approach where possible. As an example of this, S.M.I.B. is fostering the Australian Meat Board's measurement system of judging beef carcasses and helping to improve it where possible.

Bridging the gap

Meat inspection stands in a unique position between cattle producers and consumers, thus spanning the meat trade. S.M.I.B. believes this position means it should and can serve a useful public and scientific function in this area. For example, in the last few years its officers have liaised closely with cattle producers, abattoir management, the Australian Meat Board and C.S.I.R.O. officers in studies on bruising in cattle—a large source of loss in the industry.

These studies have shown that:

- Horns cause bruises. Horned cattle had twice as much bruising as hornless.
- Tipping is ineffective in preventing horn induced bruising.
- In some circumstances, bruises are caused in abattoirs.
- Females suffer more bruising than males under the same conditions.
- More recent studies have been related to how fat is distributed and measured in beef carcasses and how transport and stress influence pork quality. Both of these have great practical importance.

Collaborative, applied research of this sort is becoming a greater part of S.M.I.B.'s activities.

Slaughtering and Meat Inspection Branch is involved in trials with the Australian Meat and Livestock Corporation's automated system of carcass classification. The Branch has also developed a system of classifying beef carcasses manually. This system has been accepted as an alternative way in which to classify carcasses. This is an important area of Branch activity that will, no doubt, become vital to the continued profitability of the industry.

Forward looking

S.M.I.B. believes that there may be a place for a feedback system of consumer preference, market price information and carcass characteristics to primary producers. Such systems operate for a small fee in the U.S.A. and Canada and are very popular.

S.M.I.B. officers are currently gathering information on how such services work throughout the world and have begun a State-wide survey of beef market requirements in Queensland.

Although it was little known in the past, more and more people are becoming aware of the important functions of the well-organized Slaughtering and Meat Inspection Branch of the Queensland Department of Primary Industries.

Understand cattle worms

by R. Winks, Division of Animal Health, C.S.I.R.O.

AN understanding of cattle worms will help Queensland graziers get on top of this continuing problem.

In this article, most types of helminths (worms) are considered, but the main emphasis is placed on gastrointestinal roundworms with a concluding section devoted to *Ostertagia ostertagi*. The detailed field studies on the larval stages of the roundworms and their survival were made in South-east Queensland. The general principles, however, are applicable to other regions of Australia.

It is very important to emphasise that if owners are to control worms efficiently and economically, they must overcome the traditional habit of relying solely on anthelmintics (drenches) to do so. They must understand the life cycles of worms and the climatic and husbandry conditions that regulate their prevalence and indicate the necessary approach for their control.

Too many stock owners mistakenly believe that a wonder drench is the be all and end all to the problem.

The unnecessary use of drenches is a wasted expense. Also, if calves are not treated until they show signs of disease their tissues may be so severely damaged that treatment will not give significant improvement and recovery will be slow. Armed with knowledge and understanding of worms you will be better equipped to anticipate when your stock will become infected.

Worms

Three main types of worms occur:

Nematodes—roundworms.

Trematodes—flat and conical worms—flukes.

Cestodes—segmented worms—tapeworms.

Roundworms and flukes cause the most harm; tapeworms play a very minor role.

Incidence

Roundworms normally exist throughout most of Australia; they require relatively moist conditions and are most prevalent in the coastal and subcoastal regions with annual rainfalls of 750 mm or more. During suitably wet years, outbreaks do occur in drier areas further inland.

Parasites can be a cause of serious economic loss in both beef and dairy cattle. The greatest monetary loss results from the failure of young cattle to grow at a normal rate following infection. Deaths occur with heavy infection.

The varying climatic conditions between northern and southern Australia favour different worms. The more important species (see diagram 1) are:

Northern Australia—summer rainfall

Haemonchus placei (stomach worm)
Cooperia spp. (small intestinal worm)
Bunostomum phlebotomum (hookworm)
Oesophagostomum radiatum (nodular worm)

Southern Australia—winter rainfall

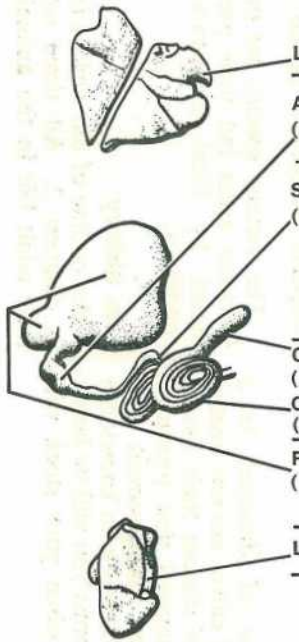
Ostertagia ostertagi (small brown stomach worm)
Trichostrongylus axei (hair worm)
Cooperia oncophora (small intestinal worm)

The various species are present in the less favoured areas but their prevalence is determined by local temperature and rainfall conditions.

Life history

An outline of the various life cycles is given in diagram 2. All three worm types spend their adult life in the animal. Eggs pass out

WORMS OF CATTLE



ORGAN	SCIENTIFIC NAME	COMMON NAME	DELAY TO EGG LAYING (days)	WORM BURDEN (death)	FAECAL EGG COUNT (drench)
LUNGS	DICTYOCAULUS VIVIPARUS	LUNG WORM	22		
ABOMASUM (stomach)	HAEMONCHUS PLACEI	STOMACH WORM-BARBER'S POLE	28	5-10000	100-1000
	OSTERTAGIA SPP.	SMALL BROWN STOMACH WORM	23	20-80000	300
	TRICHOSTRONGYLUS AXEI	STOMACH HAIR-BLACK SCOUR	21	30-50000	100
SMALL INTESTINE (runners)	BUNOSTOMUM PHLEBOTOMUM	HOOK WORM	56	500	50
	COOPERIA SPP.	SMALL INTESTINAL WORM	14	50000	1000
	TRICHOSTRONGYLUS SPP.				
	NEMATODIRUS SPP.	THIN NECKED BOWEL WORM	20		
	STRONGYLOIDES PAPILLOSUS		9		
	MONIEZIA SPP.	TAPEWORM	37		
	IMMATURE PARAMPHISTOMES				
CAECUM (blind gut) COLON (large intestine)	OESOPHAGOSTOMUM SPP.	NODULAR WORM	35	1000-2500	50-400
	TRICHURIS SPP.	WHIP WORM	41		
RUMEN & RETICULUM (paunch & honeycomb)	CALICOPHORON CALICOPHORUM	CONICAL OR STOMACH FLUKES	70	30000 IMMATURES	IMMATURE
	PARAMPHISTOMUM ICHIKAWAI				
	CEYLONOCOTYLE STREPTOCOELIUM				
LIVER	FASCIOLA HEPATICA	LIVER FLUKE	50		

FLUKE	SNAIL INTERMEDIATE HOST	SNAIL SHAPE
CALICOPHORON CALICOPHORUM PARAMPHISTOMUM ICHIKAWAI CEYLONOCOTYLE STREPTOCOELIUM	PYGMANISUS PELORIUS SEGNITILIA ALPHENA GLYPTANISUS GILBERTI	ROUND KEEL SHARP PLANOCONVEX SHARP WEDGE-SHAPED
FASCIOLA HEPATICA	LYMNAEA TOMENTOSA	RIGHT-HAND COIL

Diagram 1.

in the dung and development occurs outside the host. Roundworms undergo this development within the dung pat while flukes and tapeworms undergo development in an intermediate or second host, namely, a snail and a nonparasitic oribatid pasture mite respectively. Lungworm eggs hatch within the calf and the first-stage larvae are found in the dung.

Roundworms

In the presence of oxygen and moisture in the surface layers of the dung pat, development occurs within the egg at the right temperature and proceeds after hatching to the infective third larval stage which is the only one able to infect the calf. This infective larva retains the skin of the second-stage larva enabling it to resist desiccation.

The infective larvae, mainly situated in the centre of the dung pat, require a film of moisture to escape, and become trapped as the outer layer of the pat dries. The pat then serves as a miniature incubator and insulates the infective larvae against fluctuations in environmental temperatures. Falls of 50 mm or more of rain are required to penetrate the dry outer crust of the pat and provide the necessary film of moisture for the infective larvae to escape to the surrounding grass. Larvae accumulate in pats until rain falls when large numbers of larvae are released on to the pasture. As larvae move at random, however, the total population in a pat does not escape after one fall of rain but waves of release occur after a number of falls.

Larvae within the pat and on pasture have limited survival times as indicated in diagram 2.

Most roundworm larvae infect their host by being eaten with pasture. Hookworms penetrate through the skin and are more prevalent in wet and muddy areas.

Flukes

Liver and stomach flukes are dependent on the presence of the relevant intermediate snail hosts. Stomach flukes are fairly universal whereas liver flukes are mainly restricted to areas of South-east Queensland and more southern regions. Stomach fluke snails prefer 'gilgai holes' and irrigation areas. Liver fluke snails prefer slow-flowing streams and pools.

General

After ingestion the parasites develop within the calf to the egg-laying stage and eggs are again passed in the droppings after time intervals as set out in diagram 1.

Host

Susceptibility and incidence of infection

This is dependent on the interaction of a number of factors:

- Age and resistance of the animal.
- Nutrition.
- Rainfall.
- Stocking rate.

Age and resistance

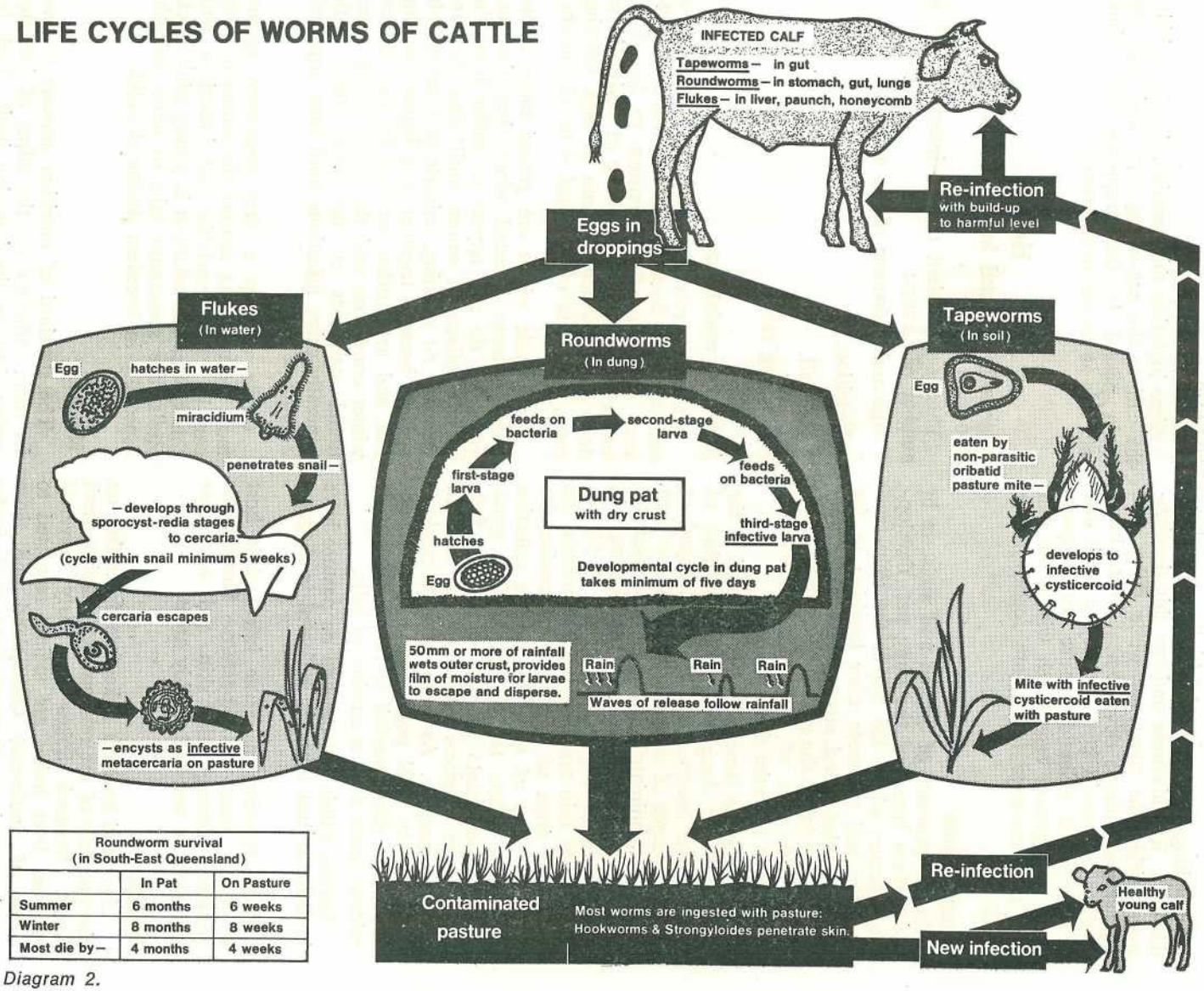
Animals survive infection by developing a resistance and throwing off their worms. Resistance develops after exposure to low level worm burdens. The majority of outbreaks in dairy cattle, which are run at high stocking rates, occurs in calves aged 4 to 12 months.

Beef cattle which are grazed more extensively become infected when they first eat grass but do not appear to suffer from the harmful effects of worms until after they are weaned. At weaning, animals of a susceptible age are brought together at a higher stocking rate and are further stressed by the adverse winter conditions and the deteriorating nutritional standards at this time. Beef cattle generally carry infections until they approach 2 years of age.

Cattle develop a firm resistance against most worms; that against the stomach worm can be rather variable and infections with this species can establish in young adult stock. Resistance sometimes fails in adult animals, especially in breeders during drought.

Nutrition

The standard of nutrition appears to have its main influence on the effect of infection rather than on the infection itself. Well fed animals are generally better able to tolerate infections.



Roundworm survival (in South-East Queensland)		
	In Pat	On Pasture
Summer	6 months	6 weeks
Winter	8 months	8 weeks
Most die by –	4 months	4 weeks

Diagram 2.

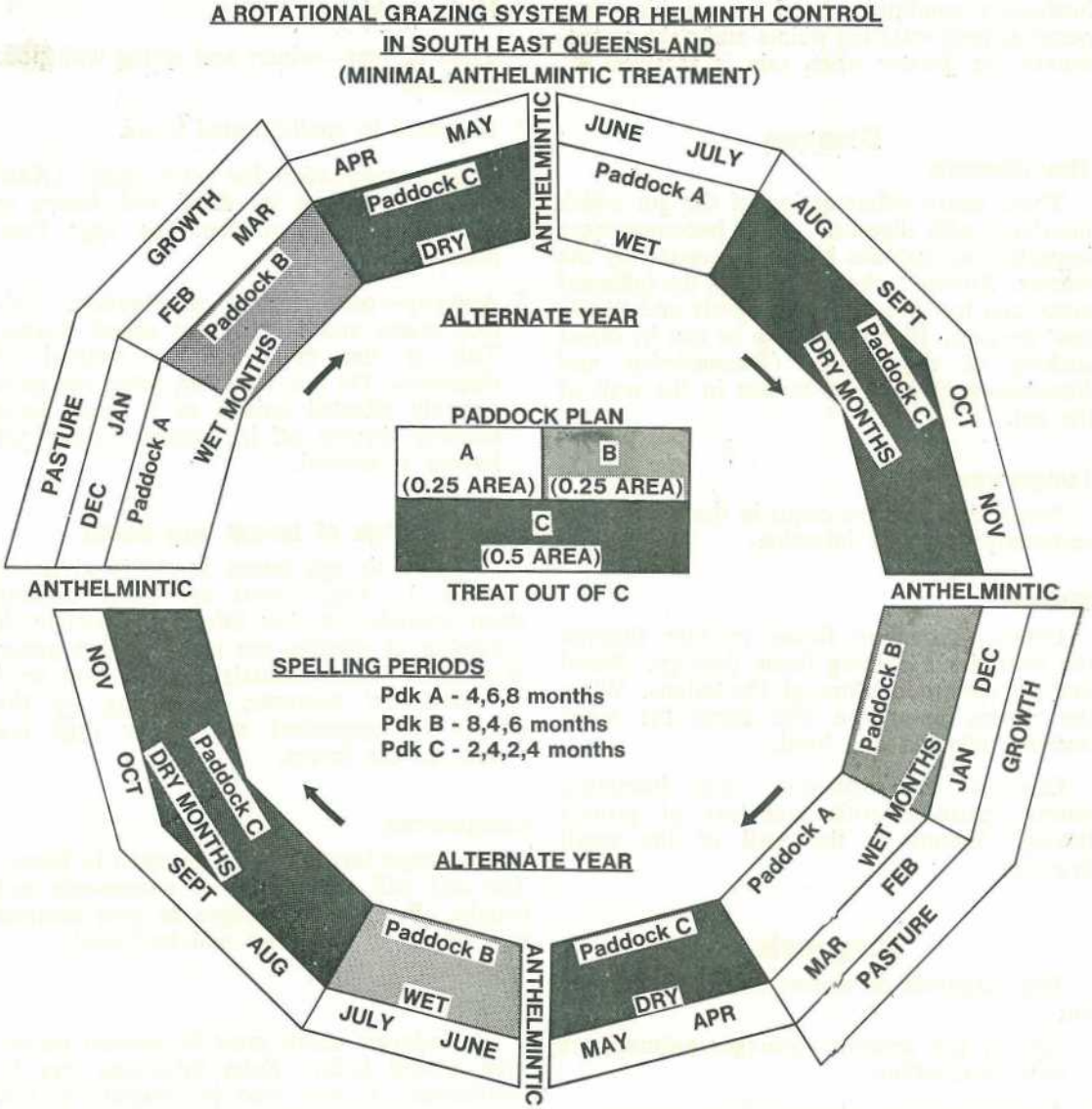


Diagram 3.

Rain

Rain is a most important factor and worms are most prevalent in high rainfall areas and during wet periods. During dry periods, infective larvae are stored up in pats to be released in large numbers when rain is received. Rain facilitates the escape of larvae from dung pats resulting in the establishment of new infections with further contamination of the pasture.

Stocking rate

More pats are deposited per unit area of pasture as the stocking rate increases and worms are more likely to be ingested as stock regraze the pasture more regularly. Higher stocking rates are therefore generally associated with greater pasture contamination and heavier worm burdens. As beef cattle husbandry becomes more intensive, worms become more significant. Under extensive

husbandry conditions, local overstocking does occur around watering points and risks of outbreaks are greater when rain is received.

Disease

Roundworms

These cause inflammation of the gut which interferes with digestion. This becomes more important as appetite is also depressed by the worms. Protein leaks out through the inflamed areas and low blood protein levels and 'bottle jaw' develop. Blood may also be lost by direct sucking of the worms (*Haemonchus* and *Bunostomum*) or from lesions in the wall of the gut.

Lungworms

Pneumonic changes occur in the lungs, with secondary bacterial infection.

Flukes

LIVER. Immature flukes migrate through the liver tissue causing tissue damage. Blood and protein are lost through the lesions. When the worms enter the bile ducts the latter become inflamed and hard.

CONICAL OR STOMACH. The immature worms cause enteritis and loss of protein through lesions in the wall of the small intestine.

Diagnosis

The diagnosis of worms in cattle is based on:

1. Age of the animals—younger animals are more susceptible.
2. Appearance and history of the animals:
   - Harsh coat
   - Poor growth rate
   - Loss of appetite
   - Diarrhoea (dirty tail)
   - Bottle jaw.
3. Environmental conditions to which they have been exposed:
   - Recent rain
   - High stocking rate
   - Time of year—winter and spring with poor nutrition
   - Exposure to snail-infested areas.
4. Faecal examination for worm eggs. (Need at least 30 gram jar filled with faeces to exclude air and prevent the eggs from hatching.)
5. Autopsy—post mortem examination. Collect, count and identify the actual worms. This is the most reliable method of diagnosis. Do not, however, select the most severely affected animal as it might have recently thrown off its worms without yet having recovered.

Shortcomings of faecal egg count

A guide to egg count levels is given in diagram 1. Egg counts are fairly reliable when animals are first infected, especially if a number of samples are taken from a group of animals. When animals develop some level of resistance, however, egg-laying by the worms is suppressed and fewer eggs are present in the faeces.

Lungworms

First-stage larvae can be detected in faeces. The calf will show signs of pneumonia and coughs. Pneumonic changes at post mortem and worms in the lungs will be found.

Flukes

The relevant snails must be present on the area grazed before fluke infections can be considered. It may also be possible to find immature stages of flukes on the grass blades.

LIVER. Eggs can be found in faeces—counts are normally low. At post mortem get fibrosis of bile ducts which contain flukes and encrustations of calcium—described as 'pipe stem liver'.

STOMACH. These flukes are pathogenic as immature worms which can often be found in the dung although no eggs are present. At post mortem see immature flukes in the small intestine.

Control

As it is almost impossible to maintain cattle free of worms under natural conditions, the aim of control is to maintain parasites at a level which stimulates the development of resistance while causing minimal damage to the well-being of the animal. Beef cattle run extensively probably approach the ideal situation as they graze large areas, pick up few larvae and develop immunity without being markedly affected. Under more intensive husbandry conditions, however, parasite populations reach higher levels.

Control measures are based on a combination of:

- Treating with anthelmintics.
- Pasture and animal management.

Anthelmintics

Immature worms generally are less susceptible to anthelmintics. Therefore, when treating after rain, a delay of 3 weeks is advisable before treatment. Stockowners should also ensure that they use an anthelmintic that will remove the species of worms present in their herd. All anthelmintics available are not effective against the immature and adult stages of all worms. Anthelmintics that remove roundworms do not necessarily remove flukes.

Anthelmintics are used to remove the worms present in the animal but have practically no residual protective effect. Animals become reinfected when they graze contaminated pasture unless they have developed an immunity to the establishment of worms.

Overuse of an anthelmintic may result in the development of resistance by the parasites and decreased efficiency of the drug (resistance of sheep worms to some drenches is well recognised). Anthelmintics are also expensive.

Anthelmintics should be used as follows:

- To reduce worm burdens when pastures are heavily contaminated.
- To remove infections when overstocking is unavoidable.
- To remove infections from animals before being moved from a contaminated paddock to one that has been spelled.
- To remove worm burdens during drought to benefit the calf and reduce the contamination of the pasture. Infected dung pats will otherwise accumulate and a massive larval release will occur after rain.

Pasture and animal management

Management can be used to reduce the level of contamination on the pasture by:

- Spelling the pasture to allow time for most of the larvae to die before stock are returned to graze it. Periods of about 4 months are required.
- Grazing young, susceptible stock ahead of older cattle. The younger stock benefit from the better nutrition and the older stock which should be resistant reduce the level of pasture contamination by ingesting the larvae which emerge from the infected dung pats of the younger stock.
- Grazing sheep and cattle alternately where possible for 6 or 12 month periods. There is little cross susceptibility to the other host's worm species and worms die before the preferred host returns.
- Making sure that dung beetles are present. Dung beetles disperse the dung and reduce the numbers of larvae on the pasture.
- Avoiding fluke-infested areas—fence them off or drain them.

A rotational grazing plan, with minimal anthelmintic treatment, which is currently being tested experimentally for worm control is presented in diagram 3. This is designed for South-east Queensland where most of the annual rain falls between December and March and in June and July. The spelling periods are designed so that most of the larvae die before calves return to a paddock. Calves are treated out of paddock C, the dry months paddock, to reduce the contamination rate of the wet months paddocks A and B.

Ostertagia ostertagi

Although this species is less common in Queensland it can be important in some areas of the State. It differs from other worms in that larvae do not always develop directly to adults after ingestion. They may develop to adults and cause disease as do other worms. Alternately they may undergo only partial development and lie dormant in the wall of the stomach. Only one currently available anthelmintic is effective against the dormant larvae.

Larvae that hatch from eggs passed in dung in autumn and winter are most prone to undergo this suspended development (hypobiosis) after being ingested in spring and early summer. These larvae recommence development after a time and cause disease as adult worms, mostly in first calf heifers and older animals, the following autumn.

It is therefore important to avoid grazing in late winter and spring pasture contaminated during autumn and winter. Contamination can be minimized by:

- Treating twice with a 1 month interval in late summer–early autumn with an anthelmintic effective against the inhibited fourth-stage larvae.
- Treating in late July and moving the cattle to a pasture grazed by sheep for the previous 6 months.

The most successful method of prevention would appear to be a combination of these two treatments.

Sunflower rust being investigated

A Department of Primary Industries Plant Pathologist based in Toowoomba (Dr Joe Kochman) is making a major investigation of the disease, sunflower rust.

The disease, under certain conditions, had caused yield losses of about 70%. Fortunately, sunflower cultivars with a good deal of resistance were currently available.

Dr Kochman said he was studying mechanisms of rust resistance within plants. As an adjunct to this study, he was determining the composition of the sunflower rust population.

He said his work was necessary because the rust population could change, and currently available rust-resistant cultivars might not provide effective control of the disease.

Testing done so far had turned up only one race of sunflower rust, but additional races might be found as the work continued. At least four races were known to occur overseas. Some of the currently available resistant cultivars were susceptible to some of these races.

Dr Kochman said that, so far, rust samples had been collected from 29 sites on the Central Highlands and Darling Downs. The rust races were being identified by inoculating imported sunflower lines of known rust susceptibility with spores of each of the collected samples.

Some of the samples had been sent to Dr W. E. Sackston of McGill University, Montreal, Canada, so that the Queensland rust could be compared with world collections.

Results of the work would be useful to plant breeders in their efforts to produce new, resistant cultivars, he said.

Dr Kochman's work is being financed by a grant provided by the Oilseeds Research Council of Australia.

Septoria leaf spot control in celery

SEPTORIA leaf spot *(Septoria apiicola)* is the most common fungal disease of celery in the Granite Belt where 80% of Queensland's celery crop is grown. The disease is particularly serious after periods of wet weather.

Field trials have shown that Septoria leaf spot can be controlled with benomyl (Benlate) plus miscible summer oil, chlorothalonil (Bravo) or copper oxychloride.

Symptoms

Small, brown spots less than 3 mm in diameter first appear on the older then later on the younger leaves (plate 1). The centres of the spots soon change in colour from brown to grey, and pepper-like bodies just visible to the naked eye develop in them (plate 2). These are the fruiting bodies or pycnidia of the fungus and produce spores. When the disease is severe, the numerous spots coalesce. This causes withering and collapse of the leaves and spotting of the stalks (plate 3).

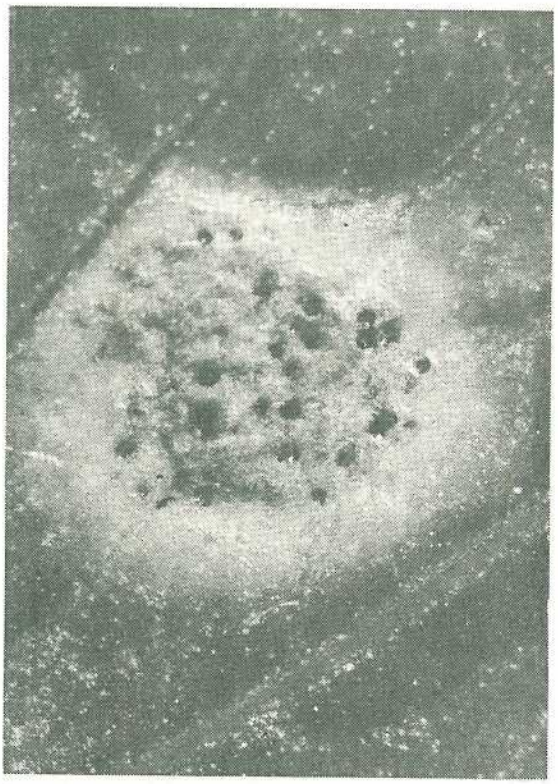


Plate 1. A celery leaf showing spots typical of Septoria leaf spot.

Source of infection and method of spread

The fungus may be carried on the seed and may survive in celery trash in the soil.

Spores ooze from the wet pycnidia on the diseased seed and are spread to the seedlings by water splash during rain or watering of the seedbed. In the field, healthy seedlings become infected from spores arising from celery crop residues or from other diseased plants.

by S. R. Dullahide, Plant Pathology Branch.

Celery requires regular irrigation and severe outbreaks of Septoria leaf spot may occur when the foliage is wet for long periods. It is therefore important that celery is irrigated under quick-drying conditions, generally mid-morning. One thorough irrigation under such conditions is preferable to frequent light waterings which keep the foliage continually wet.

Control

In the seedbed

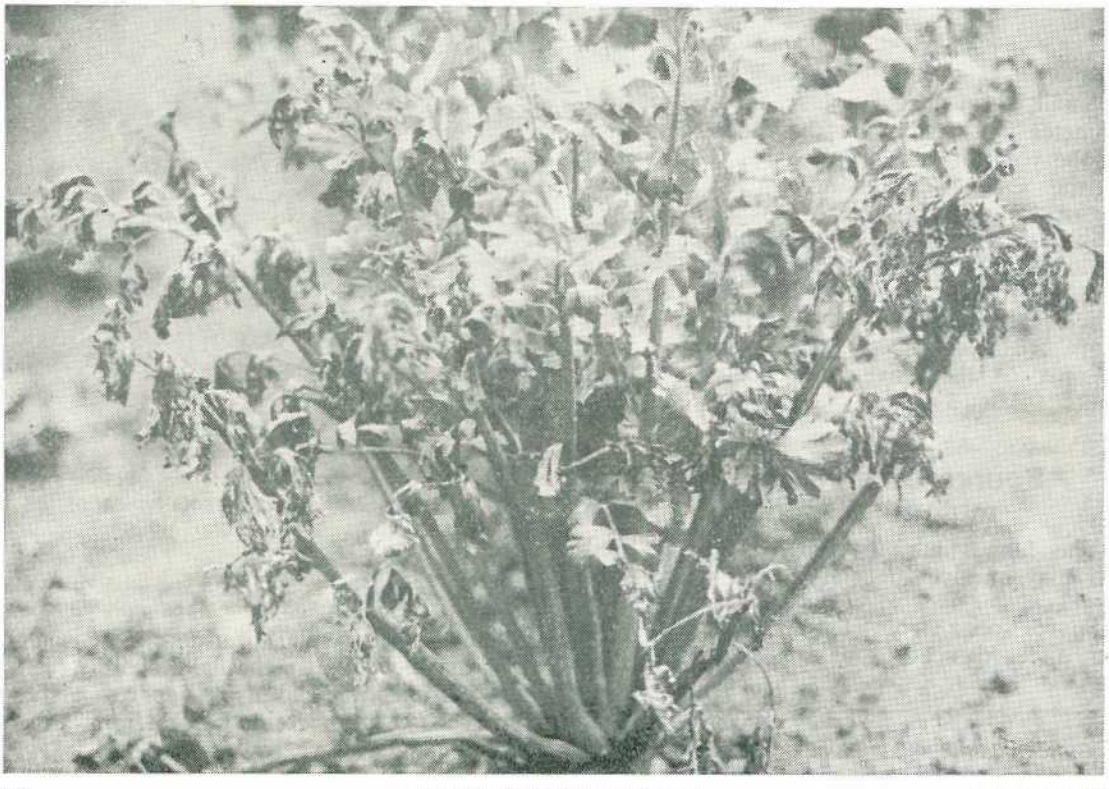
Establish the seedbed away from areas where celery is grown and fumigate it with methyl bromide (1 kg per 10 m^2).

Plant seed which has been treated in hot water at 50°C for 30 minutes and later dusted with 2 g captan (83%) per kg shortly before planting.

One week after emergence, spray the seedbed with chlorothalonil 72% (1 ml per L) and thereafter at weekly intervals at 2 ml per L.

Above. Plate 2. A Septoria leaf spot with dark fruiting bodies (pycnidia) of the causal fungus.

Below. Plate 3. A celery plant severely affected by leaf spot has a 'fired-off' appearance.



In the field

Since 1975, three field trials to test high volume application of fungicides using a variety of spray nozzles have been conducted.

Two trials were on farms where Septoria leaf spot had been a serious problem in the previous season. In these trials, benomyl plus summer oil, chlorothalonil and copper oxychloride applied every 14 days after transplanting gave very good control and were superior to benomyl alone, mancozeb or ziram.

In a third trial, plants were artificially inoculated with Septoria leaf spot fungus before spraying commenced and fungicides were applied every 5 to 14 days depending on weather conditions. In this trial, chlorothalonil was better than copper oxychloride or benomyl plus summer oil.

The following nozzle types and pressures were found to be equally effective.

Nozzle type	Size	Pressure (kPa)
Tee-Jet hollow cone ..	D2–25	1 650
	D3–25	1 000
	D4–25	400
	D4–25	500
	D4–25	1 000
Delvan 'Raindrop' hollow cone	4–25	1 000

Other combinations are available but it is important that the foliage is completely covered with fungicide (plate 4). The combination, together with the number of nozzles on the boom and travelling speed of the spray rig determine the volume of spray applied. This should increase from 400 to 1 200 L per ha to maintain thorough leaf cover as the crop increases in size.

Plate 4. Spraying a celery crop to control leaf spot.

SPRAY SCHEDULE

Fungicide—rate/100 litres	Time after transplanting	Litres per hectare
Bravo Flowable—160 ml	1 to 4 weeks	400
or		
Benlate*—50 g plus summer oil—500 ml	4 to 8 weeks	400–800
or		
Copper oxychloride (50%)—500 g	8 weeks to harvest	800–1 200

Chlorothalonil or copper oxychloride are recommended for the control of Septoria leaf spot and under most conditions will give good control provided spraying is commenced 7 to 14 days after transplanting into the field and repeated every 7 to 14 days. The shorter periods are necessary in wet weather.

