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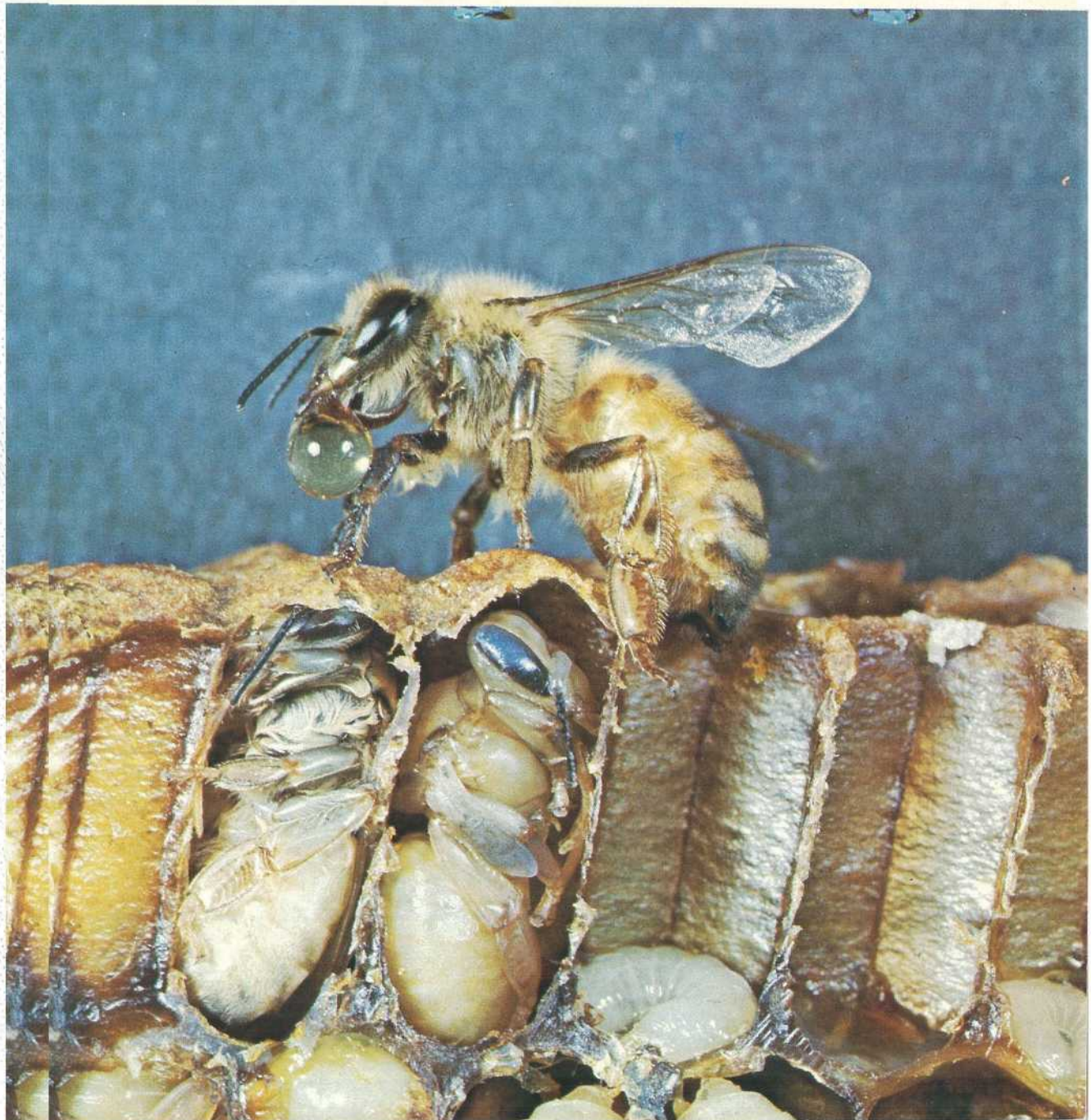

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COVER: Worker bees that gather Queensland's $1·5m honey crop begin life as eggs in honeycomb cells. These pupae are about to emerge and take their place in the work-force. Photograph by B. J. Fillery.

QUEENSLAND AGRICULTURAL JOURNAL

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Contents

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1—78687

Supplementing weaner sheep

by K. J. Wilson and J. C. Edwards, Sheep and Wool Branch and J. C. Scanlan, Agriculture Branch

POOR nutrition of weaner sheep during the winter and spring in North-west Queensland is a major limitation to productivity.

Most lambs in this environment are born in the autumn and are weaned on to low quality pasture.

Two experiments using water harvesting and forage harvesting techniques were successfully conducted at Toorak Research Station near Julia Creek to produce supplementary rations for weaner sheep during the winter.

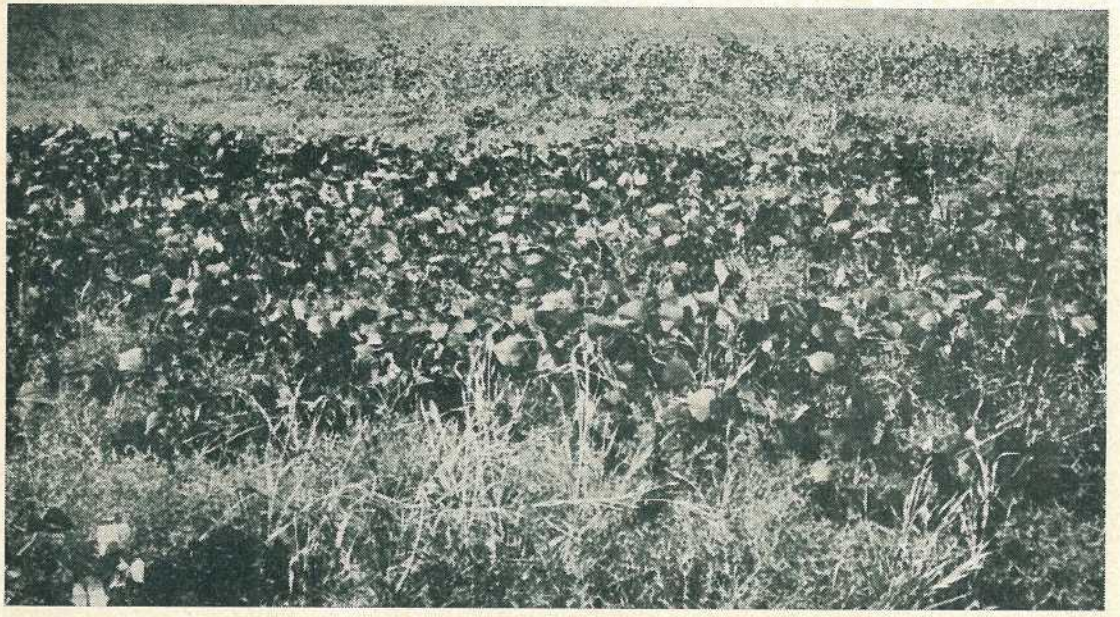
A modified version of the shallow water storage system described in the *Queensland Agricultural Journal* (March 1972) was used for water harvesting. The experiment was designed to grow a forage sorghum crop on the ponded area of the system and then offer this material to weaner sheep.

The forage harvesting system entailed planting seed of various legumes and a forage sorghum in the native Flinders grass pasture at the start of the wet season. The resultant growth of crop and Flinders grass was harvested and stored as hay.

The products of these two systems were fed to weaner sheep in order to study the utilization of the supplements and to compare the weight gains of these sheep with those of controls fed only Flinders grass hay.

Shallow water storage system

An earth bank (100 m long, 2 m maximum height) with associated by-wash was constructed to evaluate the practical and economic aspects of this type of fodder production. In the 1977 wet season, 563 mm of rain was recorded—25% more than the annual average.



Highworth lablab in the 100 m^2 plot.

in North-west Queensland

The storage filled after the first 195 mm and the by-wash diverted subsequent rains to allow the wall to remain intact. The forage sorghum (*Sorghum* sp. ST6) was planted in the ponded area as the water receded. The ground was lightly ploughed before planting and a seed drill was used to plant the sorghum. The inundated area was approximately 2·5 ha.

Soil moisture was adequate for the germination and maturation of the crop which yielded 5 tonnes of green sorghum per ha. Crude protein content of the young growing sorghum was 14% on a dry matter (DM) basis. This value fell to 12% just before flowering, and to 8% after flowering.

The site for this type of system can be determined by the amount of forage required. Most weaner ewe flocks in north-west Queensland comprise approximately 800 to 1 000 head and a supplementary ration of 20 tonnes of green forage sorghum is considered sufficient to provide their needs for 6 to 8 weeks (4 kg per head per week). A 4 to 5 ha site should therefore be adequate for a flock of this size.

Pasture hay

In November 1976, an area of Flinders grass pasture was cultivated with disc harrows. In December, several legumes and a forage sorghum were sown in separate plots of 100 m^2. The aim was to evaluate their suitability for improving the quality and yield of the native pasture.

Sample cuts from these plots were made on 6 April (after the wet season) to determine dry matter yields and the protein content of the sown species. Results for the successful species are shown in table 1. It can be seen that mung bean, cowpea and Highworth lablab were outstanding.

This forage sorghum crop was grown on the ponded area of a shallow water storage system at Toorak Research Station.

TABLE 1

SEEDING RATES, YIELD AND PROTEIN CONTENT OF LEGUMES AND FORAGE SORGHUM SOWN IN PLOTS

Legume	Seeding Rate (kg/ha)	DM Yield (t/ha)	Crude Protein %
Mung bean (*Vigna radiata*)	6·5	3·26	15·3
Cowpea (*Vigna sinensis*)	11·5	2·37	12·4
Highworth lablab (*Lablab purpureus*)	50·0	1·90	17·3
Leichhardt uniflorum (*Macrotyloma uniflorum*)	6·5	0·77	13·0
Forage sorghum (*Sorghum* sp. ST *6*)	5·0	0·83	6·0

An additional uncultivated area of 1 ha was sown in December 1976 to a mixture of all legumes at 15 kg per ha. In March the crop/grass growth was mown, windrowed and baled. These efforts yielded 3 tonnes of hay with a crude protein content of 8%. The average yield of the legume component was 0·6 tonnes. Rainfall from planting to harvesting was 365 mm.

As a result of the prolonged wet season, the cowpea was overmature when harvested and Highworth lablab was the major legume component. Because of their differing maturation rates, a mixture of the three legumes would produce a crop after light, moderate or heavy wet seasons.

At a yield of 3 tonnes per ha, material from a 9-ha site should provide adequate hay for weaner supplementation during the winter.

Sheep studies

Forty-eight mixed sex Merino weaners were stratified into four groups on a liveweight basis. They were then fed the following rations in large pens for the next 6 weeks:

Group 1—basal diet (ad lib) of Flinders grass hay.

Group 2—basal diet (ad lib) plus green forage sorghum supplement at 0·5 kg per head every second day.

Group 3—basal diet (ad lib) plus green forage sorghum supplement at 1·0 kg per head every second day.

Group 4—pasture hay (ad lib) containing legumes.

The mean liveweight changes for each group during the six week supplementation period were:

Group	Mean liveweight change (g/day)
1	−26
2	+ 3
3	+10
4	− 3

All supplementation treatments prevented the weight loss seen in Group 1 animals after weaning. Consumption of forage sorghum exceeded 95%. Pasture hay consumption could not be accurately determined under pen conditions because it was fed ad lib; however, assessments placed this figure at 65 to 70%.

A group of 350 weaners was turned on to the mature sorghum to assess utilization of the crop under natural grazing conditions. Consumption of this sorghum also exceeded 95%.

Practical advantages

A major advantage of these supplementary feeding systems is that the material produced in the autumn is consumed in the following winter. Because there is no significant winter rainfall or severe cold in this environment, deterioration of the supplement from weathering should not be a problem. The short turnover time of both systems means also that wastage of the crop by predators (kangaroos and feral pigs) is minimized.

Collateral benefits from using these supplementation techniques include the possibility of providing shade trees on the perimeter of the ponded area, and of releasing stored water via an outlet pipe for irrigation. The pasture hay could be also used for supplementing weaner cattle, rams, etc., as required.

The sheep studies described indicate the extent to which supplementation checked the decline in liveweight normally experienced after weaning sheep on to poor quality pasture. The advantages of successfully supplementing weaners on a commercial basis in this environment would lie in their improved survival and growth rates and subsequent productivity (wool growth, puberty) as well as the concomitant benefits that arise from an early weaning strategy.

Such benefits stem not only from the improved liveweight of the ewes after an early weaning, but also from the likelihood that they would be in better than usual body condition during the ensuing spring, so that reproductive performance and survival would be enhanced.

Economics

The economics of producing forage sorghum appear encouraging. Capital costs of erecting a wall to inundate a 4-ha site would be approximately $800 (construction of wall $600, electric energizer and fence for strip grazing $200). If these expenses were written off over 4 years then annual capital costs would be $200. Additional annual costs for seed and planting ($80) would mean production of a 20 tonne crop at approximately $280 or $14 per tonne.

Costs of seed and planting the pasture hay were $12 per tonne. The overall economics of the hay exercise would depend on the storage expenses involved. Baling may be suitable in some instances, though storage of the material as above ground silage may sometimes be preferable.

Another alternative presently under investigation is the growing of a slower-maturing species or a perennial shrub (for example, a saltbush) which could be fed off as standing fodder and would obviate harvesting and storing expenses.

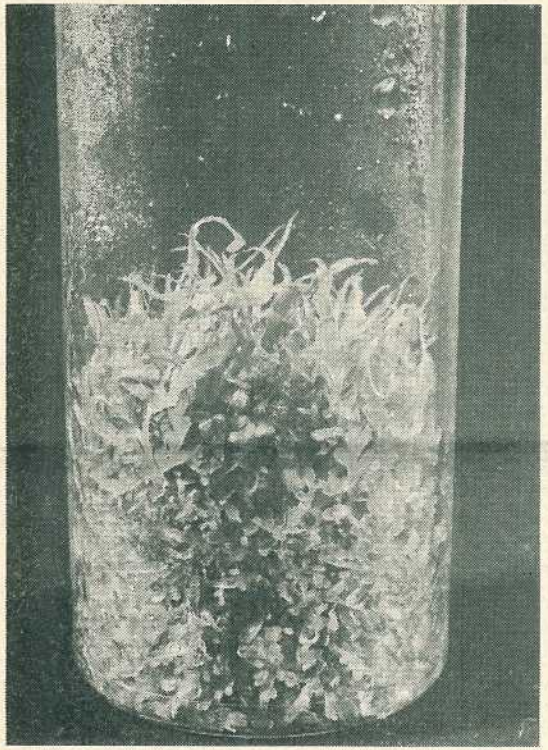
It is important to point out that these experimental efforts are preliminary in nature. It is necessary to follow up this work to establish how frequently forage sorghum or pasture hay can be satisfactorily produced and to evaluate the economics of such production over a number of years.

1979 Queensland Pocket Year Book

THE 1979 Pocket Year Book is now available from the Australian Bureau of Statistics, Ground Floor, Statistics House, 345 Ann Street, Brisbane and from the main bookstores at a cost of $1.00 per copy. For postal orders, the charges are: one copy, $1.35; two copies, $2.45; three copies, $3.65; and four copies, $4.65.

The Queensland Pocket Year Book is a 112 page ready-reference book on the more important social and economic statistics of the State. Accordingly, it has been found to be a useful and compact permanent record by persons travelling overseas or elsewhere, students, researchers, or by people seeking a concise book of knowledge of Queensland.

Tissue culture



in horticultural crops

by R. A. Drew, Horticulture Branch

PLANT tissue culture is a method of propagation of plants by growing small sections of dissected plant tissue on artificial media in sterile conditions.

The concept of growing plants from individual cells was suggested as early as 1898 by Haberlandt, a German botanist, who tried to grow leaf cell cultures in simple mineral solutions. The first practical use of tissue culture came in 1952 when Morel and Martin succeeded in producing virus-free dahlia and potato shoots and grafted them on to virus free seedlings.

Ever since this pioneer work, the technique has been used by many workers to cure infected cultivars of a wide range of plants. Tissue culture was first used commercially in 1960 for virus elimination and rapid multiplication of Cymbidium orchids. It was later used to propagate many other types of orchids.

Above left. The potential for rapid multiplication using tissue culture is shown by these nephrolepis ferns.

Above right. Strawberry culture—rapid multiplication

Many species of plants can now be rapidly multiplied by tissue culture propagation and this has become the commercial impetus of the technique. In the United States, 3 000 nurseries now use tissue culture propagation and the technique is stimulating much commercial interest in Australia. Commercial laboratories in Australia are successfully propagating orchids and ferns (particularly Boston type ferns and nephrolepsis ferns). They are also experimenting with other species like bromeliads and some Australian native plants.

Stages of tissue culture

The first stage of tissue culture is to take a small piece of dissected tissue, surface sterilize it and then place it in an antoclaved nutrient medium for 3 to 4 weeks. This initial period should confirm whether the culture is free from microbial contamination and initiate growth of the tissue.

The second stage of culture is to transfer the tissue on to a medium which will support shoot growth. If the aim of the culture is to produce virus-free material then the initial explant should be dissected as finely as possible from the apical bud and the second stage medium should produce a strong single shoot. If the aim of the culture is rapid propagation of a plant, the second stage medium should initiate multiple buds, and the initial explant may be from any part of the plant which contains meristematic tissue.

A number of approaches have been made to achieve clonal multiplication in tissue culture. In many cases, such as orchids, this has been achieved by the production of adventitious buds. Although this method can produce a very high rate of multiplication it often involves an intermediary callus stage. This has sometimes resulted in a high proportion of genetically aberrant plants, or off-types. Production of off-types is useful in some plants, like ornamentals, where it may produce new varieties.

An alternative method of multiplication which avoids genetically deviant plants is axillary shoot multiplication. This is achieved chemically by controlling the balance of plant growth substances in the media and overcoming apical dominance.

Thus the initial buds grow only slightly before developing many axillary buds which are separated from each other by very short internodes. Often the resulting cultures bear little resemblance to the normal plant and take on a moss-like habit. These axillary buds can then be cultured on different media to produce normal plants. Care has to be taken with this type of multiplication to ensure that a reversal of habit in culture is possible.

Another method of multiplication is to develop an elongated shoot from the cultured bud. This produces elongated internodes so that the new leaves and axillary buds are well separated from each other. The axillary buds can then be excized and sub-cultured. This method of multiplication is initially slower than other methods but avoids the problems associated with other methods as it requires no reversal of habit and produces no genetic deviants.