When weather conditions are highly favourable for the disease, use chlorothalonil.

As resistance of *Septoria apiicola* to benomyl occurs elsewhere in Australia use benomyl only when the protectant spray schedule has been interrupted by wet weather and infection may have already occurred or when it is required for the control of Sclerotinia mould (*Sclerotinia sclerotiorum*). For this disease, Benlate is used at a dilution of 100 g per 100 L.

Cultural practices to complement chemical control

Remove and destroy diseased leaves and stalks to reduce the build-up of the disease.

Irrigate thoroughly in the early part of the day when foliage will soon dry.

After harvest, bury crop residues by ploughing deeply and destroy all volunteer celery suckers.

Biological warfare on heliothis grubs

THE Department of Primary Industries is waging biological warfare on the Heliothis grub, a major pest of crops and pastures.

In the Emerald area, good control of Heliothis grubs had been obtained by spraying them with a commercial virus preparation. The virus produces an infection in the young larvae and kills them.

While this method of biological control was not 100% effective, it gave effective control when used in conjunction with insecticide sprays and lessened farmers' dependence on insecticides.

In field trials carried out over the past two seasons in central and southern Queensland, the virus preparation known as 'Eclar' killed the young larvae.

A follow-up spray, based on the insecticide methomyl, then killed the large larvae. Heliothis eggs are comparatively resistant to most other insecticides.

The Heliothis grub was a serious pest of about 20 commercial crops including sorghum, cotton, maize, tobacco and lucerne. Farmers are looking at alternative methods of control as one of the two major species of Heliothis has developed a resistance to some chemicals.

The virus is sprayed on the crop, preferably during the early morning when there is a dew. The young Heliothis larvae soon become infected and die. As they decompose they scatter the virus particles over the crop which in turn infect other larvae.

Heliothis larvae are also cannibalistic and when a healthy one eats a weak, infected grub the healthy grub becomes infected with the virus. The virus is effective against Heliothis only and does not harm other insects. Some insects such as ladybirds are of benefit to the farmer as they also eat the aphid pests.

A mobile creep feeder for unweaned calves

by J. Edmunds, Dairy Cattle Husbandry Branch.

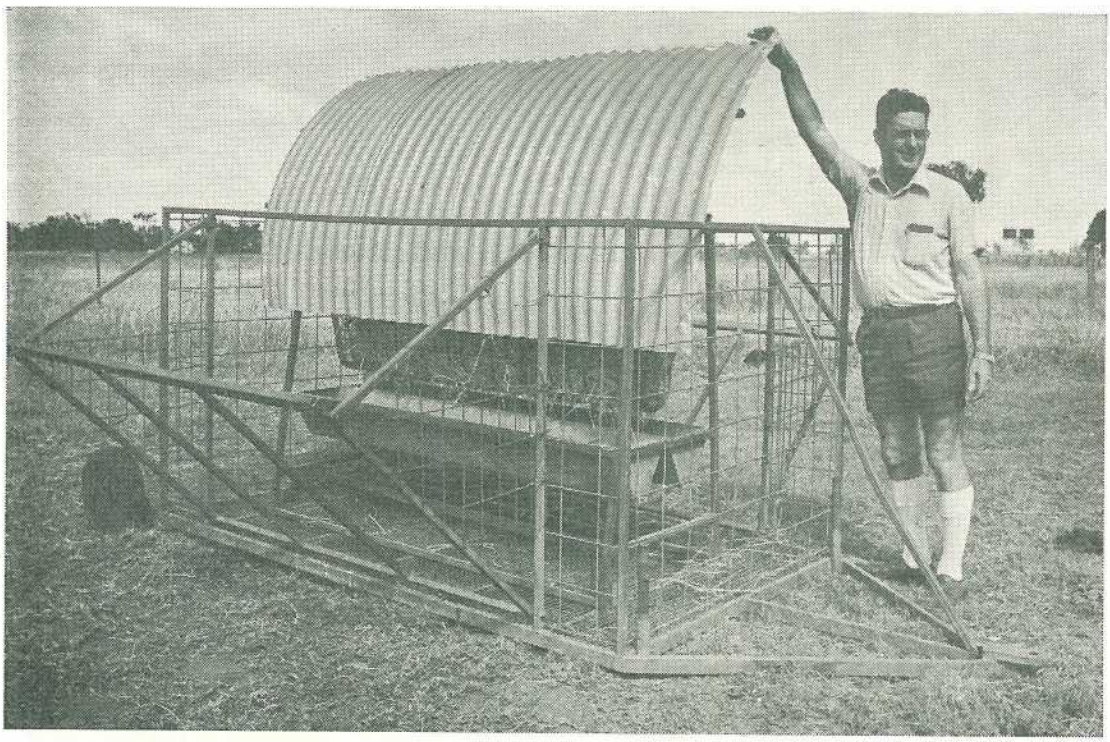
THE problem of admitting suckled calves to supplementary hay and grain and excluding their foster cows has been solved by the construction of a mobile creep feeder.

This has made possible the separate control of cow and calf nutrition levels in a suckler herd.

The control is a combination of neck bar height, distance from the feeder and vertical bar interspace. It is also necessary to block the triangular gap formed by the brace to the neck bar frame and the bottom fastening to the main cage of the creep with weld mesh. This keeps the feed out of reach of the cows.

Mobility is an asset in a creep feeder. It is simple to fence off a feeder with a high wire, or devise a narrow entrance in a fence as a static means of excluding cows. Rotational grazing makes frequent re-erection of this form of creep feeder a nuisance.

It was observed that calves would not walk on a floor of weldmesh or wooden boards, if the cage was fitted with a fixed axle. This raised the floor by the height of the wheel radius from ground level.



The author showing the hay rack access.

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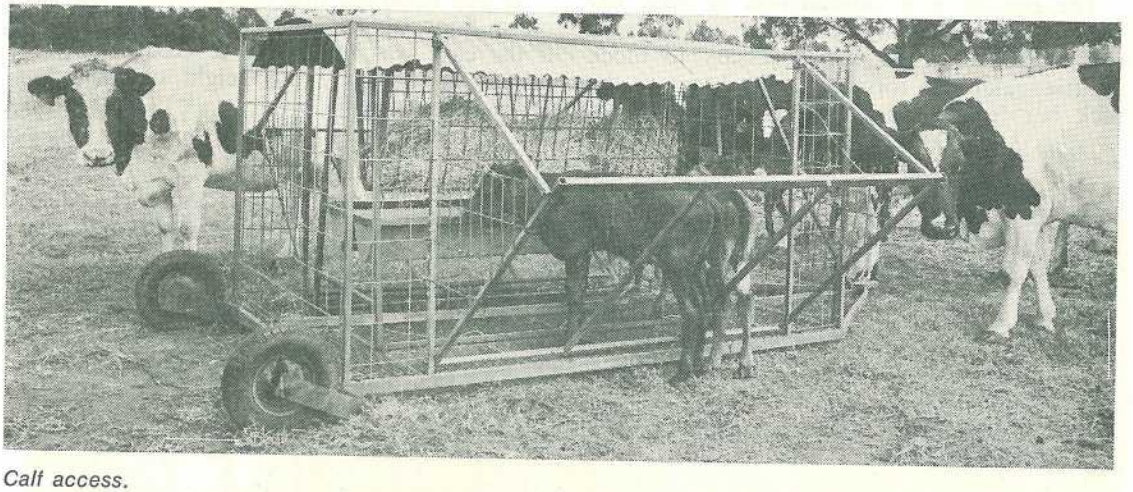
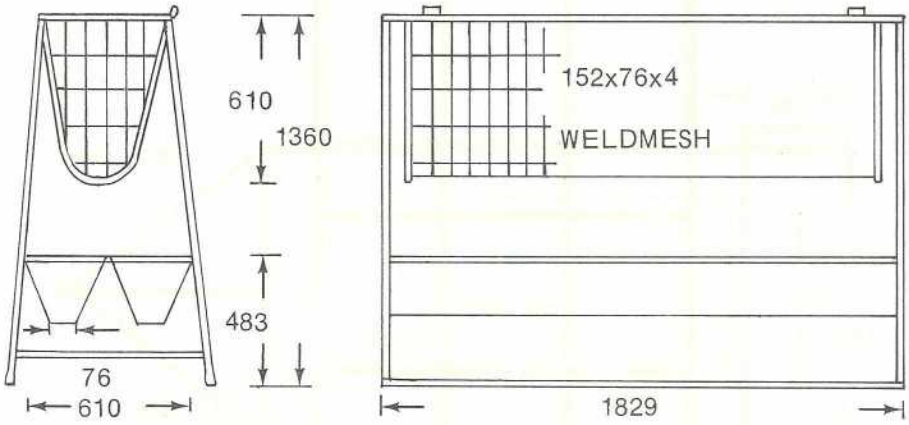
The unit is towed by a tractor.



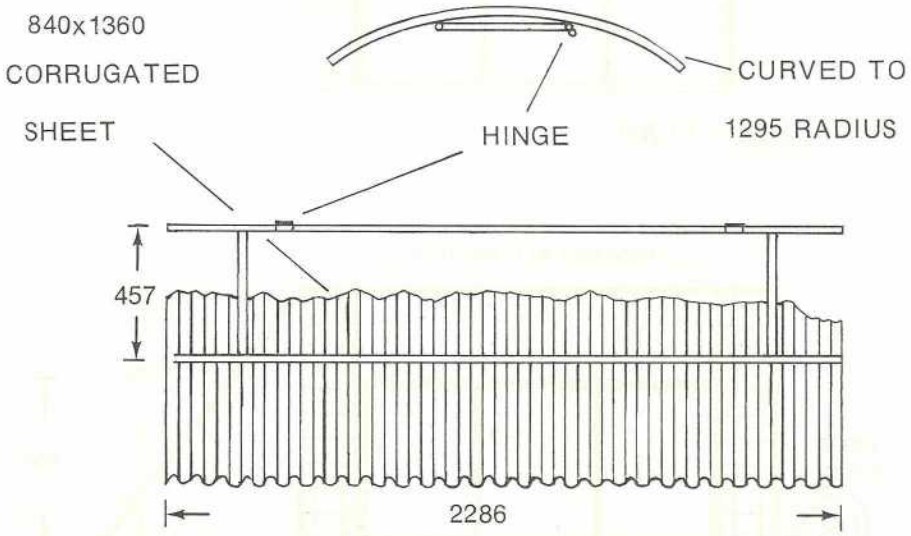
Calf access.

The swinging axle in the transport position.

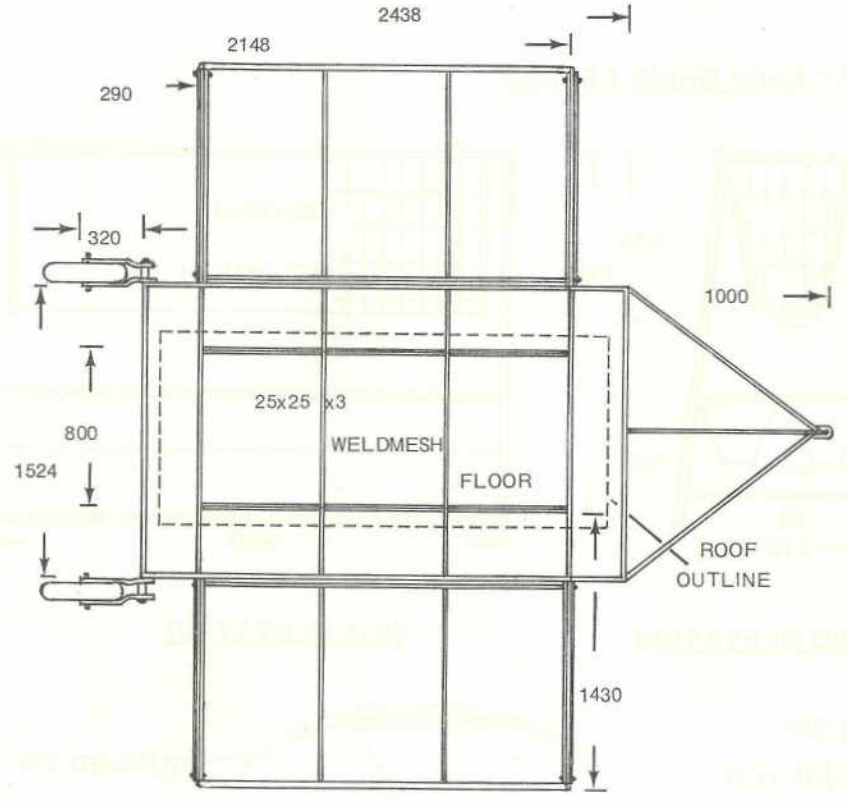
HAY RACK GRAIN FEEDER



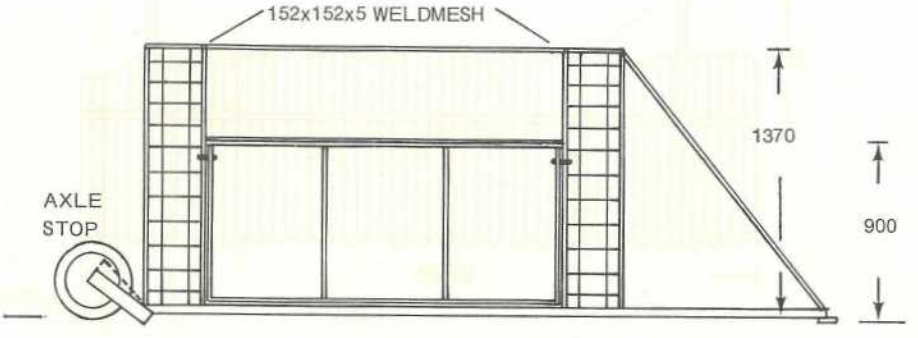
END ELEVATION SIDE ELEVATION



ROOF PLAN & END ELEVATION



CAGE – PLAN



CAGE – SIDE ELEVATION

To counter this, the swinging axle was developed, and a 25 mm² weldmesh floor fitted, to drop the floor to the ground for feeding out. One side of the unit can be lifted by one man, and the wheel swung under with the foot for transport. The steel bracket is hinged so that the inside strikes the cage frame in the transport position. The cage height is adjusted by a wedge, welded to the bracket. The unit is towed by a tractor.

The cage frame is built of 25 x 25 x 3 and 25 x 50 x 3 rectangular hollow section tube, and covered with weldmesh as detailed. The hay rack/grain feeder is a separate unit, bolted to the floor of the cage. It is designed to catch leaf fall from the rack in the trough below. This saves waste of the most nutritious part of the hay. This is particularly important with lucerne hay. The roof of the feeder is hinged, and can be lifted up to fill the rack with hay from the outsider.

This creep feeder is an original design, which was produced to solve the problem of measuring the intake of hay and grain by calves suckling foster cows in the paddock.

The feeder has the advantages of mobility, convenience and economy. The usual open trough or split oil-drum lacks its advantages.

This was part of the multiple suckling work done at Biloela Research Station from 1972 to 1977. Multiple suckling is becoming widely accepted as the best method of rearing calves. The Biloela work is associated with this trend. It has provided a great deal of practical information for the industry. One outcome has been the demonstration of the good growth possible from the method by the provision of supplements to calves while suckling. Supplementary feeding encourages early solid feed intakes and shortens the milk feeding period. This lowers costs.

Landsat aids land use

PRIMARY producers might be using satellite information in the future to plan their rural activities.

Landsat satellite information is being investigated to determine its suitability for planning the use of agricultural land.

Landsat has many uses. It presents a spectacular and detailed overview of terrain, vegetation and agricultural development. From overseas experience, it appears possible to map floods, droughts, over-grazing patterns and soil surveys. The detection of crop diseases and potential breeding sites for locusts is also feasible.

Different objects reflect different frequencies and strengths of light. It is on this principle that Landsat can identify objects from a great distance. Although still in the experimental stage, Landsat was used to predict last season's wheat crop in the U.S.S.R. with surprising accuracy.

Two operational Landsat satellites are presently orbiting the Earth at 920 kilometres every 103 minutes. They move across Australia from north to south. Another satellite was planned for 1981.

This new satellite would have more sophisticated sensory systems to overcome adverse weather conditions. It would be matched with improved computer interpretation facilities on the ground.

Why not be an owner-classer?

IN the St. George district, many good flocks are owner classed.

The owner has the advantage that he sees his sheep as lambs, in all stages of growth, woolly, shorn, fat and poor. He has the opportunity to observe faults that might perhaps go unnoticed at a single observation.

A man keen enough to do his own selection is likely to be enthusiastic and efficient in his husbandry and management throughout the whole year.

Classing trials have shown that graziers tend to select to a sheep they 'fancy' rather than sheep which are the highest producers. They have grown to accept a type of sheep as being the right commercial animal without proving how profitable their 'ideal' is in comparison with other sheep in the flock.

The best financial results in selecting Merino sheep are achieved by selecting for financial return per head. It is the return to the bank which counts.

When using visual selection this is best achieved by selecting to 'a type of sheep' rather than to 'a type of wool'. Consequently, it is necessary to keep the breeders (without conformation faults) that will give the best financial return while building up a flock.

There is a limit to fineness or strength which can be tolerated in any one flock, and consideration must be given to the environment in which the flock is run. Discounting climatic extremes, Queensland sheep reared on natural pastures mostly produce 20–23 μ wool (66's–60's count). This range can be well tolerated within a flock provided that each animal produces enough of it. This range is acceptable on visual counts for wool classed on objective measurement. Naturally, if a breeder is producing a fine wool flock he leans to fine wool and vice versa if he has a strong wool flock.

A grazier who is a competent manager and stockman can differentiate between fine, medium, and strong wools by visual appraisal and recognise hair or kemp. He is aware of faults on which most producers disqualify an animal as a breeder, such as overshot or undershot jaws, broken cud, light bone, bad legs, hocky legs, narrow hips, badly sprung ribs, devil's grip, etc. A classer's assessment of a sheep is largely done before the wool is considered.

The most accurate method of doing this is to test your visual classing against the scales. A random sample of the maiden ewes or young rams which have been run together should be visually classed and then fleeces weighed.

It is strange that there is so little desire by the producer to weigh or measure what he is buying as livestock, whereas he would not think of accepting a kilogram of meat from the butcher unless it was put on the scales and proved correct. It is only logical that we should prove our selection correct and accurate because it is the basis for profits.

The length by breadth by depth of the sheep shows its surface area and if it is growing a long staple of wool, it is very likely that it is a good producer.

All of these points are clearly visible and can be assessed accurately with the naked eye.

In summary, the process is to:

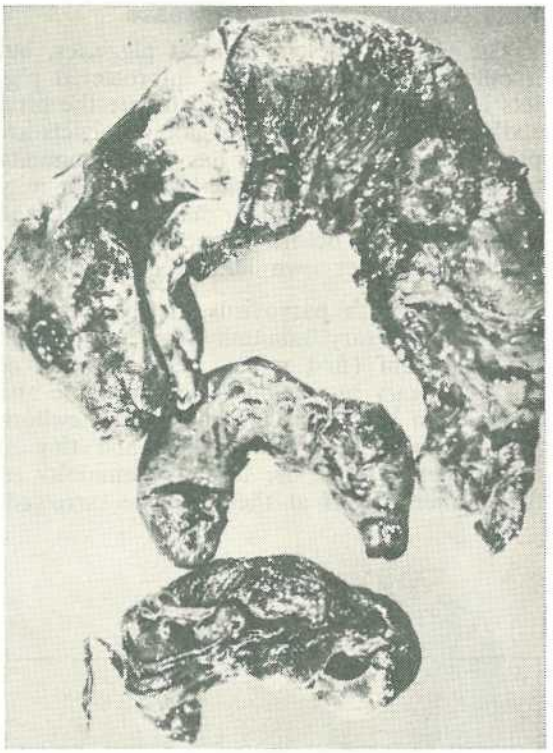
- Select for financial gain, not 'fancy' points.
- Continue to test skills against the scales.
- Base visual selection on those things that can be measured at a glance with the naked eye (body length, body depth, body width, length of staple).
- Select to a type of sheep rather than to a type of wool.
- Observe economic flock faults and select against them in the ewe flock and meticulously in the ram flock.
- Be prepared to observe measured results and change opinion of ideal sheep to coincide with these results.
- Learn by experience and not allow ideas to become too firmly fixed.
- Remember there is no sentiment in breeding.

by D. M. Allison, Sheep and Wool Branch.

Parvovirus infection of pigs

PARVOVIRUS infection is becoming an increasingly common disease problem in pigs throughout Australia.

It is a very complicated problem and much has still to be learnt about how it causes disease and therefore how it can be controlled.



Mummies of various sizes from the same litter are the most typical signs of parvovirus infection.

Signs of the disease

The most obvious feature of the disease is the presence of mummifying or mummified piglets (mummies) at birth.

Mummification is the process of sterile digestion of the tissues of piglets that die in the uterus after the skeleton has started to solidify. The degree of mummification varies considerably depending on the age at which the unborn piglet died. Early deaths lead to small, black, shrivelled, dry mummies that normally are not noticed in the afterbirth. Late deaths are larger and only partially mummified.

Parvovirus infection is also associated with stillbirths (piglets born dead but apparently normal and fully grown), weak piglets, small litters and an increase in the number of gilts and sows returning to service. Parvovirus rarely, if ever, causes true abortions.

The form of the disease within a herd is very variable. Sometimes parvovirus causes a small proportion of litters to contain a few mummies over an extended period; the litters of gilts and second litter sows being most commonly affected. It can also show up dramatically when a herd is newly infected, with large numbers of mummies and stillbirths in almost all litters born during a 5 to 8 week period.

In one recent case, an average of 1·5 piglets were born alive and 5·5 born dead per litter over a 5 week period. The figure for born dead included stillbirths and the larger mummies but many smaller, shrivelled mummies would not have been detected. The disease may range in seriousness anywhere between these two extremes. Included among the factors that determine the severity of the disease in a herd are whether sows and gilts are stalled individually or penned in groups, and whether the herd has had previous exposure to parvovirus.

by W. R. Webster, Veterinary Services Branch.

How parvovirus causes disease

The virus is present in most piggeries, but it only causes disease when unprotected piglets in the uterus are attacked before the fifty-sixth day of pregnancy. Developing piglets are protected if their mother has solid immunity to parvovirus. Solid, long-lasting immunity develops when the mother has been infected with the virus before service, as she then manufactures her own antibodies.

In herds with parvovirus, newborn piglets receive temporary immunity to the virus in the colostrum (first milk). The duration of this temporary protection is very variable and depends on how many antibodies the newborn piglet obtains from its mother, and this in turn depends upon the level of immunity of the mother herself at the time she farrowed, how long the piglet suckled during the first day of life and many other factors.

The young pig is protected against parvovirus infection until the temporary immunity falls below a certain level. Thereafter as soon as it comes in contact with the virus it is infected and develops its own long-lasting immunity. The infection has no visible effect upon the growing pig.

Parvovirus infection of pigs is comparable to German Measles infection in humans. German Measles is normally a relatively mild childhood illness. However, if a woman suffers from German Measles in the early stages of pregnancy (generally because she did not come in contact with the virus when she was a girl) part of the unborn child's brain is attacked resulting in the birth of a handicapped baby.

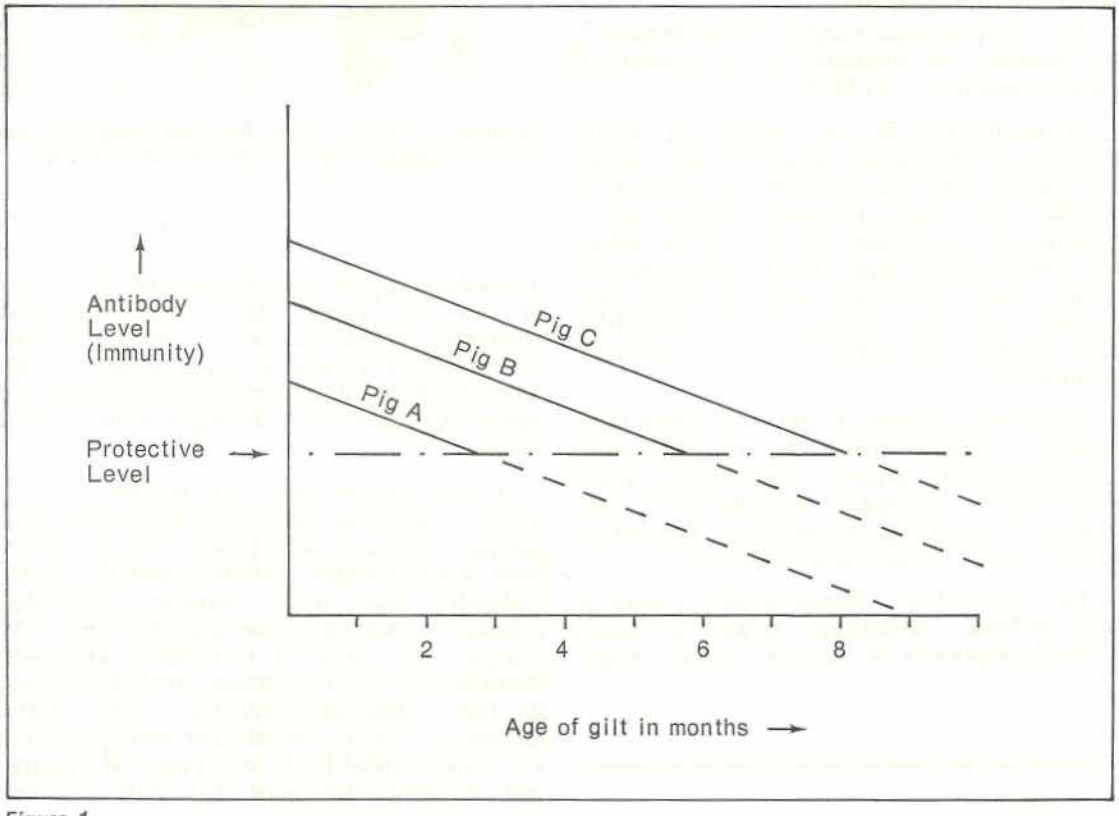


Figure 1.

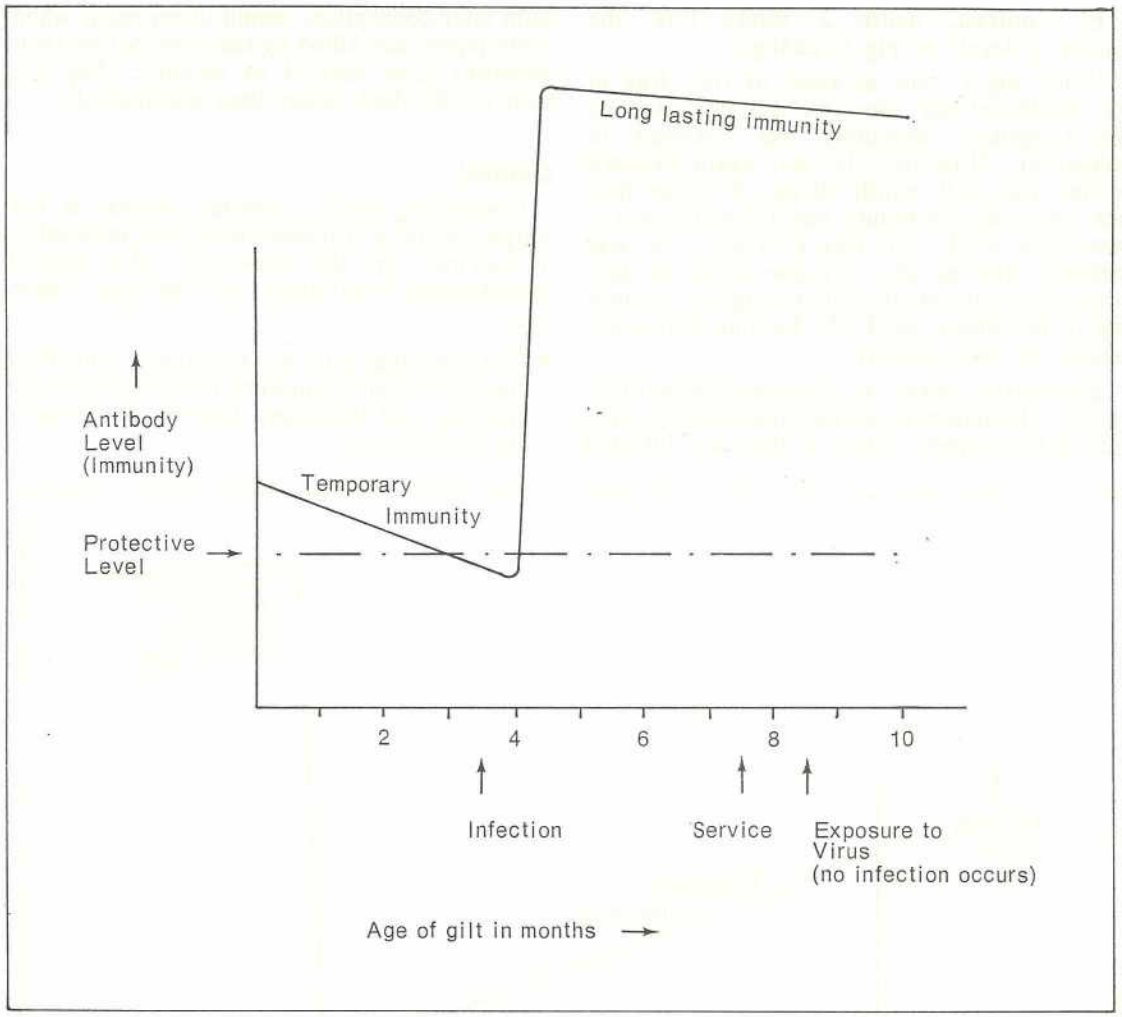


Figure 2.

In pigs, the duration of temporary immunity obtained by the mother at birth is the major factor which determines whether there is a parvovirus problem. Figure 1 shows the variation that occurs in the duration of this temporary protection.

Pig A received only a low level of immunity from colostrum and when its antibody level fell below the protective level (at the age of 3 months) it was susceptible to infection. By contrast, Pig C obtained a very high level of immunity at birth and it took 8 months to fall below the protective level. Approximately 75% of gilts lose their temporary immunity before they are 6-months-old. Obviously, the ideal situation is to ensure that all pigs lose their temporary immunity and become infected (permanently immune) before they are served.

Figure 2 shows how the immunity level of pig A changes after infection.

This pig was permanently immune to parvovirus from $3\frac{1}{2}$ months onward and therefore after service at $7\frac{1}{2}$ months of age her unborn piglets were fully protected.

By contrast, figure 3 shows how the immunity levels of pig C change.

When pig C was exposed to the virus at 3½ months of age, she was still protected by the temporary immunity she obtained in colostrum. However, she was again exposed to the virus at 9 months of age, 2 weeks after her temporary immunity had fallen below the protective level. On this occasion, she was infected, and as she was less than 56 days pregnant, some of the unborn piglets developing in her uterus died and became mummies, and some were stillborn.

Parvovirus causes an increased proportion of sows to return to service because the virus may kill complete litters if they are infected soon after conception. Small litters occur when some piglets are killed by the virus before their skeletons have started to solidify: they are then re-absorbed rather than mummified.

Control

Controlling such a complex disease is not simple. Work is at present underway to develop a vaccine. In the meantime, the control measures are based upon two principles. These are:

- Ensuring that gilts are not mated until they have lost their temporary immunity, become infected and developed long-lasting immunity of their own.

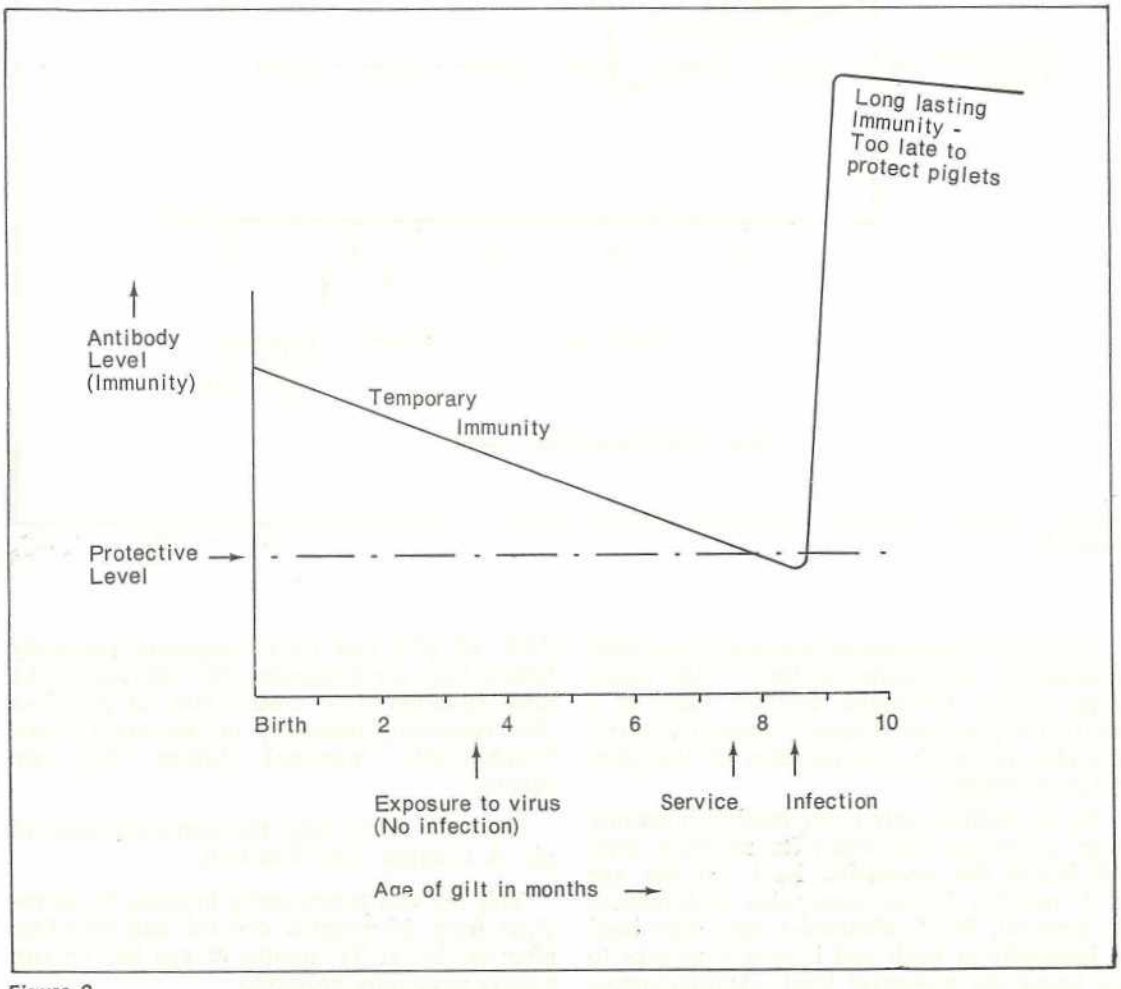


Figure 3.

- Avoiding pigs that carry the virus without producing antibodies to it.

Practical ways of controlling the disease that have been suggested by various authors include:

- Delay mating of gilts until they are 8-months-old when most will have lost their temporary immunity and become permanently immune. However, one of the ways in which herd reproductive performance is improved is by mating gilts earlier. Possibly earlier mating of gilts has led to parvovirus becoming a more common problem. One solution is to blood test gilts that are to be mated earlier than 8 months of age to establish whether or not they have developed their own immunity. Only gilts with high immunity should be mated. This is a time consuming operation and would only be possible with the co-operation of a laboratory who may charge for the service.

- Ensure that all gilts are constantly exposed to parvovirus prior to mating so that they are infected as soon as they lose temporary immunity. This can be achieved by housing them in groups in uncleaned pens vacated by an older batch of gilts. Additionally, they can be deliberately fed the dung of older gilts that is likely to contain parvovirus. For example, one suggestion that has been made is that twice a week a bucketful of dung taken from at least 12 older gilts or sows can be mixed up in water and poured on to the feed of 20 trough-fed gilts between 6 months of age and mating. It is uncertain what the non-specific side effects of this procedure would be.

- Surviving pigs from litters with mummies may be tolerant carriers of parvovirus. That is, the live virus survives within their bodies, but they do not manufacture their own immunity. It has been suggested that they should not be retained as breeders. It has also been suggested that the progeny of gilts should be excluded when selecting breeder replacements for the same reason. This would slow down the rate of genetic improvement in herds with a selection programme.

- When an outbreak of mummified foetuses occurs, nothing can prevent further cases in the immediate future. However, one should ensure that those sows and gilts that produce normal litters are infected with the virus prior to remating to ensure that their next litters are not affected. They should be exposed to the virus as described above.

- Gilts and sows that farrow litters with mummies due to parvovirus should be retained in the herd as they have produced their own permanent immunity. There is a higher prevalence of anoestrus and non-conception after farrowing parvovirus-affected litters, and in such circumstances culling may be necessary. However, sows should not be culled just because they produced a parvovirus-affected litter.

- Some herds are free of parvovirus infection. The parvovirus status of a herd can be established by submitting serum from 12 sows and gilts of varying ages to a laboratory for testing. Free herds should only introduce pigs from other parvovirus free herds. Nevertheless, previously parvovirus free herds have become infected without introducing new pigs, and dramatic outbreaks have occurred in herds in which there was laboratory evidence of previous infection.

Acknowledgement

I would like to thank Professor R. H. Johnson of James Cook University, Townsville for his assistance in the preparation of this article. Professor Johnson has been responsible for much of the recent research work on parvovirus.

Chemical weed control guide--winter cereals 1979

compiled by S. R. Walsh and J. M. T. Marley, Agriculture Branch.

THIS chart is a guide to the chemical control of weeds in winter cereal crops.

While chemical weedicides have a valuable part to play in supplementing mechanical weed control, they can never be used to replace cultural practices.

Each year, the number of chemicals commercially available increases. The successful use of these chemicals depends on a number of factors. These include the choice of the most efficient chemical, the correct timing of the spraying, and the rate and methods of application. Careful attention should also be given to applying the chemical at the correct stage of crop growth so that injury to the crop can be kept to a minimum.

It is important that the weed should be identified correctly before selecting the chemical to be used. The weeds listed in the guide are those that occur most frequently in winter cereal crops.

The explanatory notes are most important and should be read in conjunction with this guide.

When applying weedicides, producers should take care to avoid spray drift.

Further information on weed control may be obtained from your local agricultural extension officer.

Herbicide rates in millilitres per hectare

Cereal Weeds	Avadex BW	Trifluralin	Avenge 650 SP	Mataven	Hoegrass	2,4-D Amine (50% W.V.)	MCPA (27% W.V.)
Wild oats	2 100	1 000	1·15 kg	4 500–6 000	1 500–2 000 (+ W)		
Paradoxa Grass		1 000					
Climbing buckwheat						1 100 (+) W)	2 800
Wireweed		1 000				1 700 (+ W)	
Turnip weed						700	1 400
Mustard, Radish*						1 100	2 100
Variegated thistle						1 100	2 100
Saffron thistle						1 700 (+ W)	3 500

Herbicide rates in millilitres per hectare—continued

Cereal Weeds	Avadex BW	Trifluralin	Avenge 650 SP	Mataven	Hoegrass	2,4-D Amine (50% W.V.)	MCPA (27% W.V.)
Hexham-scent						1 700 (+ W)	
Spiny emex						1 700 (+ W)	
Docks						1 700	
Mintweed						1 100	
Sunflower						1 100	
Patterson's curse						1 700	
Bindweed (perennial)						1 700	3 800
Hoary cress (perennial)						1 700	
Mexican poppy						1 700	
Growth Stages for Application							
Crop	pre-sowing	pre-sowing	not beyond end tillering	early tillering to early jointing	N.A.	tillering	tillering
Annual weeds	pre-emerge	pre-emerge	2½ leaf to fully tillered, prefer 3–4 leaf	early tillering to jointing	2–3 leaf use higher rate at 3–4 leaf stage	young	young
Perennial weeds						pre-flowering	pre-flowering
Crop Tolerance							
Wheat	2 100	not recomm.	yes	yes (see note 19)	N.A.	2 200	5 600
Barley	2 100	1 000	yes	no	N.R.	1 700	4 200
Oats	non-tol.	non-tol.	non-tol.	non-tol.	N.R.	1 100	4 200
Canary seed	non-tol.	non-tol.	N.A.	N.A.	N.R.	1 100	N.A.
Undersown lucerne	2 100	not recomm.	not recomm.	not recomm.	N.A.	non-tol.	non-tol.
Linseed		not recomm.	N.A.	no	2 000	not recomm.	1 400
Methods of Application							
Boom sprayer	yes	yes	yes	yes	yes	yes	yes
Aircraft	no	no	yes	yes	yes	yes	yes
Misting machine	no	no	no	no	no	no	no

Herbicide rates in millilitres per hectare—continued

Cereal Weeds	Tordon 50D	Tordon 242	Tordon M	Brominil	Buctril MA Brominil M	Banvel 200 Banex Dicamba	Dicamba + MCPA
Climbing buckwheat	470	1 000	2 100	1 400	1 400	700	1 700
Wireweed	470+ 2,4-D(A)			1 400+ 2,4-D(C)	1 400	700	1 000
Turnip weed	470+ 2,4-D(A)	1 000	1 400–2 100	1 400+ 2,4-D(C)	1 400	700+ 2,4-D(C)	1 000
Mustard, Radish*	470+ 2,4-D(A)	1 000	1 400–2 100	1 400+ 2,4-D(C)	1 400	700+ 2,4-D(C)	1 000
Variegated thistle	470+ 2,4-D(A)	1 000	1 400–2 100	1 400+ 2,4-D(C)	1 400	700	1 000
Saffron thistle		1 000			1 400	700	1 700
Hexham-scent	470+ 2,4-D(A)				1 400	700	1 000
New Zealand spinach	470	1 000				700	1 000
Spiny emex	470	1 000			1 400	700	1 000
Docks	470		1 400–2 100			700	1 700
Mintweed	470+ 2,4-D(A)					700+ 2,4-D(C)	1 000
Sunflower	470+ 2,4-D(A)						
Hoary cress (perennial)							1 700
Mexican poppy					1 400		

Herbicide rates in millilitres per hectare—continued

Cereal Weeds	Tordon 50D	Tordon 242	Tordon M	Brominil	Buctril MA Brominil M	Banvel 200 Banex Dicamba	Dicamba + MCPA
Growth Stages for Application—							
Crop	early tillering	early tillering to jointing	see note 24–25	2-leaf through tillering	3-leaf through tillering	3-leaf through tillering	3-leaf through tillering
Annual weeds	young	young	young	young	young	young	young
Perennial weeds	pre-flowering	pre-flowering		not effective	not effective	pre-flowering	pre-flowering and seedling
Crop Tolerance							
Wheat	tol.	N.A.	2 100	2 100	2 100	700	1 700
Barley	tol.	N.A.	2 100	2 100	2 100	700	1 700
Oats	tol.	N.A.	2 100	2 100	2 100	700	1 700
Canary seed	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Undersown lucerne	non-tol.	non-tol.	non-tol.	non-tol.	non-tol.	non-tol.	non-tol.
Linseed	non-tol.	N.R.	1 750	1 400	1 400	N.A.	N.A.
Methods of Application							
Boom sprayer	yes	yes	yes	yes	yes	yes	yes
Aircraft	yes	yes	yes	no	MA no M yes	yes	yes
Misting machine	no	no	no	no	no	no	no

NOTE

1. Consult your Shire Extension Officer.
2. (+W) indicates to add non-ionic wetting agent at 1 part of 50% to 60% product to 1 600 parts of spray mixture.
3. 2,4-D and MCPA formulations vary in the percentage of active ingredient—check the label and adjust the rate accordingly.
4. Tol. indicates the crop is normally tolerant at the suggested rates of application.
5. N.R.—Not recommended indicates the chemical should NOT be used on this crop as crop damage may occur.
6. N.A. indicates crop tolerance data not available.
7. 2,4-D esters must NOT be used in declared hazardous areas.
8. + 2,4-D(A) indicates add 470 ml per hectare of 50% 2,4-D amine.

NOTE—*continued*

9. + 2,4-D(C) indicates add 700 ml per hectare of 50% 2,4-D amine. When 2,4-D is added to Brominil, application must be restricted to the tillering stage of the crop.
10. For linseed and Safflower, Avadex at the rate of 2 100 ml per hectare is recommended as a pre-sowing application for wild oats control. It is cheaper than Avadex BW but SHOULD NOT be used on wheat or barley.
11. * For adequate control of radish, extra 2,4-D above the rate indicated in this guide may be required. Consult your agricultural extension officer.
12. Some chemicals have a residual activity and may restrict the choice of the subsequent crop. Consult the manufacturers' labels.
13. For cereals undersown with lucerne, 2,4-DB may be used to control some broad-leaved weed species. Consult your agricultural extension officer.
14. Sprays should be thoroughly mixed before application.
15. To convert millilitres per hectare to pints per acre divide by 1 400.
16. Avenge or Mataven should not be mixed with any other weedicide.
17. The best results are obtained from post-emergence wild oat sprays if both the crop and the oats are growing vigorously. Crop competition is important for subsequent control.
18. It is important that the recommended rate of surfactant (wetting agent) be added to the Avenge. The required amount is contained in the commercial pack marketed by the company.
19. Do not spray Mataven on to wheat varieties Kite or Eagle after thay have passed the full tillering stage. It may cause some stem shortening and yield loss.
20. Mataven should not be applied to barley.
21. Mataven should be applied by a ground boom spray.
22. After spraying with Mataven, the green crop should not be grazed or cut for stock fodder.
23. Do not use phenoxy type weedicides within one day of spraying with Avenge or 10 days of spraying with Mataven.
24. Tordon M is recommended for spraying linseed. The crop should be 8 cm to 20 cm in height before spraying.
25. Some slight wilting may be noticed in linseed after spraying but this is only temporary.
26. Winter cereals should be in the early tillering growth stage.
27. For least effect on crop vigour and possibly best weed control, Dicamba and MCPA should be applied at the rate of 20 L per ha of spray mixture.
28. Tordon 242 cereal herbicide is also registered for the control of some other broad-leaved weeds.
29. The higher rate of 2 000 ml for hoegrass is recommended in situations where a range of germinations of wild oats occurs or if spraying is delayed 5 to 6 weeks after sowing.
30. Hoegrass is registered for the control of wild oats in linseed.
31. Read manufacturers' label for compatability of hoegrass and phenoxy-type weedicides.
32. ALWAYS READ LABELS THOROUGHLY BEFORE USING CHEMICALS AND APPLY IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

EDITOR'S NOTE: There have been some changes in herbicide registration since this article went to press. Consult your agricultural extension officer.

Insect pests of grain sorghum—part 1

NUMEROUS insect pests attack grain sorghum crops in Queensland. Information about the more important of these and their damage is presented here to help growers identify pests and take timely control action to ensure maximum returns.

Sorghum midge

The sorghum midge (*Contarinia sorghicola* (Coquillett), Family Cecidomyiidae) is the most damaging insect pest of grain sorghum. Its damage is confined to the developing seed in the head and a severely damaged crop shows a large percentage of partially-sterile heads. Midge damage can be readily distinguished from injury such as heat blast, disease or frost injury by the presence of pupal cases at the tip of the florets or by the emergence hole in the glume caused by a tiny wasp parasite of the midge. In addition, with heat blast or frost injury, none of the seeds develop into mature grain but even with a heavy midge infestation one or more grains usually occur on an otherwise sterile head.

LIFE HISTORY AND HABITS: The adult insect is a small fly, a little over 1 mm long with a bright orange abdomen and a single pair of transparent wings. The female rarely lives for more than 2 days while the male lives for a much shorter period. During its short life, the female may lay up to 100 eggs. These are laid into the developing flowers before the yellow pollen is shed and during pollen shedding. All damage from the insect is initiated by eggs laid in the flowers during this brief period.

by D. A. Ironside, Entomology Branch.

Tiny, white maggots hatch from these eggs within a few days and feed on the developing grain. When fully grown, they pupate within the florets. At the end of the pupal period, the adult insects emerge from between the tips of the glumes. The tiny, white pupal cases are left attached to the glumes.

During summer, the midge has a life cycle from egg-laying to emergence of the new generation adults and the recommencement of egg laying of only 17 to 19 days. Therefore, a quite rapid increase in pest numbers may occur within a crop or within adjacent crops when flowering is continuous and in any way prolonged.

SURVIVAL AND SEASONAL INCIDENCE. The midge survives from one sorghum season to the next as fully developed maggots in diapause (a state of suspended development) within the individual damaged florets. A few insects from each summer generation and most of the insects in the late generations in autumn enter this stage and so survive in trash in the sorghum fields and in unharvested heads along fence lines and headlands. Survival also occurs in residues of Sudan grass, sorghum almum, Johnson grass, sweet sorghums and broom millet.

The insect's redevelopment is initiated when there is warm weather together with sufficient rainfall to ensure a thorough soil wetting followed by a period of about a fortnight of relatively high humidity. Adult insects then emerge and crops flowering at the time may suddenly be severely infested.

As populations of the insect arising from diapause are directly related to wet weather, it follows that, in any season, crops that flower during or immediately after the expected wet season are more likely to be damaged by the pest than crops that flower at other times.

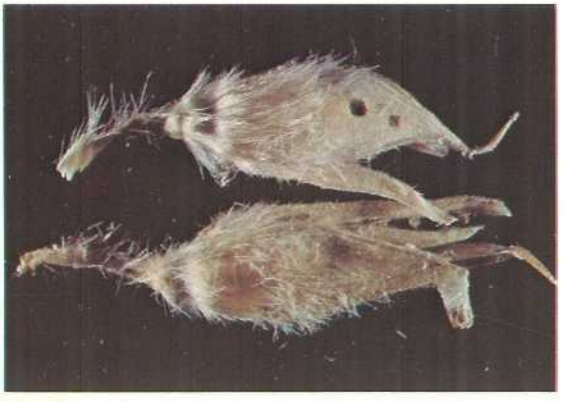
Insect pests of

Photographs by D. A. Ironside, Entomology Branch.

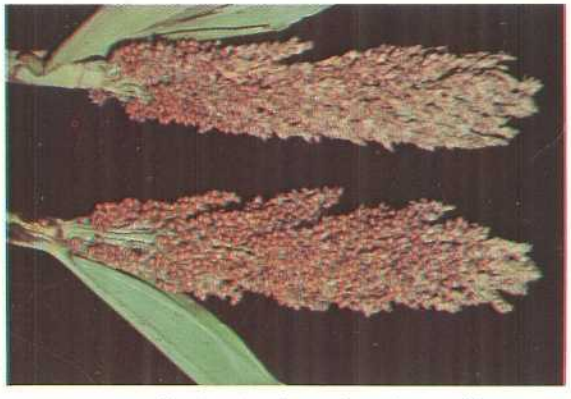
Sorghum midge adult (left) and sorghum midge parasite adult (x 3.8).

Sorghum midge adult on flowering sorghum.

Sorghum midge larva (left) and pupae and aborted ovaries from damaged florets (x 3.8).



Sorghum florets—upper showing parasite emergence hole, lower the midge pupal case protruding after adult emergence.



Sorghum heads showing loss of grain resulting from midge attack.

Green vegetable bug adult on sorghum (x 1).

grain sorghum—part I

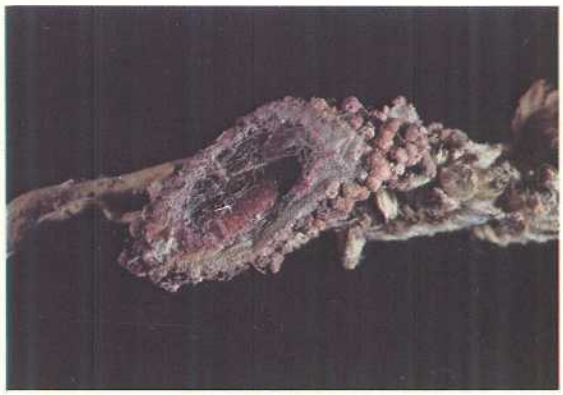
Green vegetable bug nymphs feeding on sorghum heads at green dough stage (x 1).

Colony of corn aphid on the heart leaf of young sorghum (x 1.5).

Larval, pupal and adult stages of an important ladybird predator of corn aphid (x 1).

Yellow peach moth female.

Yellow peach moth larva and damage to sorghum grains.



Pupa and loosely woven cocoon of yellow peach moth on a sorghum head.

Green vegetable bug

The green vegetable bug (*Nezara viridula* (Linnaeus), Family Pentatomidae), a pest on a wide variety of crops, feeds on grain sorghum particularly during flowering and grain development.

LIFE HISTORY AND HABITS. The adult bug measures about 14 mm long and 9 mm wide and is green in warm weather and brownish-grey in winter. The female insect lays its eggs in batches of 20 to 150 on the undersurface of leaves. The incubation period is a little less than a week and the small, newly-emerged bugs are wingless and bright orange-brown in colour. They remain near the egg shells for a few days and then gradually scatter over the plant, but are particularly attracted to the heads.

The young bugs become marked with black, yellow and red colour patterns which are superceded by green in the later stages of development. During its development, the bug passes through five nymphal stages before becoming the fully winged adult.

DAMAGE. Both the nymphs and adults feed by piercing and sucking the contents of the developing seed. The importance of green vegetable bug damage on grain sorghum has not been investigated in detail. However, heavy infestations can result in failure to set seed, in malformed seed and even in crop failure.

Corn aphid

The corn aphid (*Rhopalosiphum maidis* (Fitch), Family Aphididae) is a soft-bodied, predominantly green insect up to 3 mm long. All the immature stages are wingless, while the adults may be either wingless or have two pairs of transparent wings.

HABITS AND DAMAGE. Aphids develop in colonies on the individual leaves, in the 'throats' of the sorghum plants or in the immature heads. At times, huge populations may be present in a crop. They feed by piercing the plant surface and extracting sap but loss of sap is of no real significance in vigorously growing plants. They secrete a sticky substance which often gives the leaves a shiny appearance and fungal moulds may develop on these secretions making individual plants unsightly. The moulds usually dry out before crop maturity and neither the aphids nor the moulds normally cause any real trouble at harvest.

High aphid numbers in the throat of the plants before head extrusion may occasionally cause a type of malformation in the top leaf and prevent full extrusion of the head. This type of damage is not common, however, and should not be confused with similar symptoms caused by drought.

NATURAL ENEMIES. Aphid colonies are invariably attacked by a variety of insect predators and parasites. These are capable of bringing severe aphid populations back to negligible proportions in a few weeks.

Yellow peach moth

The larvae of the yellow peach moth (*Dichocrocis punctiferalis* (Gvence), Family Pyralidae) develop to a maximum length of about 25 mm. They are greyish-green in colour, usually tinged with pink but with darker oval spots on the body. They feed on a wide variety of cultivated crops. In grain sorghum, infestations are more severe in tight-headed than in open-headed varieties.

DISTRIBUTION. The pest is more commonly encountered in the wetter coastal regions of the State and it is rarely a pest of any real significance in inland districts such as the Darling Downs and the Central Highlands.

DAMAGE. Grain sorghum becomes infested as the grain begins to mature, infestation sometimes developing rapidly. The larvae feed on the grain and in severe attacks the inside of the head becomes cluttered with their webbing and excreta. Stalks may also be injured by larvae boring into and tunnelling through the pith, thus rendering the stems rather liable to break.

Wattles in South-eastern Queensland

flowers in spikes

THIRTEEN wattles with their flowers arranged in narrow, cylindrical spikes are native to South-eastern Queensland.

The plants range in size from sprawling shrubs less than 2 m high to erect, spreading trees 10 m or more in height. Their phyllodes can vary in texture from leathery to thick and almost rigid, while some have phyllodes which are rather thin in texture. They can be linear and as narrow as 0·2 to 0·3 cm, linear-oblong or oblong-lanceolate to falcate- lanceolate and up to 5 cm broad.

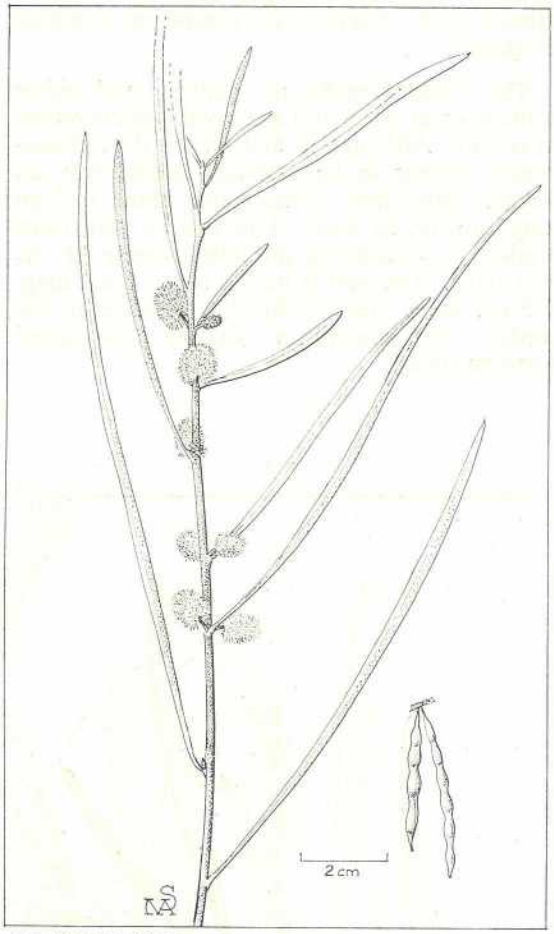
One of the most obvious differences between the phyllodes of different species is the presence of anastomoses in the secondary venation. These are slanting connections which join the secondary veins one to the other at intervals. These anastomoses may be conspicuous and frequent or faint and infrequent.

The colour of the inflorescence ranges from almost white or pale cream to pale or bright lemon-yellow and even to vivid golden-yellow. There is variation in perfume from very faint to fragrant and one even has what some people find a rather unpleasant odour.

Great variation also is found in the pods. One has a pod almost like a string of long beads, about 10 cm long and 0·5 mm wide. In others, the pods are linear and can be nearly straight, undulating or twisted, and are sometimes very contorted.

One wattle has a very distinctive pod which is spirally coiled like a flattened spring and less than 1 cm wide.

by Beryl A. Lebler, Botany Branch.



Acacia granitica

Species in South-eastern Queensland are: *Acacia granitica, A. obtusifolia, A. longissima, A. floribunda, A. sophorae, A. julifera, A. blakei, A. aulacocarpa, A. orites, A. maidenii, A. cincinnata, A. leiocalyx* and *A. concurrens.*

Acacia granitica

The Latin word *granitica* means granite loving, or of granite, and was used to describe the situation where this wattle was first found.

DESCRIPTION. In open, exposed situations among granite outcrops this wattle is a glabrous sprawling bush with many woody stems arising from a central root stock and forming a rounded clump to 1·5 m in height and 2 m in diameter. The phyllodes are linear, up to 20 cm long and 0·3 cm wide and usually stand upright. They are firm and thick in texture—almost rigid. There is no prominent venation or glands.

The inflorescences are axillary and either solitary or in pairs and are vivid golden-yellow in colour. Although at first glance the inflorescences appear to be globular heads they are actually very short, dense spikes about 0·7 cm long and not as wide. This can be seen most readily by examining an inflorescence at the bud stage. The pod is linear, about 6 cm long, 0·5 cm wide and is slightly raised over the seeds and sometimes slightly contracted between them.

As an understorey plant in open eucalyptus forest, it develops into a tall, dense shrub to 3 m high.

FLOWERING TIME. This wattle flowers in spring.

HABITAT. It is usually found growing on granite.

DISTRIBUTION. It grows in New South Wales on the New England Tableland and near Grafton and in Queensland on the Darling Downs in the Stanthorpe district. In South-eastern Queensland, it can be found in the vicinity of Crow's Nest and in the Plunkett area north of the Albert River where it grows on sandstone.

Acacia obtusifolia

The Latin word *obtusifolia* means blunt-leaved. It refers to the blunt tips on the phyllodes.

Acacia obtusifolia

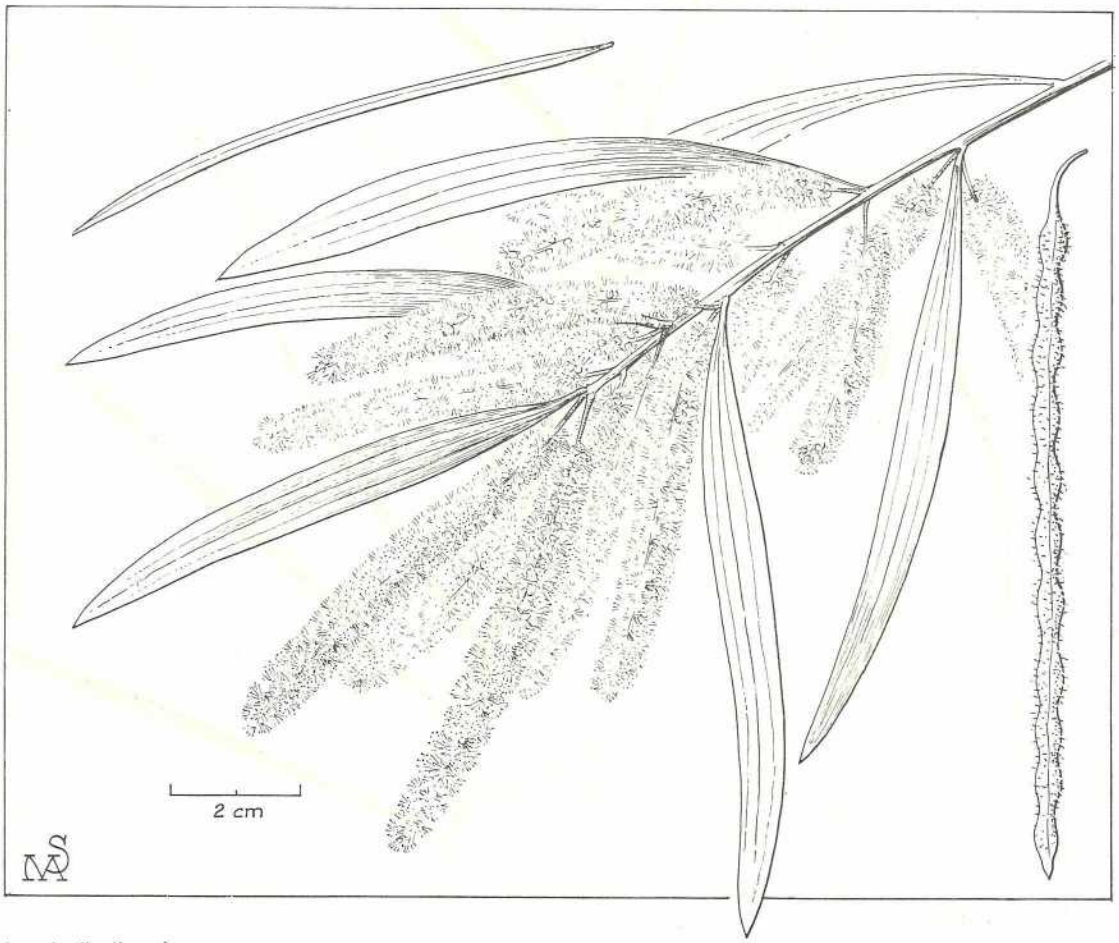
DESCRIPTION. This wattle is a tree to 5 or 6 m high with a rounded crown and spreading branches tending to droop at the ends. The phyllodes are linear-oblong or oblong-lanceolate, up to 19 cm long and 2 cm wide, with obtuse tips. They are firm in texture, but not leathery, and are a dull green tending to blue-green. A network of fine parallel veins which anastomose can be seen as lighter lines when held against the light.

The overall appearance of the flower spikes is pale creamy-yellow. Microscopic examination shows that the sepals and petals are pale yellow-green, the staminal filaments are white and the anthers bright gold.

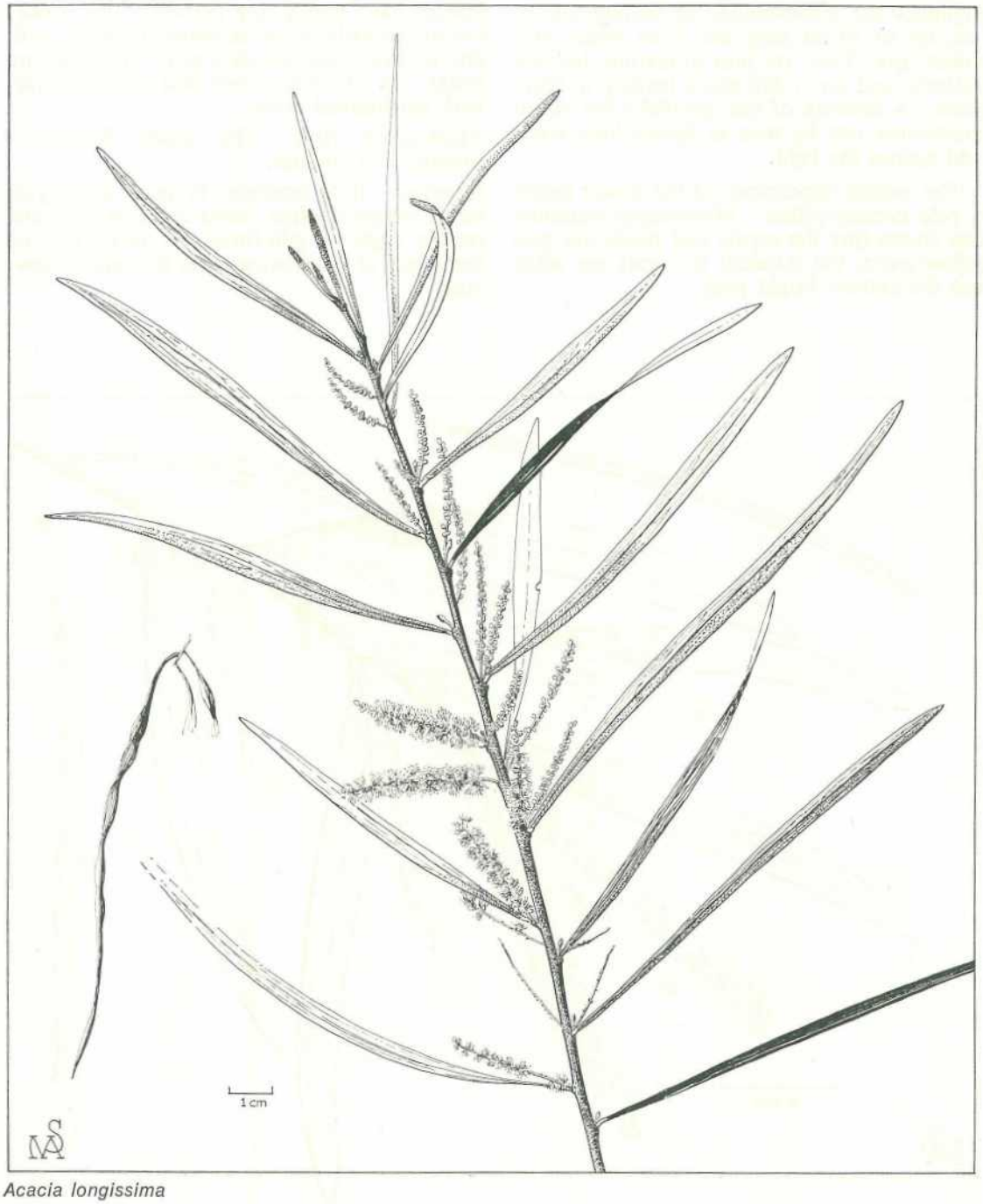
The spikes are up to 6 cm long with the flowers sparsely and irregularly placed. This is particularly noticeable in the bud stage. The flowers have hardly any perfume. The spikes are in the axils of the terminal phyllodes with one or two spikes in each axil. The pods are linear, up to 15 cm long and 0·3 cm wide, with longitudinal seeds.