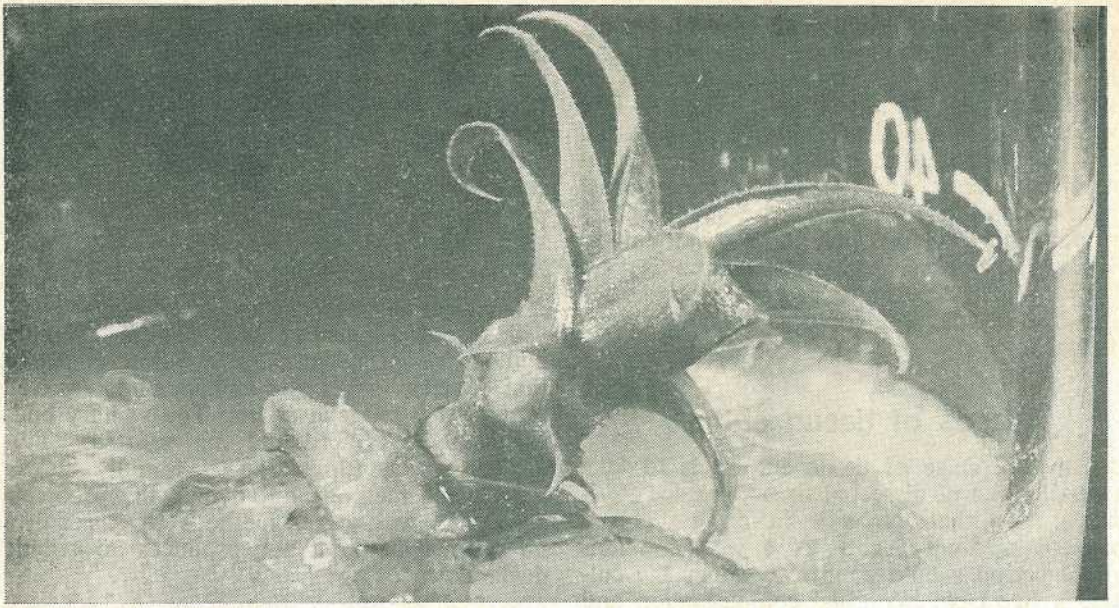
If a single explant produces five new shoots, and each of these in turn produces five more new shoots, by starting with 50 explants you could have 6 250 plants in just three generations. One generation of nephrolepsis ferns, for example, takes 4 to 6 weeks.

The final stage of tissue culture is to transfer the single buds on to a media which will initiate roots on the plant. Plants may then be transferred to pots in a glasshouse or shade house. Plants often are hardened for transfer to soil by removal of hormones from the media and by increasing the light intensity.

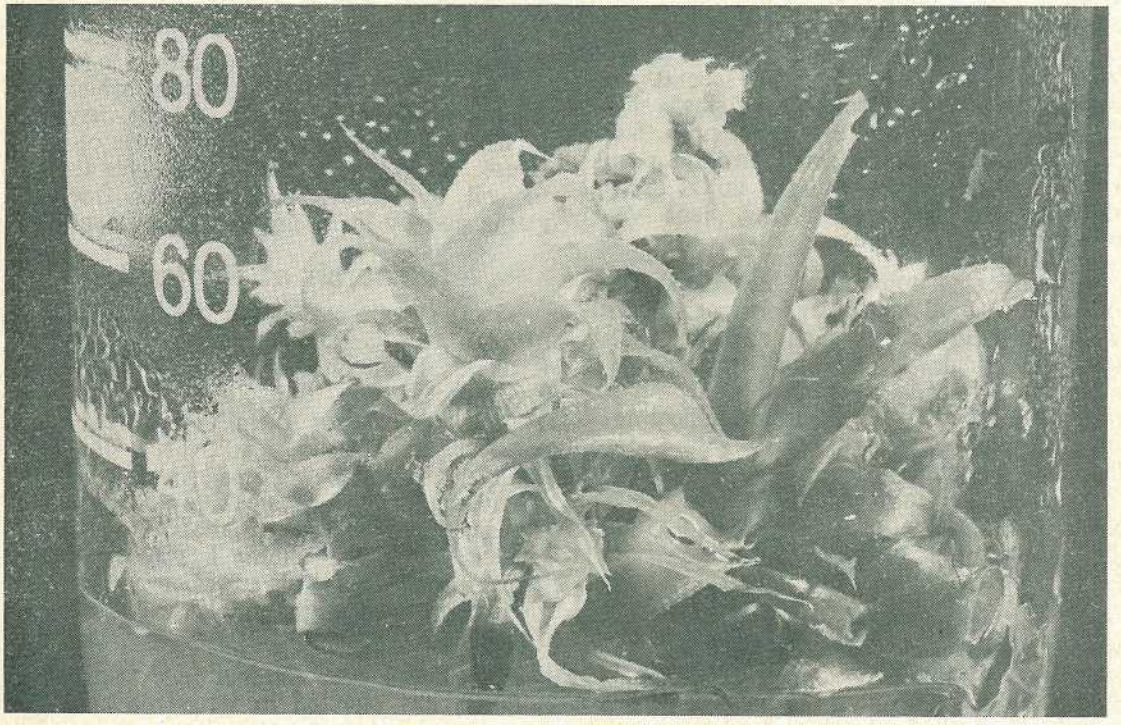
Research at Redlands

Tissue culture techniques are being applied to both fruit and vegetable crops. At the Redlands Horticultural Research Station, the first success was the elimination of Mild Yellow Edge Virus from the current commercial strawberry cultivar, Redlands Crimson in 1976. These virus-free plants provided the 'mother' stock for all virus-free runners available through the C.O.D. runner scheme. The programme has resulted in a higher, early yield of strawberries and has also removed the potential threat of virus diseases in strawberry crops.

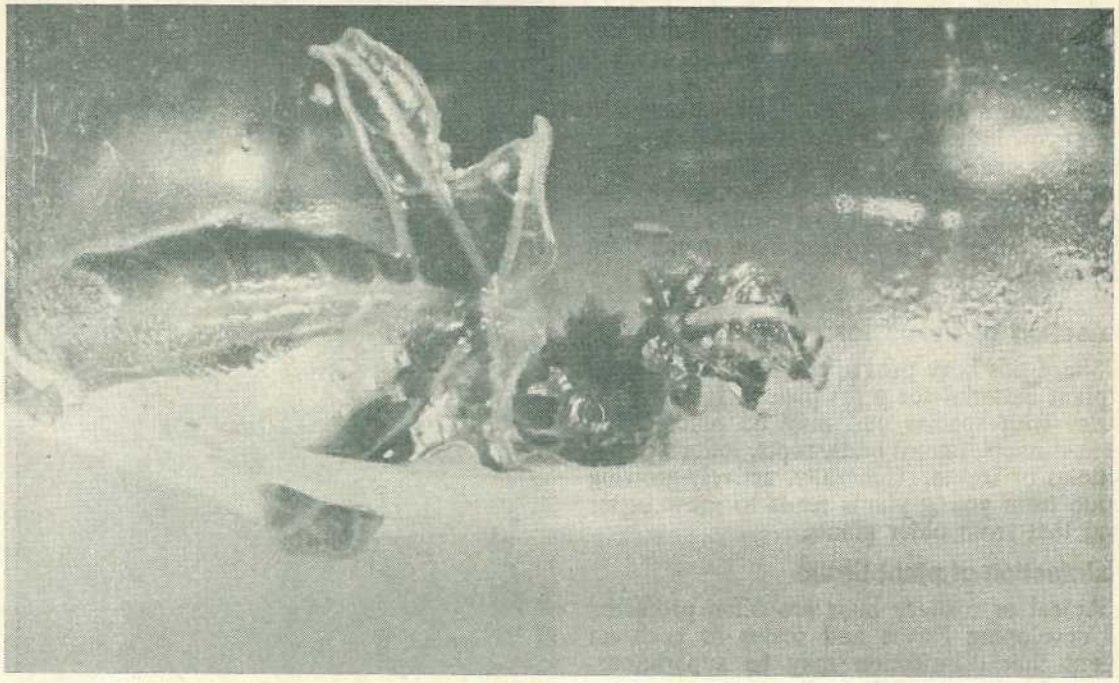
In addition, virus elimination work in sweet potatoes has resulted in virus-free plants of new American sweet potato varieties in 1978. Currently, a programme is being undertaken



Pineapple culture-single shoot.



Pineapple culture-rapid multiplication.



Papaw culture-single shoot.

Papaw culture-undifferentiated callus growth.

to produce virus-free plants of present varieties for both the New South Wales and Queensland sweet potato industries. Research on passionfruit tissue culture is also being undertaken with the aim of producing plants free of passionfruit woodiness virus—a disease causing severe losses in the industry. At present, the work is incomplete as it has not yet been possible to grow passionfruit successfully in culture.

The other facet of tissue culture work at Redlands H.R.S. involves using tissue culture for rapid multiplication of new varieties or clones of pineapples and papaws. The technique has been successfully applied to pineapples, and a single shoot media and also good multiplication and rooting media have been produced. One of the problems other workers have experienced with pineapple tissue culture is the production of genetic off-types. This has resulted from cultures which have been through a callus stage. Hence current work involves an alternative approach to callus culture by the production and sub-culturing of axillary buds. This should produce pineapple plants free of off-types.

At present, the papaw tissue culture programme has resulted in successful multiplication media but not in the development of a rooting media. Propagation of papaws by tissue culture could overcome two problems in the papaw industry. Firstly, as each plant produced is identical to the mother plant this would eliminate the extreme variability in yield between trees. Secondly, it would eliminate the problem of distinguishing male plants from female plants.

Technique

Selection of tissue for culture

Shoot tips have proved the most satisfactory explant material for most plants. However, it varies with species and may be plant tissue from runners, lateral buds, roots, inflorescense, petioles or leaves. Generally, actively-growing tissue from young plants tends to grow better than that from older plants.

Disinfection of plant tissue

Apical or axillary buds are often protected by developing leaves and scales to such an extent that disinfection may be superfluous. As a result, small bud explants are more likely to be free from contamination but their survival rate in culture is lower than for larger explants. For mild surface sterilization of shoots and other explant material, they are dipped for a few seconds in 96% ethanol or rinsed from 15 to 30 minutes in running water; then submerged in a filtered solution of calcium hypochlorite 5% (w/v) for 10 to 20 minutes and rinsed several times in sterile water.

A passionfruit shoot grown from the exised apical tip of a seedling.

Culture room

Most laboratories have laminar-flow or other sterile 'air-flow' systems for dissections and transfers. If these facilities are not available, these procedures may be carried out in normal dust-free laboratory space. Fungistatic paint on the bench and walls or surface sterilization with a disinfectant like Zephiran is desirable. Lighting fixtures should be recessed with a glass front to provide even illumination without holding dust or causing air convection currents. An alcohol burner for flaming instruments is also needed.

Dissecting microscope

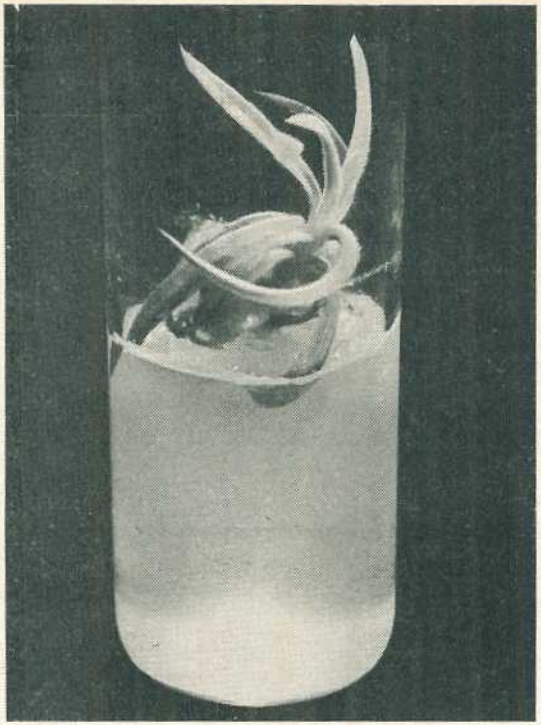
A binocular dissecting microscope with ample lens-to-stage working distance and magnification of 6 x to 25 x is required. The stage of the microscope should be surface sterilized with ethanol.

Dissecting instruments

Dissecting instruments consist of fine needles, mounted razor blade pieces, or fine scalpels. To avoid microbial and viral contamination, frequent disinfection of the instruments is essential. This is achieved by flaming with ethanol and rinsing in sterilized water.

Culture tubes

Tubes and flasks of various shapes and sizes have been used. Until recently, pyrex borosilicate glass has been recommended with cotton wool plugs and aluminium caps. These



A good, single gypsophila shoot grown from an excised lateral bud.

Chrysanthemum plantlet ready for transfer to potting mix in a glasshouse.

are now being replaced by autoclavable plastics such as polycarbonate. A flat bottom tube 10 cm x 2·5 cm, available from Disposable Products, has proved satisfactory with 5 to 10 mls of culture medium. The tube plus medium is autoclaved for 15 minutes at 121°C before transfer of dissected tissue.

Culture medium

The success or failure of tissue culture often depends on the right culture medium being used at each stage in the process. The solution needs to contain all the chemical ingredients that the plant tissue needs for growth that are normally supplied by the plant. This includes both major and minor elements, plant growth substances (including vitamins and amino acids), plant hormones (auxins, cytokinins and gibberellins), and sugar as a carbon source. The right balance of these components is critical as it will determine the type of growth that is achieved.

Few generalizations can be applied to solutions as most species require a different balance and combination of the components in the culture medium. However, the presence of the plant hormones and the balance of them has the biggest single influence on the type of growth that occurs. Auxins stimulate root initiation and callus growth, though their continued use may inhibit root development and necessitate the transfer of the tissue to medium without growth substances for root development. Cytokinins may be needed to stimulate dormant buds to grow and also to influence shoot growth.

In some cases (such as papaw), kinetin influences single shoot growth whereas benzylamino purine (B.A.P.) causes multiple shoot growth. Gibberillins may be added and often suppress unorganized divisions which lead to formation of callus and stimulate the bud to differentiated, fast growth.

As a source of carbon, glucose, fructose, or sucrose are available, of which the latter is most widely used.

A useful basic medium which has often been used as a starting point for tissue culture, is one devised by Murashige and Skoog in 1962 (table 1). It is characterized by high concentrations of potassium and ammonium ions, and of miso-inositol. Recently, a broad spectrum experiment has been devised by Dr De Fossard at the University of New England and has proved useful for the investigation of new and unresolved tissue culture situations. This experiment consists of testing four broad categories of constituents—mainly minerals, auxins, cytokinins and sucrose plus growth factors plus amino acids—with a factorial design on 81 agar based media.

TABLE 1

MURASHIGE AND SKOOG BASAL MEDIUM, 1962

Component	Milligrams per litre of solution
NH4NO3	1 650
KNO3	1 900
CaC12-2H2O	440
MgSO4-7H2O	370
KH2PO4	170
Na2EDTA	37·3*
FeSO47H2O	27·8*
H3BO3	6·2
MnSO4 4H2O	22·3
ZnSO4-4H2O	8·6
K1	·83
Na2MoO4-2H2O	·25
CuSO4-5H2O	·025
Sucrose	30 000
Edamin (optional)	1 000
Glycine	2
Myo-Inositol	100
Nicotinic acid	0·5
Pyrodoxin HCl	0·5
Thiamin HCl	0·1
Indoleacetic acid	1–30
Kinetin	·04–10
Agar	10 000

*5 mgms/1 of a stock solution containing 5·57 gm FeSO4 7HSO plus 7·45 gm. Naz EDTA per litre of H2O.

The usefulness of a starting medium and the variations which can be needed are demonstrated by the strawberry media used at R.H.R.S. Good single shoots can be produced on a medium using Murashige and Skoog major and minor nutrients with the substitution of the growth substances and hormones for those in table 2. Multiple budding can be achieved with strawberry tissue by the substitution of the growth substances and hormones in table 3.

TABLE 2

GROWTH SUBSTANCES AND HORMONES USED IN STRAWBERRY SINGLE SHOOT MEDIUM

Component	Milligrams per litre
Thiamin hydrochloride	1
Pyrodoxin hydrochloride	1
Nicotinic acid	5
Riboflavin	0·5
Calcium pantothanate	5
Folic acid	0·1
Biotin	0·01
Choline chloride	1
Para-amino-benzoic acid	0·05
Inositol	10
Indolebutyric acid	1
Benzyl amino purine	0·1

TABLE 3

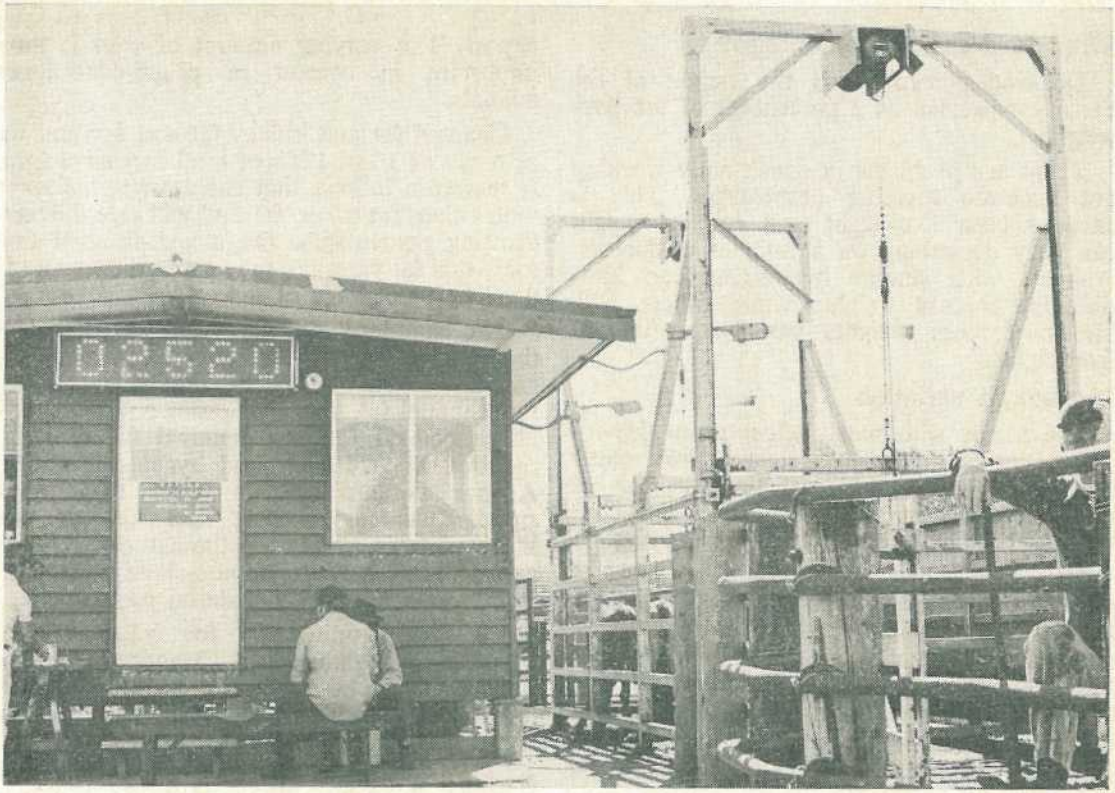
GROWTH SUBSTANCE AND HORMONES USED IN STRAWBERRY MULTIPLICATION MEDIUM

Component	Milligrams per litre
Inositol	54
Nicotinic acid	2·5
Pyrodoxine HCl	1·1
Thiamin	0·6
Riboflavin	3·7
2-Naphthoxyacetic acid	1·2
Benzyl amino purine	0·2

Strawberry tissue grows successfully on either an agar based media or in liquid culture supported by filter paper bridges. Some species show a preference for solid or liquid media and this often has to be determined before routine testing of solutions takes place. Often the production of adventitious buds for multiplication is achieved by placing the tissue in a liquid medium which is kept moving by either shaking or rotation. This method is used with orchids and pineapples.