FLOWERING TIME. This wattle flowers in summer and autumn.

HABITAT. It is common in open eucalpytus forest where it often forms dense stands, and on the edges of rain-forest. It also grows on the edges of peat swamps on the coastal lowland.



Acacia floribunda



Acacia longissima

DISTRIBUTION. It is found in the eastern mainland States to as far north as Southport. In Queensland, it is more plentiful on the border ranges.

Acacia longissima

The Latin adjective *longissima* means very long and describes the phyllodes.

DESCRIPTON. This is an erect shrub or tree to 5 m, with slender, slightly angular, reddish branches. The phyllodes are thin-textured, linear, up to 16 cm long and 0·9 cm wide, with a prominent longitudinal vein and up to three widely-spaced, fainter veins on each side. Occasional anastomoses can be seen. Plants growing on the mountains often have phyllodes only 0·2 cm wide. The phyllodes are bright to dark green. Small lenticels are present on some plants on the thin, woody, flowering twigs.

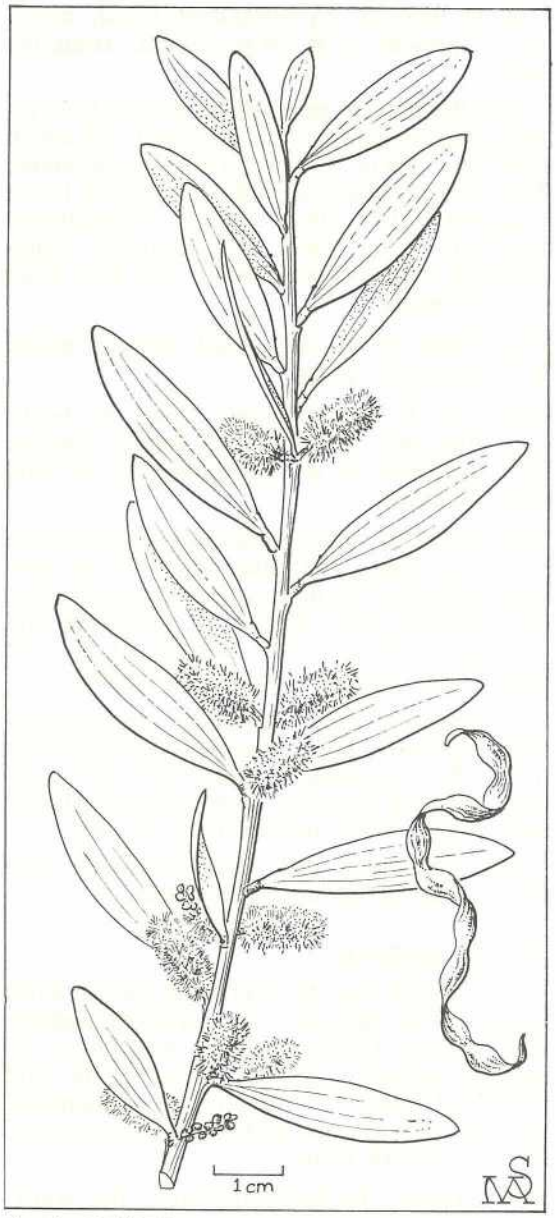
The flower spikes are up to 5 cm long, and 0·6 cm wide with large flowers widely-spaced and scattered along the rhachis so that the inflorescence is very loose and interrupted. Magnification shows very pale, lemon-yellow sepals and petals, white filaments and lemon-yellow anthers. The overall appearance of the spike is almost white or a very pale creamy-yellow.

The pods are linear, up to 15 cm long and 0·5 cm wide. They are almost circular in cross section with prominent margins, and have longitudinal striations. The seeds are longitudinal and the walls are raised over the seeds.

FLOWERING TIME. This wattle flowers spasmodically and sparsely throughout the year.

HABITAT. It is found on the edges of swamps in open eucalyptus forests and on the margins of scrubs.

DISTRIBUTION. It grows in all the eastern mainland States and Tasmania to as far north in Queensland as Eumundi.



Acacia sophorae

Acacia floribunda

The specific epithet means free-flowering or producing abundant flowers.

DESCRIPTION. This wattle can be a large, bushy shrub or tree to about 8 m and has arching branches which droop at the ends. The twigs are angular and are covered with appressed, short, white hairs. Lenticels are sometimes present on older twigs.

The phyllodes are linear to narrow lanceolate and can vary in length from 5 to 10 cm and in width from 0·2 to 1 cm. They are dark green with numerous veins, usually with some being more prominent than the rest.

Usually there is no prominent gland, but if one is present, it is about 0·5 cm from the base.

The flowers are pale yellow and are in interrupted spikes about 8 cm long and 0·5 cm in diameter. There is very little or no perfume. The pods are linear and straight, up to 13 cm long and 0·3 cm wide and are longitudinally wrinkled. The seeds are arranged longitudinally with the walls raised on both sides over the seeds.

FLOWERING TIME. This wattle flowers in late winter or early spring.

HABITAT. It usually grows along the banks of creeks and rivers in open forests (on the Darling Downs it is best developed on sand along creeks).

DISTRIBUTION. It is found only in the eastern mainland States. In Queensland, it is now found only near Stanthorpe but it was collected once in 1932 from Tamborine Mountain and again in 1961 from Mt. Barney. It has not been found since then in those localities.

GENERAL REMARKS. This wattle is in cultivation and has a graceful and compact growth habit. It is interesting to note that the specimen collected from Mt. Barney had phyllodes only 0·2 cm wide and spikes 3 cm long.

The illustration and description were prepared from herbarium specimens.

Acacia sophorae

This wattle was discovered in 'the sandhills by the sea' in Tasmania by the French explorer and botanist Labilladiere. It was given the specific epithet *sophorae* because its pod resembled that of *Sophora,* an ornamental tree grown in Europe with a long, narrow pod like a string of beads.

DESCRIPTION. In its natural state, this wattle is a shrub 30 cm high which in exposed situations is prostrate with its branches rooting at the nodes. The twigs are erect or ascending and the phyllodes are leathery, elliptic or oblong-elliptic, up to 10 cm long and 3 cm wide. Usually, there are two or three nerves more prominent than the others but there can be as many as five. The secondary longitudinal veins anastomose. One gland is present on the upper margin at the base.

The flowering spikes are almost sessile, and either solitary in the axils or in pairs. They are rather dense, up to 3 cm long and 0·5 cm in diameter and have a faint perfume. All parts of the flower are bright lemon-yellow.

The pod is linear, curved and twisted. It is about 8 cm long, less than 0·5 cm wide and is raised over the longitudinal seeds.

FLOWERING TIME. This wattle flowers in late winter and early spring.

HABITAT. It grows only on coastal dunes and sandy seashores.

DISTRIBUTION. It is found in South Australia, Tasmania and in all the eastern mainland States to as far north as the mouth of the Maroochy River.

GENERAL REMARKS. It has been planted as a sand stabilizer on the frontal dunes in some places.

Acacia julifera

This wattle was first found by Allan Cunningham at Rodd's Bay, just south of Gladstone. The Latin word *iulus* means a catkin and the suffix *fera* means bearing. The combination of the two alludes to the dense inflorescences resembling catkins.

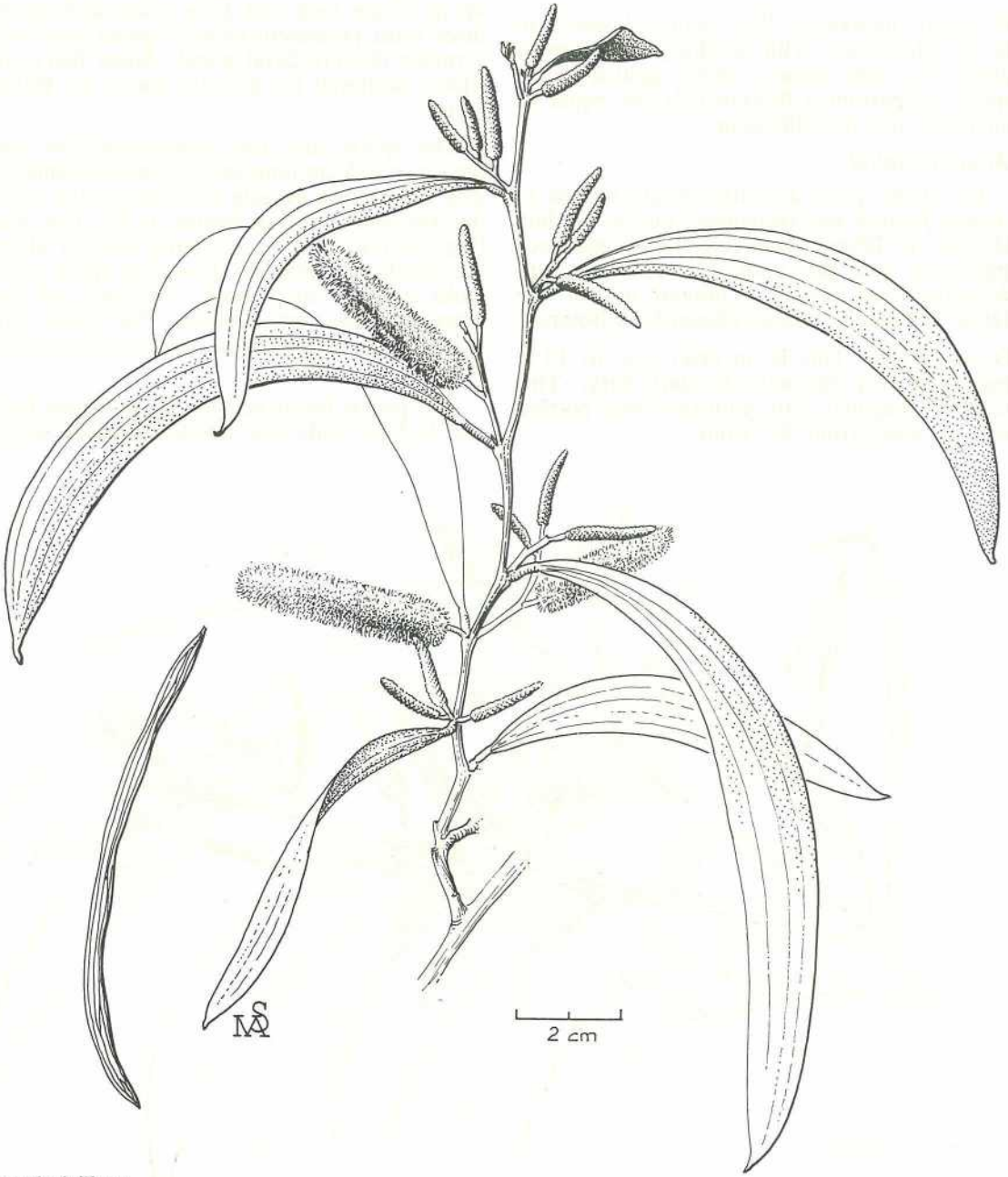
DESCRIPTION. This is an erect tree to about 10 m tall, with dark furrowed bark and shining green falcate-lanceolate phyllodes which can be up to 25 cm long and 2·5 cm wide and are narrowed to each end. They are thin and leathery in texture with crowded longitudinal nerves and no anastomoses. Three or five nerves are usually more prominent than the rest. Young plants are densely pubescent and the stems are often tinged with red.

The spikes are axillary, dense and uniform, and are vivid golden-yellow in colour and very sweetly scented. They can be up to 5 cm long with a diameter of almost 1 cm. They may be solitary or two or are together on a short common peduncle.

The pod is terete or slightly flattened and up to 9 cm long and 0·5 cm wide.

FLOWERING TIME. It blooms from midautumn to the beginning of spring.

HABITAT. It is found on rocky sandstone slopes and ridges and in shallow, gravelly soil on hillsides.



Acacia julifera

DISTRIBUTION. It grows only in Queensland to as far north as Proserpine on the coast and Pentland inland.

GENERAL REMARKS. This wattle deserves to be in cultivation. With its glossy bright green phyllodes, and dense, vivid golden-yellow spikes of perfumed flowers it is the equal of anything now in cultivation.

Acacia blakei

For many years a wattle closely related to *Acacia julifera* was recognized on the Darling Downs. It differed in having slightly glaucous phyllodes and flat pods. In 1974, it was described and named in honour of the late Dr S. T. Blake, a famous Queensland Botanist.

DESCRIPTION. This is an erect tree to 13 m high with very characteristic dark bark. This flakes in diagonal strips with the lower portion curving away from the trunk.

In South-eastern Queensland, the mature phyllodes are dark green and slightly shiny. They are falcate-lanceolate or almost straight, up to 17 cm long and 3 cm wide, with up to three veins prominent as paler green lines and a rather obscure basal gland. Some hairs are widely scattered on juvenile leaves on young plants.

The spikes are deep primrose-yellow and are up to 4·5 cm long and 0·6 cm in diameter. The flowers are densely crowded on the spike but the most striking feature is the fact that they do not open in a regular fashion along the rhachis so that the flowering spike often looks crooked or twisted. All parts of the flower are the same colour. The spikes are axillary and solitary or in a very short raceme of only two spikes.

The pod is linear and flat up to 10 cm long and 0·3 cm wide and has longitudinal seeds.

Acacia blakei

Acacia aulacocarpa

FLOWERING TIME. In South-eastern Queensland, this wattle blooms early in spring.

HABITAT. It sometimes forms pure stands on hillsides and grows on stony ridges in ironbark forest and on sandstone cliffs in open forest woodland.

DISTRIBUTION. It is found only in Queensland to as far north as the Drummond Range in central Queensland. In spring time in South-eastern Queensland, it is very evident around Moogerah Dam. It also grows at Mt. Alford near Boonah and in the Stockyard Creek area south-west of Helidon.

Hickory wattle *(Acacia aulacocarpa)*

The specific epithet is derived from two Greek words meaning furrowed fruit and describes the fruit.

DESCRIPTION. This wattle is a grey-looking, erect and spreading tree to 15 m high. The bark is grey and on some trees it is nearly smooth, but on older trees it is deeply furrowed.

The phyllodes are slightly curved and are narrowed at both ends, and are usually 7·5 to 10 cm long and 1 to 2·5 cm wide. Thin, almost powdery grey wax covers the surfaces of young leaves and eventually wears off. The closely packed secondary nerves do not anastomose.

The flowers are densely packed in cylindrical spikes up to 5 cm long and less than 0·5 cm wide. They are pale yellow in colour with little perfume.

The pods are flattened, thick and hard, up to 10 cm long and 2 cm broad. Transverse, oblique veins form the furrows which give the plant its name. The seeds are transverse.

FLOWERING TIME. This wattle flowers from midsummer to early in autumn.

HABITAT. It is found on the coastal dunes, on hillsides in mixed open forest, on sandy, rocky soil in open scrub, and on the drier ridges in rain-forest.

DISTRIBUTION. It grows to as far south in New South Wales as the Richmond area, is widespread in eastern Queensland and is also found in the Northern Territory and southern New Guinea.

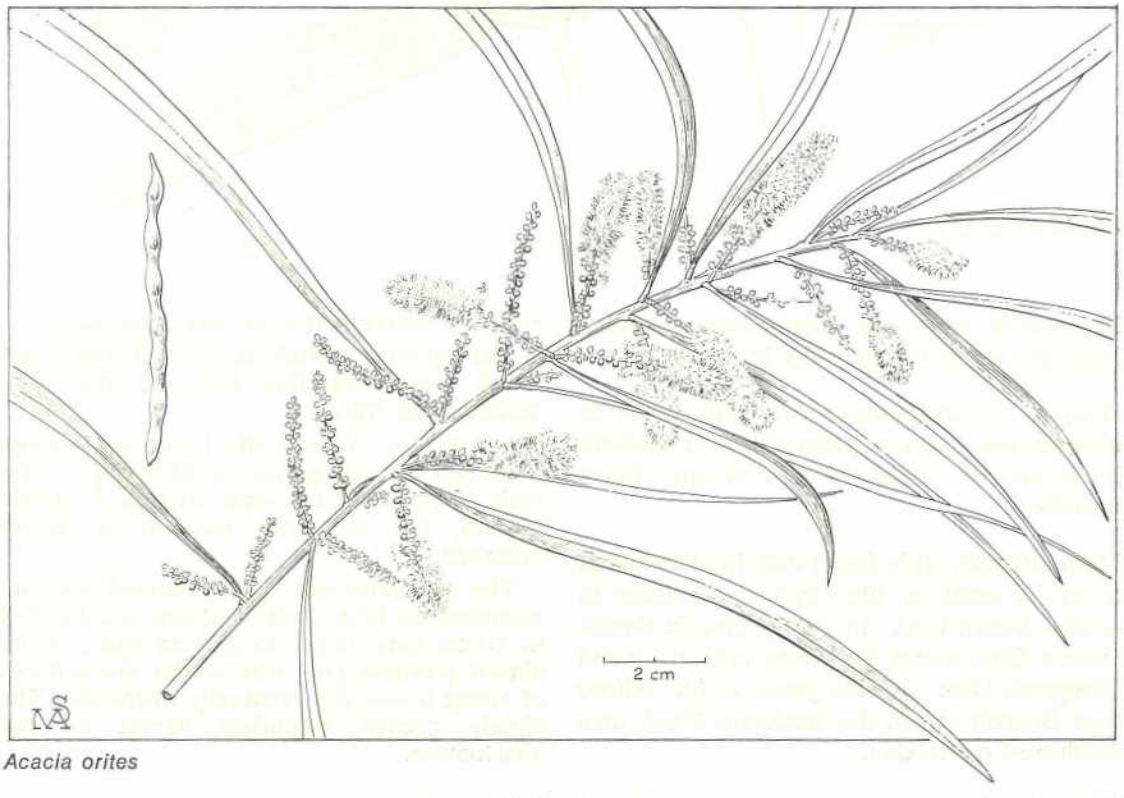
Acacia aulacocarpa var. *fruticosa* is a shrub which grows to 3 m high with acutely triangular branches. Its phyllodes are up to 10 cm long, and 2·5 cm broad. The flower spikes are deep, bright yellow and are up to 4 cm long. It differs from *A. aulacocarpa* in its shrubby habit, the deep yellow flowers and acutely triangular twigs and is found only in the Glasshouse Mountains, and on Mt. Tinbeerwah, Mt. Cooroora and Mt. Coolum.

Acacia orites

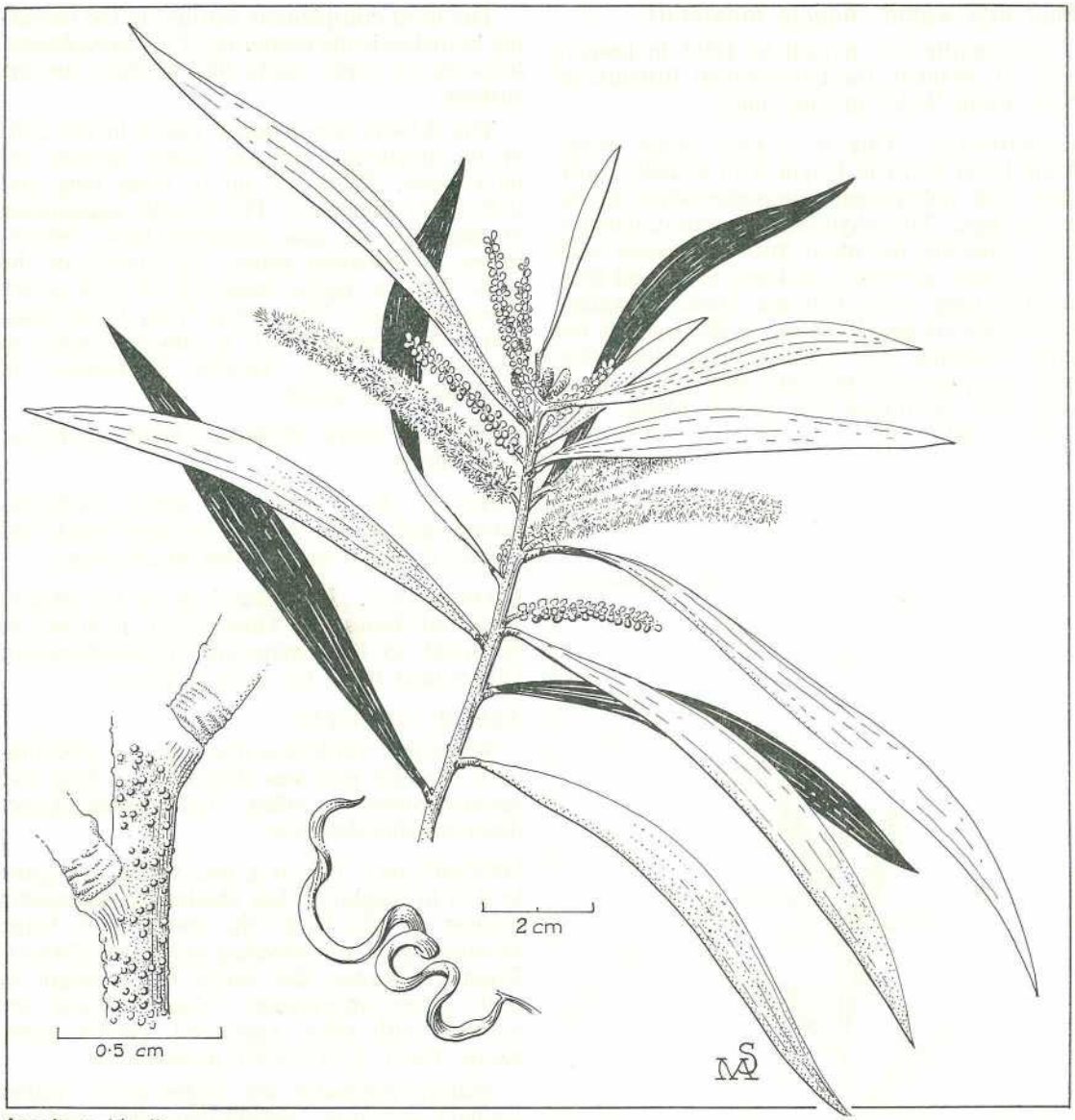
The Greek word *orites* means mountaineer. It was chosen because this wattle is commonest on mountains.

DESCRIPTION. This is a tree which can grow to 30 m. It has a rounded crown and, when old, often has a gnarled appearance. The twigs are either glabrous or sometimes have sparse, appressed hairs. Lenticels can be found on the flowering twigs and young branchlets. The phyllodes are bright green, straight or slightly falcate, with a prominent midrib and anastomosing secondary venation and can be 20 cm long and 0·7 cm wide.

The flower spikes are about 4 cm long and 0·8 cm in diameter and all parts of the flower are very pale lemon-yellow.



Acacia orites



Acacia maidenii

The spikes are loose, with the flowers widely spaced on the rhachis. The spikes are usually in pairs in the upper axils and to some people they have an unpleasant odour. In South-eastern Queensland, the pods are often badly insect galled, becoming spherical. Unaffected pods are straight and linear, up to 11 cm long, and less than 0·5 cm wide and are raised over the seeds.

FLOWERING TIME. This wattle flowers in late winter or very early in spring.

HABITAT. It is restricted to rain-forest margins.

DISTRIBUTION. It has been found only in high rainfall areas on both sides of the border between Queensland and New South Wales from as far south as the Whian Whian State Forest north of Lismore, to the McPherson Range and Upper Tallebudgera.

Maiden's wattle *(Acacia maidenii)*

This wattle was named in 1893 in honour of J. H. Maiden, the Government Botanist of New South Wales at that time.

DESCRIPTION. This is a tree which grows from 10 to 15 m in height with a thick, hard, dark bark and spreading branches which droop at the tips. The phyllodes are falcate-lanceolate, generally narrowed into the petiole with two to four or more prominent veins and finer anastomosing veins between them. A rather inconspicuous gland is close to the base on the upper margins. The phyllodes are rather firm in texture, up to 20 cm long, and 2·5 cm wide, with the phyllodes on young plants only 0·3 cm wide.

Acacia cincinnata

The most conspicuous feature on the flowering branches is the scattering of cream-coloured lenticels or corky spots like freckles on the surface.

The flowers are in loose spikes in the axils of the phyllodes and are rather sparse and interrupted. They are up to 6 cm long and 0·6 cm in diameter. The overall appearance of the spike is pale creamy-yellow. Microscopic examination shows the rhachis of the spike have a sparse covering of very short, appressed hairs. The pod is up to 12 cm long, and 0·4 cm wide and it is almost circular in cross-section, very twisted sometimes in irregular loose spirals.

FLOWERING TIME. It flowers from summer to midautumn.

HABITAT. It is found in open eucalyptus forests, and on the margins of rain-forest, and is very common as regrowth in clearings.

DISTRIBUTION. It is found in all the eastern mainland States. In Queensland, it grows as far north as Proserpine and in South-eastern Queensland to as far west as Oakey.

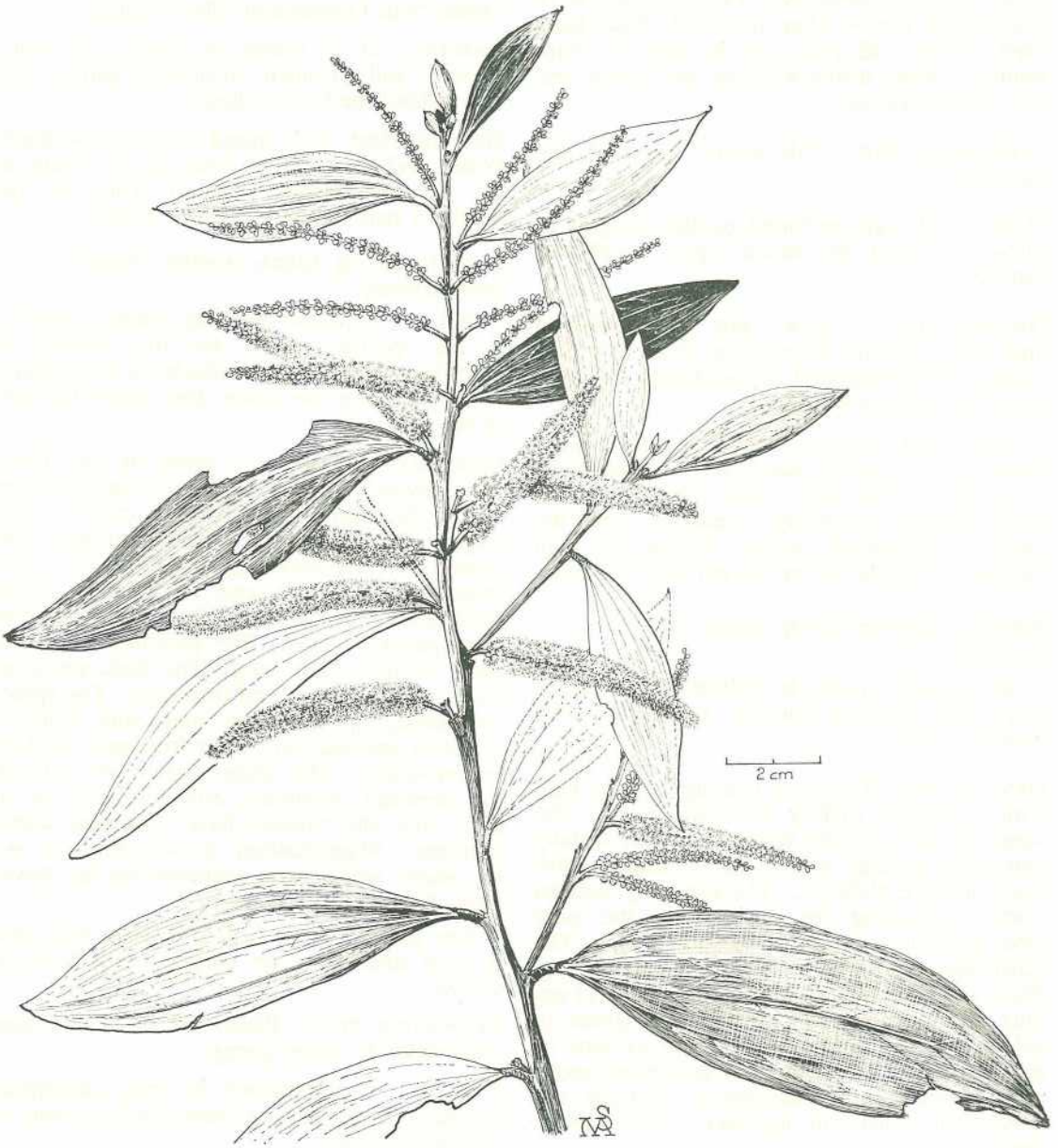
Acacia cincinnata

When this wattle was first found at Rockingham Bay the pod was described as long and spirally curled or coiled. The specific epithet describes this character.

DESCRIPTION. This is a tree which can grow to 9 m in height. It has shallow anastomosing fissures in the bark, the outer bark being brownish-grey and showing red in the fissures. From a distance, this wattle has a bright to dark green appearance. Young shoots are covered with silky, appressed, golden hairs, giving them a yellowish appearance.

Mature phyllodes are bright green, rather leathery in texture, falcate-lanceolate, and can be 10 to 15 cm long and 3 cm wide, with three or four paler green prominent veins. These run together at the base and are connected by a loose network of anastomosing veins. A prominent raised gland is at the base of the phyllode.

The spikes are axillary, up to 35 cm long and just under 1 cm in diameter. They are rather loose, with the individual flowers spaced along the rhachis. The spike is pale yellow and is very faintly perfumed.



Acacia leiocalyx

The pods are very characteristic. They are spirally and tightly coiled like a flattened spring with about five coils and are 0·6 cm wide. Young pods are grey-blue, with a bloom which can be rubbed off. Old pods are dark brown and persist after the seeds have been shed. These old pods can be seen on bare branches some distance below the leaves and are very noticeable.

FLOWERING TIME. This wattle blooms in late autumn.

HABITAT. It can be found on the margins of rain-forest, and in mixed open eucalyptus forest.

DISTRIBUTION. It grows only in Queensland and has a patchy distribution from Burleigh Heads on the mainland, Bribie Island offshore, to as far north as Kuranda.

Until 1974, both the remaining wattles were known as *Acacia cunninghamii,* a name given to those wattles with large phyllodes with anastomosing secondary venations and the major longitudinal nerves tending to run together or to the lower margin near the base.

Early flowering black wattle *(Acacia leiocalyx)*

The specific epithet is derived from a Greek word *leio* meaning smooth. It describes the glabrous calyx.

DESCRIPTION. This is a tree up to 6 m high with a rough, slightly furrowed bark. The stems, particularly the young twigs, are usually extremely angular with a pronounced reddish tinge and are glabrous. The distinctly swollen portion attaching the phyllode to the stem (the pulvinus) is up to 0·5 cm long. The phyllodes are lanceolate to falcate-oblong. They are narrowed to both ends, up to 11 cm long and 3 cm broad and are dirty green in colour. Three or more veins are evident as nearly parallel lines and the less pronounced veins between them anastomose. Usually, the lower two veins run together a little above the base.

The flowers are densely packed into axillary spikes. These are pale yellow in colour and are up to 6 cm long and 0·8 cm in diameter. The pods are linear, about 0·4 cm wide and 7 cm long and are loosely and irregularly curly or twisted.

FLOWERING TIME. This wattle begins to flower at the start of winter and is usually a little earlier than Queensland Silver Wattle.

HABITAT. It is found on sandy or stony, gravelly soil in open eucalyptus forests and also behind the frontal dunes.

DISTRIBUTION. It is found only in New South Wales and Queensland from as far south as the coastal districts around Tara to the northern part of the Burdekin Basin.

Late-flowering black wattle *(Acacia concurrens)*

A Latin adjective meaning running together is the specific epithet for this wattle. It describes the manner in which all the primary veins join into the lower vein near the base of the phyllode.