Transfer to potting media

When a rooted plantlet has developed, it may be transferred to a potting media (preferably steam pasteurized) in pots in a glasshouse. A few days under mist propagation or placing the pot in a sealed plastic bag helps this transition stage. Often the plantlets can be hardened before transfer by removal of hormones from the solution and by increasing the light intensity for a few weeks. If it is not possible to induce root formation, grafting the tissue-cultured shoot on to a healthy seedling may result in an established plant.



Dressing percentage . . .

becoming more important in beef cattle marketing

THE installation of scales at many saleyards has led to an increased interest in the liveweight auction system.

This system relies on accurate estimates of carcass beef being calculated from a known animal liveweight. Therefore, an accurate estimate of dressing percentage is needed.

Many producers are also installing scales on properties and using these scales for the sale of beef animals. A common practice is to weigh bullocks straight out of the paddock and accept payment as cents per kilogram estimated dressed weight. The figure most commonly used for converting liveweights to estimated dressed weights is 50%.

But is this figure correct or even close?

Whichever selling system a producer uses, an accurate estimate of the carcass weight being sold is essential if he and the buyer are to be satisfied with the price.

Photograph above. Dressing percentage is important when selling cattle by liveweight. Estimates of the average dressing percentage should be more accurate with sale lots of 20 rather than with two or three animals.

by A. E. Holmes, Beef Cattle Husbandry Branch

What is dressing percentage?

Dressing percentage is the weight of the carcass expressed as a percentage of the liveweight.

There are problems in consistently working out accurate dressing percentages. This is because both liveweight and carcass weight can vary depending on a number of factors. Animals with similar liveweights can have different carcass weights while others with similar carcass weights can have different liveweights.

Liveweight variation

The factor with most influence on day-to-day variation in the liveweight of beef cattle is gut fill. It is the largest single source of error in weighing ruminants and can constitute 12 to 23% of an animal's liveweight.

Both feed and water can affect the level of gut fill. Weighings throughout Queensland have shown that cattle lose 6 to 8% of paddock liveweight after a 24 hour fast off feed and water. The figure has been remarkably constant for different breeds of cattle and different pasture types.

When recording animal liveweight, it is essential to standardize the weighing procedure to be followed. Either full weights or weights recorded after a set fasting time should be used. If full liveweights are to be used, the time of day when animals are weighed must be standardized.

In Queensland, when animals are weighed for liveweight auctioning, it is after a set minimum fasting period. This fasting period aims to reduce liveweight variation due to gut fill.

Dressed weight variation

Abattoirs weigh carcasses immediately after dressing. This 'hot' weight is reduced by 3% for payment purposes to give the 'cold' dressed weight. The 3% has been adopted as a standard figure to allow for evaporation of moisture from the carcass during the chilling period. Dressing percentage will vary depending on whether the 'hot' or 'cold' carcass weight is used in the calculations and whether a full or fasted liveweight is used.

Carcasses are subjected to varying amounts of fat trimming depending on the market they will supply. Those destined for the local trade will be trimmed less than similar carcasses for export. The varying amount of trim is most important in overfat or prime-conditioned animals.

Channel fat and kidney fat can account for as much as 10 to 12% of total carcass weight. It therefore follows that carcass weights taken with either 'fat in' or 'fat out' will give different dressing percentages. On a well-finished bullock, this fat variation may cause differences in dressing percentage of 3 to 4%.

The 'standard' carcass weight is defined as the hot weight recorded after removal of the tail, thick and thin skirts, kidney and kidney fat, channel fat, udder or testes and penis and all associated fat and removal of all items required in veterinary and hygenic trimming. A 'non-standard' carcass is the same as a standard carcass except that kidneys and kidney fat are retained in the carcass. A 'part' carcass is a standard or non-standard carcass from which additional material is removed.

To obtain uniformity for calculation of dressing percentages, a standard carcass weight should be used. We have based our dressing percentages in this paper on standard hot carcass weights and full liveweights.

Factors affecting dressing percentage

Body condition

Animals in good condition yield higher dressing percentages than poor animals.

In a North Queensland study where 63 Droughtmaster type bullocks were scored for condition prior to slaughter, nine animals were classed as forward stores, 46 as fats and 18 as prime fats. Dressing percentages were 48·7%, 51·3% and 52·9% respectively. Although weight increased with level of condition there was a progressive increase in dressing percentage as animal condition improved.

An observation at 'Swan's Lagoon' with store cattle showed that within each condition level there was a remarkable degree of uniformity. Dressing percentage increased slightly with increasing level of condition from backward store to forward store. Store animals dressing out at 115 to 135 kg had dressing percentages in the 46 to 49% range.

On the other hand, good quality vealers of similar carcass weights would be fatter due to a better quality diet. They would also have a lower gut fill and a higher dressing percentage overall.

Diet and pasture type

The type of diet an animal is on influences the weight of gut contents and so affects dressing percentage.

As the energy content of the diet increases, the amount of material in the digestive tract is reduced. Animals on poor quality dry feeds will have a bigger proportion of their weight as gut contents than animals on high quality pastures.

Relatively small differences in diet quality can lead to higher dressing percentages. This may be due partly to a better condition effect from the higher quality diet.

Queensland experiments where ad lib molasses has been fed on both dry rank feed and on lush succulent pastures have shown 1·5% to 3% better dressing percentages where the molasses was fed.

There are numerous reports of cattle being fattened on crops on the Darling Downs and dressing out at 55 to 56%. Feedlot cattle usually yield dressing percentages 1 to 2% higher again.

Breed

Different breeds of cattle have different dressing percentages. In general, dressing percentages decrease from Zebu crossbreds to large European breeds then to British breeds and finally to the dairy breeds. Each step in the chain is approximately 1%. Nevertheless, there is more variation within breeds due to differences in condition and pasture type.

Within each of these broad breed groups differences are generally small (for example, Shorthorns and Herefords generally give similar results). However, within the Zebu crosses, Sahiwal crossbreds seem to dress out at 0·5 to 1·5 units higher than Brahman crossbreds. Differences between Brahman crossbreds and Africander crossbreds tend to be small.

Body condition and pasture type affect dressing percentage more than breed.

The advantage of the Zebu crossbreds over the other breeds is related to their smaller digestive tract and therefore less gut fill.

Age

In a study using Angus, Hereford, Friesian and Charolais crossbred animals, dressing percentages increased as the animals aged from 12 to 18 months. Absolute liveweights increased with age but animals were all fat at slaughter after being fed feedlot rations from 9 months of age.

Age does not appear to influence dressing percentage. However, as animals become very old they are likely to be in poorer condition and therefore return lower dressing percentages.

Sex

Because dressing percentage is affected by the level of fatness, or condition, differences between sexes are largely a reflection of differences in maturity.

At equal weights, steers have dressing percentages slightly better than bulls and both have higher dressing percentages than heifers.

However, at equal levels of fatness, all three have similar dressing percentages.

The reduction in dressing percentages of bulls is due partially to their heavier hide and offal cuts.

Miscellaneous factors

Other factors such as bruising and stage of pregnancy in the female will affect the dressing percentage.

All bruised tissue is trimmed from carcasses prior to weighing. This bruise trim varies from very small amounts to total carcass condemnation. Carcasses which have been heavily trimmed for bruising give reduced dressing percentages.

Observations in the United States suggest that pregnancy up to the fifth month does not affect dressing percentage. However, after this foetal growth increases rapidly. At birth, the foetus and associated membranes may weigh 55 to 70 kg. This will affect liveweight and thus dressing percentage by as much as 4 to 7%.

Conclusions

The two most important factors affecting dressing percentage are:

- Gut fill
- Animal fatness

Other factors such as breed and sex can be easily identified and appropriate allowances incorporated into the estimate. The allowances can not be as easily or accurately made for gutfill or animal fatness.

There can be a great deal of variation between groups of cattle which might be expected to return similar dressing percentages. Consequently, the larger the group, the more accurate any estimate of dressing percentage is likely to be. With liveweight selling, the average estimate for sale lots of 20 animals should be more accurate than for lots of two or three animals.

SUMMARY OF FACTORS AFFECTING DRESSING PERCENTAGE

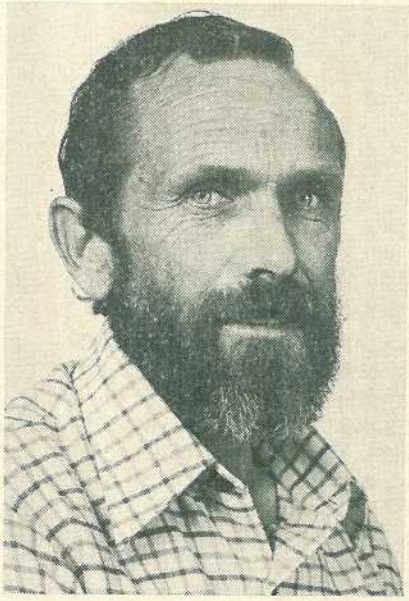
	Low D.P.	———	———	> High D. P.
CONDITION	Poor Condition	———	———	> Good Condition
DIET	Poor Quality Feed	———	———	> High Quality Feed
BREED	Dairy ——— >	British ——— >	European ———	> Zebu
SEX	Cows ———	> Bulls ———	———	> Heifers and Oxen
GUT FILL	Full Weights	———	———	> Fasted Weights

Management of the breeding pig part 1

PROFITABLE pig production hinges largely on managing the breeding herd efficiently.

The need for good herd management is now more urgent than ever, to offset the higher costs of establishing and running a modern piggery.

One of the most important areas needing concentrated attention in pig breeding is mating management. After all, successful mating is the key to producing more pigs per sow per year which is a vital factor in profitable pig production.



The author—D. B. Preston, Pig and Poultry Branch.

Sow management before mating

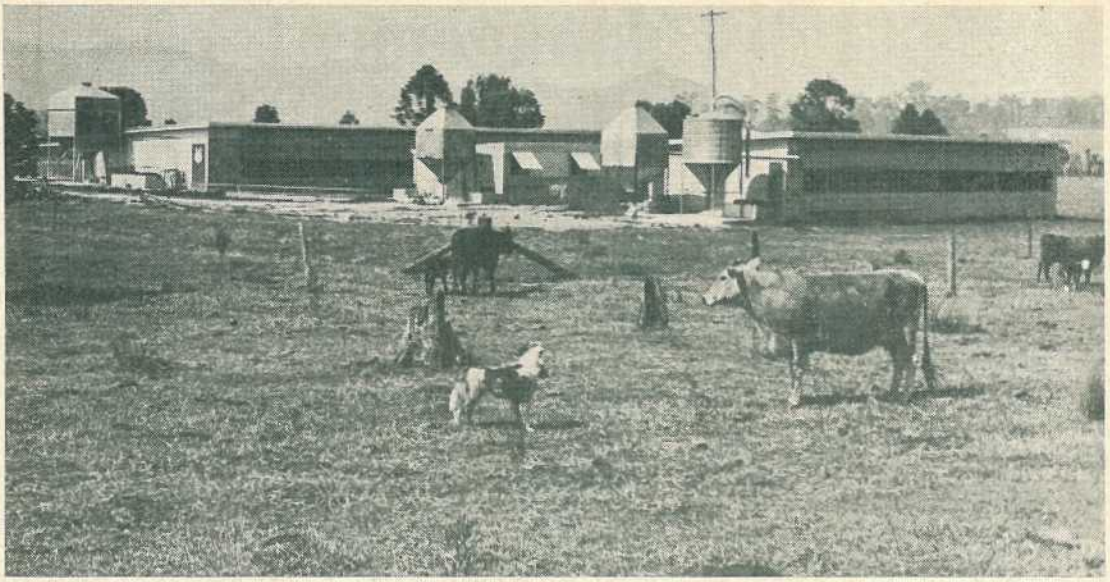
Weaning strategies

Batch weaning is practical in many large Queensland piggeries. By weaning a batch of sows on the same day, mating and farrowing dates later coincide fairly well. There are many examples of Queensland piggeries weaning batches of sows on Thursdays or Fridays, with most of these sows being mated on the following Monday or Tuesday. Farrowing can be expected a little over 16 weeks later on Wednesdays or Thursdays, with routine jobs largely avoided over weekends. With batch farrowing, routine tasks from farrowing to weaning can be done with several litters at the same time.

An important advantage of batch weaning, mating, and farrowing is being able to even up litter sizes by fostering. Fostering is a valuable tool in reducing pre-weaning loss of piglets.

Feeding levels over the weaning-mating period

Sows weaned after their first litter respond favourably to increased feed levels (flushing) over the weaning to mating period. This is supported by an experiment at Nottingham University; results are shown in Table 1.



A modern 60 sow piggery showing (from left) the grower shed, the farrowing and weaning house and the dry sow quarters. Since capital investment in a piggery enterprise is high, management skills need to be of a high standard for profitable operation.

TABLE 1

EFFECT OF FEEDING OVER WEANING/MATING PERIOD, FIRST LITTER SOWS

Feed (kg/day)	1·8	2·7	3·6
No. Sows	12	12	12
No. Mated ..	8	9	12
Days to Re-Mating	21·6	12	9·3
Conception % ..	87·5	100	100
Litter Size ..	9·4	10·1	11·6

TABLE 2

FEED LEVEL IN WEEK BEFORE WEANING

Feed/Day	1·8 kg + 0·45 kg/Piglet	2·7 kg
No. Sows	26	26
Days to Re-Mating ..	5	5·4
Conception % ..	96·2	92·3
Litter Size	11·2	11·5

The same levels fed to sows after their fourth litter generally showed no significant response.

The first litter sow is a special case as she is still growing, and often needs generous feeding to offset weight loss from rearing her first litter.

It follows that any sow in poor condition at weaning may respond to generous feed levels following weaning. Other work has concentrated on flushing on the day of mating or the day after mating, to increase ovulation rate.

Research has shown there is no special advantage in reducing the milking sow's feed in the week prior to weaning.

Oestrus normally follows the removal of the 'suckling stimulus' and the engorgement of the sow's udder. Sows should be offered adequate amounts of feed and water over the weaning period. Claims in favour of starving weaned sows, or depriving them of water for 24 hours in an attempt to hasten 'drying off' and the onset of oestrous are not supported in normal circumstances. In New Zealand, an adverse effect of starvation on the weaning to mating interval and the size of the next litter has been demonstrated.

TABLE 3

Feeding Treatment	2·7 kg/day from Weaning	24 hours fasting then 2·7 kg/day
Days to Re-mating ..	8·5	13·1
Litter Size	11·7	8·9

Some of the research work on feeding levels following weaning may not agree with farmers' practical experiences. Furthermore, a particular method of management working well in one piggery may not work in another situation. An example is mating sows during lactation. From an 85% conception rate to first service in one piggery, the researchers apparently failed to repeat their initial success on another piggery under similar management.

It is wise to treat each sow as an individual. For example, sows weaned in poor condition may respond to more generous feeding after weaning. However, poor condition at weaning indicates a need for increasing the feed level during lactation. On the other hand, sows weaned in good condition can be given a normal level of feed during the weaning to mating period with satisfactory results.

Gilt management before mating

The average gilt reaches puberty at 180 to 210 days of age. They can reach puberty earlier when exposed for the first time to a sexually mature boar at 24 to 27 weeks of age. Further, a high proportion of gilts reach puberty at the same time in such circumstances. On the other hand, exposing gilts to boars for the first time at 19 weeks of age or earlier delays puberty because gilts become conditioned to the boar's presence.

These observations are often confirmed by producers. The stress of movement and group mixing into new surroundings plus the presence of a sexually mature boar stimulate the onset of heat in gilts on the brink of oestrus. Gilts selected as herd replacements should be housed in groups and allowed exercise, as individually penned gilts have been revealed as erratic breeders.

Ovulation in the gilt at puberty is at a low rate or even absent. The ovulation rate increases through the second to the third heat period (usually at about 8 months of age) and delaying mating to this time ensures a larger litter. There is no point in mating a gilt later than the third heat as no worthwhile increase in litter size will result.

On the other hand, it costs money to keep a gilt, and experiments at Nottingham University have shown gilts can be profitably mated at the second heat period provided they are generously fed from first oestrus to mating.

In practical terms, there is no reason to delay mating gilts beyond the second or third heat period. The aim should be to get a maiden litter farrowed, if not weaned, by the time the sow is 12-months-old.

Feeding gilts before mating

Nutrition has little effect on the age at which a gilt reaches puberty provided feeding levels are not lower than 50% of appetite.

In the average piggery, gilts are expected to show signs of oestrus by 6 to 7 months of age. Gilts are selected from the bacon pens where restricted feeding levels are usually not severe enough to delay puberty.

The main effects of feeding level around sexual maturity appear to be on ovulation and embryo mortality.

Small maiden litters are often excused as being the first. However, the fault may lie with management rather than the gilt's ability to conceive and farrow a normal-sized litter.

Experiments with gilts have shown that the level of feeding before, during and after the mating period affects the percentage of eggs surviving and the resulting litter size.

TABLE 4

INFLUENCE OF FEED LEVEL ON MAIDEN LITTER SIZE (FROM AGE 70 DAYS TO DAY 25 OF GESTATION)

Feed Level	1 Ad-lib	2 Limited	3 Limited-Ad-lib-Limited
No. of Eggs ..	13·6	11·1	13·5
Litter Size at 25 Days of Gestation	7·6	8·8	9·3

FEED LEVEL 1. Ad lib feeding throughout improved ovulation rate but embryo survival was low.

FEED LEVEL 2. Limited feeding (two-thirds of ad lib) throughout lowered ovulation rate but embryo survival rate was improved.

FEED LEVEL 3. Beneficial effects of limited and ad lib feeding were combined to improve both ovulation and embryo survival rate. Gilts were limited fed to first oestrus, fed ad lib to next oestrus and mating followed by limited feeding after mating.

In practice, it is beneficial to feed gilts more generously for 10 days or more prior to mating, thus improving ovulation rate. The feeding level should be reduced following mating to ensure a high embryo survival rate.

Oestrus in the sow

Sows normally show oestrus 3 to 7 days after weaning from a lactation period greater than 3 weeks. However, in some areas of Queensland the weaning to mating period increases during summer. This is commonly called 'summer infertility' and the problem is apparently of a complex nature.

A case study in the South Burnett district showed that 63% of sows were mated within 7 days of weaning in autumn, 57% in winter, 46% in spring and only 31% in the summer period.

It has also been shown that the interval between weaning and mating increases when sows are weaned at less than 21 days after farrowing. Another and more important effect of very early weaning is a decrease in the size of the next litter.

The sow cycles approximately every 21 days until she is mated and conception occurs. This can be misleading, as a cycle range of about 18 to 22 days is commonly seen. Thus returns to service need to be checked from the 18th day following initial service and again at a similar interval later.

The average duration of oestrus is about 50 hours, with a range of 12 to 120 hours, and sows have been shown to have a longer receptive period than gilts.

Ovulation occurs in the second half of oestrus between 38 and 42 hours after onset of oestrus, and lasts an average of nearly 4 hours. In practice, sows are served as many times as they will stand for the boar. Thus they may be mated two or three times during their receptive period in an attempt to ensure a larger litter than a single service would achieve.

The best time to mate the sow is shown in figure 1.

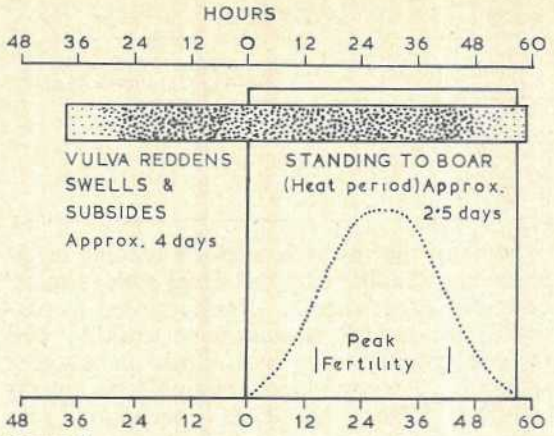


Figure 1.

Signs of oestrus appear gradually in the sow. She becomes increasingly restless, frequently sniffs the genitals of pen mates, mounts others or is mounted; her appetite may be variable and she often utters characteristic grunts. Sows which are receptive to mating are often difficult to move. Swelling and reddening of the vulva, the presence of a mucous discharge, and mounting behaviour indicate onset of oestrus, but not necessarily acceptance of mating. Acceptance of pressure on the back (that is, standing still) is commonly said to indicate willingness of the sow to mate.

However, research in France demonstrated this 'standing reaction' in only 48% of gilts in the absence of the boar. The standing reaction was increased to 100% in the presence of the boar. The receptive sow stands fast, is hard to move, arches her back and often cocks her ears. Standing reaction was also observed in 90% of oestrus gilts which could smell and hear the boar. This reaction increased to 100% when the gilts could also see and touch the boar.

The evidence indicates that under farm conditions weaned sows and gilts should be housed near sexually mature boars; this ensures maximum sexual stimulation from the boar due to smell, sound, sight and touch—in that order of importance.

Recognition of the sexual behaviour patterns of each sow is essential in deciding the time for mating.

Mating management

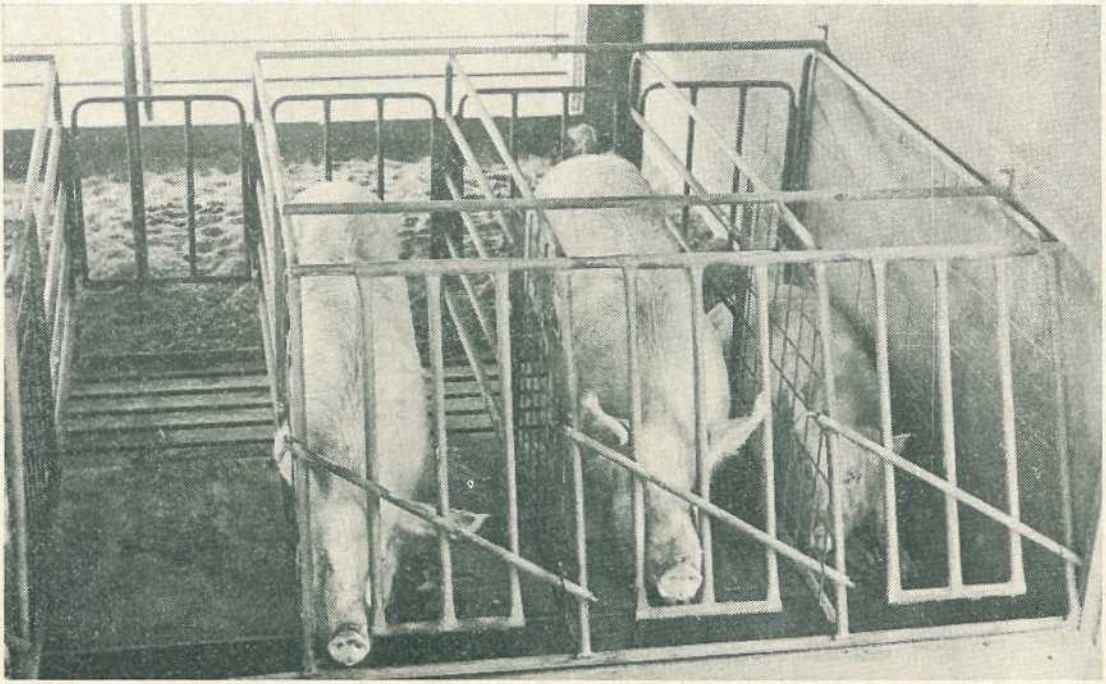
Because symptoms and patterns of sexual behaviour in the intensively-housed sow are not always clearly shown, or recognised, putting her with a boar will often decide if she is receptive or not. The boar should not be allowed to bully an unreceptive sow as she can be tried later the same day or the following morning.

The boar's interest is aroused and increased by a succession of reactions from the sow to his courtship attempts. Nosing, sniffing, head to head contact, mock fighting and mounting attempts result in the standing reaction followed by mating.

A second service 12 to 24 hours later helps to ensure a better conception rate and bigger litters than could be achieved with a single mating.

Under intensive conditions, mating should be supervised and promptly recorded. It is best to take the oestrus sow to the boar, as the boar works more quickly in his own territory. Mating can be performed in the boar's pen or in a mating yard floored with sand or soil. Some larger piggeries in Queensland are equipped with special accommodation for mating purposes. These mating 'stations' make the job of mating supervision more convenient.

Mating is preferably done in the early mornings before feeding time when both stock and stockman are rested and ready for the job. This time of day is also likely to be cooler and free of interruption. During the summer months in Queensland, it is worthwhile keeping breeding stock cool. Experiments during hot weather have shown that misting water over boars and sows around mating time helps to improve litter size.



The onset of oestrus in sows is stimulated by the proximity of the boar in the centre stall. Note the covered mating pen behind the stalls.

Following mating, the sow or gilt should be individually penned to allow her peace and quiet which helps to ensure successful conception.

Recently-mated sows should be kept near a boar, which assists the stockman in detecting returns to service 18 to 22 days after mating.

Boar management

Compared with other domestic animals, the boar produces a large volume of semen—ranging between 100 and 500 mls at each ejaculation. The concentration of sperm within the ejaculate apparently bears no relationship to semen volume and it varies between boars and between ejaculations of the same boar. Sperm density within boar semen can vary between 5 and 1000 million sperms per millilitre.

Ejaculation has three phases, the pre-sperm fraction of almost clear fluid, a second sperm-rich fraction, followed by a gel fraction from the accessory sex glands. The gel fraction amounts to about 25% of the total ejaculate.

The process of ejaculation lasts 4 to 6 minutes following penetration and 'locking' of the penis in the cervix. The presence of large quantities of gel after mating ends indicates the sperm fraction has been deposited in the female.

The sow therefore must be in the receptive phase of oestrus, the standing reaction being the principal stimulus for the boar to mount. The sow should stand still for 6 minutes or more and be able to bear the weight of the boar. An important factor in mating is soundness of legs and feet in both sow and boar.

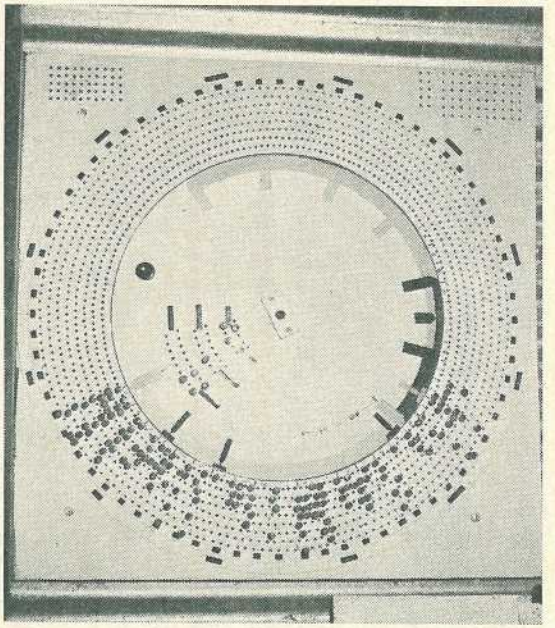
Boars are usually housed individually, with a mating yard nearby. Services can be successfully carried out on a variety of floor surfaces but it is important that a good footing be provided. Soil or sand floors are often preferred, though concrete floors can be successful if the surface is not too wet or slippery. Since many boars and sows urinate during courting, concrete floors can become slippery and require a covering of sand to provide a satisfactory footing.

Catering for each boar's needs is important in terms of ability to work on different floor surfaces and assistance with mating. Some boars may be able to work on concrete, some may not. Observations will soon show which boars need assistance serving sows.

The young boar needs some help at his first service attempt. Providing a docile, receptive sow about his own size helps the young boar to succeed and develops his confidence.

Irregular serving habits such as head mounting or anal penetration by the young boar should be discouraged at the outset. His workload is usually light at first, increasing as he reaches sexual maturity and by 12 months of age the young boar should be able to handle a full workload.

It is important to let boars feel they are in charge of the situation but no nonsense should be tolerated and the boar should be accustomed to handling before he reaches working age.



A circular calendar installed in the piggery or farm office is a valuable management and record keeping aid.

Regular de-tusking of boars is advisable to avoid a potential risk of injury to other stock and to the stockman. Useful aids for boar handling are a sheet of 5 ply, 1 m x 0·5 m, with a hand hole at the top, and a length of polythene hose.

Working boars need to be kept fit but not fat and as a general guide 2 kg of feed daily is an adequate level. A similar feed mixture to that used for sows is usually satisfactory. Extra feed may be allowed depending on the boar's size, condition and workload.

The boar's workload may be variable, but it is necessary in batch mating to have a sufficient number of boars on hand to double serve each group of sows. In such herds the boar/sow ratio may need to be about 1:15. Boars may be worked heavily for short periods, but should be rested between periods of heavier than usual workloads. Mature boars should have about 10 services per fortnight and it is good policy to use boars regularly, as an extended period of idleness often reduces fertility and sexual drive.

Boars supply half the inherited characteristics of their progeny and therefore the best boars available should be selected. Usually performance tested boars offer the best chance of herd improvement in terms of growth rate, feed conversion efficiency and grading. These traits are moderately to highly heritable, and are most likely to result in financial benefits in the long term.

Record keeping

Keeping an accurate record of matings is a very necessary aid in making timely management decisions which contribute to successful piggery operation.

Mating records help to identify and cull unproductive sows and often provide the means of tracking down an infertility problem. Consulting these records assists with planning for farrowing accommodation needs as they arise.

Clear identification of each sow in the herd is necessary if records are to be kept. Ear notching offers a permanent and reliable means of identification although a wide choice of numbered plastic ear tags are commonly available and it is good policy to tag sows in both ears, in case a tag is lost or destroyed.

Effective records should consist only of information which is likely to be useful. For best results, mating records should be simple and easy to follow.

Suggested headings and entries are shown in table 5.

TABLE 5

MATING RECORD

Sow Number	Date Weaned	Date Mated	Boar	Date 1st Return	Date 2nd Return	Date Farrowing Due
84	2–3–79	6–3–79	3	24/28–3–79	15/19–4–79	28–6–79
33	2–3–79	7–3–79	4	25/29–3–79	..	Returned

Record keeping aids may consist of notebooks, index cards, blackboards, mating sheets and/or a gestation calendar.

Summary

Successful matings are the key to profitable pig farming so the pigman needs to adopt a management routine which will best achieve this end.

A knowledge of each sow's sexual behaviour can be used to advantage in mating but the ultimate decider is the boar.

Available evidence supports flushing as against starvation to promote drying off and oestrus in sows.

Housing weaned sows and gilts in close contact with mature boars promotes oestrus.

Keeping accurate and useful records is an essential ingredient of good herd management.

Oxley stylo . . . a small plant

by E. J. Bowen, Agriculture Branch

OXLEY stylo is a pasture legume that withstands climatic extremes and persists under grazing with minimum management.

It has naturalized from sowings made in subcoastal native pasture south of the tropic, where it is making a valuable contribution to the protein requirements of cattle—rivalling any other legume.

In Queensland's coastal and subcoastal native pastures, protein deficiency from autumn to early spring limits the feed intake and productivity of grazing animals. This means that pastures have to be stocked below the level indicated by the amount of grass available, necessitating an annual burn to remove the surplus dry grass.

There are three practical options to help overcome the problem:

- Use of supplements such as urea, concentrates, or legume hay.
- Replacement of native pasture with a sown grass-legume mixture.
- Inclusion of a legume in the natural pasture.

The last option provides the cheapest long term solution, since legumes convert atmospheric nitrogen into protein. The difficulty has been to find a suitable legume, but recent evaluations have shown Oxley stylo to be successful.

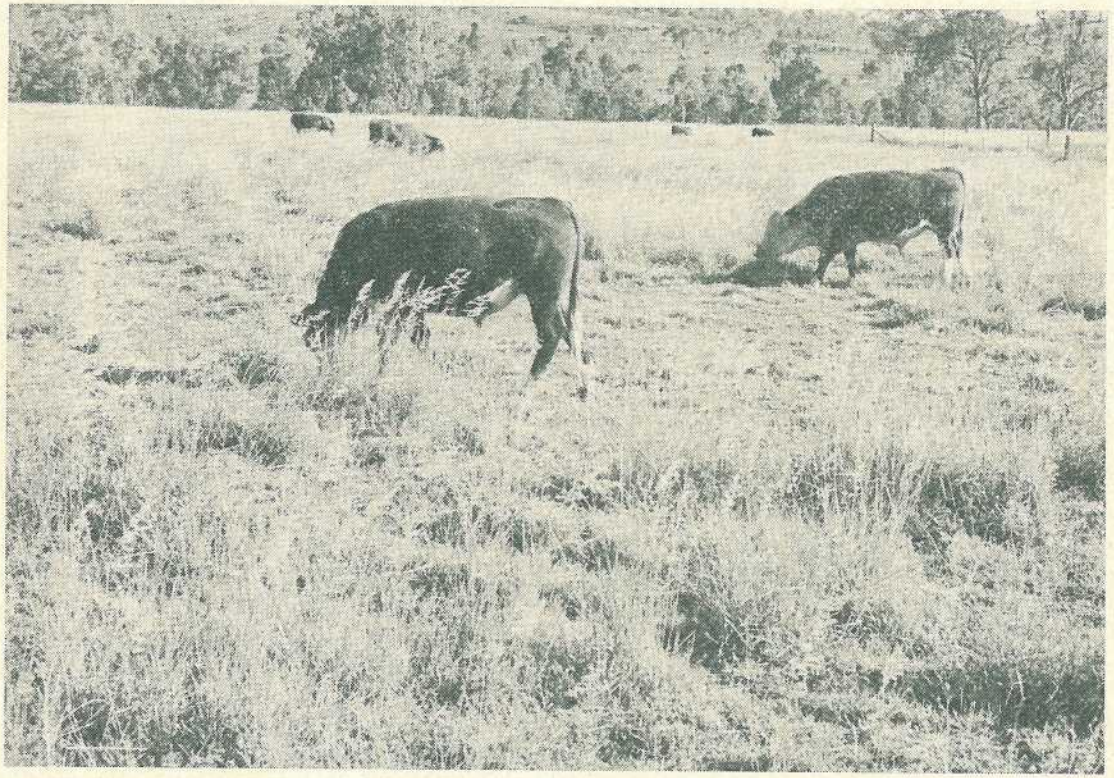


Plate 1. Hereford weaner steers grazing Oxley stylo-red Natal grass pasture at Brian Pastures. Optimum grazing pressure is shown by an absence of tall, ungrazed grass. Patch grazing is characteristic.

for big beef production

History and plant description

'Oxley' is a commercially released cultivar of fine-stem stylo (*Stylosanthes guianensis* var. *intermedia*). Introduced by C.S.I.R.O. from South America in 1948, it was sown in experiments on Brian Pastures Pasture Research Station at Gayndah by the C.S.I.R.O. and the D.P.I., and later by the D.P.I. on private properties in the Gin Gin, Gayndah and Monto districts. Because the plant is small and inconspicuous in the pasture, it has failed to impress the casual observer. Despite low yields of plant material, however, cattle weight gains have been impressive in trials conducted over several years.