DESCRIPTION. This is a shrub or tree 10 m, with phyllodes up to 17·5 cm long and 5 cm wide. On barren shoots, they can be even larger. The secondary veins anastomose like those of early-flowering black wattle. The twigs are triangular and are usually scurfy with small appressed bran-like powder, looking like specks of dust. The pulvinus is usually more than 0·5 cm long. The bark on large trees is rough, dark and furrowed. The spikes are dense, up to 10 cm long, and 1 cm in diameter and vary in colour from pale to deep lemon-yellow. The spikes are in the axils of the terminal phyllodes, either solitary or in pairs and the flowers have a strong wattle perfume. Magnification is necessary to see the short, white hairs scattered on the lower part of the calyx.

The pod is linear, 0·2 to 0·4 cm wide and is very undulating or twisted, with leathery valves.

FLOWERING TIME. Plants are in bloom from mid-winter to early spring.

HABITAT. It is common in open eucalyptus forest, on soils ranging from sand or loam to granitic in origin.

DISTRIBUTION. It is restricted to the coastal areas in New South Wales and Queensland from as far south as the Hastings River to as far north as the Mooloolah River.

FIELD KEY TO THE WATTLES OF SOUTH-EASTERN QUEENSLAND WITH FLOWERS IN SPIKES

1. Spikes less than 1 cm long, ovate or sub-cylindrical, almost sessile. Flowers bright golden-yellow. Phyllodes firm and thick-textured, almost rigid, more than 30 times as long as broad *Acacia granitica*

   Spikes more than 1 cm long or not subsessile. Phyllodes less than 30 times as long as broad 2

2. Spikes sparse and interrupted, flowers widely-spaced 3

   Spikes dense, flowers crowded; or, if sparse, not interrupted 5

3. Phyllodes linear-oblong or oblong lanceolate, rather firm in texture, 4–20 times as long as broad; with anastomosing venation. Spikes pedunculate, 4–6 cm long, flowers pale creamy-yellow *Acacia obtusifolia*

   Phyllodes linear to linear-lanceolate and thin in texture 4

4. Phyllodes bright to dark green, 6–16 cm long, and 0·1–0·9 cm wide, thin in texture, with one prominent vein and several fainter ones on either side. Spikes slender, to 5 cm long, flowers almost white, widely-spaced and scattered *Acacia longissima*

   Phyllodes dark green, 5–10 cm long, 0·2–1 cm wide, 1–3 prominent nerves and anastomosing secondary venation. Spikes to 8 cm long, sparse, flowers pale yellow *Acacia floribunda*

5. Flowers brightly-coloured, primrose-yellow or vivid golden-yellow 6

   Flowers not brightly-coloured, pale creamy-yellow or lemon-yellow 8

6. Phyllodes leathery, elliptic or oblong-elliptic, obtuse, 3–6 times as long as broad; 2–5 or more prominent veins with connecting reticulations. Spikes almost sessile, dense, to 3 cm long; flowers bright lemon-yellow, faintly perfumed *Acacia sophorae*

   Phyllodes not leathery; lanceolate-falcate or more or less straight 7

7. Foliage and stems on young plants densely pubescent. Mature phyllodes glabrous, light green, narrow-lanceolate to falcate-lanceolate. Spikes to 5 cm long, dense and of uniform diameter. Flowers vivid golden-yellow, sweetly scented. Pods terete and straight, to 9 cm long, 0·5 cm wide *Acacia julifera*

   Foliage on young plants glabrous. Mature phyllodes grey-green to dark green, more or less straight, with 3 prominent veins. Spikes to 4·5 cm long, dense, but buds opening irregularly. Flowers primrose-yellow. Pods linear and straight, to 10 cm long *Acacia blakei*

8. Secondary veins not anastomosing; phyllodes grey-green covered with thin, grey wax, spikes to 5 cm long. Flowers pale yellow. Pods woody, more than 1·5 cm wide, flat but thick, with oblique reticulate veins and transverse seeds *Acacia aulacocarpa*

   Secondary veins anastomosing; phyllodes green, dirty-green or grey-green. Pods less than 1 cm wide 9

9. Lenticels always or sometimes present. Branchlets glabrous or with sparse appressed hairs 10

   Lenticels never present. Branchlets glabrous, scurfy or with appressed golden hairs 11

10. Young shoots glabrous or with a few white hairs. Spikes to 4 cm long with widely spaced pale yellow flowers with an unpleasant odour. Pods linear and straight to 11 cm
Acacia orites

Young shoots sometimes with appressed golden hairs. Interrupted spikes to 6 cm long with pale creamy-yellow flowers. Pod linear, to 12 cm long, very twisted in loose spirals
Acacia maidenii

11. Young shoots with appressed golden hairs. Interrupted spikes about 3·5 cm long with lemon-yellow flowers. Pods flattened, spirally and tightly coiled *Acacia cincinnata*

Young shoots, glabrous or scurfy. Pods linear, straight, curly or twisted 12

12. Twigs glabrous, reddish and prominently angled. Pulvinus to 0·5 cm. Spikes to 6 cm long, dense, flowers pale lemon-yellow. Pods loosely and irregularly twisted *Acacia leiocalyx*

Twigs scurfy. Pulvinus more than 0·5 cm long. Spikes to 10 cm long, dense, flowers pale to deep lemon-yellow. Pods linear but not straight *Acacia concurrens*

Strain 19 vaccine and brucellosis eradication

WHERE does Strain 19 vaccination fit into the brucellosis eradication campaign?

This question is becoming more real as the campaign progresses and the endpoint of the brucellosis programme approaches. More than 4 million breeders are now under eradication conditions in Queensland and the balance of about 1 million breeders will come under test in the next year or two.

The short answer is that Strain 19 vaccination will continue to have a key role—until the early 1980s at least. Major setbacks occurred in brucellosis programmes in Canada, the United States and in Tasmania and these, in hindsight, appear to have resulted because vaccination was discontinued too early. It is known that stock show a severe loss of natural resistance of infection when the disease is no longer present in the area. This natural resistance is difficult to measure while it exists, but is dramatic in its absence. Outbreaks of brucellosis in 'eradicated' areas, overseas and in Tasmania, have been explosive and uncontrollable, except by a vigorous slaughter-out policy in all infected herds.

This is why the Queensland Department of Primary Industries is strongly advocating that calfhood vaccinations continue in herds that have been infected and in 'at risk' herds located in areas with a history of infection. In 1973–74, over 360 000 doses of vaccine were used and in 1977–78, about 120 000. Most believe this decline has been too rapid.

by Officers of Veterinary Services Branch.

Arguments to the contrary usually revolve around the occurrence of 'false positives' and this certainly is a complex issue.

After vaccination with Strain 19, cattle almost always react for a period to the tests used for diagnosis of brucellosis. The point is that there can be great differences between the results of agglutination tests—depending upon whether or not the animal was vaccinated before, or after, puberty. For instance, the serum agglutination test, which was used for routine diagnosis until the scheme gained some momentum in 1973, is likely to give false positives for a longer term in cattle vaccinated after puberty. Those vaccinated before puberty are likely to become negative in 6 to 12 months.

The serum agglutination test has been replaced in routine eradication testing by the complement fixation (C.F.) test. The C.F. test rarely gives false positives in Strain 19 vaccinates for more than 6 months after vaccination—irrespective of whether vaccination was performed before or after puberty. This, theoretically, means that Strain 19 now can be used in cattle of any age.

Some field trials by the Queensland Department of Primary Industries, using Strain 19 in Channel Country weaners and in adults in heavily-infected dairy herds, have confirmed that the vaccine and the test are very efficient. False positives in these trials were so rare as to be insignificant and the level of infection fell from 25% to 5% in the vaccinated group.

There is no doubt that the trend toward the use of Strain 19 for control of brucellosis will accelerate in the low Channel Country and also in fire brigade control of outbreaks in intensive herds. The other vaccine available, Strain 45/20, is being used less frequently because it invariably does confuse C.F. results for at least 12 months and often longer. It also can be associated with carcass damage at the site of injection.

The problem with Strain 19 is that of exception to the rule. In some herds, a few vaccinated cattle continue to give low grade positive results to the C.F. test for 2 to 4 years after vaccination. This feature is confined to certain herds and seems to appear without rhyme or reason, although some breeds appear to be more susceptible.

There are a number of possible causes of persistent titres in Strain 19 vaccinates.

- ANIMALS ARE INFECTED—The most common cause, especially in the dairy situation. Calves may be infected at birth, or by drinking milk from an infected transient herd replacement—perhaps discarded because of poor performance (or infertility) before she calves in the herd and establishes the cycle of infection among adults. Also, the vaccine will fail in a percentage of animals in heavily-infected herds.
- ANIMALS EXPOSED AFTER VACCINATION AND RESISTING INFECTION—Exposure to challenge after vaccination often stimulates significant levels of diagnostic antibody, although the animal may withstand, or throw off, infection.
- ABERRANT ORGANISMS IN THE VACCINE—Strain 19 is a laboratory strain of *Brucella abortus* which does not cause disease. It does not have colonizing abilities and dies a few days after it is inoculated into the animal to be immunized. But it does persist for long enough to immunize the animal. It seems that a few organisms in certain batches change in nature occasionally and regain the ability to colonize the vaccinated animal for longer periods, although without causing disease.

It is the animals so affected which give positive results—usually low grade, and often fluctuating between negative and positive, or suspicious. These animals provoke thought on the part of the testing officer who can only evaluate them on the basis of the results for the remainder of the herd, the herd's history, and the status of surrounding and other herds.

If all such omens are favourable, the reactors usually can be safely disregarded by the testing officer—although a check test is always made on the herd at a later date.

Although vaccinates with low grade positive results are always carefully considered if they fall within the 2 to 4-year-old age group (and few wrong decisions are made) there undoubtedly are some innocents condemned to slaughter as a consequence of vaccination. Biology can never be a totally exact science, because of the individuality in individuals. Biological testing can never be perfect.

The present combination of Strain 19—an agglutinin producing vaccine, and a test insensitive to agglutination (the complement fixation test), is logical. Work to produce better systems is continuing and the Indirect Haemolysis Test (I.H.L.T.) for brucellosis developed by C.S.I.R.O. in Australia shows promise.

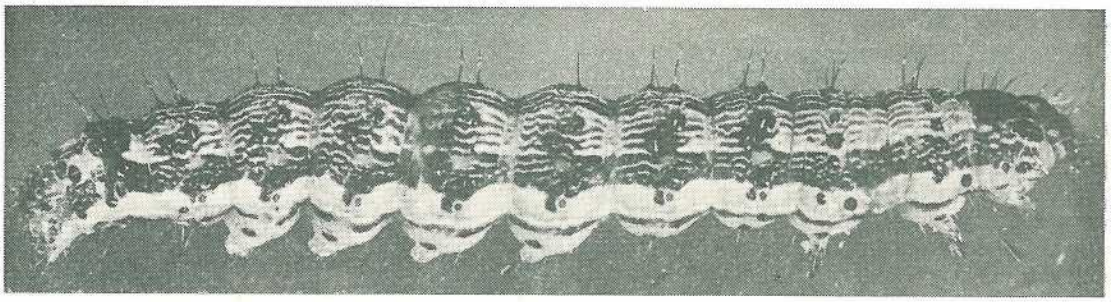
Brucellosis can be eradicated with present technology. It was, in fact, eradicated from European countries and Tasmania with much inferior test systems. But Queensland will need Strain 19 protection during the period when brucellosis has not been completely eradicated, but natural immunity has disappeared.

Strain 19 should be used in calves in risk situations now.

First Australian Jojoba Conference

THE First Australian Jojoba Conference will be held at Bathurst, NSW, from 19 to 21 September 1979. The conference sponsored by Agricultural Technologists of Australasia will discuss the potential for jojoba under Australian conditions, and bring together current research and experience around the country.

Speakers will cover the problems to be overcome if this promising new agro-industry is to succeed. Topics will include the areas suitable for planting and the likely markets and demand for jojoba oil. The conference is open to everyone interested in jojoba and particulars are available from the First Australian Jojoba Conference, Suite 303, 20 Loftus Street, Sydney.



When is a soybean 'pest' a pest?

by J. W. Turner and I. Titmarsh, Entomology Branch.

CROPS such as soybean have a remarkable ability to tolerate damage from insects without suffering losses in yield.

The sensible approach to management of a soybean crop is to apply control measures only when the insect populations reach a level (the economic injury level) where the value of the increased yield due to insect control is greater than the total cost of the control measures applied.

Although economic injury levels vary with factors such as fertility, weather and market prices it is possible to draw up guidelines for pest management decision-making based on current knowledge of the pests. Their implementation should lead to successful pest management with lower pesticide costs than when pesticides are applied on an 'insurance' oriented basis.

What insects are commonly found on soybean?

A crop of soybean attracts a large range of insects—some of which feed on the leaves, stems and pods, while others feed on the nectar and pollen. It does not necessarily mean that just because an insect species is present in a crop, economic losses will occur. Indeed, many species which are present are parasites of insects or feed on decaying organic matter.

Departmental records list 47 species of insects which actually feed on soybean. However, of these, only the ones listed below cause noticeable damage to the plants.

- GREEN VEGETABLE BUG

The adult green vegetable bug is shield-shaped, about 13 mm in length and coloured light green. The females deposit rafts of 20 to 150 eggs on the lower surfaces of leaves. The juvenile bugs which emerge are initially orange-brown and wingless. Later they develop black, yellow and red patterns but green predominates during the later instars. The egg to egg cycle occupies about 5 weeks in summer. Both the juvenile and adult stages feed on the developing soybean seeds.

The bugs have a wide range of hosts which allow multiplication from the overwintering population of adults through several generations before soybean becomes an attractive host. Soybean losses are frequently severe.

Although a number of other species of bugs have been recorded on soybean, the green vegetable bug is the only shield bug which causes economic loss.

Pod-sucking bugs occasionally cause economic loss. These are about 16 mm in length, predominantly brown with an elongate body and long legs. Unlike the green vegetable bug, pod-sucking bugs are very active—running and flying when disturbed.

Photograph above. Larval corn ear worm.

• CORN EAR WORM

The caterpillars of this species, which grow to 50 mm in length, vary widely in body colour and intensity of the markings. The colours are usually combinations of green, buff, reddish-brown and black. Larval feeding is concentrated mainly on the developing pods, but leaves are also damaged. Following pupation in the soil, the stout-bodied, strong-flying adult moth with a wing span of 35 mm emerges.

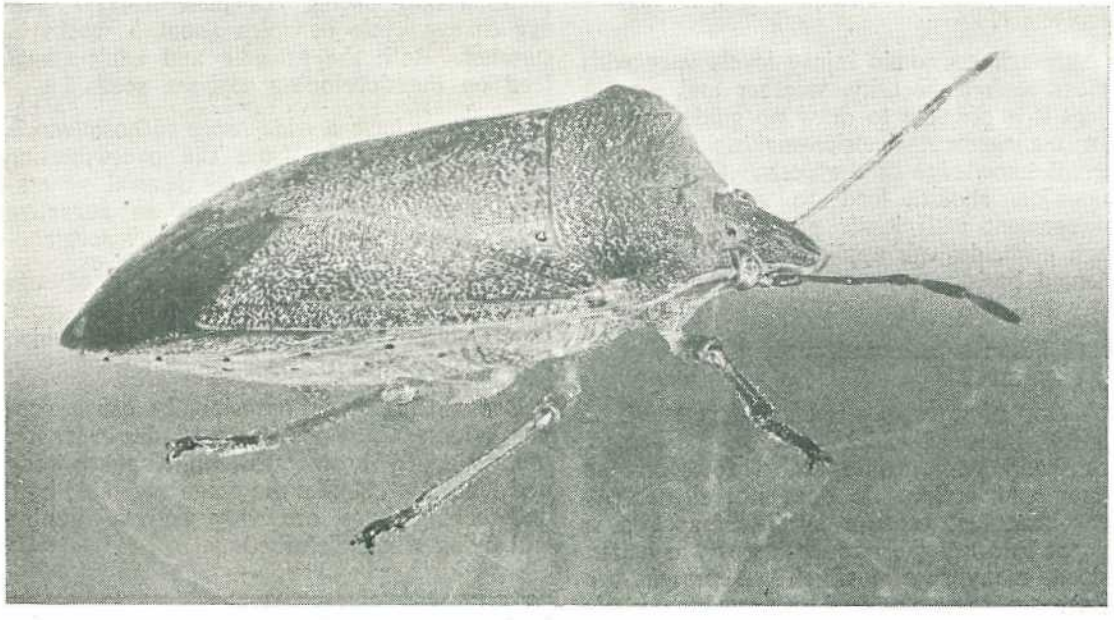
The forewings are reddish to buff coloured while the hind wings are creamy-yellow with large, marginal, smoky areas. Dome-shaped, pearly-white eggs are laid by the moths on the terminals and leaves. Eggs darken as the embryo develops. The life cycle during summer takes from 5 to 7 weeks, and usually only one generation of the insect is completed in any soybean crop. The species is hosted by numerous crops including sorghum, maize and cotton and by a wide variety of weeds. As a result of this wide host range, heavy invasions sometimes occur in soybean.

• STEM BORERS

These pests are the larvae of small longicorn beetles, characterized by long antennae. The most common species is the lucerne crown borer which is 14 mm in length, coloured light orange with black markings and long, black antennae. The larvae, which grow to 13 mm in length, are white and elongate with deep constrictions between the body segments. They tunnel and feed in the pithy section of the stem. The life cycle has not been studied in great detail but there appears to be only one generation per year in Southern Queensland. Lucerne and native legumes such as Sesbania are alternative hosts.

• SPIDER MITES

Adults are up to 0·55 mm in length and their spider-like appearance can just be distinguished without the aid of a hand lens. Damage to soybean causes a mottling in leaf colour, with 'bronzing' of badly affected leaves. Leaf fall may result from severe or sustained attack. The young growing points of the plant may be webbed by fine silken strands among which mites will be seen moving. They feed and breed on the lower surface of the leaf with the life cycle being completed in about 11 days in summer. Hosts include a wide range of cultivated and weed



Adult green vegetable bug.

species and the pests are able to migrate during the early juvenile stage by drifting on air currents. The rapid build-up in populations which occurs during periods of hot, dry weather is accentuated when broad spectrum insecticides remove population checks by destroying predators.

• LUCERNE SEED WEB MOTH

Several generations of this insect occur each year in rattle pods and lucerne. Occasional 'overflows' occur from these preferred plants into the less preferred soybean crops where the insect occasionally causes severe damage.

The adult is a grey moth with a wing span of about 20 mm. The forewings are marked with an orange band across the inner third of each and a white stripe along the outer margin from the base to the apex. There is a conspicuous 'snout' on the head. Eggs are laid on the hairs of the pods. The larvae tunnel into the pod shortly after hatching, and feed internally for most of the life cycle. Early detection of infestations is therefore difficult. The reddish-pink larvae may deposit dung and webbing outside the pods.

• BEAN POD BORER

The bean pod borers' larvae also bind soybean pods with webbing contaminated with frass but as they attack the plants rather earlier than lucerne seed web moth, flowers are damaged and webbed. The larvae which are 18 mm in length when fully grown are greenish-yellow with several rows of characteristic dark spots along the body. The forewings of the moth are yellowish-brown with several translucent spots while the hindwings are mostly free from scales except for a brownish fringe.

The moth which has a wing span of 25 mm shelters among plants during the day. While soybean appears to be one of the less preferred hosts of this species, occasional outbreaks occur.

• LUCERNE BLUE BUTTERFLY

The blue butterflies with a wing span of 25 mm which are frequently observed flitting over soybean patches are the adult stage of green, slug-like larvae. These feed on the foliage, buds and pods but are never present in sufficient numbers to reduce yield.

• SOYBEAN MOTH

This small, inconspicuous moth with a wingspan of 9 mm is dark brown in colour with a transverse mark across the centre of the forewing. The leaf rolling and feeding activities of the larvae are obvious particularly during the seedling stage. When fully grown, the larvae are slender, olive-green in colour with a reddish head capsule. They are about 7 mm in length.

• SPUR-THROATED LOCUST

Spur-throated locusts feed mainly on the buds and young pods and can reduce yield. Locusts may breed in soybean fields or swarms may fly in.

• LOOPERS

These moth caterpillars are foliage feeders and are characterized by their 'looping' form of movement. When fully grown, they are about 38 mm in length. The plain green larvae of the green looper is frequently found at low levels in soybean but has not been recorded as causing economic losses.

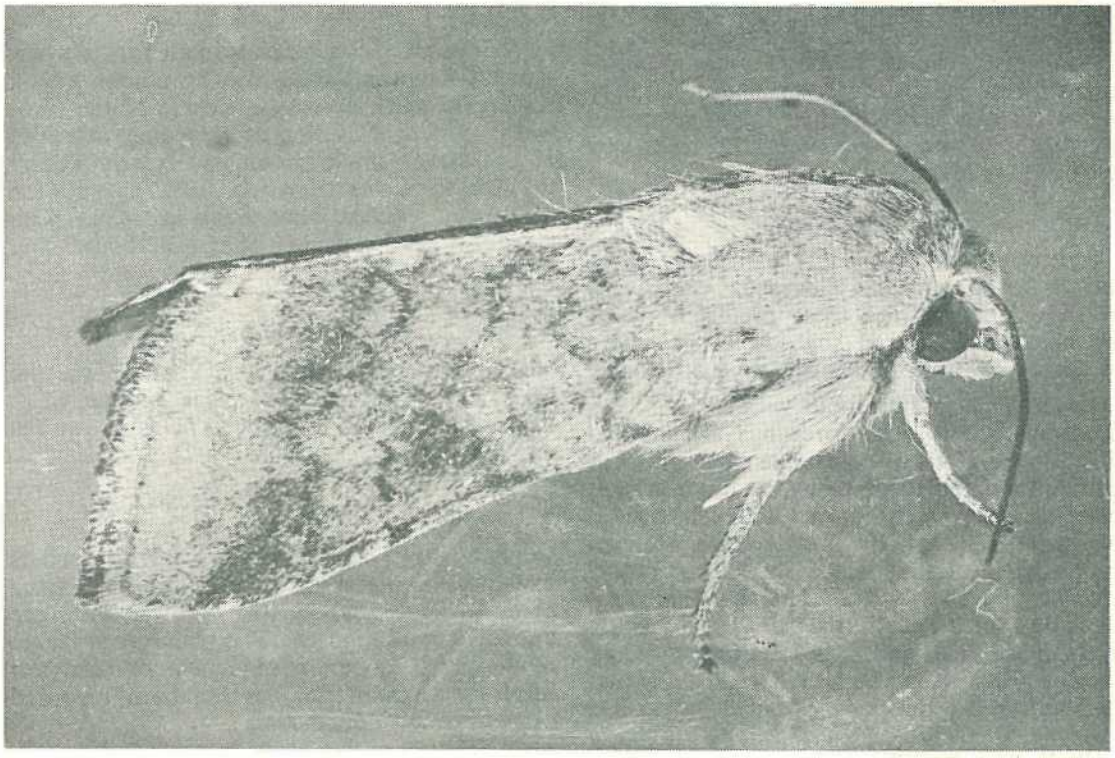
The most destructive species is the soybean looper which is distinguished by light-coloured markings on larvae while the adults with a wingspan of 35 mm have a shiny golden area on the forewings. They have caused major losses during one of the 3 years during which they have so far been present in Australia.

• CUTWORMS

The grey to brownish larvae up to 45 mm long develop from eggs laid in the soil adjacent to the base of the seedlings. Larval feeding often results in plants being cut-off near ground level and stand densities are occasionally reduced to a subeconomic level.

• JASSIDS

Jassids are small green to yellowish-green sucking insects up to 2·5 mm long commonly found running, hopping or flying on or around plants. The soybeans currently grown commercially in Queensland are hairy and thus relatively resistant to jassids. Young plants growing under substandard conditions appear to be most susceptible to damage.



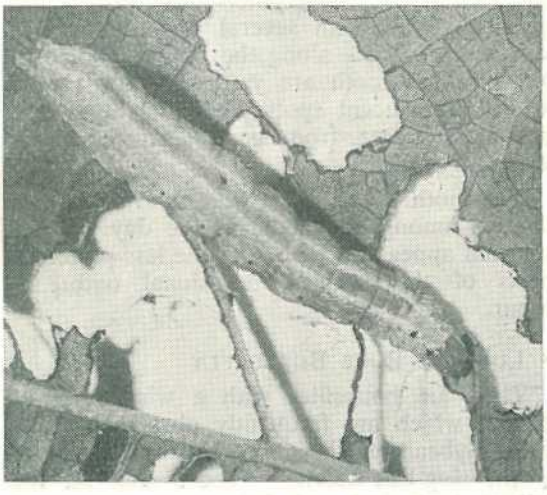
Above. Corn ear worm moth.

What losses do they cause?

Leaf-feeding insects reduce the photosynthetic area of plants, thus reducing the plants' ability to manufacture food from sunlight. Damage can also increase water loss. Soybean plants have a remarkable ability to tolerate loss of leaf tissue and if adequate soil moisture levels are available, plants during the preflowering stage can tolerate up to 33% defoliation. The plants are more sensitive to defoliation from the stage of pod setting until the seeds are fully expanded.

During the early flowering stage, plants are able to tolerate up to 20% leaf loss where adequate moisture and nutrients are present and up to 10% leaf loss when growing conditions are poor. From this stage until the beans are fully expanded, the plants are sensitive to defoliation and removal of more than 6% of the leaf area from vigorous plants will cause a significant economic loss. Defoliation does not reduce yield if it occurs after the seeds are fully expanded.

Below. Looper larvae feeding.



A different set of circumstances operates where insects feed on growing points of the plant as this can stunt growth and cause excessive branching. Young plants are very intolerant of terminal loss.

Although mites are leaf feeders their interaction with the plant differs greatly from chewing insects. Mites feed on the sap of the plant and in the process inject saliva. The chemicals contained in the saliva affect the metabolism and the growth promoting substances present in the plant.

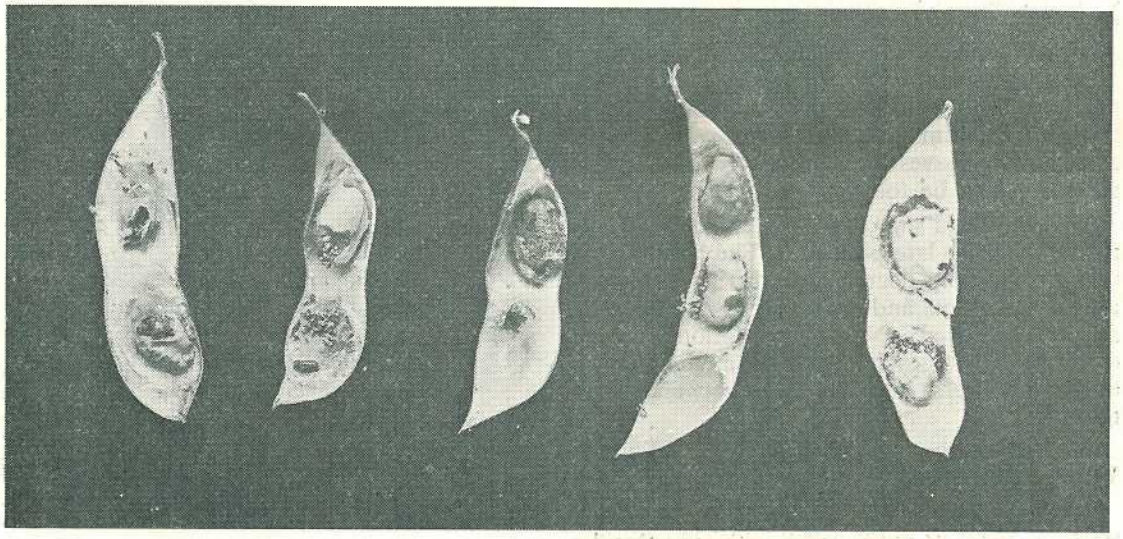
Data indicates that plants can tolerate 3 to 5 mites per cm^2 at any period of growth. When the population approaches 20 to 25 per cm^2 the leaflets are shed by the plant and yields are reduced. The plants are most susceptible to damage during the period from pod setting until the seeds are fully expanded.

The dense canopy of a well grown soybean crop makes chemical control of mites difficult. Early application of miticides are advisable if mite populations are detected and seem likely to reach high levels before the seed is fully expanded. Application as the populations approach the economic injury level are less reliable in preventing losses. If mite populations reach high levels after the seeds are fully expanded no action should be taken as defoliation will not affect yield.

When seeds are damaged, the resources of the plant are redirected and the remaining seeds often grow larger so that the final yield may remain unchanged. This ability to compensate for seed damage is greatest during the early pod setting stage and decreases as the seeds mature, reaching zero when the seeds are fully expanded. Vigorous plants compensate most efficiently so all agronomic factors including available moisture affect the outcome.

The degree to which a seed is damaged is also significant as slightly damaged, large seeds will continue to develop. These utilize plant resources and prevent the compensation which can occur if a small seed is aborted following damage. This gradation of reactions can be seen in the effects of the green vegetable bug sucking on seeds. Young seeds are aborted, while partly grown seeds are shrivelled.

Fully expanded seeds exhibit a black spot in a depressed area at the puncture point but more importantly have reduced weight, and oil and protein percentages. Control measures



Lucerne seed web moth damage to seeds.

are warranted when an average of one adult or juvenile bug is located per m of row in crops from pod set to the commencement of haying-off.

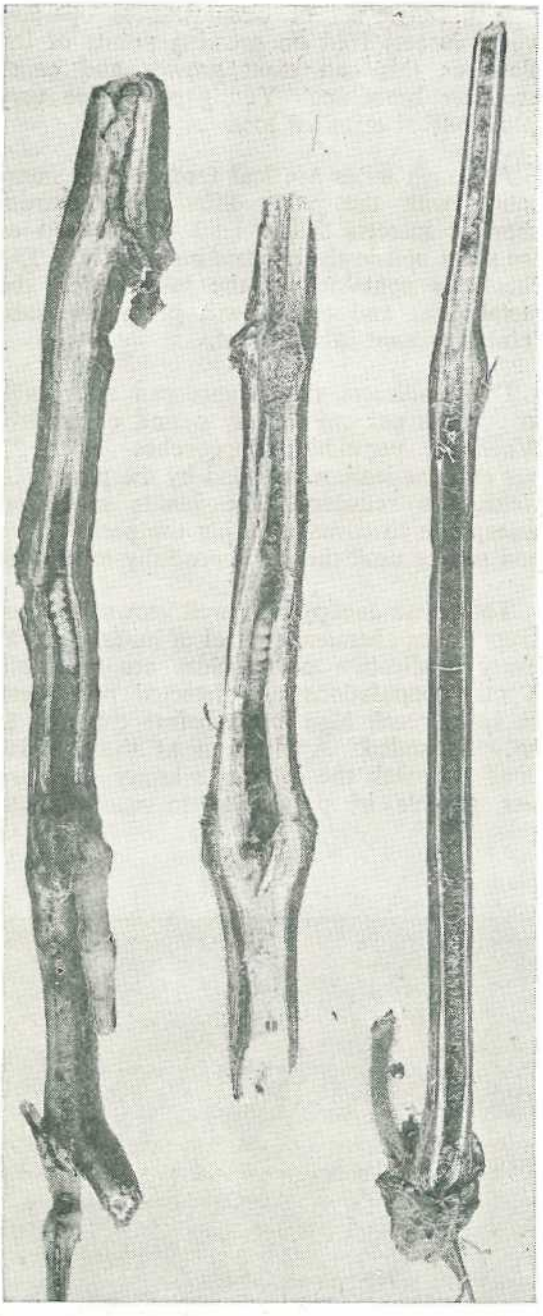
The corn ear worm is the most common of the caterpillars which attack seeds. Studies carried out in the United States of America utilized manual simulation of damage when the seeds were fully expanded. During a season when adequate moisture was present, the injury of 50% of the pods did not reduce yields. However, during a subsequent season when moisture was limited later in the season, injury to 30% of the pods caused a yield reduction.

If it is assumed that in an average Queensland crop 30% injury causes loss then when two larvae are located per m of row, spraying is warranted. (This is a conservative estimate which allows for the failure of the observer to find all larvae).

Slightly higher populations may be tolerated in irrigated crops because of their greater ability to compensate for damage. Proportionally higher populations of larvae of smaller insects such as soybean web moth can feed before economic loss occurs.

Both cutworms and stem borers can reduce the density and evenness of the plant stand. The recommended plant density varies with location and time of planting and incorporates a safety margin for adverse seasons. Populations of early-planted young seedlings can often be uniformly reduced by 50% without producing a reduction in yield if adequate moisture is present during the remainder of the season. Similarly, in plants with five to six trifoliate leaves, approximately 25% stand reduction can be tolerated.

Early-planted stands are better able to compensate than late-planted. The ability to tolerate thinning decreases with the increasing age of the plants and ceases when the podding stage is reached. No compensation can be expected for losses of plants from the feeding of stem borers between pod set and seed maturity.



Stem borer damage.

What crop surveillance is required?

Frequent surveillance is required during the seedling stage to allow early detection of cutworm damage. From the end of the seedling

TABLE 1

——	Withholding period (days)	Green vegetable bug	Corn ear worm	Looper	Cutworm	Mite	Spur-throated locust
endosulphan ..	28	735 (a)	735				
methomyl ..	1	340 (b)	340–450 (c)	340			
monocrotophos	5	280 (d)				360 (e)	275–550 (f)
fenvalerate ..	14		80–100 (g)	80–100			
chlorpyriphos	2				350 (h)		
naled	4						400–600 (i)

Equivalent rates of product
(a) 2 100 ml of 350 g/L; (b) 1 500 ml of 225 g/L; (c) 1 500–2 000 ml of 225 g/L;
(d) (e) (f) 700 ml, 900 ml, 690–1 350 ml of 400 g/L; (g) 400–500 ml of 200 g/L; (h) 700 ml of 500 g/L;
(i) 2 250–3 000 g/L (U.L.V.)

stage until pod set, losses can occur from attack by locusts, loopers and corn earworms. During this phase, the plants are more tolerant of damage, but the pests often invade in large numbers and weekly crop inspections should be made. More frequent inspections will be required during periods of locust activity. It is crucial that twice-weekly inspections should be made during the period from pod set to maturity to detect infestations of green vegetable bug, corn earworm, loopers and mites.