Oxley stylo is a perennial semi-prostrate legume with a subterranean crown giving rise to fine hairless to moderately hairy stems. The trifoliate leaves are similar to those of Townsville stylo, are palatable and never sticky. The subterranean crown affords protection to the plant from grazing, fire and frost damage, and a deep tap root confers drought resistance. Low temperature tolerance and some frost resistance allow a longer growing season than many of the so-called 'tropical' legumes.

Plate 2. Overgrazing gives a high density of Oxley stylo but too little grass for good weight gains and no drought reserve. The pasture should never look like this in summer or autumn.

Adaptation

Oxley stylo grows well on light-textured soils in the Burnett region and parts of Capricornia where rainfall is between 700 and 1000 mm a year. Although best suited to light textured soils, it also grows on red volcanics and even basaltic clay. On the heavier soil types, there is a problem with establishment in dry areas, and excessive plant competition where rainfall is high. On all soil types, however, adequate drainage is essential. Soils with any tendency to waterlogging, often recognizable by the presence of sedges (*Cyperus spp.*), should be avoided.

So far, Oxley stylo is confined to neutral and acid soils where it has the ability to persist at very low fertility levels. However, the plant responds to phosphate fertilizers and indirectly soil fertility has a marked influence on beef production.

An obvious dominance of spear grass (*Heteropogon contortus*) in the native pasture indicates suitability for Oxley stylo. Other grasses with which Oxley is compatible are red Natal (*Rhynchelytrum repens*) and Gayndah buffel (*Cenchrus ciliaris*). On the other hand, tall buffel cultivars and green panic (*Panicum maximum* var. *trichoglume*) are not suitable companion grasses.

Seed treatment and establishment

The fruit of Oxley stylo is a single-seeded pod with no hook. More than 90% of the seeds are 'hard' and do not germinate readily. This attribute is desirable for regeneration in the pasture and may contribute to the success of the legume. There are numerous methods of removing the seed hardness, but the simplest commercial method is by mechanical sacrification, which can be arranged through some seed merchants.

Seed inoculation with Oxley stylo *Rhizobium* before sowing is necessary. When ordering the inoculant from commercial sources, Oxley stylo inoculant must be specified as no other stylo culture is suitable. The quality of seed to be treated should also be stated.

The sown seed is vulnerable to seed harvesting ants and can be protected with lindane. Rate of application of the insecticide is 450 g of 20% lindane dust per 100 kg of seed.

Research has shown that soil disturbance markedly improves the success of establishment—the more complete the destruction of existing species at sowing the better. Sowing on uncultivated land is therefore not recommended as few seeds establish. If, however, aerial sowing is considered to be the only option open to large scale development, the following suggestions are offered: Seed must not be scarified, but it should be inoculated and dusted with lindane. The native pasture should be burnt and the heaviest possible seeding rate applied (upwards of 5 kg per ha) with the pasture being continuously grazed as it grows.

An effective method of establishment, and one that is recommended for most situations, involves the use of a seed-box mounted on the back of a set of disc harrows. The implement, which is calibrated to drop seed behind the discs at a rate of 2 kg per ha, is drawn in single widths along the contour to give a banding effect.

Natural spread occurs between the bands, with the closeness of the bands being dictated by availability of seed and the speed of pasture development required. Natural spread is aided chiefly by water movement. As a result, the higher the bands are up the slope, the greater the area of potential spread with the quickest spreading occurring in depressions where water flows.

The most rapid establishment of Oxley stylo is achieved by total cultivation and a sowing rate of 4 to 6 kg per ha. In this and the previous method of establishment, a small proportion of scarified seed (25 to 30%) may be used to take advantage of wet weather soon after sowing. Any increase in this proportion could result in establishment failure through lack of follow-up rain. The seed should be broadcast on a freshly worked or 'open' soil surface and left uncovered.

Initial establishment is often slow with little obvious showing of legume in the first year. During this period when the plants are small, it is essential to maintain grazing to reduce plant competition. In fact, for the first 2 or 3 years, overgrazing is preferable to undergrazing, but from the second season, a rest in February to March would assist seed production.

Animal production

STORES. An Oxley-spear grass pasture at 'Tecoma' Station, Monto, produced average liveweight gains in Santa Gertrudis X Hereford weaners of 154 kg per head annually over 4 years. The weaners were running at a beast to 1·2 ha on light-textured, partially-cleared silver-leaf and narrow-leaf ironbark (*Eucalyptus melanophloia* and *E. crebra*) forest country. At Brian Pastures, Hereford weaners gained 147 kg per head when stocked at a beast to 0·73 ha on fully cleared country. The weaners were put in the paddock in June, where they remained at a fixed stocking rate until the following May when they were replaced.

FORWARD STORES. At Brian Pastures, when Oxley stylo became well established in native pastures, red Natal grass replaced the spear grass. Weaners grazing this pasture reached forward store to fat condition at less than 2 years of age. The pasture was fertilized annually at 125 kg of superphosphate per ha. From June 1975 to May 1976 an average liveweight gain of 211 kg per weaner was achieved (plate 1).

Based on a 4-year average, the possible liveweight gain of weaners grazing this type of pasture on a sandy granitic soil fertilized with superphosphate is shown in table 1. Extra animals were grazed on the pasture to keep down summer growth, hence the variable stocking rates shown in the table. There was no direct comparison with similar animals on a similar pasture without Oxley stylo. However, annual liveweight gains obtained in a study of some 800 weaners on native pasture at Brian Pastures over an 8-year period from 1955 to 1962, ranged from 80 to 90 kg per head. These figures should serve as a comparable indication of native pasture performance.

EFFECT OF STOCKING RATE ON LIVEWEIGHT GAINS. As the stocking rate is increased, so liveweight gain per animal decreases. This relationship is shown in the following table based on Brian Pastures results:

Stocking rate in ha per weaner	1·25	1	0·75
Annual liveweight gain in kg per weaner ..	198	181	153

Obviously these weight gains would vary between properties, since the carrying capacity of country varies considerably according to rainfall, development and soil fertility.

Pasture management

The pasture is sensitive to stocking rate which influences the proportion of grass, legume and weed. Heavy grazing pressure favours Oxley stylo (plate 2) while light grazing pressure favours the grass (plate 3). However, persistent overgrazing particularly in summer causes an increase in weeds. Green couch (*Cynodon dactylon*), blue couch (*Digitaria didactyla*) and broad-leafed weeds can become a problem causing loss of production.

TABLE 1

WEANER LIVEWEIGHT GAINS FROM OXLEY STYLO AND RED NATAL GRASS PASTURE AT GIVEN STOCKING RATES AND RAINFALL WITH DATA FROM NATIVE PASTURE FOR COMPARISON

	Oxley Stylo—Red Natal Grass				
	Winter (Jun.–Aug.)	Spring (Sep.–Nov.)	Summer (Dec.–Feb.)	Autumn (Mar.–May)	Total
Liveweight gain (kg/head) ..	4	73	65	45	187
Stocking rate (ha/beast) ..	1·1	1·1	0·6	0·8	..
Rainfall (mm)	115	183	371	108	777
	Native Pasture*				
Liveweight gain (kg/head) ..	1	15	50	22	88

* From an article 'Growth of Beef Cattle to Weaning' by G. I. Alexander and A. W. Beattie. *Queensland Journal of Agricultural and Animal Sciences*, Volume 25, page 7 (March, 1968).

Plate 3. Under-utilization results in tall, ungrazed grass with too few legume plants. The pasture should never look like this in spring.

The ideal pasture has legume evenly distributed through the grass and easily seen (plate 4). At Brian Pastures, this would be achieved at approximately 1 weaner per ha and at 'Tecoma' 1 weaner per 1·2 ha.

Although burning can be used to restore the legume balance in an over grassy pasture, regular use of this practice is wasteful in animal production through the need to de-stock. If the full potential of the pasture is being utilized, it should not be necessary to burn.

STORE PRODUCTION. The best stocking rate is that which maintains the pasture in ideal balance between grass and legume. The pasture should be well grazed by spring. On the other hand, there should be adequate feed available at the end of summer to last through the winter.

A system used successfully at Brian Pastures combines two age groups of animals on the same pasture. A constant number of weaners enter the pasture each June and remain there until they are sold in February 20 months later, at around 500 kg liveweight. From February to June (when the next weaners arrive) there is therefore, a lightening of the stocking rate by half. This gives the Oxley stylo a chance to seed and assures an adequate carry-over of legume for the winter months.

The stocking rate for this system is about the same as that for set stocking with weaners (that is, one animal per ha at Brian Pastures). The extra size of the older group of animals is compensated for by their removal from February to June.

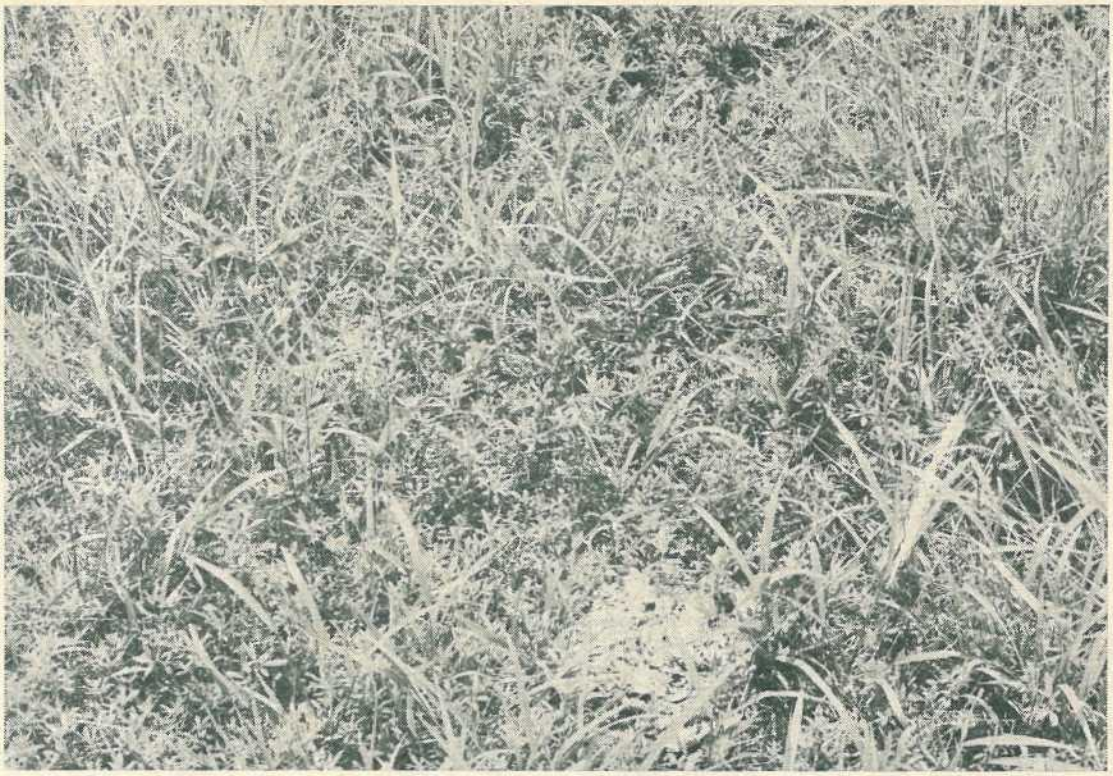


Plate 4. Spring growth of Oxley stylo and red Natal grass in a continuously grazed paddock, 1 weaner to 1 ha.

FORWARD STORE PRODUCTION. Managing an Oxley stylo pasture for forward stores requires a stocking rate more lenient than that required for an ideal grass-legume balance. About 1 weaner per 1·2 ha is satisfactory at Brian Pastures. However, at this stocking rate, there is a build-up of grass in the summer which, if allowed to continue, leads to a decline in the legume component. On large properties, it should be possible to add extra stock in December and January to eat the surplus growth. In small, intensive situations a hay cut would serve the same purpose. In either case, it is essential that this pasture conditioning be done in December and/or January when pasture growth is rapid and cattle weight gains are least affected.

Seed production

Seed supplies of Oxley stylo are very short at present and it may be necessary for those desirous of using this legume to produce their own seed.

Flowering, which commences with lengthening days, begins in December at Brian Pastures (lat. 25° 38′) and continues into March with the main seed crop produced in February-March. The flowers are small, pale to bright yellow, opening in the morning and wilting by afternoon. Seeds are produced over a long period, falling as they ripen. This makes efficient harvesting difficult and has caused problems in seed production, restricting the area sown to Oxley stylo to date.

The most efficient method of harvesting would be the collection of ripe seed only. Several ideas have been put forward, but the most promising involves the use of a specially designed tray which is drawn through the crop. The tray collects ripe seed as it falls. This machine designed by Forsyth Engineering of Monto has not been fully developed.

A less efficient, but practical, method is to cut off the plants when there appears to be the largest quantity of ripe seed present. The cut material is fed into a winnower or header which produces a roughly cleaned sample of seed. Some producers have used a header alone for this purpose. Others have used a flail harvester and stationary header. Seed yield can be up to 200 kg per ha.

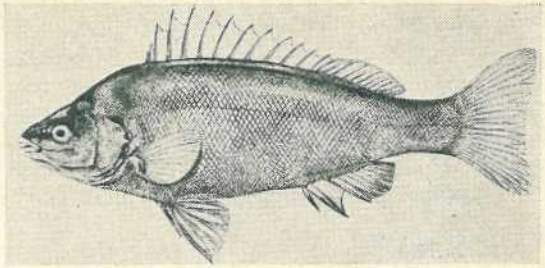
Future prospects

If large quantities of cheap seed can be produced, Oxley stylo promises to be of great value in the up-grading of native pastures from Brisbane to Rockhampton, east of the Dividing Range.

The geographic, climatic and soil limitations for this legume have yet to be determined. While the day length factor in flowering is likely to influence its northern limit, the western and southern limits will be determined by adequacy of summer rainfall, the requirements of which are unknown.

The apparent usefulness of red Natal grass as a pasture species should be vigorously pursued, particularly in association with Oxley stylo. This combination performs as well as any sown pasture mixture in a similar environment and has the advantage of long term persistence.

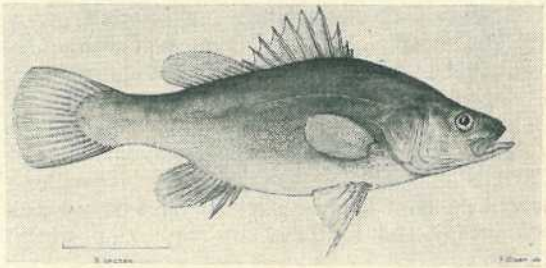
Fish for dams . . . recent developments



Silver perch.

UNTIL recently, people who wished to stock dams on their properties with suitable fish were faced with difficulties in obtaining sufficient numbers.

Hatchery techniques have now been developed so that some of the better freshwater food fishes (native to Queensland) can be raised in large numbers. In particular, fingerlings and small fish of several species are available from the privately-owned Tinbeerwah Fish Hatchery near Cooroy.



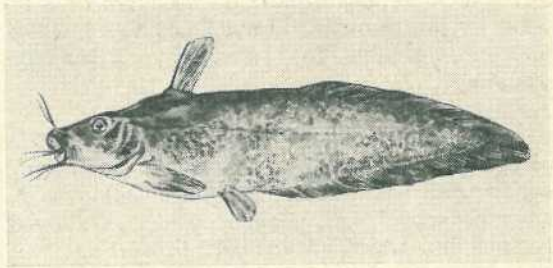
Golden perch or yellowbelly.

Fish available

The main species which can be purchased from hatcheries for stocking purposes include:

Silver perch

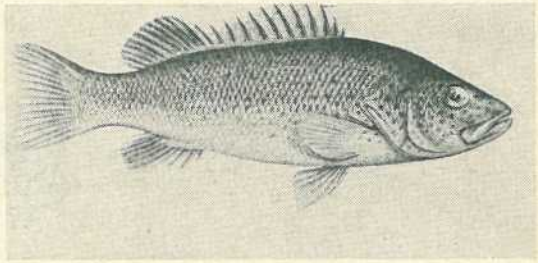
These fish show good growth rates in small and large dams (pan size within 12 months). They are excellent eating and fish up to one kg are not uncommon. These fish eat a variety of animal and plant material. They are not timid and even in small dams will rise for food such as compressed poultry pellets when given regularly. Because silver perch will not breed in dams, it is necessary to restock every 2 or 3 years.



Freshwater catfish.

Golden perch or yellowbelly

These fish tend to be more timid than silver perch. However, they show greater growth rates in small dams and are excellent food fish. Like silver perch, they have not been known to breed in small dams and as a result, dams require restocking.



Spangled perch.

by B. R. Pollock, Queensland Fisheries Service

FRESHWATER CATFISH

These fish thrive in small dams. However, they possess three poisonous spines and because of this and their appearance they are not as highly regarded as the previous two species. Freshwater catfish will breed in small dams and are good eating if prepared correctly.

Other fish which may be obtained from hatcheries in small numbers are Murray cod and saratoga or Dawson River salmon. Saratoga is regarded as an excellent angling species because of its spectacular fighting qualities but most people consider them as poor table fish. Since saratoga produce few offspring, they are not readily available from hatcheries and tend to be somewhat expensive, but they will breed even in small dams.

The largest of the freshwater fishes of Queensland, Murray Cod, is used for stocking large dams. This species is another which will not breed in dams so restocking would be necessary.

Fish are not available from the hatcheries throughout the year. The breeding season at the hatcheries is usually early summer with the first fingerlings attaining the length of 3 to 4 cm by midsummer (about December) when they are suitable for transfer to dams for stocking.

Prior to consignment, the fingerlings are placed in plastic bags in a small amount of water and the plastic bags are fiilled with oxygen, sealed and placed inside cardboard cartons for added protection. Fingerlings will live for several days under these conditions so hatcheries usually rail fish to their customers.

Some problems

ESCAPE OF FISH

Recent experimental work by the Queensland Fisheries Service has shown that both silver perch and golden perch may leave even large dams when water flows over the dam wall. To prevent the escape of fish during wet periods, a wire mesh fence may be constructed across the lowest part of the dam wall. This remedy may not be appropriate in all situations.

SPANGLED PERCH

The spangled perch is an extremely aggressive, small fish which is capable of breeding in dams. It may be useful in some situations but it is not regarded as a good food fish because of its small size.

Spangled perch apparently interfere with the eggs and young of other fish so careful consideration should be given before spangled perch are used for stocking purposes.

AQUATIC PLANTS

Floating and submerged aquatic plants provide little advantage in establishing fish populations in dams. In practice, it has been found that these plants may cause interference when the recapture of fish is attempted—particularly if dense growths of aquatic plants are present.

Further information

The booklet 'Fish for Farm Dams' which provides additional information and advice may be obtained on request from: Queensland Fisheries Service, P.O. Box 36, NORTH QUAY, Qld. 4000.

Further details in relation to the availability of various species of fish may also be obtained from the Service.

Spray races

by G. H. Dunwell, Veterinary Services Branch

A spray race can be an efficient method of treating cattle for tick control, providing it has been designed, constructed and maintained correctly.

There are several spray units available commercially and at least one of these could be classed as efficient.

Some of the others will give some tick control, but could not be classed as really efficient units.

Before a decision is made to purchase a spray unit, its design and efficiency should compare favourably with the specifications of the units described in this article.

These plans are available free of charge from the D.P.I.

Figure 1 shows the 'yoke', and in this design, 25 mm spray lines are screwed into sockets A to H.

FIG. I

VIEW FROM ENTRANCE LOOKING THROUGH SPRAY

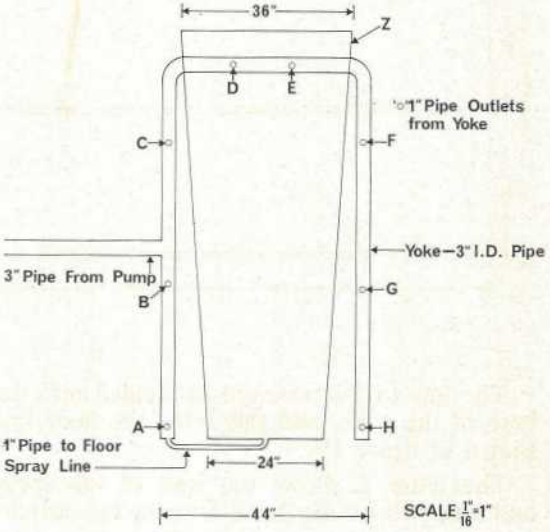


FIG II

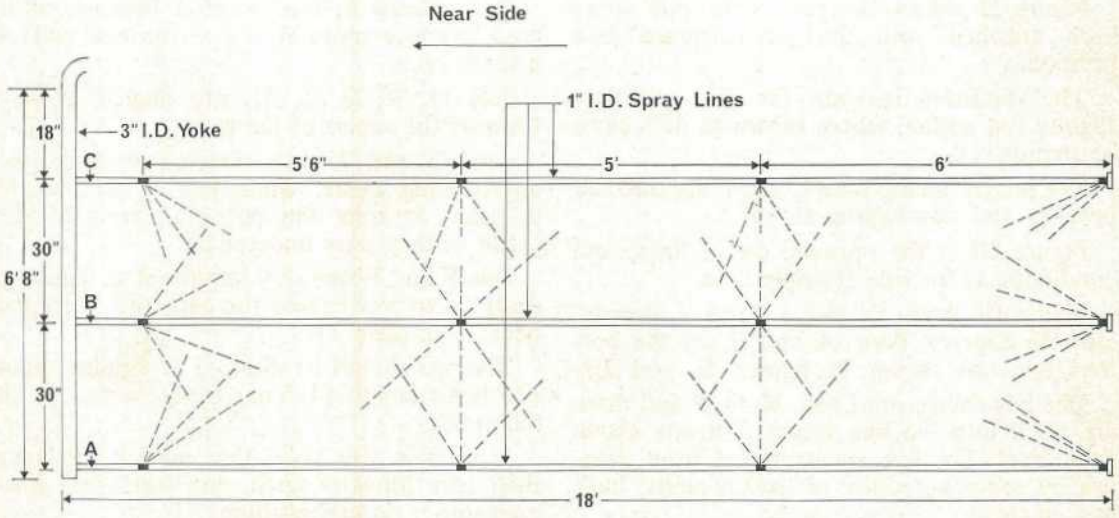


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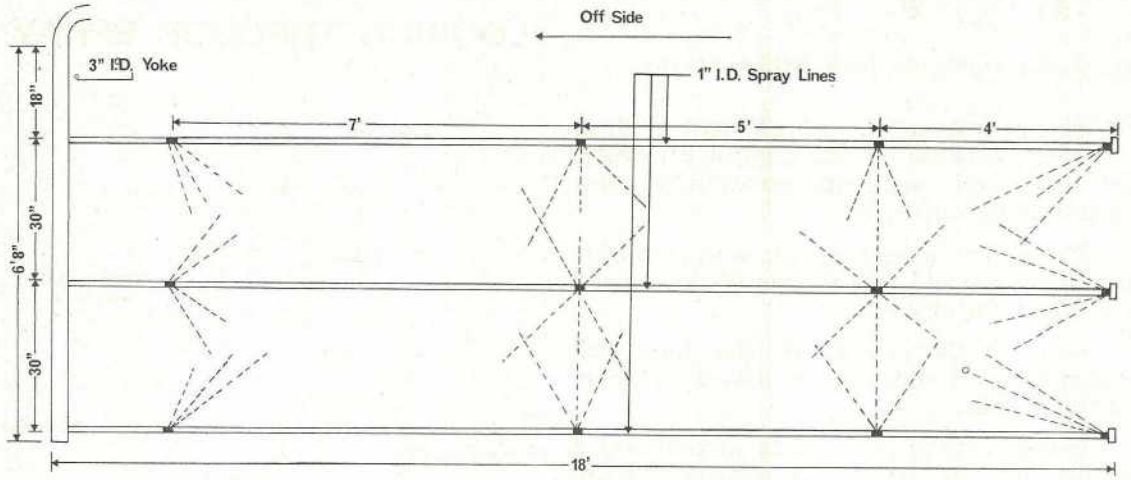
FIG. III



The line to J is screwed or welded into the base of the yoke, and this feeds the floor line shown in figure IV.

The letter Z shows the wall of the spray unit and will be discussed later in this article.

The section K can be connected to the pump with 75 mm flexible hose, instead of G.I. pipe, if desired.

Plastic or rubber hose can be used anywhere in the unit, as the fluid is pumped at the low pressure of 100 K.P.A. on 15 lb P.S.I.

Figure II shows the yoke with side spray lines attached with the jets fastened into position.

The distances between the jets can vary slightly but angles, where shown at 45°, must be maintained.

The jets in the top lines C and F are directed inwards and downwards at 45°.

Figure III is the opposite set of lines, and conditions as for side II apply here.

Figure IV shows the line J which is recessed into the concrete floor. A and H are the bottom lines as shown in figures II and III.

The jets shown are L, M, N. O. P and these are fitted into the line J and protrude above floor level. The jets are protected from damage by concrete 'cones' or 'turkey nests' built around them.

Jets L and M are angled 45° towards the entrance of the unit. These spray the front and lower parts of cattle.

Jet H is directed upwards and fanwise across the unit.

Jets O and P are at 45° and are directed towards the exit end to spray the lower posterior parts of the cattle.

Figure V shows the overhead line, D and E (joined) which extends at least two-thirds of the length of the unit, from the exit end.

It is placed in this position because cattle tend to move more slowly at the exit end of a spray race.

Jets Q, R, S, T, U, are angled at 45° towards the centre of the race.

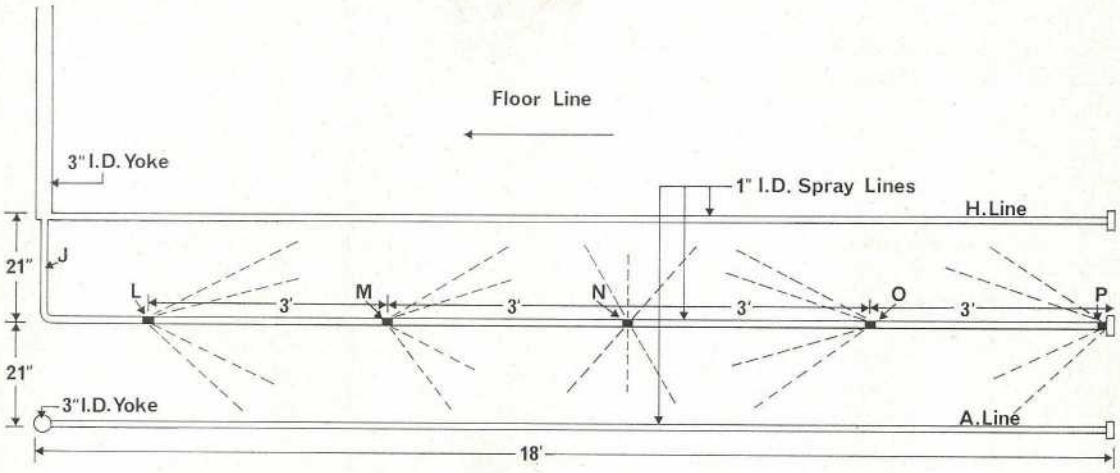
Jets Q and U are directed towards the approaching cattle, while jets R and S are designed to treat the posterior parts of the cattle as they pass underneath.

Jets V and W are very important as these are designed to wet behind the ears and along the neck. (see plate 1).

The jets should be directed at a point about one beast length (1·5 m) from the last jet in the spray.

It is from this point that most cattle have their ears forward again, and heads are lowered into a normal position.

FIG. IV



This is a general plan of the spray unit which can be varied to suit different situations.

With a high volume, low pressure unit it is desirable to have the sump and pump midway along the race. This will allow the fluid a much quicker return to the sump. It also prevents excess fluid flooding over the floor jets. This can occur when the jets are placed at one exit.

It is important to remember that whatever is in the sump may be pumped out to the jets. If the article is large enough, a jet will be blocked, and this can mean a dry spot on the cattle.

A good strainer should be fitted above the sump with holes smaller than the jet openings.

A sound cover on the sump to prevent leaves etc. from entering will prevent jet blockages.

FIG. V

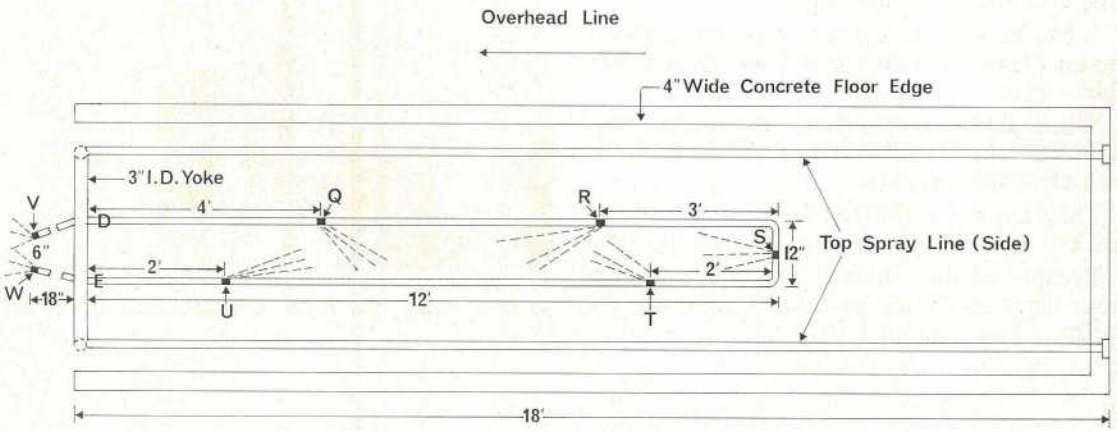
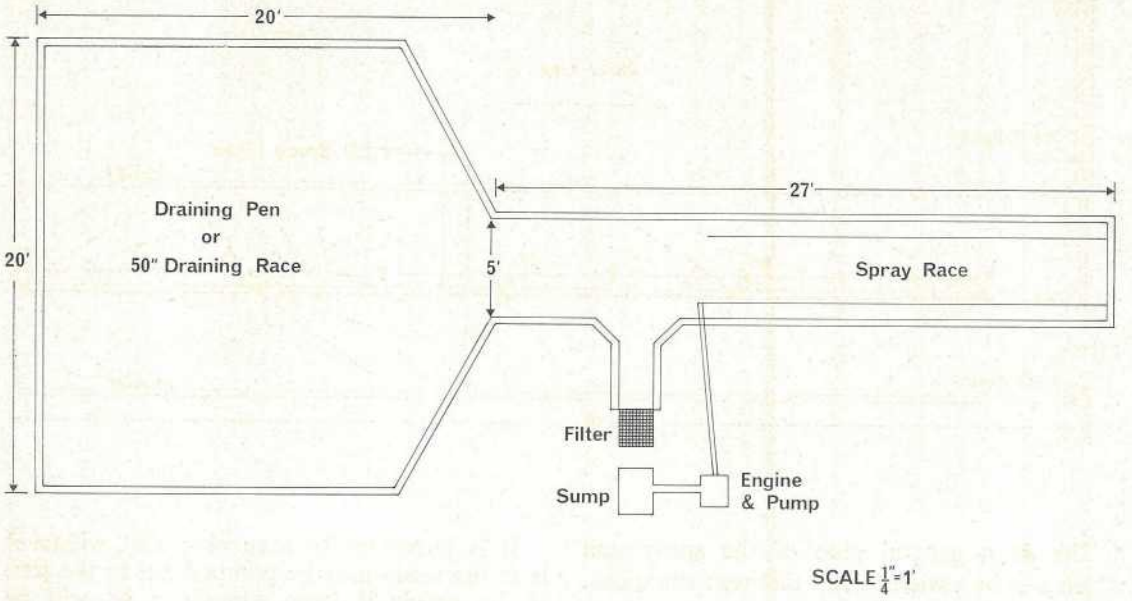


FIG. VI



Draining race or pen

The size of the draining pen is at the owner's discretion, but it should be large enough to hold sufficient cattle to avoid frequent trips to release them.

A draining race has many advantages and can be constructed of much lighter material than that required for a draining pen.

The race would need to be at least 17 m long and about 760 mm wide.

It can be straight, curved or angled, depending on the owner's choice and the space available.

When cattle emerge from the spray area, they slow down and usually walk out of the race reasonably slowly.

They are not restrained and do not become restless or excited as in a draining pen.

Because of this, there is less contamination from dung and urine as cattle pass along the draining race without restriction.

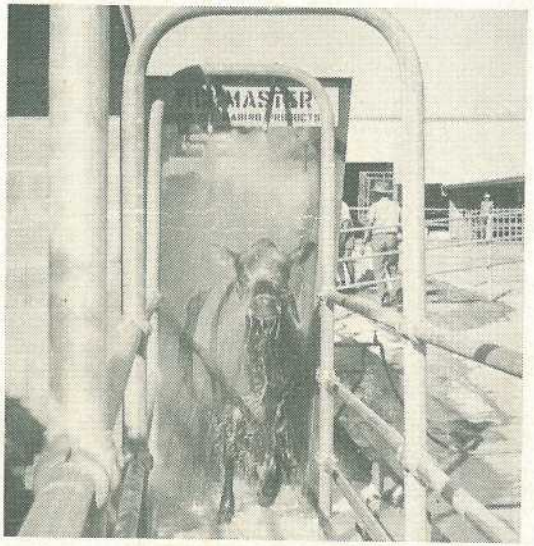


Plate 1. Note the head and ears in the normal position.

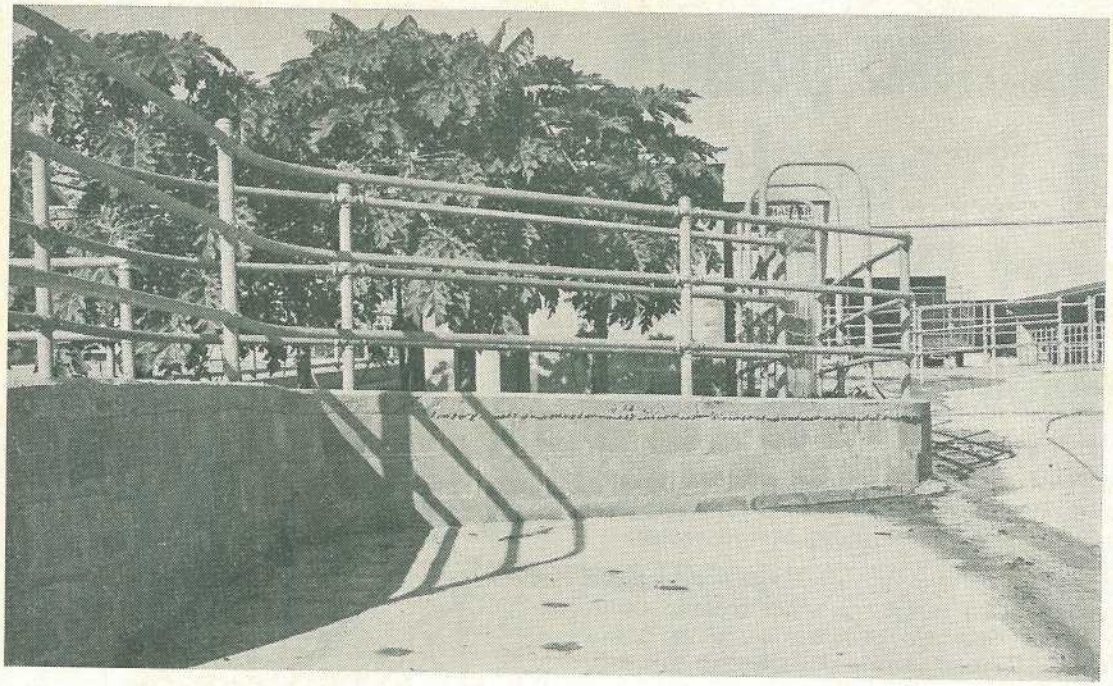


Plate 2. Draining race.

Power plant

A pump with an output of around 22000 G.P.H. at 100 K.P.H. is required.

This will require a petrol engine of around 12 H.P. or an electric motor of about 7·5 H.P. for power.

Thirty-eight brass jets are required with spray apertures of $\frac{1}{4}''$ to $\frac{5}{16}''$ and designed to spray as a 'fan'.

The walls of the spray unit are of 16 G flat galvanized iron, supported by a 38 mm angle iron framework.

This unit, constructed on D.P.I. Plans, would be the least expensive way to obtain an efficient spray unit.

However, there are some inexpensive commercial units available, but these are usually too small to be efficient.

They are usually designed with the small herd in mind, and some control can be obtained from them. They should not be compared with the larger, more efficient units.

With a spray race of around 6 m in length, it takes a beast about 4 seconds to pass through. This is a very short period in which to wet all parts. A large amount of fluid from carefully placed jets is necessary to achieve this.