Insect distribution in crops is often patchy and at least five sites should be inspected in every 100 ha. The sites chosen should be distributed through the field and not concentrated on the edges. Cutworm damage and locusts are easily detected. If plants are shaken vigorously, corn earworms and loopers fall to the ground and can be seen after a short time moving over the soil. An inspection for damaged pods will indicate the presence of corn earworm as well as lucerne seed web moth. Slight leaf bronzing and inspection of the lower leaf surface, preferably with a hand lens, will confirm the presence of mites.

Green vegetable bug populations are often very patchy and at least 20 m of crop should be inspected at each site to obtain a measure of the bug population. A large proportion of the bugs move to the top of the canopy and 'bask' in the sunlight between 8 and 10 a.m. Observations during this period are recommended to save time in looking very critically into the plant canopy.

What control measures can be used?

Table 1 gives the grams of active constituent of chemical per hectare required for control of damaging populations of pests.

The most efficient application of insecticides during the seedling stage can be achieved by mounting a hollow-cone nozzle on a boom spray over each row. Furthermore, considerable savings can be involved as the rate of chemical application can be reduced proportional to the reduced area of coverage. Boom sprays fitted with additional nozzles and preferably with some mounted on droppers are efficient applicators until plant height or coverage of the inter-row space results in plant damage. During later growth, ground application can only be made using a high clearance spray rig with guards to miminize damage from passage of the wheels and droppers.

Aerial application of insecticides during the seedling stage is more expensive than boom spraying over individual rows. Efficient control from aerial application can readily be achieved before the crop closes across the inter-row space. After closure in dense crops, satisfactory control can only be achieved through precise applications under optimum conditions. Green vegetable bug control may be improved by applying pesticides during the 'basking' period described earlier.

Quite a number of pest species may be encountered with the production of soybeans. Observations during recent years suggest that a grower will have experienced a most difficult pest season if more than two pesticide applications are required during the growth of a crop.

Scientific names of insects and plants mentioned in the text

Green vegetable bug		*Nezara viridula* (L.)
Pod-sucking bugs		*Riptortus* spp.
Corn ear worm		*Heliothis armigera* (Hübn.)
Lucerne crown borers		*Zigrita diva* Thoms.
	and	*Corrhenes stigmatica* (Pasc.)
Spider mite		*Tetranychus* spp.
Lucerne seed web moths		*Etiella* spp.
Bean pod borer		*Maruca testulalis* (Geyer)
Lucerne blue butterfly		*Lampides boeticus* (L.)
Soybean moth		*Stomopteryx simplexella* (Walk.)
Spur-throated locust		*Austracris guttulosa* (Walk.)
Green looper		*Chrysodeixis eriosoma* (Dbd.)
Soybean looper		*Trichoplusia orichalcea* (F.)
Cutworm		*Agrotis* spp.
Jassids		*Austroasca viridigrisea* (Paoli)
	and	*A. alfalfae* (Evans)
Rattlepods		*Crotalaria* spp.
Sesbania		*Sesbania* spp.
Soybean		*Glycine max* (L.)
Lucerne		*Medicago sativa* (L.)

Poultry Advisory Board members appointed

THE Minister for Primary Industries, Mr V. B. Sullivan, has announced the appointment of members of the Poultry Advisory Board for a 3 year term from July 1 this year. The term of the previous Board expired on June 30.

Membership of the Board is: Messrs J. W. Ryley (Chairman), Director, Division of Animal Industry, D.P.I.; R. V. Byrnes (ex officio), Husbandry Officer-in-Charge, Poultry Section, D.P.I.; B. Venamore, Carbalah (Egg Marketing Boards); K. J. Turner, Millmerran (commercial producers of eggs); E. J. Rigby, Redcomb Stock Feeds (commercial processors of chicken meat); J. P. Godfrey, Capalaba (commercial growers of broiler chickens) and G. L. Gilbert, Capalaba (stock suppliers engaged in the business of hatching chickens for sale).

Flowering times of eucalypts in North Queensland

THERE are many eucalypts native to North Queensland. At present, there is not much information published about their flowering times.

The principal months in which the tree has been observed to be flowering are listed. For certain species, only limited information is available. The flowering times of these species are indicated by a dotted line. As more information becomes available, it may be found necessary to list slight variations from the flowering time as now shown.

Eucalypts are important species for beekeepers but no attempt has been made to list the importance of the individual species, that is, quality or quantity of honey or of pollen.

During compilation of the list of flowering times, it was found that odd trees can flower well outside the period given. These isolated occurrences are not listed in this text. I particularly mention lemon-scented gum (*E. citriodora*) which seems to be rather erratic in its flowering pattern. Isolated trees have been observed to flower all year round. A significant flowering can occur in July to September.

The taxon shown as 'ironbark' (*E. crebra/drepanophylla*) has been recorded as such because botanists have variously identified it as *E. crebra* or *E. drepanophylla*. It appears to be different from both. The taxon shown as 'grey ironbark' (*E. drepanophylla*) is found around Charters Towers. It varies from the form found in South Queensland.

by T. F. Weatherhead, Department of Forestry.

The list has been compiled using Australian standard trade names or in their absence preferred common names and botanical names to lessen confusion. Other common names may be used locally for the species listed. Most of these can be found in the Queensland Department of Forestry Pamphlet No. 13 'The Nomenclature Density and Lyctus-Susceptibility of Queensland Timbers'. Standard trade names are as published by the Standards Association of Australia in AS 02–1970—'The Nomenclature of Australian Timbers'.

Some of the species listed are of limited occurrence but are included in an effort to give a comprehensive list of the eucalypts which grow in North Queensland. There are other species, for example, tallowwood (*E. microcorys*) which have been introduced to North Queensland. These species are not included because they are not naturally occurring species although they may be used quite extensively in ornamental or farm plantings.

Acknowledgements

The author's observations were made partly in the course of duties with the Department of Forestry whose permission to publish same is acknowledged.

Information other than from the author's own observations has been obtained from the following:

B. P. M. Hyland and A. K. Irvine—Division of Forestry Research, C.S.I.R.O., Atherton.

Ron Knowlton, Mareeba.

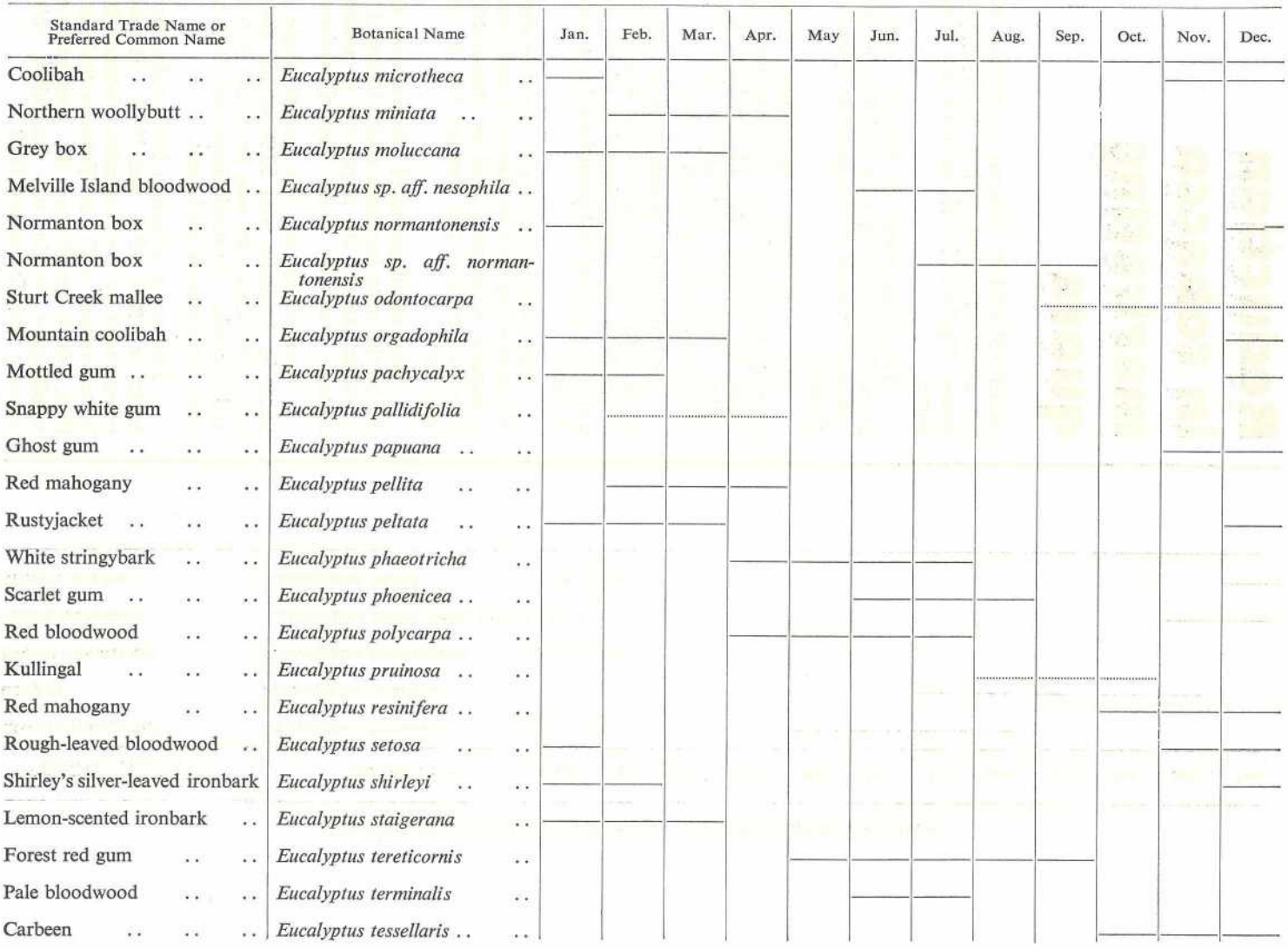
Sam Collins, Toumoulin.

The author wishes to thank these gentlemen for their help.

Principal Flowering Times of Eucalypts in North Queensland

Standard Trade Name or Preferred Common Name	Botanical Name	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Range bloodwood	*Eucalyptus abergiana*												
White mahogany	*Eucalyptus acmenioides*												
Poplar gum	*Eucalyptus alba*												
Brassiana gum	*Eucalyptus brassiana*												
Brown's box	*Eucalyptus brownii*												
River red gum	*Eucalyptus camaldulensis*												
Coowarra box	*Eucalyptus cambageana*												
Lemon-scented gum	*Eucalyptus citriodora*												
Gympie messmate	*Eucalyptus cloeziana*												
Broad-leaved carbeen	*Eucalyptus confertiflora*												
Narrow-leaved red ironbark	*Eucalyptus crebra*												
Cullen's ironbark	*Eucalyptus cullenii*												
Narrow-leaved ironbark	*Eucalyptus crebra|drepanophylla*												
Gum-topped bloodwood	*Eucalyptus dichromophloia*												
Grey ironbark	*Eucalyptus drepanophylla*												
Queensland peppermint	*Eucalyptus exserta*												
Gilbert River bloodwood	*Eucalyptus gilbertensis*												
Large-leaved cabbage gum	*Eucalyptus grandifolia*												
Rose gum	*Eucalyptus grandis*												
Howitt's box	*Eucalyptus howittiana*												
Red bloodwood	*Eucalyptus intermedia*												
Molloy red box	*Eucalyptus leptophleba*												
Silver-leaved ironbark	*Eucalyptus melanophloia*												
Gilbert River box	*Eucalyptus microneura*												

Principal Flowering Times of Eucalypts in North Queensland—*continued*



Standard Trade Name or Preferred Common Name	Botanical Name	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Coolibah	*Eucalyptus microtheca*												
Northern woollybutt	*Eucalyptus miniata*												
Grey box	*Eucalyptus moluccana*												
Melville Island bloodwood	*Eucalyptus sp. aff. nesophila*												
Normanton box	*Eucalyptus normantonensis*												
Normanton box	*Eucalyptus sp. aff. normantonensis*												
Sturt Creek mallee	*Eucalyptus odontocarpa*												
Mountain coolibah	*Eucalyptus orgadophila*												
Mottled gum	*Eucalyptus pachycalyx*												
Snappy white gum	*Eucalyptus pallidifolia*												
Ghost gum	*Eucalyptus papuana*												
Red mahogany	*Eucalyptus pellita*												
Rustyjacket	*Eucalyptus peltata*												
White stringybark	*Eucalyptus phaeotricha*												
Scarlet gum	*Eucalyptus phoenicea*												
Red bloodwood	*Eucalyptus polycarpa*												
Kullingal	*Eucalyptus pruinosa*												
Red mahogany	*Eucalyptus resinifera*												
Rough-leaved bloodwood	*Eucalyptus setosa*												
Shirley's silver-leaved ironbark	*Eucalyptus shirleyi*												
Lemon-scented ironbark	*Eucalyptus staigerana*												
Forest red gum	*Eucalyptus tereticornis*												
Pale bloodwood	*Eucalyptus terminalis*												
Carbeen	*Eucalyptus tessellaris*												

Principal Flowering Times of Eucalypts in North Queensland—*continued*

Standard Trade Name or Preferred Common Name	Botanical Name	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Darwin stringybark . .	*Eucalyptus tetrodonta* . .												
Cadaga . .	*Eucalyptus torelliana* . .												
Brown bloodwood . .	*Eucalyptus trachyphloia* . .												
White mahogany . .	*Eucalyptus umbra subsp. umbra*												
White's ironbark . .	*Eucalyptus whitei* . .												

Reduction in tobacco marketing quota

QUEENSLAND'S tobacco marketing quota for the 1980 season will be 8 130 000 kilograms. This was 3·1% down on last season's quota.

The Department of Primary Industries' Marketing Services Branch said that the reduction was made up to two parts for Queensland growers.

The Australian Agricultural Council recently announced that the Australian quota would be reduced from 15.3 million to 15.1 million kilograms. Queensland's share of this reduction required a cut of 2·1%.

In addition, the growing side of the industry decided that a further 1% cut was necessary to eradicate the over-allocation of the quota which has existed in Queensland for a number of years.

The continued decline in the consumption of tobacco products in Australia and growing stockpiles of tobacco held by manufacturers were two reasons put forward for the quota reduction.

Sales of all grades of tobacco were affected by the price increases which followed rises in excise tax and the imposition of additional tobacco taxes by some State Governments.

Queensland was the largest single producer in Australia with 53% of the national crop. The remainder was produced in N.S.W. and Victoria. Australia imported 43% of its total requirements each year.

This quota reduction follows similiar cutbacks in 1976, 1977 and 1978. It was recommended by the Australian Tobacco Board in accordance with the Tobacco Stabilisation Plan which guaranteed the continuation of stabilisation within the Australian tobacco industry until December 1983.

Bovine Brucellosis Accredited-free Herd Scheme

The following is a complete list of Accredited-Free Herds as at 31-3-79:

J. L. & S. E. Abraham, 'Kaho' Stud Farms, M.S. 892, Meringandan.	AIS, JS, SM
Agar Pastoral Co., P.M.B. 3, Murgon.	SG
D. A. N. Agnew, Mikobe Poll Hereford Stud, Imbil.	PH
Alcheringa Pastoral Co., 10 Coomber St., Bundaberg.	CH
R. N. Alexander, 'Trefoil Pk.', Warra.	HF
J. H. & B. J. Amor, 'Carinya', Dulacca.	BF
F. Anderson, 'Castle Mitchell', Clifton.	MA
F. J. & M. I. Anderson, Currumbin Creek Rd., Currumbin.	JS, FSX
Anderson Pastoral Co., 'Inverary', Yandilla.	PH
E. R. Andrew, Woodford Rd., Peachester.	FS
Animal Husbandry Research Farm, Dept. of Primary Industries, Rocklea.	M
F. R. B. Anning, 'Cardross Charolais Stud', Grandchester.	CL
H. R. Arthy, 'Beauvale', Laravale via Beaudesert.	JS
W. J. Atkin, 'Sandon', Durah Rd., Chinchilla.	AG
Atkinson & Co., Glenavon, Yaamba.	SG
P. Atkinson, P.O. Box 1, 'Coorumburra', Marlborough.	SG
S. J. Atkinson, 'Wairuna Brahman Stud', 'Bundarra', Nebo.	BM
Australian Estates, 'Wainui', Bowenville.	SG
W. S. & E. M. Badcock, 'Wandall Estates', Serpentine Creek Rd., Redland Bay.	MG
N. D. Bahnisch, 'Brafield' Stud, 'Orchard Vale', Guluguba.	BF
H. A. Balke, 'Balhaven', Westbrook.	JS
R. Barr, Eukey Murray Grey Stud, P.O. Box 194, Stanthorpe.	MG
D. J. Bartkowski, 'Sunnyglyn Stud', M.S. 892, Meringandan.	AIS
A. Bassingthwaite, Yabba Pastoral Co., Yabba, Junica, via Kilcoy.	SG
E. Bassingthwaighte, 'Woodlands Stud', Greenmount.	PH
A. V. Bayer, 'Warralea' Droughtmaster Stud, M.S. 825, Ipswich.	DM
D. E. Bayliss & Co., 'Delspring', M.S. 537, Kingaroy.	MG
D. J. & E. M. Beal, 'Tara Park', Gowrie Junction.	MG
G. W. Beck, 'Banbeck', Blenham Rd., Laidley.	DM
C. H. Beckingham, Cosme Jersey & Hereford Stud, 'Bridgemen Downs', Darien St., Aspley.	JS, HF
N. R. & E. A. Beckman, 'Glendra Stud', Aubigny, M.S. 212, Oakey.	AIS
R. J. Begg, 'Misty Downs', M.S. 848, Rosehill, via Warwick.	MG
E. C. Behrendorff, 'Inavale' Stud, M.S. 488, Boonah.	FS
L. G. Bell, 'Delgowrie', Jimbour.	BF
A. J. & M. A. Bell, 'Belheath' Stud, 'Karingal', M.S. 1231, Millmerran.	PH
M. G. Bell, 'Heatherlea' Stud, Dulacca.	BF
W. H. Bell, 'Bilandra', Jambin.	BM
J. Bennett & S. A. Wells, Box 3202, Townhall, Toowoomba.	FS, HF
H. G. & C. M. Benstead, 'Analwon', Wonglepong, via Tamborine.	AIS
E. J. & P. A. Bentley, 'Jedda Park', No. 1 Pope Rd., Mother Mtn., Gympie.	AG
Berajondo Pastoral Co. (R. J. Stephenson), 'Glenmore', Berajondo.	BM
B. & E. Bergstrom, 'Chrisaelgy', Brahman Stud, 'East End', Mt. Larcom.	BM
J. W. & J. K. Best, 'Idlewild' Stud, Warwick.	CL
Binda Brae Pastoral Co., 'Binda Brae', P.O. Box 2, Jimbour.	BF, HF
P. R. Bishop, Garglen, Southside, Gympie.	BM
T. G. & M. K. Black, 'Hazeldean' Stud, M.S. 692, Nanango.	SG
C. J. H. & M. E. Blackley, 'Alshceringa', M.S. 851, Wandoan.	BF
N. J. & E. B. Blumel, 'Willow Glen Farm' Stud, Farm Road, Bunya.	DM
A. R. & V. H. Bondfield, 'Palgrove', Dalveen.	CL
J. S. & S. & W. N. & P. M. Bonthrone, Ingaby Station, St. George.	SG
Boreview Pastoral Co., 'Boreview', Wallumbilla.	PH
R. Boshammer, 'Glenock' Angus Stud, 'Sandon', Durah Rd., Chinchilla.	AG
Estate of W. Bourke, 'College Green', M.S. 422, Clifton.	AIS
R. R. & I. A. Bowen, 'Pine Tree Farm', Roma.	HF
J. C. Brandon, Boomerang Park, Hill 60 Yangan.	MG
K. & L. Bredhauer, 'Carana', Charleville.	PH
L. J. Breen, 'Tarrawatta', Eukey, via Stanthorpe	AG
J. J. & S. L. Brider, 'Kenmar' Stud, Cryna, M.S. 1916, Beaudesert.	FS
Brigalow Research Station, Dept. of Primary Industries, M.S. 1586, Theodore.	HF
I. & D. J. Brimblecombe, 'Wyalong', Jimbour.	BF
Broadlea Partnership, 'Broadlea', Box 35, Theodore.	BM
A. & A. J. Brown, Kioman Ck., Obi Obi, Maleny.	AIS, HF, JS
H. D. & P. R. Brown, 'Westerngales' Stud, Wight's Mountain Rd., Samford.	SG
W. L. & J. M. Brown, 'Acedale' Stud, P.O. Box 18, Southbrook.	AIS
T. J. Brownlie, 'Thornton', Columboola.	SG
Buchanan & Wagner, 'Strathfarve' & 'Wathroongah', Dalveen.	SM
C. E. Buchholz, 'Baron Downs', P.O. Box 175, Maryborough.	SG
Bundaberg Sugar Co., 'Avondale' Brahman Stud, Marlborough Station, Marlborough.	BM
Burnett Downs Pastoral Co., 'Burnett Downs', P.O. Box 11, Brigalow.	MG
B. A. & B. J. Burnham, Bimbadeen Brangus Stud, 'Upson Downs', Abercorn.	BS
H. E. Burnham, 'Boolgalgopal', Abercorn.	BM
J. A. & A. W. Butler, 'Coochin', Old Gympie Rd., Beerwah.	BF
R. V. & L. M. Cahill, 'Carinya', Lamington, via Beaudesert.	HF, HFX
Calliope Cattle Co., Calliope Station, Gladstone.	HF
F. & E. L. Cameron, Evelor A.I.S. Stud, M.S. 767, Yarraman.	AIS
R. B. & J. P. Cameron, 'Belconnen', McDougall St., Warwick.	MG
J. D. & H. Campbell, 'Hilden', Burpengary Rd., Narangba.	MG, LM
M. P. Campbell, Tiaro Park, Tiaro.	BM
J. Cardillo, 'Oena', Springs Rd., Mareeba.	DM
D. I. & J. C. Carlyle, 'Wonga Hills' Stud, M.S. 355, Chinchilla.	PH
C. J. Chambers, 'Marbett Park', Goombi.	BF
L. A. & C. M. Chesworth, 'Willette', Crynard, Beaudesert.	FS, SW
B. L. & M. O. Christensen, 'Elavesor' Poll Hereford Stud, Rosevale, via Rosewood.	PH
G. E. Christensen, 'Double E', Moorang, via Rosewood.	SG

T. & W. Christensen, 'Omaha', Tarome, via Kalbar. **PH**

J. R. & H. M. Ciesiolka, 'Trebon' A.I.S. Stud, Taylor St., Toowoomba. **AIS**

C. Cho, S. H. Clarke, M.S. 825, Peak Crossing, via Ipswich. **JS, FS**

R. B. Clarke, 'Allawah', c/- P.O. Box 476, Theodore. **BM**

P. J. Clarkson, 'Baroona', Bowenville. **BF**

D. B. Coates, 'Narayen', Mundubbera. **BR**

W. C. & C. B. Cole, Alligator Creek.. **FS**

B. K. Coleman, 'Greenstock', P.O. Goombungee. **JS**

N. A. Collins, (R.J.) Kuloe, Ocean View, via Dayboro. **BM**

I. S. Conochie, 'Brookland', M.S. 461, Kalbar. **JS**

B. M. Conroy, 'Logan View, via Coominya. **CL**

Coombe Bros., 'Roxborough', Greenlake Rd., Rockhampton. **BM**

Mrs E. B. Corden, 'Currajong Angus Stud', 'Netherby', Warwick. **AG**

W. D. Cormack, 'Fourex Braford Stud', 'Oakwood', Wallumbilla. **BF**

R. T. & P. A. Craig, 'Dulong' Stud, M.S. 1096, Nambour. **MG**

D. B. & E. Crane, 'Keglsugl', P.O. Box 7, Dayboro. **PH**

V. R. & T. W. Crank, 'Gracelyn', Mt. Tyson. **AIS**

C. N. & P. J. Crisp, 'Destiny Stud Farms', P.O. Box 40, Stanthorpe. **HF**

Mrs M. Crombie, Old Hiddenvale Santa Gertrudis Stud No. 49, Old Hiddenvale, Grandchester. **SG**

M. H. & R. M. Crouch, Mt. Mee, Dayboro. **FS**

C.S.I.R.O. Belmont Research Station, P.O. Box 542, Rockhampton. **BR**

E. T. & E. H. Dalzell, 'Canimbla', M.S. 355, Chinchilla. **AG**

N. V. & N. J. Dalzell, 'Daldee', Pelican, via Chinchilla. **PH**

D. Dance, 'Double D' Murray Grey Stud, M.S. 720, Millmerran. **MG**

Dandilla Pastoral Co., 'Dandilla', M.S. 514, Kingaroy. **BF**

S. H. & V. I. Davidson, 'Cedar Grove' Poll Hereford Stud, Cedar Creek Rd., Wolfdene, via Beenleigh. **PH**

J. J. E. Davies, 'Glenwyn Park Stud', Charker St., Toowoomba. **HF**

B. H. Davis, Petrie Ck. Rd., Nambour. **MG**

K. W. Davie, 'Walkah', Carpendale, via Helidon. **JS**

W. D. Davis, Wambo A.I.S. Stud, M.S. 918, Toowoomba. **AIS**

G. F. & A. M. Dean, 'Gadfield' Stud, Home Creek, Wooroolin. **CH, SM**

T. W. & M. D. Deans, Dino Glen, Watson's Lane, Reeseville, Maleny. **FS**

Dept. of Children's Services, Westbrook Training Centre, Westbrook. **JS**

N. J. & E. J. Dingle, 'Dingleville Braford Stud', 'Dingleville', M.S. 221, Maryborough. **BF**

H. J. & L. G. Dippel, Thornton Mountain Crest, M.S. 182, Laidley. **GS**

M. G. Doro, Upper Wheatvale, M.S. 848, Warwick. **FS**

W. A. Dodd, Glengannon Stud, M.S. 435, Rosewood. **PH**

C. M. & B. E. Dolding, 'Dilston', Gayndah. **DM**

F. M. & G. Donovan, 'Ashby' Braford Stud, Jimbour. **BF**

Doondi Pastoral Co., 'Doondi Poll Hereford Stud', St. George. **PH**

Doro Park Friesians, 'Doro Park', M.S. 918, Toowoomba. **FS**

E. O. & L. A. Dorries & Son, 'Panorama', M.S. 212, Oakey. **AIS**

F. R. & G. A. Dowe, 'Wahroonga', Tara. **PH**

L. J. Drew, 'Bluevale' Stud, M.S. 1116, Haden. **AY**

V. L. Duhs, Murray Grey Stud, Image Flat Rd., Nambour. **MG**

D. P. H. & C. G. Earl, 'Boolaroo', Boyland, via Tamborine Village. **MG**

Eidsvold Station Holdings Pty. Ltd., 'Belvedere', Eidsvold, c/- Douglas, Heck and Burrell, G.P.O. Box 35. **SG**