The shorter units available will do this, and stock owners should keep this in mind when considering the best type to buy or build.

Contact your nearest tick extension officer or stock inspector for advice on construction or purchase of a spray unit.

Aquatic plants of Queensland part IV

Hornwort and water nymphs

HORNWORT is a common species of submerged aquatic. It produces no roots and is usually found floating in the water.

The water nymphs are rooted submerged aquatics. Two species of water nymphs occur in Queensland and both belong to the genus *Najas*. All three species described in this article are native to Australia.

Hornwort

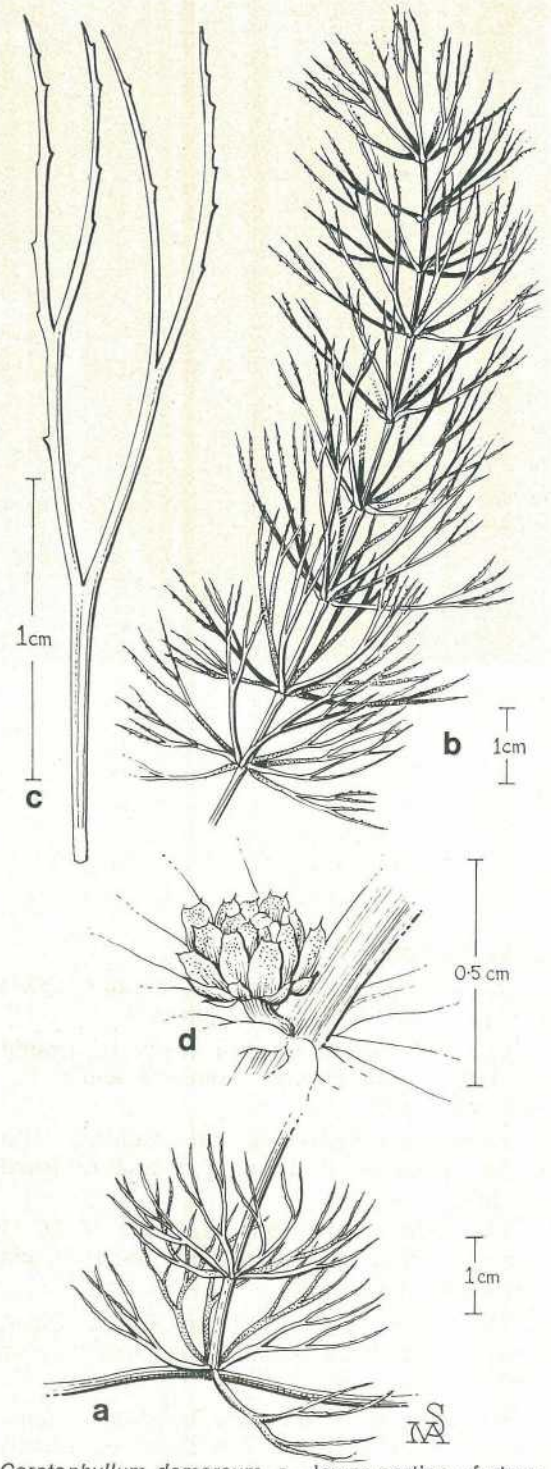
Ceratophyllum demersum

Ceratophyllaceae

Hornwort produces masses of soft, dark-green leaves and often has the appearance of a bushy fox tail.

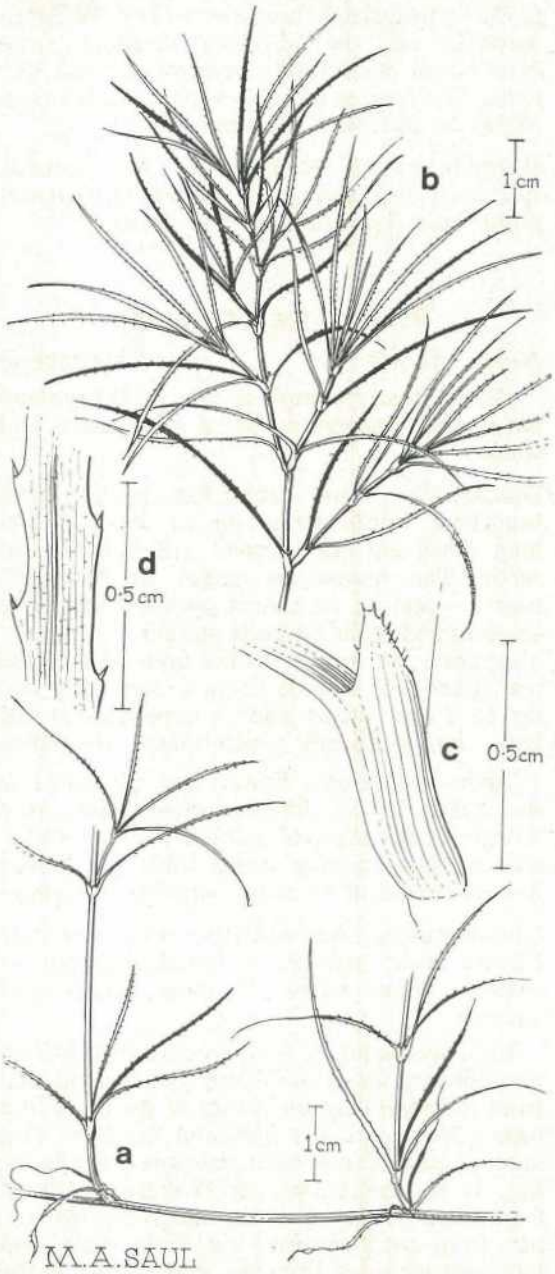
DESCRIPTION: The plant produces branched stems up to about 2 m long with whorls of two to seven leaves spaced along each stem. Each leaf is 1 to 4·5 cm long and is forked one to four times. The leaf segments bear two rows of small, spine-tipped teeth.

This species produces separate male and female flowers with individual male and female flowers being produced in the axils of different leaf whorls. The flowers are inconspicuous and are up to about 2 mm long. Male flowers each consist of a cluster of stamens surrounded by greenish membranous appendages. Female flowers each consist of a single ovary with a slender style surrounded by greenish membranous appendages. The fruits are about 5 mm long, are black when ripe and have three long, soft spines.



Ceratophyllum demersum. a—lower portion of stem; b—upper portion of stem; c—leaf; d—male inflorescence.

by T. D. Stanley, Botany Branch



Najas tenuifolia.
a—basal portion of stems with creeping rhizome;
b—upper portion of stem;
c—leaf sheath;
d—portion of leaf showing teeth.

Although this species produces no roots, individual plants may sometimes become anchored to the mud by their leaves. In areas with cold winters, the plants produce thickened shoot tips which sink to the bottom to overwinter. These commence growth the following season.

GEOGRAPHICAL DISTRIBUTION AND HABITAT: Hornwort is found in fresh, still or very slow-flowing water in dams, lagoons, rivers and creeks. The depth of water may be up to about 4·5 m. The plants float submerged in the water at depths up to about 2 m. Rapid growth occurs in spring and summer as the water temperature rises. In areas of the State with mild winters, the plants persist all year round, although growth may cease during the coldest parts of the year. In parts of southern Queensland with cold winters, the plants may disintegrate as the water temperature falls.

In Queensland, it is found in areas east of the Great Dividing Range. It is also known from the Arnhem Land region of the Northern Territory, New South Wales, Victoria, south-eastern South Australia and near Perth in Western Australia. Hornwort also occurs in Europe, Asia, Africa, North America, New Guinea and New Zealand.

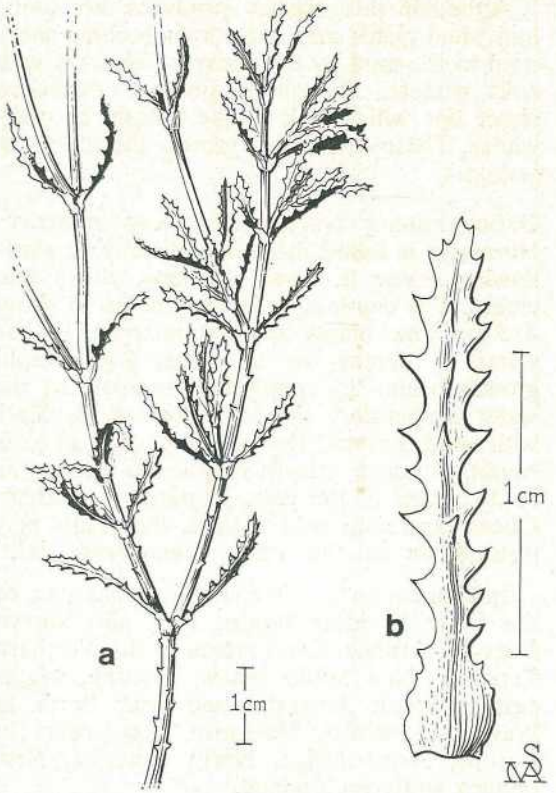
IMPORTANCE: Dense growths of hornworts, especially in association with other species, can be a nuisance in dams. It can block pump inlets and interfere with sailing boats and power craft.

Water nymph

Najas tenuifolia Najadaceae

This is a common submerged aquatic with long, narrow, dark-green or brownish leaves.

DESCRIPTION: The basal stems creep along the substrate, rooting at the nodes. Many ascending, much branched stems up to 1 m long are produced from the basal stems. The leaves are opposite on the stem and lack a stalk. They are mostly 2 to 4 cm long, very narrow and are very finely toothed along the margin. Each leaf is expanded at the base into a leaf sheath 0·5 to 5 mm long which clasps the stem.



Najas marina. a—portion of plant; b—leaf.

The species produces separate male and female flowers on the one plant, with one to three flowers in each leaf axil. Male flowers each have a solitary anther 1 to 3 mm long, enveloped in tight, clasping tissue. Female flowers each consist of a single ovary with two stigmas and without any enveloping tissue. The fruits are ellipsoid and are about 3 to 4 mm long.

The species is usually stated to be annual. However, the author has had plants survive in a glasshouse for 2 years.

GEOGRAPHICAL DISTRIBUTION AND HABITAT: *Najas tenuifolia* is found in fresh, occasionally brackish, still or slow-moving water of dams, rivers and streams, in depths up to about 1·5 m.

In Queensland, it is known from eastern parts of the State, as far north as about Cairns and as far west as Richmond and Jericho. It is also known from northern parts of Western Australia and the Northern Territory, from New South Wales and northern parts of Victoria. The species has also been recorded from Malaysia and New Caledonia.

IMPORTANCE: If present with other aquatic species it can contribute to the blocking of pump inlets and interfere with boating.

Prickly water nymph

Najas marina Najadaceae

Prickly water nymph is rare in Queensland but is easily recognized by its spiny leaves and stems.

DESCRIPTION: This species has slender, much branched, brittle stems up to about 1·5 m long. They are often armed with spine-tipped teeth. The leaves are green or brownish, coarse, opposite or almost opposite and have spine-tipped teeth on each margin and usually also along the midrib on the underside of the leaf. Each leaf may be up to 4·5 cm long and up to 3 mm broad and is expanded at the base into a sheath which clasps the stem.

Male and female flowers are produced in the leaf axils on different plants. The male flowers each consist of a solitary anther enclosed in tight clasping tissue while the female flowers consist of an ovary with 2 to 4 stigmas.

GEOGRAPHICAL DISTRIBUTION AND HABITAT: Prickly water nymph is found in fresh or slightly saline water of dams, lakes and streams.

In Queensland, it has been recorded from the Flinders River in North Queensland and from the south-eastern corner of the State in a lagoon between Currumbin and Burleigh. This latter area has now been developed for housing. It is also known in Western Australia from about Dampier to the south-western corner, from north-eastern New South Wales and has been recorded from the Finke River in the Northern Territory. Prickly water nymph has also been recorded from Europe, Asia, Africa and North and Central America.

IMPORTANCE: In Queensland, the species is of no economic importance. In New South Wales it reportedly forms large masses which can interfere with boating.

Cook . . . a prime hard wheat variety for Australia

by J. R. Syme, D. P. Law and R. G. Rees, Queensland Wheat Research Institute

District Adviser Mr Nev. Douglas (left) and Senior Plant Breeder Dr Jim Syme inspecting a crop of Cook.

THE wheat variety, Cook, released in 1977 from the Queensland Wheat Research Institute has rapidly found favour with both growers and millers. This variety has a unique combination of high yield and disease resistance with outstanding prime hard quality.

Following the release of the successful mid-season wheat, Oxley, the Queensland Wheat Research Institute in April 1977 named a second variety Cook after the famous explorer of the eastern Australian coast.

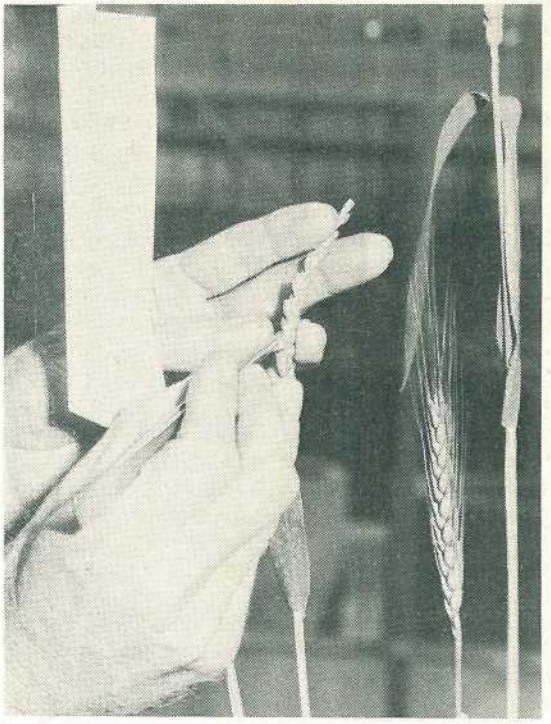
The variety was bred from two parents well known to Australian wheat farmers, Condor and Timgalen (the crosses, made in 1970 and 1971, were Timgalen/Condor sib/Condor). Condor is now the leading variety in southern and central New South Wales, with high grain yield derived from the Mexican semi-dwarf introduction WW15, but lacking adequate rust resistance for northern areas. Timgalen has been a major variety in Queensland and northern N.S.W. possessing both rust resistance and excellent grain quality. In Cook, the best features for both parents were combined and, in some quality aspects, even exceeded.

Agronomic characters

Cook is a true spring wheat with no vernalization or cold requirement as in Oxley, hence it is adapted to main season planting in all wheat areas of Queensland. It is, however, about 1 week later in flowering than Gatcher and is the slowest of the quick maturing varieties now grown.

The early leaves of Cook are unusually narrow, giving it a weak appearance in the vegetative phase, and it is later than other varieties in jointing. It tillers vigorously and produces fine straw of medium semi-dwarf height which is a little susceptible to lodging. The heads are relatively small, fully awned, white chaffed and free threshing.

Table 1 summarizes 4 years of yield testing in D.P.I. trials throughout the Queensland wheat areas. It can be seen that Cook and Kite were the two highest yielding varieties in all years with the exception of 1977, a very dry season in which Gatcher was advantaged by its very early maturity. Kite is another semi-dwarf variety, released by the N.S.W. Department of Agriculture, but lacking prime hard quality.



Preparing an ear of Cook wheat for cross pollination. The anthers are removed and a bag excludes unwanted pollen.

Disease resistance

In Cook, the genes for resistance to stem rust from Timgalen, *Sr6 and* $SrTt_1$ have been added to *Sr5, Sr8* and another gene in Condor, thus giving protection against all current field strains of rust. Although fully effective at the present time, it must be anticipated that in the future a new strain of stem rust will develop with virulence on Cook and also on several other current varieties with similar resistance. Breeders are therefore working to incorporate additional genes for resistance by further crossing.

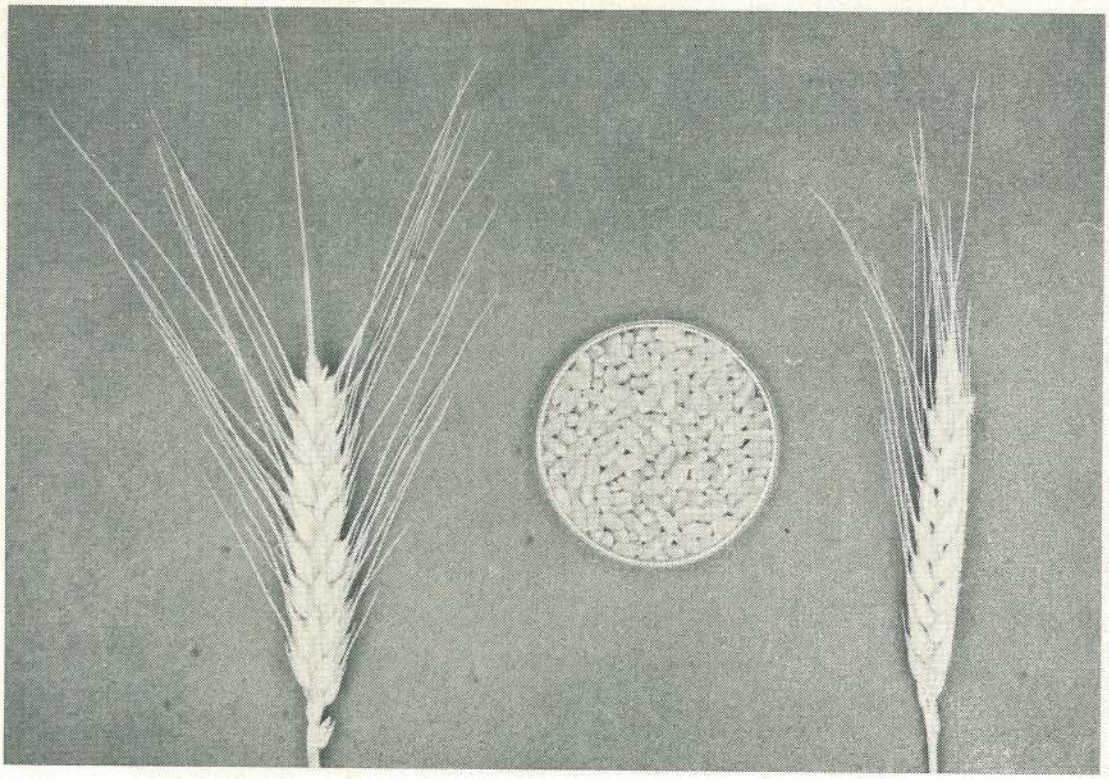
Cook is moderately susceptible to leaf rust, but does not have the high susceptibility of Condor. Of the other diseases, Cook is known to be resistant to flag smut and has also shown a good level of resistance to crown rot.