R. W., A. J. & D. G. Elder, 'Katupna Park', Goombi, via Chinchilla. **PH**

T. V. & P. M. A. Erbacher, 'Everush', M.S. 465, Cambooya. **JS**

E. G. Evans, Lauraven, Mountain View Rd., Maleny. **AIS**

G. D. Evans, 'Arababy Stud', 'Arababy', Moore. **AG**

P. J. Evans, Dragon St., Warwick. **FS**

R. C. Fahl, 'Sandalwood', Meandarra. **PH**

R. J. A. & C. M. Farmer, 'Morel Stud', Oaklea, Killarney. **SH**

G. T. C. Farrawell, Lander Shute Rd., Palmwoods. **DM**

Dr E. S. P. Ferguson, 'Coonoona', Wellcamp. **PH**

J. A. & D. P. Ferguson, 'Dorallah' Jersey Stud, Veresdale, via Beaudesert. **JS**

M. J. & J. Ferguson, 'Antrim', The Gums. **HF**

Finlay Pastoral Co., Emu Plains, Texas. **HF**

G. C. Fischer, 'Karalee' Murray Grey Stud, 68 Hume St., Pittsworth. **MG**

M. J. & M. Fitzgerald, 'M-Jay' Stud, 'Tarooma', Texas. **HF**

D. J. Fogg, 'Den-Dia' A.I.S. Stud, M.S. 336, Toogoolawah. **AIS**

S. R. Ford & Sons, 'Wattlebrae', M.S. 514, Kingaroy. **CL**

F. & D. Fordyce, 'Waterhole', Bloomsbury. **BM**

M. R. & J. E. Fowler, 'Donna-Lynn', M.S. 195, Pittsworth. **CH**

Franz Josef Pty Ltd., 'Bellevue Pk.', Tara. **HF**

F. & I. C. Fraser, 'Dundee' Brahman Stud, Richmond. **BM**

W. A. Freeman, Trevlac Stud, Walloon Rd., Rosewood. **CL**

A. J. & Y. I. French, 'Wilston Park', M.S. 181, Pittsworth. **FS**

R. Freshney, Karena Hereford Co., 'Karena', Bowenville. **HF**

J. Friedland & Son, 'Glen-Opal', Obi Obi, via Nambour. **JS**

A. W., E. M. & D. W. Frohloff, 'Trinity', M.S. 191, Cambooya. **FS**

Garryowen Pastoral Co., 'Corolla' Stud, M.S. 29, Clifton. **HF**

C. Gauld, 'Moongana', Brooweena. **SG**

Gayway Pastoral Co., 'Gayway', Anduramba. **BM**

H. H. & P. E. Gear, Takura, via Maryborough. **MG**

M. & G. M. Geddes, 'Rhodavale', Hodgson Vale, via Toowoomba. **FS**

J. S. & E. J. Genge, 'Carinya', P.O. Box 78, Miles. **SG**

H. C., K. C. & I. E. Genrich, P.O. Box 10, East Cooyar. **CL**

P. & J. Gibbons, 'White Mists', Mt. Glorious, via Kilcoy. **DM**

W. W. Gibson, 'Glencrest', Mooloo, via Gympie. **GS**

D. H. & G. M. Glasser, 'Yagaburne', Goondiwindi. **PH**

Glenrae Pastoral Co. Pty. Ltd., 'Bowenfels', P.O. Box 54, Kingaroy. **PH**

B. Goddard, 'Inverell', Mt. Tyson, via Pittsworth. **AY**

Golden Grove Pastoral Co., 'Golden Grove', Glenmorgan. **SM, HF**

Goondicum Pastoral Co., 'Goondicum', Gin Gin. **HF**

H. A. Gordon, 46 Mellifont St., Banyo. **MG**

K. J. & J. L. Gordon, 'Merriwa', M.S. 499, Toowoomba. **BF**

B. B. Gotke, Reynold Valley Jersey Stud, M.S. 461, Kalbar.	JS
G. B. Gould, 'Guluguba' Stud, 'Waitangi', Guluguba.	PS
L. M. Graham, 'Glenmore' and 'Glenlea' Studs, P.O. 1494, Nanango.	BF, HF
R. N. & L. M. Graham, 'The Homestead' Stud, Couper's Rd., Westbrook.	FS
L. R. Granzien, 'Caboonbah' Jersey Stud, Kalbar.	JS
W. J. Grayson, 'Linda Vale', Killarney.	DV
K. F. & K. P. Greiss, 'Glendon Friesian Stud', The Caves.	FS
G. W. & A. L. A. Green, 'Woodridge', M.S. 371, Greenmount.	GS
G. A. Greenup & Co., 'Benroy', Kingaroy, c/- 'Rosevale', Jandowae.	SG
J. R. & R. Grieve, 'Invernaion', Yandilla.	PH
J. C. Grigg, 'Bethonga' Braford Stud, P.O. Box 4, Wamuran.	BF
D. H. & P. O. Guilford, 'Mooloolah' Stud, 'Richmond', Allora.	HF
N. J. & H. M. Guppy, 'River Dell', M.S. 852, Hodgson Vale, via Toowoomba.	FS
S. K. Guppy, 'Lynstarr', M.S. 1096, Nambour.	FS
N. D. & A. V. Hams, 'Shandah', P.O. Box 89, Nanango.	SG
B. & M. Hannant, 'Croalah' Stud, M.S. 243, Kingaroy.	PS
S. & P. E. Hardgrave, 'Arrawatta Stud', Sharon, via Bundaberg.	FS
C. R. Hardwick, 'Charlyn', Marlborough.	BM
B. M. & J. R. Hare, 'Wahpunga', Kin Kin.	BF
H. R. Harris, 'Temora Park' Stud, M.S. 33, Cedar Creek, via Samford.	PH
N. & F. M. Harrison, 'Oakridge Stud', Bartholomew Rd., Elimbah.	BS
I. & B. J. Hart, Trahni, M.S. 1867, Greenmount.	HF
A. E. Harvey, 'Ronel', Kingsthorpe.	FS
E. & R. F. Harvey, 'Dumboy', M.S. 918, Toowoomba.	FS
E. A. G. & P. L. Hawthorne, 'Richmondale', Peranga.	JS
T. R. Hay & Co., Pindi Pindi.	BM
B. E. Hayward, 'Denville' Stud, M.S. 465, Cambooya.	HF
G. H. & L. F. Hayward, 'Nashville', M.S. 1840, Greenmount.	PH
M. E. & V. J. Heinemann, 'Maralinga', Luck St., Drayton.	PS
C. R. & M. Hemming, 'Birra Birra', Thallon.	SG
M. F. Hemmings, 'Bileena', Canningvale Rd., Warwick.	AIS
V. A. Henderson, Barkala Stud, Greenmount Rd., Cambooya.	HF
J. & J. L. Henry, 'Rocky Ponds', Massie, via Warwick.	HF
K. Henry & Sons, 'Tara' Stud, M.S. 465, Cambooya.	AIS
W. G. Henschell, 'Yarranvale', M.S. 1444, Brookstead.	PH
R. S. & E. M. Heslip, Shamrock Friesian Stud, Sommerville Rd., Beechmont.	FS
H.M. Prisons, Etna Creek, via Rockhampton.	M
H.M. State Farm, Numinbah Valley, Numinbah, via Nerang.	FS
H.M. State Farm, Palen Creek, Rathdowney.	JS
H.M. Prisons, 'Wolston' Stud, Station Rd., Wacol.	FS
Superintendent, H.M. Prison, Neurum Rd., Woodford.	JS
C. J. Hewitt, 'Judel' Friesian Stud, Delaney's Creek, via D'Aguilar.	FS
H. L. Higgs, 'Bangalla', River Rd., Tinana.	BR
Hindmarsh & Son, 'Wingfield', Monto.	HF
Estate H. & F. H. Hinz, 'Glenmoya', Rossmoya Rd., The Caves, via Rockhampton.	BF
F. J. Hirn & Sons, 'Glen Avon,' Peachester Rd., Beerwah.	JS
A. Hobbs, Birkdale, Dartmouth.	CL
G. & J. F. Hodgens, Bunyeris, Peachester, via Beerwah.	JS
C. F. & V. M. Hodgson, 'Wingfield', P.O. Box 35, Dalby.	DM
G. F. & N. E. Hoey, 'Coolalinga Jersey Stud', M.S. 74, Clifton.	JS
J. L., Z. P. & L. M. Hoey, 'Emoh-Ruo' & 'East Lynne', M.S. 74, Clifton.	SG
N. T. & M. A. Hoey, 'Merrawah' Stud, M.S. 371, Greenmount.	JS
J. R. & M. R. Holmes, 'Benbecula', Charlton, M.S. 1497, Toowoomba.	AY
A. T. Holt & Son, 'Karowara Santa Gertrudis Stud', Hartley Rd., Mt. Tamborine.	SG
L. R. & E. E. Hoopert, 'Happy Valley', M.S. 212, Oakey.	SG
H. W. Hopper, 'Ellendean' Guernsey Stud, P.O. Box 4, Maleny.	GS
I. C. & S. D. Huey, 'Ashview', M.S. 918, Toowoomba.	JS
M. E. & V. E. Hughes, 'Mi-von', Hopelands, via Chinchilla.	HF
Sir A. Hulme, c/- R. Ledger, 'Alcheringa Stud', Highlands Rd., Eudlo.	DM
S. E. Hunt & D. J. & M. Doyle, 'Kudo' Stud, 'Komirra Pastures', Glasshouse Mountains.	PH
R. B. & S. R. Huth, M.S. 27, Moorang, via Rosewood.	JS
C. J. & M. E. Jackson, 'Jaffra', Gogango, Fairy Bower Road, Gracemere.	BM
E. P. J. & M. Jackson, 'Rotherham' Stud, 'Ennismore', Nobby.	PH
M. D. & B. E. R. Jannusch, 'Albion Park', c/- P.O. Box 25, Pittsworth.	FS
G. D. & B. M. Jensen, 'Kuyura', Jimbour.	BF
L. G. Jensen, 'Tower Town' Stud, Glenwood, Gunalda.	FS
F. M. & K. W. Jobling, 'Karalee' and 'Karanga' Studs, M.S. 979, Monto.	AIS, PS
F. S. Johnston, 'Jon-Dene', Obi Obi, via Mapleton.	AIS
R. W. Johnston, 'Wallum Hills' Santa Gertrudis Stud, Franks Lane, Wamuran.	SG
C. H. & D. N. Jones, 'Glen Wkga', M.S. 423, Hopeland, via Chinchilla.	HF
R. L. & S. S. Jones, 'Valley View' Stud, Samford Rd., Samford.	AY
B. C. Juers, Mimosa B.J. Stud, 'Mimosa', Gayndah.	DM
M. E. Just, Double Dee, Bergen P/A, P.O. Box 606, Toowoomba.	SM
C. & D. I. Kajewski, 'Glenroy', Glencoe, M.S. 1049, Gowrie.	AIS
L. K. Kath, 'Kathleigh', M.S. 1049, Gowrie Junction.	JS
C. L. Keaveny, Kerry, via Beaudesert.	HF
F. A. & M. Kehl, 'Hillview', Wallumbilla.	BF
J. T. & F. Kelman, 'Mt. Tabor' Station, Warwick.	SH X CH
J. E. Kemph, 'Bunya Vale', M.S. 222, Oakey.	CL
Kengoon Pastoral Co., 'Kengoon' Studs, Kengoon, Kalbar.	BM, CL, DM, AF, PH
G. D. Kenman, 'Corang', Armstrong Ck., via Dayboro.	FS
W. T. & G. M. Kenny, Shirley, Meson St., Gayndah, P.O. Box 15, Gayndah.	BF
G. H. Kerr, 'Glenora', Chinchilla.	HF
R. & M. Kerr, 'Maryview', Miva.	BF
R. R. Kerr, 'Sunnyside', M.S. 117, Monto.	GS
Kerwee Pastoral Co., 'Argyle', Kingsthorpe.	SG
F. W. & E. M. Kiepe, M.S. 223, Nobby.	FS
R. J. & J. J. Kiepe, 'Charlton View Ayrshire Stud', Charlton, via Toowoomba.	AY

D. H. Killer, 'Kilbunda' Brahman Stud, M.S. 108, Bundaberg. **BM**

A. J. Kinbacher, 'Garthowen', P.S. 1216, Biggenden. **DM**

E. W. King, c/- Kengoon Pastoral Co., Dingley Dell, M.S. 1017, Biloela. **DM, AF, BM**

J. L. King, Ridley Park, 79 Bridgeman Rd., Bridgeman DNS, Aspley. **PH**

L. B. & M. Kirby, 'Kalanga' Stud, Wesley Rd., Kallangur. **CL**

K. R. & M. S. Knight, Mt. Mee, via Dayboro. **FS, SW**

S. G. Knight & Co., 'Baalgammon', Manumbar Rd., Nanango. **AIS**

S. S. Knitter, 'Charnu' Stud, M.S. 546, Forest Hill. **FS, JS**

J. W. & M. J. Koehler, 'Wattleview', Yamsion, via Jandowae. **HF**

A. F. Krinke, 'Plain View', c/- Box 92, Pittsworth. **HF**

B. R. & J. H. Kummerfield, 'Lonley', c/- P.O. Box 7, Goovigen. **GS**

L. H. Kunset, 'Sunnyside', Miva. **BS**

B. G. & R. M. Lamb, North Kolan, M.S. 311, Avondale. **BM**

P. A. & J. L. Lange, 'Cerana', M.S. 222, Oakey. **AIS**

K. J. & M. Lau, 'Rosallen', Goombungee. **JS**

A. E. Lawley, 'Arley AIS Stud', Reesville Rd., Maleny. **AIS**

K. R. & E. A. B. Lawler, 'Coolibah' Stud, M.S. 292, Marburg. **AIS**

D. C. Lawrie, 'Croxley', M.S. 918, Toowoomba. **DM**

F. Lax & Sons, 'Wyroona', M.S. 212, Oakey. **FS**

C. F. Leacy, Coominga Droughtmaster Stud, 93 Summit Rd., Pomona. **DM**

Leacy & Pavan, 'Calmrancho', 93 Summit Rd., Pomona. **DM**

R. S. & R. I. Learmont, 'Scotlea', P.O. Box 102, Monto. **SG**

K. J. Lee, 'Brigalow Park', Kurrumbul. **HF**

S. R. & J. M. Lee, 'Reservoir' Braford Stud, P.O. Box 60, Allora. **BF**

Lenorco Pastoral Co., Pierce Ave., P.O. Box 143, Caloundra. **CL**

W. M. Leonard & Sons, 'Welltown', Goondiwindi. **SH**

Lester Brothers, 'St. Andrews' Stud, M.S. 623, Warwick. **AIS**

C. J. & W. T. Lewis, 'Medland', Toowoomba Rd., Crows Nest. **HF**

C. N. & D. V. Lewis, 'Bramleigh', Baralaba. **BM**

P. M. Lewis, 'Spring Glen', Kingsthorpe. **FS**

C. P. & E. G. Liebke, 227B, West St., Toowoomba. **MG**

O. H. & W. L. Lind, 'El-Jaycee', Gordon Brook South, M.S. 780, Kingaroy. **BF**

L. J. & L. V. Litster, Hillside, M.S. 192, Malakoff Rd., Dalby. **FS**

K. D. & J. K. Little, 'Woodleigh' Stud, Beaudesert. **JS**

G. W. Little, 'Glengarry', Jimbour. **MG**

R. & M. Little, Laurov Pastoral Co., 'Lauroy', P.O. Box 72, Miles. **CL, SM**

H. V. & N. A. Littleton, 'Lanacoora', Bowenville. **LM**

W. J. & A. Lloyd, 'Wriembilla', Chinchilla. **SG**

Lobegeiger & Co., Wallaville. **BF**

G. L. & A. E. Lobegeiger, 'Sunny Grove' Jersey Stud, Moorang, via Rosewood. **JS**

N. E. Lobley, 'Neloby', Mt. Pleasant, via Dayboro. **FS**

D. D. Logan, 'Pineview', Kilcoy. **BS, BM**

D. D. Logan, 'Glenmaurie', Kilcoy. **BF, HFX**

G. M. Logan, 'Neara Stud', Pineview, Kilcoy. **CL**

L. K. Lostrock, 'Shamrock Yale', M.S. 212, Oakey. **AIS**

J. R. & M. D. Louttit, 'Lagoona', M.S. 979, Monto. **BM**

C. R. Loweke, 'Willowside', Kenilworth. **JS**

J. P. & A. M. Lowther, Silverleaf Hereford Stud, M.S. 355, Chinchilla. **HF**

K. D. & D. R. Ludwig, 'Sun Valley', Tarragalba, M.S. 411, Beaudesert. **FS**

S. H. & R. L. Ludwig, 'Glenvale', Boyland, via Tamborine. **GS**

Lynn-Eden Braford Stud, 'Warrigal', Columboola. **BF**

J. R. & A. McCamley, 'Lancefield' Brahman Stud, Dululu. **BM**

W. J. McClelland Pty. Ltd., 'Oakland', Jandowae. **HF**

E. F. McCormack t.a. Dilga Pastoral Co., 'Clonlara', 'Dilga', Glenmorgan. **DM, HF**

D. J. & W. E. Macdonald, 'Rosneth' Jersey Stud, Goombungee. **JS**

A. McDowall, Logancrail Cement Mills. **HF**

W. D. & M. M. McErlean, 29 Rowbotham St., Toowoomba. **PH**

F. W. McFalzen, Glenvale Friesian Stud, M.S. 1598, Sarina. **FS**

D. D. & J. L. McGuckin and I. D. & B. J. Francis, 5 Mile Rd., Tinana. **HF**

M. M. & G. E. McGuire, 13 Burton St., North Booval. **CL**

L. M., M. B. & I. D. McIntosh, 'Widgee Homestead', Widgee, via Gympie. **AG**

W. R. McIntosh, 'Roadvale' A.I.S. Stud, 1 Tipman Rd., Gympie. **AIS**

J. MacIntyre, Dulong Rd., Dulong, via Nambour. **JS**

P. D. MacIntyre, Ti Tree Springs, P.S. 1096, Dulong, via Nambour. **JS**

M. L. & R. G. McKewen, Tansey, Goomeri. **GS**

R. MacLean, c/- Kerwee Pastoral Co., 'Berwick', Jondaryan. **SG**

R. M. & E. C. McNaught, 'Kenjame Park', Abels Rd., Woolooga. **FS**

B. W. & L. J. McNamara, 'The Glen', Bell. **BF**

D. J. McNamara, 'Holmwood', M.S. 360, Bell. **BF**

G. N. & V. M. McNamara, 'Strath-Vale', M.S. 360, Bell. **BF**

J. & T. McNamara, 'Athol Pines', Athol, via Westbrook. **PS**

L. & M. MacNeill, 'Miamba', Condamine. **HF**

F. A. Mallison, 'Ganbeer' A.I.S. Stud, M.S. 438, Boonah. **AIS**

B. J. & S. L. Mann, 'Mylo', P.O. Box 27, Chinchilla. **AIS, AG, HF**

C. R. & J. L. Marquardt, 'Cedar Valley' Stud, Box 69, Wondai. **AIS**

A. G., E. B. & L. G. J. Marshall, 'Yoronga', Beechmont, via Nerang. **JS**

R. J. P. Martin, 'Jacaranda' Friesian Stud, M.S. 546, Forest Hill. **FS**

V. & D. Mason, 'Deejay', M.S. 150, Pittsworth. **AIS**

R. G. & M. Matheson, 'Inabui', Eatonvale Rd., Tinana. **DM**

R. G. & M. Matheson, 'Mioko', Owanyilla, M.S. 221, Maryborough. **DM**

J. B. & J. M. Matthews, 'Mt. Moriah', P.O. Box 15, Jondaryan. **SM**

R. F. & R. M. Maynard, 'Greenfields', Jambin. **BM, CL**

W. H. C. Mayne & Sons, 'Gibraltar', Texas. **AG**

F. D. & P. A. Mayo, 'Logan Park' Simmental Stud, Pacific Highway, Loganholme. **SM**

A. R. Meldrum, 'Brackyn Hill', Parkhurst. **BM**

B. J. & B. F. Melrose, 'Glen Eildon' Braford Stud, 'Glen Eildon', Highfields. **BF**

G. H. Miller, Greenlake Rd., Rockhampton. **BM**

S. J. & H. L. Miller, 'Nardoo', Miller St., Warwick. **SM**

Mimosa Stud & Cattle Co., 'Mimosa', Gayndah. **DM**

Mindaribba Pastoral Co., c/- W. H. Perkins, P.S. 1608, Nanango. **SG**

R. C. Mogg, 'Raymount' Friesian Stud, Dulong, via Nambour. **FS**

P. A. Moore, 'Bell Tower', South Isis, Childers. **BF**
A. E. Morris, 'Hillsdale', Gowrie Junction. **JS**
R. Morris, Piccadilly Pastoral Co., 'Cotswold Hills Stud', Gowrie Rd., Toowoomba. **CL**
P. Mort, 'Franklyn Vale' Braford Stud, Franklyn Vale, Grandchester. **BF**
Moulton Pastoral Company, Noosa Charolais Stud, Old Tewantin Rd., Cooroy. **CL**
G. W. Mowat, 'Town View', Jame St., Yarraman. **AIS**
H. A. Muir, Church Rd., Bethania. **PH**
J. Mulholland, 'Widgee Crossing Santa Gertrudis Stud', 'Widgee Crossing', Gympie. **SG**
A. C. & G. A. Muller, 'Quamby', P.S. 1767, Maleny. **FS**
K. B. & K. T. Muller, 'Lyndon', P.O. Box 69, Clifton. **CL**
J .T. Mundell, 'Redmarley Stud', 'Redmarley, Condamine. **SH**
K. E. & D. M. Nauschutz, 'Gold Park', M.S. 118, Warra. **SM**
M. Newton, 'Malland', Kaimkillenbun. **PH**
M. R. & D. E. Newton, 'Royelle', Kaimkillenbun. **PH**
D. J. & E. M. Nielson, 'Kintyre', Mt. Tyson. **MG**
A. & K. Niethe, Lockrose, M.S. 546, Forest Hill. **DM**
A. B. Nixon, 'Devoncourt Stud', Dulacca. **HF, PH**
P. E. C. & V. K. Nobbs, 'Lyndhurst', Biloela. **BM**
D. M. & M. T. Nolan, 'Maydan', M.S. 848, Warwick. **BF**
J. D. & K. F. Noonan, M.S. 182, Laidley. **GS**
M. J. & B. F. Norgaard, 'Yarrabine', Box 61, Post Office, Yarraman. **FS**
Norolle Pastoral Co., 'Norolle', P.O. Box 138, Roma. **PH**
A. F. & J. E. North, 'Northbrook', Millman. **BM**
R. J. & B. M. Nothdurft, 'Glen Heath', Yalangur, M.S. 918, Toowoomba. **AY**
N. F. Nutt, Ferny Vale, Canungra. **FS**
T. A. & M. W. O'Brien, Coolum Park Stud, Toolborough Rd., Yandina Creek. **BF**
A. O'Dwyer, 'Mt. Manning Pastoral Co.', M.S. 422, Clifton. **SG**
J. M. Officer, Warrawee, Miles. **DV, PD**
L. & N. M. Ogden, 'Red Hill Brangus Stud', M.S. 1017, Biloela. **BS**
G. & K. G. Orphant, 'Westbank', Paterson. **HF**
P. W. O'Sullivan, 'Navleigh' A.I.S. Stud, M.S. 371, Greenmount. **AIS**
J. D. O'Sullivan, Navilloween, M.S. 371, Greenmount. **PH**
R. J. O'Sullivan, 'Beenbah' Stud, Killarney. **HF**
B. W. Overton, Galaxy Stud, 5 Gap Rd., Cedar Pocket, via Gympie. **CL**
E. I. & S. Pacholke, 'Sunnylawn', M.S. 74, Clifton. **BF**
Pagel & Hayes, 'Trafalga' Stud, Tarampa, via Lowood. **AIS**
L. R. Pain, 'Cabandah', Jandowae. **BF**
S. J. & L. J. Pain, Taitlands Braford Stud, M.S. 708, Jandowae. **BF**
B. M. Paine, 'Tolga', Yengarie. **DM**
Palahra Farming Pty. Ltd. (N. Rose), P.O. Box 19, Grantham. **BF**
L. S. Park & Co., 'Parklands', Maclagan. **MG**
C. W. W. Pask, 'Beacon Pastures Brahman Stud', 33 Perry St., Mackay. **BM**
P. A. & J. T. Paterson, 'Wheel Park', M.S. 852, Hodgsonvale, via Toowoomba. **FS**
A. F. Paton, 'Warragah' Stud, M.S. 30, Millmerran. **SG**
C. F. Paton, 'Glenroy' Stud, M.S. 30, Millmerran. **SG**
E. A. Paton, 'Sherdale', M.S. 30, Millmerran. **SG**
K. H. Paton, Wallanba Pastoral Co., 'Sherglen Stud', Wallanba, Meandarra. **SG**

K. S. R. Patrick, Boyland, via Tamborine. **GS**
S. & S. M. Paulger, 'Adadale', Kenilworth. **JS**
M. C., R. C. W. & I. M. Pearce, M.S. 582, Toowoomba. **JS**
Pearson Bros., M.S. 1184, Murgon. **COM**
J. N. Penglis, 'Pendale' Poll Hereford Stud, Westbrook Rd., Wellcamp. **PH**
M. J. & E. N. Perkins, Byce Jersey Stud, M.S. 692, Nanango. **JS**
K. J. & D. M. C. Perrett, 'Kerralea' Goombuara, P/A 12 Creek St., Bundamba. **MG**
Perrett Grazing Patrnership, P.O. Box 181, Kingaroy. **PH**
A. V. Peters, Gladwyn Angus Cattle Co., M.S. 892, Meringandan. **AG**
L. W., M. J. & G. F. Peters, 'Wilmington' A.I.S. Stud, M.S. 212, Oakey. **AIS**
P. J. & V. R. Peters, Ripple Vale Angus Stud, M.S. 582, Toowoomba. **AG**
R. G. Pharoah, 'Merroo' Encourage Stud, P.O. Box 34, Chinchilla. **HF, SM**
C. W. Phillips, 'Sunnyview Park', M.S. 623, Warwick. **AIS**
J. Phillips & Sons, 'Sunnyview' Stud, M.S. 90, Kingaroy. **DM**
Pickering Bros., 'Granite Vale' Stud, Sellins Rd., Mt. Mee, via Dayboro. **FS**
J. F. Porter, Westwood Jersey Stud, M.S. 16, Maleny. **JS**
W. T. & E. A. Potter, 'Derrymore', Texas. **CL**
D. A. Price & Co., 'Deloraine', P.O. Box 7, Jimbour. **CL**
C. & E. L. Prosser, 'Thuruna' Stud, Tara. **HF**
H. D. N. & C. K. Quast, 'Lincolnfield', P.O. Box 150, Beaudesert. **SM**
E. R. & H. G. Quilty, 'The Grange', Nanango, c/- P.O. Box 7, Nanango. **SG**
R. D. & G. R. Radunz, 'Cool Hill', Wooroolin. **SG**
D. G. Raff, 'Forres', Karara. **AG**
O. A. Raine, 'Raine Drops Poll Hereford' Stud', 43 Dunbeath Drive, Burpengary. **PH**
A. A. & M. I. Ranger, 'Glenoyra', M.S. 222, Oakey. **AIS**
A. W. Rasmussen Pty. Ltd., 'Praguelands', Alligator Ck., via Mackay. **DM**
E. J. Rasmussen, 'Euluma Stud', c/- P.O. Box 80, Mossman. **DM**
P. D. & T. R. Rauchle, 'Oakmount', M.S. 150, Pittsworth. **SM**
P. Rawson, 'Beenbah', P.O. Box 21, Killarney. **SG**
K. R. & G. A. Reid, Goomeran, Thane, via Warwick. **HF**
Reid & Sons, 'Bundarra Hereford Stud', 'Gregmore', Malakoff Rd., Dalby. **HF**
K. G. Reinhardt, 'Kenway' Red Poll Stud, M.S. 906, Mapleton. **RP**
A. I. Reis, Marlan Pastoral Co., Marlan, Condamine. **HF, SM**
B. W. & R. A. Reisenleiter, 'Viscount', M.S. 149, Gatton. **HF**
Research Station, Biloela. **FS**
F. T. Rowe, 'Green Acres', Banana. **BM**
S. B. & L. W. Reynolds, 'Moorlands', M.S. 918, Toowoomba. **HF**
N. E. & B. G. Richardson, Mt. O'Reilly Rd., Samford. **FS**
K. O. Roberts, Purga Pastoral Co., 9 Woodgate St., Churchill. **CL**
J. & E. Robinson, 'Pinora Hereford Stud', Railway St., Jackson. **HF**
W. E. & R. M. Rose, 'Rosevale' Friesian Stud, M.S.I. 1184, Murgon. **FS**
A. J. T. & I. M. Ross, 'Rosedale' Stud, Dayboro Rd., Samford. **FS**
W. Ross & Co., 'Starview' Stud, M.S. 23, Rosewood. **AIS**
H. G. & B. Rowe, 'The Hollow', Mirani. **BS**

P. D. & B. M. Rowley, 'Lac-Mel', Mt. Pleasant, via Dayboro. **FS**

L. D. Russell, 'Courtleigh' Brahman Stud, Woodford Rd., Peachester, via Woodford. **BM**

H. L. Rutledge & Co., 'Darrian', Jondaryan. **PS**

St. Peters Lutheran College, 'Ironbark', Crows Nest. **DM**

G. G. Savage, 'Ven Vale', Ramsay, via Cambooya. **AIS**

Estate of W. T. Savage, 'White Park', M.S. 852, Toowoomba. **AIS**

Sawley Family, c/- R. M. Sawley, 'Nakara Poll Hereford Stud', M.S. 394, Warwick. **PH**

T. D. & I. F. Sawley, 'Glengallan Poll Hereford Stud', M.S. 394, Warwick. **PH**

M. L. & D. M. Sawtell, M.S. 346, Nanango. **AG**

N. N. Schelbach, 'Allanview', M.S. 848, Warwick. **AIS**

Mrs K. W. W. & V. J. Schlodfeldt, 'Wyandah', P.O. Box 212, Beaudesert. **SM**

K. G. & M. A. Schloss, 'Tarlatin Hereford Stud', M.S. 648, Yarraman. **HF**

B. & T. Schmidt, 'Bando', Wyandra. **BM**

J. C. Schmidt, 'Cordell County', Winn Rd., Mt. Samson. **FS**

W., L. W. & D. J. Schossow, 'Teviot Brooke', M.S. 488, Boonah. **FS**

E. A. & R. E. Schroeder, 'Elverum Jersey Stud', Farm 21, Dagun, via Gympie. **JS**

C. N. Scott, M.S. 1471, Manumbar Rd., via Nanango. **FS**

D. I. Scott, Shepherd Hill Stud, Beechmont Rd., Nerang. **JS**

E. I. Scott & J. S. Edwards, 'Auchenflower', Glenore Grove, via Forest Hill. **AY, FS**

W. J. T. & D. V. Scrymgeour, 'Aberfoyle', 'Arran', Warwick. **AG**

A. E. & M. V. Scurr, 'Domvale', M.S. 720, Millmerran. **MG**

G. C. Seibel, 'Mountvale', M.S. 848, Warwick. **HF**

Shannon Partnership, Cardowan Grazing Co., 'Cardowan', via Sarina. **BF**

L. Shaw, 'Padue' Stud, Kareelpa, via Nambour. **SM**

L. J. Sheahan, 'Kyilla Park Stud', 'Kyilla', Condamine. **HF**

N. K. & S. B. Shelton, 'Vuegon', Hivesville. **BF**

W. J. Shepherd, 'Morwidgee', M.S. 1231, Millmerran. **MG**

J. S. & E. A. Sichter, 'The Loch Brahman Stud', Alligator Creek. **BM**

J. & S. C. Siebenhausen, 'Merriton', M.S. 195, Pittsworth. **AIS**

D. J. & S. R. Simpson, 'Kildirk', Commissioners Flat Rd., Woodford. **AIS**

R. E. Simpson, 'Tangarine Springs', 25 Waraba Cres., Caboolture. **MG**

F. Sippel, 'Callemondah', Ballandean. **JS**

A. W. & M. J. Skerman, 'Ar-Dee' Braford Stud, 'Rossman Downs', Wandoan. **BF**

B. S. Skerman, 'West View' and 'The Highlands', Boorabin, via Maleny. **AIS**

S. A. & V. M. Skerman, 'Rarcamba', Wandoan. **BF**

W. R. Slatter & Sons, Berryglen Murray Grey Stud, M.S. 1605, Killarney. **MG**

E. J. Smith, 'Hillcrest' Ayrshire Stud, Borallon, via Ipswich. **AY**

F. H. & E. Smith, Sommerville Brahman Stud, 'Brahmeadows', M.S. 1883, Rockhampton. **BM**

F. J. & H. R. Smith & Sons, 'Rubyvale' Angus Stud, 'Bralea', Burnside Rd., M.S. 1096, Nambour. **AG**

J. Z. Smith, Alum Rocks, Amiens. **HF**

L. D. & G. L. Smith, 140 Wecker Rd., Mansfield. **AIS**

L. W. & K. J. Smith, 'Judi-Jindi Braford Stud, M.S. 501, Dalby. **BF**

M. T. & B. R. Smith, 'Pamplyn' Friesians, Wellcamp. **FS**

N. S. Smith, 'White Gates' Friesian Stud, M.S. 90, Kingaroy. **FS**

L. R. & B. Sommerfield, Hayfield, Cunnamulla, Box 308, Cunnamulla. **SG**

J. D. & P. W. Spann, 'Minlacowie Droughtmaster Stud', M.S. 422, Clifton. **DM**

W. Spresser & Sons, 'Carnation', Mt. Walker Rd., Rosewood. **JS**

A. H. & B. J. Springall, 'Beralan' Braford Stud, Imbil. **BF**

Stanbroke Pastoral Co., 'Waverley', St. Lawrence. **BM**

A. E. Stanton & Sons, Stanton's Dairy, South Pine Rd., Strathpine. **FS**

P. Steel, 'Jerra Marumba', Witta, via Maleny. **RP**

Dr J. A. Stephenson, 'Sahwalid Sahiwal Stud', 'Belli Downs', Kenilworth Rd., Belli, via Eumundi. **SW**

H. J. Stewart, 'Wycombe', St. George. **BF**

N. L. Stiller, 'Vine Veil', Guluguba. **PH, HFXCH**

M. Stitz, Ocean View, Dayboro, P.O. Box 50. **BF**

M. D. Stokes, P.O. Box 56, Laidley. **JS**

C. J. & Y. M. Stone, 'Stoneleigh', M.S. 514, Ironpot. **MG**

E. A. Stubbs, 'Baroona Pk., Canaga Rd., Chinchilla. **BF**

R. L. & V. M. Stumer, 'Lavron Nook' Friesian Stud, M.S. 484, Boonah. **FS**

M. C. & C. P. Sullivan, 'Valera', Springvale, Pittsworth. **AIS**

L. R. & P. M. Summerville, 'Fairy Bower', Cryna, via Beaudesert. **FS**

K. Sutton, 'Startwell', Basin Rd., Wamuran. **BM**

Tarata Pty. Ltd., 'Tarata', M.S. 212, Oakey. **CL**

G. A. Teese & Son, Toolamba Cattle Co., Innisplain, Beaudesert. **AIS, FS**

Tennant & Geddes, 'Doonside', Rossmoya, via Rockhampton. **BF, BS**

H. R. & D. M. Thomas & Son, 'Eurangatuck', Jandowae. **HF**

C. Thompson, 'Kingston', Dulacca. **BF**

W. H. & D. M. Thompson, P.O. Box 20, Nanango. **AIS**

M. A. S. Thomson & G. J. Michael, Meltonia Stud, M.S. 336, Toogoolawah. **FS**

H. G. M. & B. V. Thorne, 'Dewhurst Stud' Hatton Vale, via Laidley, c/- Saunders St., Raceview, Ipswich. **JS**

T. L. & W. J. Tidcombe, 'Wallumlands A.I.S. Stud', M.S. 483, Bells Bridge, Gympie. **AIS**

A. J. & E. A. Tigell, 'Avondale', Googa Ck., Blackbutt. **MG**

J. R. Todd, 'Aberfoyle', Laravale, via Beaudesert. **JS**

Tomkins Pastoral Co., 'Stuart's Creek', Roma, P.O. Box 479. **HF**

Mrs B. Tout, 'Berrima', Elbow Valley, Warwick. **AG**

R. N. & C. M. Towner, Par Deux Droughtmaster Stud, Thornton, M.S. 182, Laidley. **DM**

N. C. Tranberg, Loloma Brahman Stud, Upper Pin Barren Rd., M.S. 626, Pomona. **BM**

R. R. & E. D. Treasure, 'Iona Park', Brigalow. **MG**

D. A. Treweeke, 'Umbercollie', Goondiwindi. **SH**

J. P. & V. Trier, 'Tamrookum Valley' Braford Stud, Rathdowney. **BF**

D. C. Tunstall, 'Hi Valley', M.S. 692, Nanango. **SH**

M. Vandoren, 'Glen-Aero' Stud, P.O. Box 46, Applethorpe. **MG**

P. & B. H. Van Popering, 'Brunetta' Jersey Stud, Coominya Rd., Lowood. **JS**

S. I. Vellnagel, 'Rosedale', Brigalow. **HF**

A. R. Vohland, M.S. 150, Pittsworth. **JS**

E. M. Voight, 'Chelmadale' Stud, M.S. 825, Ipswich. **BF, AIS**

W. T. & L. Voss, Mt. Vista Stud, M.S. 292, Glamorganvale, Ipswich. **AIS**

P. F. Wadley, Nindethana & Bendemeer Studs, M.S. 21B, Kalbar.	JS, FS
D. V. Wagner & Co., 'Aranbanga Braford Stud', 'Barncleuth', Gayndah.	BF
Wal-Anne Pastoral Company, 'Wal-Anne' Stud, P.O. Box 2, Haden.	PH
I. L. & M. R. Walker, Menlo Park Stud, M.S. 1573, Southbrook.	DM
R. A. & M. L. Walker, Rosewood.	SM
Sir James Walker, 'Cumberland', Longreach.	SG
Sir James Walker, 'Camden Park', Longreach.	SG
L. N. & S. A. Walker, 'Strathmore Santa Gertrudis Stud No. 65', 'Strathmore', Longreach.	SG
Walloon Pastoral Co., 'Walloon', Banana.	AF X BR
R. & M. Walther, 'Roseborough', P.S. 1790, Lowood.	BM
G. I. Warfield, 'Dernan Court', M.S. 223, Nobby.	PH
R. C. & S. A. Warren, 'Garrendenny', 77 Hope St., Kilcoy.	AFS, FS, SW
P. R. & H. D. Watters, 'Lynford' Stud, Callemondah, Ballandean.	JS, HF
G. C. & C. A. Webster, Gympie.	BF
B. G. & B. Wells, Burdilla Murray Grey Stud, Thorton, M.S. 182, Laidley.	MG
M. G. & G. E. Weier, 10 Wickham St., Laidley.	PH
E. E. W. West, 'Belmadochie' Friesian Stud, 19 Oatlands Court, Samford.	FS
A. C. & V. J. Westphal, 'Alun Jersey Stud', M.S. 342, Roadvale.	JS
E. J. & G. J. Weymouth, Murraber Hereford Stud, 'The Grange', Tara.	HF
Wharton Creek Pastoral Co., Wharton Creek, Springsure.	BF
K. Wheildon, 'Good Luck', Lower Cressbrook, Toogoolawah.	FS
Whitney Pastoral Co., Claverton Stud, Wyandra.	SH
F. A. Willey, 'Mar-sel Stud', M.S. 292, Lowood Rd., Glamorgan Vale.	AIS
J. R. Williams, 'Forest Glen', Columboola.	BF
C. T. Williamson & Son, 'Colelgre Angus Stud', 'Eagle Farm', Nobby.	AG
J. R. & M. E. Willis, 'Avalon', Bell.	BF
L. W. & N. E. Wilmot, Koetong Hereford Stud, P.O. Box 7, Applethorpe.	HF
J. C. Wilson, 10 William St., Buderim.	SM
J. N. Wilson & Son, 'The Valley', Blackbutt.	DM, BM
W. G. Wilson, 'Tarko', M.S. 444, Jondaryan.	RP
S. J. & N. E. Wippell, 'Morocco', Roma.	HF
A. R. & G. G. Wockner, 'Durn' Stud, Maclagan.	AG
N. W. Wolff & Sons, 'Brigalow Plains', Brigalow.	SG
D. B. & V. M. Wolter, 'Cobba Poll Hereford' Stud, Beenleigh.	PH
O. J. & S. D. Woodcock, 'Kanara', Yelarbon.	BF
A. & A. Woodgate, 'Woodgate Park', Biddadabba, via Tamborine.	FS
G. T. & H. E. Woods, 'Hazelwood' Jersey Stud, M.S. 906, Mapleton.	JS
J. R. & A. Woods, 'Jarmal', M.S. 16, Maleny.	DM
W. Woodside, 'Kiewa', Guluguba.	BF
W. Woodside, 'Wallace Bank', Guluguba.	BF
K. V. Wright, 'Wattle Vale', M.S. 288, Boonah.	FS
M. G. Wright, 'Bethany' Stud, Mapleton Rd., M.S.F. 956, Montville.	FS
Wyallat, D. T., 'Wyalla', M.S. 886, Texas.	CL, LM, SM
J. A. Wyatt, 'Rokeby', Warwick.	HF
L. & J. Wyvill, P.O. Box 116, Warwick.	SM
Dr B. R. Yeates, 'Ugarapul', Boonah.	DM
G. S. Young & M. J. Cooper, 'Coograli', Nth. Maleny Rd., Maleny.	BF
A. R. Ziebarth, 'Lynton Brahman Stud', 35 Campbell St., Laidley.	BM
R. & J. Ziesemer, Belbar Stud, Bell.	HF
L. W. & H. M. Zirbel, 'Lacewood', Derrymore, via Helidon.	PH
E. F. & I. M. Zische, 'Lynview' Jersey Stud, M.S. 231, Laidley.	JS

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BM—Brahman	**LM**—Limousin	**MA**—Marchigina
BS—Brangus	**M**—Mixed	**DV**—Devon
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The following herds have been withdrawn from the Scheme:

Australian Estates, Eurella, Mitchell.	SG
Ford Holdings, Maraja Stud, P.O. Box 238, Caloundra.	BM
R. B. & S. R. Huth, 'Crestview', Roadvale.	FS
A. J. & M. T. Peters, 'Ashwell', M.S. 366, Rosewood.	AY
Dr S. M. Piaggio, Natural Arch Farm, Natural Bridge, Numinbah Valley, via Nerang.	FS
R. J. Pontifex, Roburn Friesian Stud, M.S. 212, Oakey.	FS

Four woody vines

by Beryl A. Lebler, Botany Branch.

TOWARDS the end of spring, flowering jacaranda trees beautify our parks and gardens.

Four native vines, which are closely related to jacarandas, can be found flowering profusely from winter to midsummer in rain-forest or near creek banks.

Three of these vines are species of *Pandorea* and produce either masses of small white or cream flowers or large, showy flowers in clusters. These large flowers are usually some shade of pink and have dark red throats.

The fourth vine is *Tecomanthe hillii*. This plant produces masses of beautiful rosy-purple flowers. It differs from *Pandorea* in having racemes of flowers which are often borne on old wood. Also the calyx is bell-shaped, large and has five lobes, and the inside of the corolla tube is always glabrous.

Pandoreas

In Greek mythology it was Pandora who opened a box and thus released on the world all the evils it contained. The first Pandorea was discovered on Norfolk Island. A very destructive insect plague which first appeared on the young shoots of this vine eventually spread over all the vegetation on the island. Because of the plant's association with this destruction it was given the name based on the Greek myth of Pandora.

All Pandoreas are glabrous climbers which can become rampant and woody. They have opposite, pinnate leaves with two to seven or more pairs of leaflets and a terminal leaflet. Leaves at the ends of flowering twigs usually have three leaflets. The margins of the leaflets are usually entire, but sometimes, especially on sterile shoots, they are coarsely toothed. These leaves have leaflets which are smaller and more numerous than those with entire margins.

The flowers are in terminal branched inflorescences and can be 1 to 8 cm long. They have five sepals, five petals, four stamens and a staminode and an ovary with two cells, ending in a slender style with a stigma divided into two flattened, thin lobes.

The sepals are joined into a tube which is truncate or ends in five small teeth, and the petals are united to form tubular bells. The four stamens are arranged in pairs, one pair much shorter than the other. In each pair, the staminal filaments are curved in towards each other so that the anthers lie side by side. Each anther has two cells which spread in opposite directions from the end of the filament.

The fruit is a short capsule which splits into two hard and leathery boat-shaped valves containing a very great number of flattened seeds with transparent, papery wings.

Three species are found in South-eastern Queensland: *Pandorea jasminoides, P. baileyana* and *P. pandorana.*

(Pandorea jasminoides)
Bower plant or jasmin-leaved wonga vine

The specific epithet means resembling jasmine, and refers to the similarity between the leaves of these plants.

Pandorea jasminoides.

DESCRIPTION. This is a woody climber with leaves which have up to four pairs of leaflets and a terminal leaflet. The leaves can be up to 14 cm long. The leaflets may be up to 5 cm long and 2 cm wide and are ovate or ovate-lanceolate, somewhat leathery in texture and dark, glossy green on the upper surface but dull and paler beneath. The terminal leaflet is usually the smallest. The showy flowers are massed in a compact, branched terminal inflorescence. The calyx tube is pale green, and truncate or obscurely five-toothed. The corolla is up to 5 cm long, narrow and tubular at the base and then flared out into spreading, free lobes. These are up to 2 cm long and 3 cm wide and overlap at the base. To the naked eye, the corolla appears to be glabrous. However, under magnification, minute, white, appressed hairs can be seen. They are scattered sparsely over the outer surface but on the inner surface and along the margins they are longer and more numerous.

The flower colour varies in plants from different localities. The plant first described had a milky white corolla with a carmine throat. Plants with white flowers and crimson throats have been found on Fraser Island, in the Noosa National Park and inland from Coolum. In south-eastern Queensland, the corollas are usually some shade of pink, from very pale to as deep as rose-purple. The colour of the throat varies from crimson to ruby-red.

If the fallen corolla tube is split down one side and opened out flat, it is possible to see the stamens attached to the base of the tube. One pair is twice as long as the other. The filaments arch in towards each other. The anthers have two cells which spread in opposite directions from the end of the filament and in each pair of stamens the anthers lie close together.

The pods are roughly banana-shaped, up to 9 cm long and 2 cm wide, widest below the middle and ending in a point. They are dark brown and woody and split into two boat-shaped valves, containing crowded rows of almost heart-shaped, flattened seeds with lateral papery wings.

FLOWERING TIME. Flowers can be found from spring time through summer and often there is a big flush of blossom in midsummer.

HABITAT. It is found in rain-forest, and on the banks of freshwater streams in marginal rain-forest.

DISTRIBUTION. This vine grows only on the northern coast of New South Wales to as far south as the Clarence River, and in coastal Queensland to as far north as the Eungella Range, west of Mackay.

GENERAL REMARKS. In Australia, this was one of the first native plants to be brought into cultivation. It strikes readily from cuttings. When grown from seed, the flower colour of those forms with pink flowers may vary from that of the parent plant.

When Allan Cunningham first found this plant in the Moreton Bay district he gave it the name *Bignonia jasminoides*. In 1928, the species was transferred to *Pandorea*.

Pandorea baileyana.

Pandorea baileyana

This species was named in honour of F. M. Bailey, the Government Botanist of Queensland at the time the plant was discovered in 1895. It was first found on the banks of Mullumbimby Creek, a tributary of the Tweed River in north-eastern New South Wales.

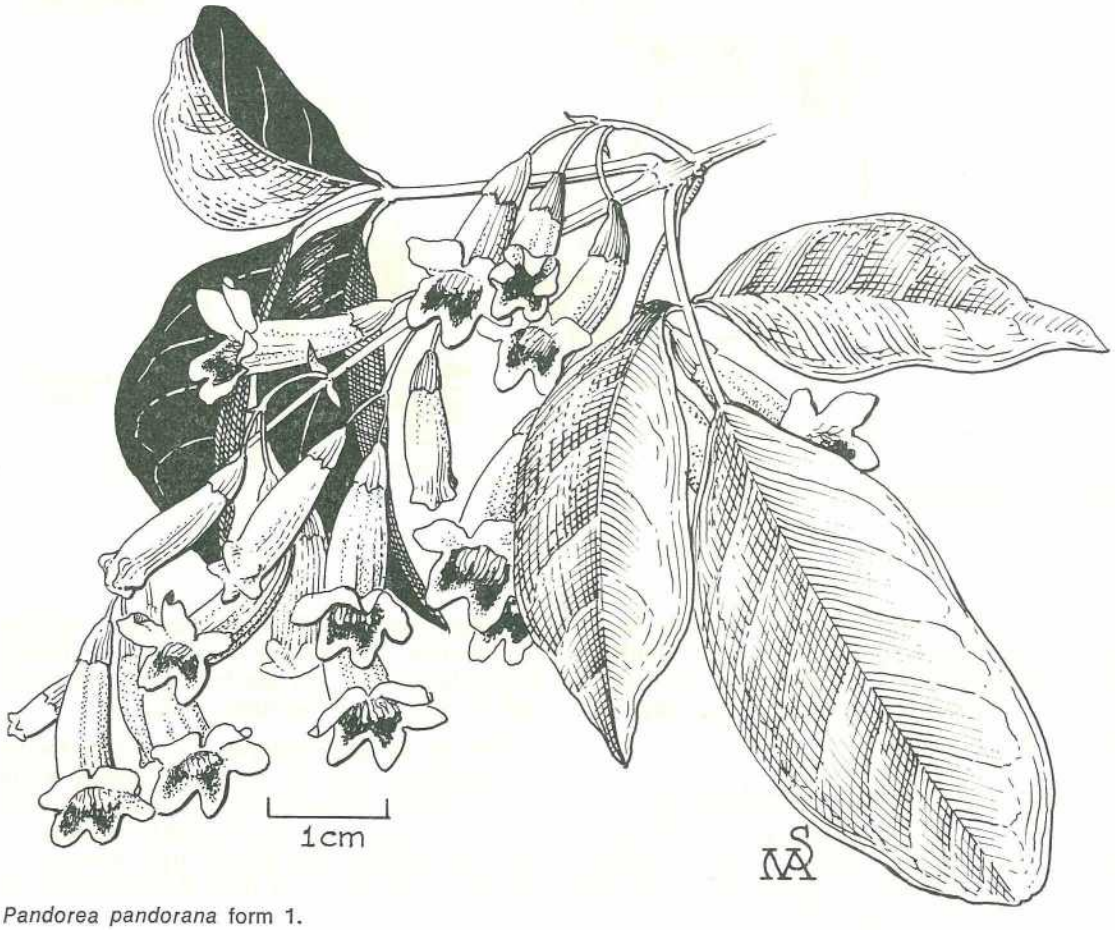
DESCRIPTION. It is a rampant vine which can have a thick, woody main stem. The secondary branches can be up to 3 m long and are usually pendant. The leaves can be as much as 60 cm long with seven to nine leaflets. These are leathery in texture, dark green and shiny on the upper surface and are broad-oblong or ovate-acuminate with a pointed tip. The leaflets can be up to 12·5 cm long and 7 cm broad.

It is a very floriferous plant with many faintly-perfumed flowers massed in axillary panicles. Often there is more than one inflorescence in a leaf axil.

Individual flowers can be up to 2 cm long, and the incurved corolla tube is perfectly cylindrical. The outside of the corolla tube is cream, and the throat is flushed on the inner surface with delicate pink. The corolla lobes are 0·3 cm long, 0·2 cm wide and have rounded tips. Magnification shows minute, thick hairs covering the whole corolla.

FLOWERING TIME. This vine flowers late in spring.

HABITAT. It is confined to rain-forest.



Pandorea pandorana form 1.

Pandorea pandorana form 2.

DISTRIBUTION. It grows only in New South Wales and Queensland from as far south as the Richmond River to just over the border in the Lamington National Park and Mt. Lindesay.

Wonga vine *(Pandorea pandorana)*

This was the vine found on Norfolk Island by Colonel Paterson when he was stationed there as Governor of the new colony. He sent seeds to England in 1793 and it was first described from a cultivated plant as a species of *Bignonia*. In 1928, a revision of the family established that it did not belong to this genus and it was given the name *Pandorea*.

One of the principal causes for abandoning the settlement was the plague of downy white insects which spread from this plant all over the island. Because of the plant's association with this plague, the Greek myth concerning Pandora is the basis of both the genetic name and the specific epithet.

DESCRIPTION. This is a climber with twining branchlets. Great variation is found in the size, shape and number of leaflets and also in flower size, shape and colour. At the present time, at least six forms can be easily distinguished in Queensland. It is possible that when the genus is critically examined some or all of these forms will be treated as varieties at least.

In South-eastern Queensland, three forms can be found. One produces masses of short, narrow, tubular flowers which are white or cream outside and have dark streaks on part of the corolla tube inside. This form is common on the banks of creeks around Brisbane and in the Lamington National Park where it is very conspicuous at flowering time.

The second form is similar but although the base of the corolla tube is white the corolla lobes and the upper end of the tube is the colour of port wine.

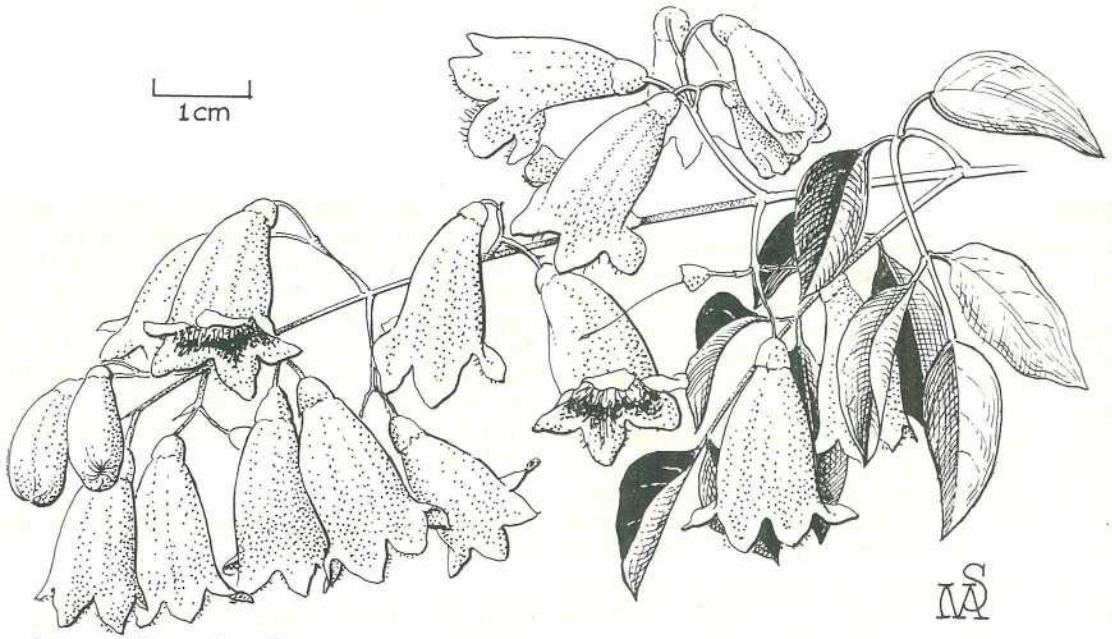
The third form has larger and wider bell-shaped flowers. Usually these are white on the outside of the corolla tube with reddish or purple markings covering the whole of the inner surface. This is the common form around Gatton and Ipswich and on isolated peaks near the border.

Form 1

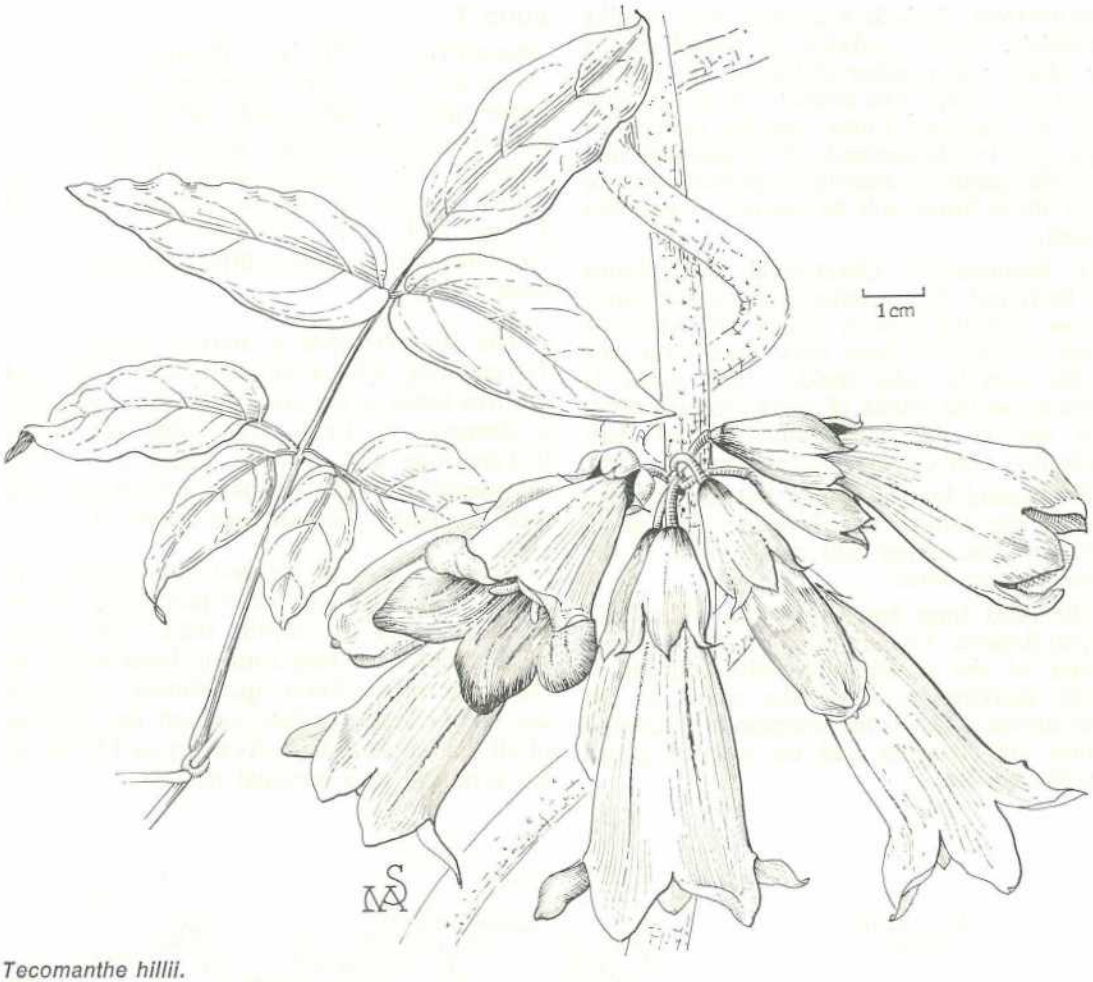
DESCRIPTION. This is a vigorous vine with leaves which are dark green and shiny on the upper surface, paler and dull beneath. On flowering portions of the vine, the leaves have three to five ovate-lanceolate leaflets. The lateral leaflets are up to 3·5 cm long and 1·8 cm wide. The terminal leaflet is about 5 cm long and usually a little more than 2 cm wide.

The flowers have a narrow tube up to 1·8 cm long. with a throat 0·5 cm wide, and the free lobes at the end of the tube spread to a diameter of 1 cm. The lobes are about 0·3 cm long and as wide. They are almost rectangular in shape and have a blunt tip. The tube is slightly flattened and curves upwards.

Near the base of the two upper lobes, the throat is streaked with deep purple-red almost to the base of the corolla tube. Fine, erect hairs about 2 cm long form a dense beard on the inside of the lower lip. Minute, soft hairs are on the inner surface and on the margins of all the corolla lobes. As many as 18 flowers are arranged in a terminal panicle.



Pandorea pandorana form 3.



Tecomanthe hillii.

Form 2

DESCRIPTION. This is also a vine which twines over supporting vegetation. The leaves are up to 13 cm long with up to six pairs of lateral leaflets and a terminal leaflet. They are dark glossy green on the upper surface, paler and dull beneath. The terminal leaflet can be 8 cm long and 2 cm wide. In the young growing parts, the margins are usually entire but further back some of the leaflets have coarse, blunt teeth towards the tips of the leaflets. The leaflets are ovate-lanceolate and the lateral leaflets are up to 5 cm long and 1·5 cm wide.

The inflorescences are axillary, up to 6 cm long with about 12 flowers, or terminal, 12 cm long with about 25 very striking flowers.

They are pendulous, with corolla tubes about 2 cm long, 0·5 cm wide across the throat, and ending in five blunt lobes 0·5 cm long. The tube at the base is white but the upper half is the colour of port wine and is darker on the inside. Minute, white hairs are scattered over the corolla lobes. Looking into the throat of the flower, two bands of long, erect hairs can be seen—one on either side of the lower corolla lobe.

FLOWERING TIME. This vine flowers in late winter to early spring.

HABITAT. It is found in open eucalyptus forests.

GENERAL REMARKS. This form has been found at Crow's Nest, Mt. Barney and in the Lamington National Park.

Form 3

DESCRIPTION. This is a less vigorous creeper than form 1. Leaves are up to 13 cm long and consist of three to five leaflets. They are ovate-lanceolate and the upper surfaces are not very glossy or much darker in colour than the lower surfaces. Lateral leaflets are up to 4·5 cm long and 2 cm wide with the terminal leaflets longer and broader.

The inflorescences are terminal, up to 10 cm long, and contain up to 30 flowers. These are about 2 cm long with a slightly curved tube which broadens to an open throat 1 cm wide. Five bluntly-tipped triangular lobes curve outwards at the end of the corolla tube. They are 0·5 cm wide at the base and as long. The outside of the corolla tube is white and the inner surface has deep reddish-purple streaks to the bottom of the tube. The flowers are pendulous.

FLOWERING TIME. Flowers can be found from midwinter to midsummer depending on where the plant is growing but on an individual plant the flowering flush may not last for long.

HABITAT. Wonga vine grows over trees in rain-forest regrows or near creek banks.

DISTRIBUTION. In Australia, the species is found in all the eastern mainland States, Tasmania and the Northern Territory. It also grows in the eastern half of Malaysia and New Guinea.

GENERAL REMARKS. Various forms of this creeper have been cultivated for some years. Probably the most attractive plants are those with broad bell-shaped flowers with dark-coloured stripes in the throat.

Field key to the pandoreas of South-eastern Queensland

1. Corolla funnel-shaped, up to 5 cm long, ending in large, spreading lobes. Throat of corolla red *Pandorea jasmmoides*

   Corolla tubular, up to 2·5 cm long, white or cream outsides 2

2. Leaves leathery, up to 60 cm long. Leaflets broad-oblong or ovate, up to 12·5 cm long. Throat flushed with pink

   Pandorea baileyana

3. Leaves not leathery, up to 13 cm long. Leaflets variable, up to 4·5 cm long. Throat striped or streaked with deep red

   Pandorea pandorana

Fraser Island creeper *(Tecomanthe hillii)*

The name *Tecomanthe* was first used in 1888 for a vine from New Guinea closely related to the American flowering shrubs belonging to the genus *Tecoma*. Fraser Island Creeper is the only species of this genus native to Australia.

It was first discovered in 1876 during a survey of timbers in the Hervey Bay district. This survey was carried out on behalf of the Colonial Botanist, Walter Hill. It was reported that the vine 'had entirely enveloped with its long flexible stems' the tree supporting it. On these stems were 'thousands of beautiful rosy-purple flowers'. Initially the plant was believed to be a *Tecoma* and was named in honour of Walter Hill. Subsequent investigations have proved the correct name is *Tecomanthe hillii*.

DESCRIPTION. It is a rampant climber and its rope-like branches festoon the canopies of the trees supporting it. The leaves are pinnate, with five leaflets which are rather thin in texture, oblong-lanceolate in shape and 2·5 to 7·5 cm long. In some leaves, the lower pair is again divided, with a smaller leaflet on the lower side of the petiolule. The flowers are in compacted racemes about 2 cm long containing up to ten flowers. The inflorescences are sometimes in the axis of the upper leaves but are usually on the old wood near ground level.

Flowers are borne on rose-purple pedicels up to 1·5 cm long. The bell-shaped calyx tube is about 2·5 cm long. The corolla tube is firm in texture, up to 8 cm long and has a narrow cylindrical section at the base. This widens out into a slightly flattened, trumpet-shaped bell.

Five triangular lobes about 2 cm long spread from the end of the tube. The corolla is rosy-purple with darker lines on the inside of the tube, which is often much paler. The flower is completely glabrous and the stamens are easily seen by looking into the mouth of the wide tube. The fruit resembles those of the pandoreas but is longer and narrower.

FLOWERING TIME. In its native habitat, this plant flowers in winter or early spring.

HABITAT. Usually it grows on creek banks in coastal rain-forest or on forest edges.

DISTRIBUTION. The species is found only in Queensland and has been collected at Hervey Bay, Cooloola, Fraser Island, on the summit of Mt. Finnegan, south of Cooktown and on Thornton Peak north of the Daintree River.

GENERAL REMARKS. Fraser Island Creeper has recently become available in nurseries specialising in native plants and is a worthy addition to any garden. It would make a very attractive screen when grown on a trellis.

Quarantine veterinary officer for North Queensland

A Department of Primary Industries veterinary officer is to be appointed soon to strengthen quarantine surveillance and exotic disease prevention work in North Queensland.

The Minister for Primary Industries (Mr V. B. Sullivan) said the need for such a specialised officer based in Cairns had been recognised for some time by the Queensland Government.

The area, which included Cape York Peninsula, The Torres Strait Islands and the eastern Gulf of Carpentaria, was close to countries where diseases and parasites exotic to Australia were endemic.

Fishing activity by foreign vessels, movements by ethnic people and tourists and illicit movements by the unscrupulous presented a constant risk.

The veterinary officer will complement the concerted programme against penetration of the quarantine barrier at present being undertaken by Departmental staff, surveillance flights and naval patrols.

A major component of his work will be to watch for entry of the screw worm fly, a parasite known to exist at present in New Guinea, and the education of local stockowners in detection and reporting of suspected outbreaks of fly infestation.

The Minister said other important tasks of the veterinary officer would include:

- Increasing the surveillance cover by advising the local population as to what to look for and where to report suspected quarantine breakdowns.
- Instituting a control programme for those diseases in dogs clinically similar to rabies and conducting a regular speying clinic to control the stray dog problem in the area.

The appointment would be funded by the Commonwealth Department of Health.

New recipes for yoghurt

by June Nickerson, Dairy Research Branch.

YOGHURT is becoming very popular in Australia and many people, both old and young, are enjoying the additional satisfaction of making it in the home.

A method for making yoghurt was printed in the *Queensland Agricultural Journal* in 1963. Copies of this have been distributed since then to people wishing to make their own yoghurt. There has been a steady demand for this leaflet and also for the culture needed to make yoghurt. Both are obtainable from the Otto Madsen Dairy Research Laboratory.

In the process of updating the information in this leaflet, different recipes for making yoghurt were tried out at the laboratory and the yoghurt was tasted by staff members. Their preferences were used in choosing the recipes to go into the new leaflet.

Plain yoghurt can be made to suit many different tastes. Some people, for health reasons, prefer to use skim milk while others like yoghurt made with full cream milk and made a little milder by the addition of sugar.

Whatever type of yoghurt is preferred, the total solids content of the milk to be used should be increased by adding milk powder before manufacture commences. This will give a thicker product. Sugar may be added or omitted according to personal preference.

The recipes which prove the most popular are as follows:

Using whole milk

500 ml full cream milk

31 gm skim milk powder

15 gm sugar (optional)

Using skim milk

500 ml water

96 gm skim milk powder

15 gm sugar (optional)

For a sweeter product

500 ml full cream milk

45 gm skim milk powder

25 gm sugar

The yoghurt is made by boiling the mixed ingredients for half an hour, cooling to about 45°C and adding culture (1·5 to 2%).

The mix is then kept at 40 to 46°C for 3 hours or until just starting to set.

It is then placed in a refrigerator to cool. The slow cooling in the refrigerator will assist in the completion of clotting.

When cool, the yoghurt is ready to eat. If desired, fruit may be added and stirred gently into the cool yoghurt.

Full information on yoghurt making is available from the Otto Madsen Dairy Research Laboratory, 19 Hercules Street, Hamilton, 4007. Cultures are available for 50c plus 30c postage.

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Foliar symptoms of sulphur deficiency in wheat

ALTHOUGH most soils of the Queensland wheat belt have adequate amounts of sulphur to grow high yielding wheat crops, some light soils on the eastern uplands of the Darling Downs are deficient in sulphur.

However, as sulphur levels decline with continued cropping, soils now well supplied with sulphur may become deficient in the future.

Plants growing on sulphur deficient soils show characteristic deficiency symptoms in their leaves. This article describes the symptoms in wheat and shows how they can be used to diagnose sulphur deficiency in that crop. Because deficiencies of sulphur and nitrogen are sometimes confused, the article also compares and contrasts the symptoms of these two deficiencies.

The symptoms

Sulphur deficiency of wheat causes stunted growth, delayed maturity and a general yellowing of the foliage. However, the number and complexity of the symptoms depend on how severe the deficiency is. For example, mild deficiency causes little stunting and the plant may be only pale green in colour (see plate 1), while severe deficiency produces stunted growth and low grain yields.

YELLOW LEAVES: When sulphur deficiency first develops, the youngest or upper leaves turn pale green to yellow while the lower, older leaves remain green (see plates 1 and 2). If the deficiency persists and becomes more severe, the upper leaves turn pale yellow to white and the lower leaves turn yellow.

Usually, yellowing is not confined to areas between the veins but affects the whole leaf, including the veins (see plate 3). Furthermore, death of leaf tissue usually does not occur even when the leaves have turned white.

FIELD APPEARANCE: In young crops, growth is stunted and spindly and the whole plant has an overall pale green or yellow colour. At this stage, it is very difficult to distinguish between nitrogen and sulphur deficiency.

In more mature crops, the upper leaves are pale green or yellow and the lower leaves are usually green. However, the whole field has a distinct pale yellow appearance.

Comparison with nitrogen deficiency symptoms

A number of points can be used to distinguish between nitrogen and sulphur deficiency in mature plants.

- The oldest leaves of nitrogen deficient plants are yellow or dead whereas those of sulphur deficient plants are usually a healthy green (see plate 4).
- The youngest leaves are green on nitrogen deficient plants but yellow or white on sulphur deficient plants (see plate 5).
- Nitrogen deficiency causes death of the lower leaves whereas with sulphur deficiency the leaves turn yellow or white without dying.

Correction of the deficiency

Applying any sulphur fertilizer, such as elemental sulphur (flowers of sulphur) or gypsum, will correct the deficiency. If nitrogen is also deficient, ammonium sulphate can be used to provide both nutrients. Similarly, where phosphorus is deficient, dressings of single superphosphate rather than double or triple superphosphate frequently correct both deficiencies.

by N. J. Grundon, Queensland Wheat Research Institute

Foliar symptoms of sulphur deficiency in wheat

Plate 1. Mature wheat plants showing mild symptoms of sulphur deficiency. Note pale yellow-green upper leaves and dark green lower leaves.

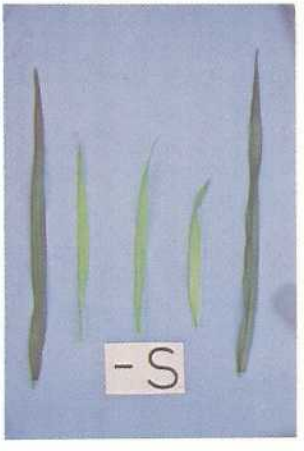

Plate 2. Close-up leaves from the plant in plate 1. Healthy, dark green, lower leaves flank the pale yellow-green, sulphur deficient leaves from the top of the plant.

Left.—Plate 3. Sulphur deficient leaf. Note even, pale yellow-green colour with no interveinal chlorosis or death of tissue.

Plate 4. Lower leaves of nitrogen (left) and sulphur (right) deficient plants.

Plate 5. Upper leaves of nitrogen (left) and sulphur (right) deficient plants.