Grain quality

The grain of Cook is hard, translucent amber with an attractive smooth seed coat and some resistance to pre-harvest weathering. The main quality characters are summarized in table 2 in comparison with other varieties, as assessed from D.P.I. trials.

The outstanding features of Cook are its test weight, milling quality and dough strength. Its test weight was superior to that of all other varieties. The combination of high flour yield with low flour colour suggests that it has better milling quality than all other Australian varieties. Dough strength exceeded that of any other variety and was combined with high extensibility and adequate water absorption. Protein content was lower than Timgalen but higher than Gatcher, and baking score was higher than Timgalen per unit of protein.

This photograph shows the shorter straw of Cook (Cook on left, Spica on right).



The ears and grain of Cook.

Harvesting Cook.

Conclusion

For the first time, a quick maturing variety is now available which has the high yield potential of the new semi-dwarf wheats combined with resistance to stem rust and prime hard quality. The rapid acceptance of Cook by the wheat industry has endorsed the confidence expressed in it on the basis of trial results, and it is expected to make a major contribution to the industry in the years ahead.

TABLE 1

GRAIN YIELD IN QUEENSLAND WHEAT VARIETY TRIALS

Variety	Mean Yield as Percentage of Timgalen			
	1975	1976	1977	1978
Cook	108	119	109	132
Songlen	99	110	98	..
Gatcher	106	103	113	104
Kite	108	117	111	129
Timgalen	100	100	100	100
Number of trials	20	16	16	20

TABLE 2

GRAIN QUALITY IN QUEENSLAND WHEAT VARIETY TRIALS
(mean of 4 years testing 1975–1978)

Variety	Test Weight kg/hl	Protein %	Flour Yield %	Water Absorption %	Extensograph Resistance (E.U.)	Baking Score
Cook	81·3	12·6	75·6	62·4	425	34·5
Gatcher	78·6	12·4	74·3	64·5	349	32·0
Kite	79·5	12·7	72·2	64·5	352	33·8
Timgalen	78·2	13·7	73·5	64·0	349	34·8

Grain sorghum planting guide Central and North Queensland 1979-80 season

THE grain sorghum hybrids recommended for planting in Central and North Queensland are listed in this guide. They have not been listed in order of preference.

The hybrids recommended have been well tested and are proven performers. The hybrids listed as 'for trial' should be planted in smaller areas on a trial basis if they are unknown to the grower. Other relevant hybrids are listed in the guide to grain sorghum characteristics.

In order to reduce risk, it is always advisable to plant more than one hybrid. This also allows the grower to assess a wider range of material under his own conditions.

Plant populations for rain-grown crops should range from 50 000 to 100 000 plants per hectare. The planting rate will vary according to available soil moisture, time of planting and soil type; the rate should increase with the likelihood of better soil moisture conditions. Your Agricultural Extension Officer will provide further information.

Grain sorghum seed sold by major seed companies is of high quality and is required to have a laboratory germination of 70% or higher. Seed size varies with the hybrid but is generally in the range of 20 000 to 40 000 seeds per kilogram. A number of hybrids now have the seedsize on the label.

APPROXIMATE PLANTING RATE FOR GRAIN PLANT POPULATIONS

Plants/ha	Planting rate kg/ha
50 000	2·5–3·0
75 000	3·75–4·0
100 000	5·0–5·5
150 000	7·5–8·0

Hybrid characteristics

- The important characteristics of a wide range of hybrids are given in table II. The hybrids included are those which are commercially significant or showing good potential in Central Queensland.
- Faster maturing varieties have a role very early and very late in the season.
- Open-headed varieties are desirable in areas where sorghum head caterpillars are expected.
- Leaf diseases can be severe in wet seasons.

Compiled by J. H. Cutler, Agriculture Branch

- Resistance to lodging is a valued characteristic particularly in more marginal situations.
- The yield index is only a guide to relative yield.

This guide has been compiled from information collected in D.P.I. trials in Central Queensland. It is basic information only, consult your Shire Agricultural Extension Officer for more details.

TABLE I

VARIETAL GUIDE 1979–80

Region/Shires	Planting Time	Recommended Hybrids
Far North/North Queensland		
All Shires Proserpine and North ..	Dec.–Mar.	RAIN-GROWN E57; Goldfinger *For trial:* Tropic, SM10, SM8, Sundowner, Solo
	Mar.–Aug.	IRRIGATED E57; F64a *For trial:* SM8, Tropic, Sundowner, Solo, SM10
Capricornia		
Livingstone, Fitzroy, Calliope, Nebo, Broadsound Shires	mid Dec.–mid Feb.	RAIN-GROWN Leader, E57, F64a, Dorado, Y101 *For trial:* SM10, SM8, Solo, Sundowner
Banana, Duaringa, Emerald, Peak Downs, Belyando, Bauhinia Shires	mid Dec.–mid Feb.	RAIN-GROWN E57, F64a, Leader, Dorado, Y101 *For trial:* Sundowner, Solo, SM8
All Shires	mid Dec.–late Jan.	IRRIGATED E57, F64a *For trial:* Leader, Sundowner, SM10, Solo, Y101, Big Red, Dorado

TABLE II

GUIDE TO GRAIN SORGHUM CHARACTERISTICS* CENTRAL QUEENSLAND 1979

Compiled by J. W. Foreman, R. L. Brengman and J. H. Cutler

Seed Company	Hybrid	Time of flowering	Height	Head	Grain colour	Reaction to			Standability or resistance to lodging	Mean yield as % of Texas 610 SR up to and including 1978–79 trials	
						S.C.M. virus	Rust (*Puccinia purpurea*)	Leaf blight (*Drechslera turcica*)		Central Queensland	
										Yield %	No. of Trials
Asgrow	Dorado ..	MS	MT	Open ..	Bronze	M	S	R	***	109	20
DeKalb	C43 ..	MS	M	Open ..	Bronze	M	S	S	**	113	5
	E57 ..	MS	M	Open ..	Bronze	M	S	S	****	112	29
	F64A ..	S	T	Open ..	Bronze	M	R	R	****	105	24
Northrup King ..	NK150 ..	MQ	M	Open ..	Bronze	M	S	HR	*	96	4
	NK250 ..	MQ	M	Semi-open	Bronze	M	NA	NA	**	NA	1
	NK280 ..	M	M	Semi-open	Light red	M	NA	NA	NA	NA	..
Pacific Seeds	Nugget ..	Q	S	Open ..	Red	M	HR	S	***	94	8
	Goldfinger	MQ	M	Semi-open	Bronze	M	S	R	**	105	18
	Goldrush	MQ	M	Semi-open	Red	M	HR	S	***	96	22
	Sovereign	M	M	Semi-open	Red	M	NA	S	***	NA	1
	Tropic ..	S	T	Open ..	Bronze	Red leaf	S	S	**	109	4
	Sundowner	MS	MS	Open ..	Bronze	R	NA	NA	***	125	3
	Golden .. Acres Y101	MS	MS	Open ..	Bronze	M	S	R	***	105	13

TABLE II—continued

Seed Company	Hybrid	Time of flowering	Height	Head	Grain colour	Reaction to			Standability or resistance to lodging	Mean yield as % of Texas 610 SR up to and including 1978–79 trials	
						S.C.M. virus	Rust (*Puccinia purpurea*)	Leaf blight (*Drechslera turcica*)		Central Queensland	
										Yield %	No. of Trials
Pioneer	Gem ..	MQ	M	Semi-compact	Light red	M	HS	S	***	104	5
	Pride ..	M	MS	Semi-compact	Bronze	M	S	S	****	101	14
	Leader ..	MS	MS	Open ..	Bronze	M	R	S	***	109	14
	Big Red ..	S	M	Semi-compact	Bronze	M	S	S	**	108	12
	Solo ..	S	M	Open ..	Bronze	R	R	R	****	122	4
Yates	Yates 233	MQ	M	Semi-compact	Bronze	M	S	R	**	97	12
	SM 8 ..	M	M	Semi-open	Bronze	M	S	R	****	104	11
	SM 9 ..	M	M	Open ..	Bronze	Red leaf	S	R	**	NA	2
	SM 10 ..	S	M	Semi-open	Bronze	M	R	S	***	111	9
Hylan, Panorama ..	Texas 610 SR	M	M	Compact	Red	M	S	S	**	100	29
	Q 5161	MS	M	Compact	Bronze	Red leaf	R	HR	****	96	18
	Trojan 1	MS	M	Semi-open	Bronze	R	NA	NA	NA	NA	..
Open Pollinated variety	Alpha ..	S	MS	Semi-compact	Red	M	HS	R	****	81	21

KEY: Time to flowering: Q—Quick; MQ—Medium quick; M—Medium; MS—Medium slow; S—Slow.
Lodging behaviour rating: *—Below average; **—Average; ***—Above average; ****—Very good standability.
Height: VT—Very tall; T—Tall; MT—Medium tall; M—Medium; MS—Medium short; S—Short.
Head: Open; Semi-open; Semi-compact; Compact.
Leaf rust: HS—Highly susceptible; S—Susceptible; R—Resistant; HR—Highly resistant.
Sugarcane mosaic virus reaction: R—Resistant; M—Mosaic; Red stripe; Red leaf.

NA: Sufficient information is not available. In the yield comparison columns, the "Number of Trials" shows the number of trials in which both Texas 610 SR and the particular hybrid both appeared. The greater the number of trials used to calculate the average, the greater the reliability of results.
All trials were planted in late December, January or February.

* The hybrids listed in this table are those marketed by seed companies in Central Queensland. It is not an exhaustive list of all grain sorghum hybrids.

Minor insect pests of macadamia—part 2

Predominantly foliage pests

Orange fruitborer

The orange fruitborer (*Isotenes miserana* (Walker); Family Tortricidae), the larva of a light grey moth, feeds on young shoots, flowers and fruit of macadamia. It lives within the protection of silken shelters which incorporate the part of the plant being eaten. Young leaves are rolled and webbed together, terminal shoots may be killed and plants become bunched due to the development of side shoots. This damage is important on nursery trees where it is desirable to produce trees with single leaders. Numbers of the insect on flowers are usually too low to be of importance but tunnelling in young fruit may reduce the crop.

Fully grown larvae may be up to 24 mm long and the general body colour is brown to greenish-brown with two longitudinal brown stripes. Pupation occurs within the webbed shelters at the feeding sites.

Macadamia cup moth

During summer and autumn, young trees may be completely defoliated by heavy infestations of the macadamia cup moth (*Comana fasciata* (Walker); Family Limacodidae). The larva is oval, flat and slug-like, green in colour with a mid dorsal yellow stripe which resembles the mid vein of a leaf. When fully grown, it is up to 35 mm long and 20 mm wide. Pupation occurs in the cup-like cocoon usually in debris at the base of the tree.

Large bagworm

Larvae of the large bagworm (*Oiketicus elongatus* Saunders; Family Psychidae) when numerous may severely defoliate young trees. Bagworm larvae live in tough, portable cases made of silk with sticks or leaves woven into their structure. The male adult, a dark slender-winged moth, is a rapid flier but the female adult is a wingless, stout, grub-like creature which never leaves its case. It deposits its eggs within the case and the young larvae emerge from the case and spread to surrounding foliage. Natural enemies usually keep insect numbers low.

Latania scale

Latania scale (*Hemiberlesia lataniae* (Signoret); Family Diaspididae) occurs commonly on branches and nuts of macadamia but has little harmful effect. Heavy infestations sometimes form dense encrustations covering branches and to a lesser degree the nut husks. The body of the insect is yellow but the grey to light brown scale covering, about 2 mm across, is what is seen externally.

Macadamia mussel scale

Macadamia mussel scale (*Lepidosaphes macadamiae* Williams; Family Diaspididae) occurs mainly on foliage. Infested leaves turn yellow about the feeding points and heavy infestations result in leaf fall and reduced tree vigour. Adult scales are elongate, light brown or pale yellowish-brown, the females about 3·5 mm long and the males about 1·5 mm long.

Macadamia white scale

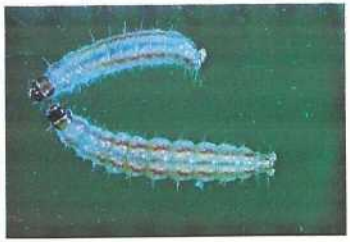
Macadamia white scale (*Pseudaulacaspis brimblecombei* Williams; Family Diaspididae) occurs on the undersurface of leaves and on the green nut husks. Heavy infestations occur occasionally resulting in loss of foliage. The adult female is silvery-white, up to 4 mm long and 2 mm wide and a pale yellow tip. The male scale is about 1·25 mm long, white with dark longitudinal lines. The insects group together forming white patches.

Bizarre looper

The bizarre looper (*Eucyclodes pieroides* (Walker); Family Geometridae) is an unusual-looking brown looper larva with flat lateral expansions like the fronds of a fern. It feeds mainly on new growth such as young foliage, flowers or the outer layer of immature nuts. When fully grown, the caterpillar is 25 to 30 mm long.

by D. A. Ironside, Entomology Branch.

Minor insect pests of macadamia part 2

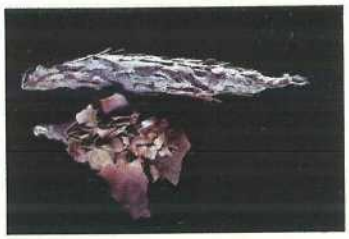


Orange fruitborer larva.

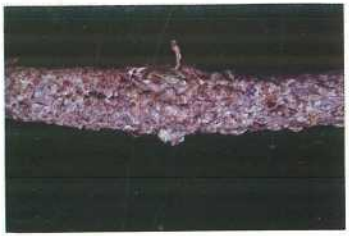
Orange fruitborer damage to macadamia foliage.

Photographs by D. A. Ironside, Entomology Branch.

A mature larva of the macadamia cup moth.

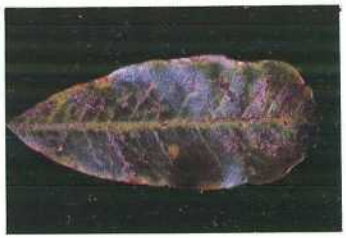


Large bagworm showing the female case (about 100 mm long) and the male case (about 50 mm long).



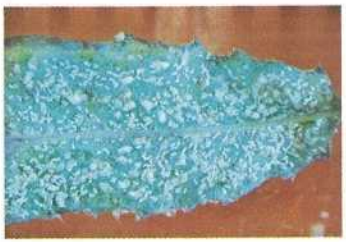
Heavy infestation of latania scale on a macadamia twig.

Latania scale on a macadamia nut.



A macadamia leaf heavily infested with macadamia mussel scale.

Macadamia mussel scale on a macadamia leaf.



A macadamia leaf heavily infested with macadamia white scale.

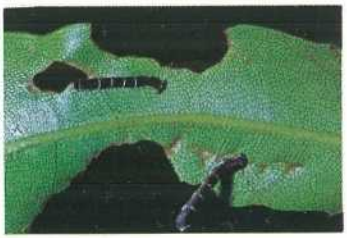
Macadamia white scale on a nut.

Bizarre looper on a macadamia leaf.

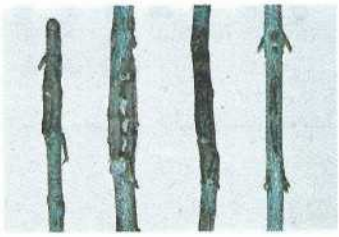
Doubleheaded hawk moth larva feeding on macadamia foliage.

Brown tufted caterpillar (45 mm long with bristles) on a macadamia leaf.

Variegated hairy caterpillar on a macadamia leaf.



Brown loopers (young larvae) damaging a macadamia leaf.



Macadamia twigs showing damage caused by cicada egg laying.

Doubleheaded hawk moth

One of the largest insects attacking macadamia is the larva of the doubleheaded hawk moth (*Coequosa triangularis* (Donovan); Family Sphingidae), which feeds mainly on mature foliage and when fully grown is up to 120 mm long. The insect derives its common name from the pair of black spots resembling eyes at the anal end.

Brown tufted caterpillar

The brown tufted caterpillar (*Olene mendosa* Hübner; Family Lymantriidae) is one of several tufted caterpillars known to feed on macadamias. The larvae of this insect feed at first on young foliage or flowers and then as they mature on older foliage. Fully grown larvae are up to 40 mm long and ornamented with tufts of long hairs over the body.

Variegated hairy caterpillar

The variegated hairy caterpillar (*Anthela varia* (Walker); Family Anthelidae) is commonly found on macadamias but not often in large numbers. It feeds on foliage and to a lesser degree on flowers and is sometimes damaging on young trees. The fully grown larva is about 60 mm long.

Brown looper

The larva of the brown looper (*Lophodes sinistraria* Guenée; Family Geometridae) is at first a delicate satiny-black looper with narrow silvery-white transverse bands, however, when fully grown it is brown in colour and about 50 mm long. The larva at first feeds on lush growth and the surface of nut husks but as it matures it consumes hardened foliage. Heavy infestations sometimes defoliate young trees.

Cicada

In some seasons, adults of the cicada (*Psaltoda* sp.; Family Cicadidae) emerge in large numbers in macadamia orchards during summer. The adults mate and the female deposits its eggs in slits cut in the branches by its spear-like ovipositor. Such branches become splintered and bristling with torn fibres and may be prone to wind damage. On hatching, the nymphs immediately drop to the ground, enter the soil and start feeding on the roots. They may remain there for some years before emerging to recommence the life cycle.

Wattles of South-eastern Queensland with flowers in globular heads

Acacia baueri

This wattle was named in honour of Ferdinand Bauer, the Austrian botanical artist who accompanied Robert Brown on Matthew Flinder's voyages in 1801 to 1805.

DESCRIPTION: It is a subshrub, less than 0·3 m tall, with erect or ascending stems. The branches arise from a woody rhizome to form a sparse cushion or tussock. They are slender, terete and sparsely hairy, with 5 to 7 phyllodes arranged in regular whorls at intervals of about 1 cm. The phyllodes are linear-subulate to terete, blue-green in colour, up to 2 cm long, and end in a pointed tip which is recurved. On erect stems, the phyllodes spread slightly from the stems but on the upper portion they lie close to the stems and point towards the ends. On ascending stems, the phyllodes tend to twist so that most of them point upwards from the upper side of the stems.

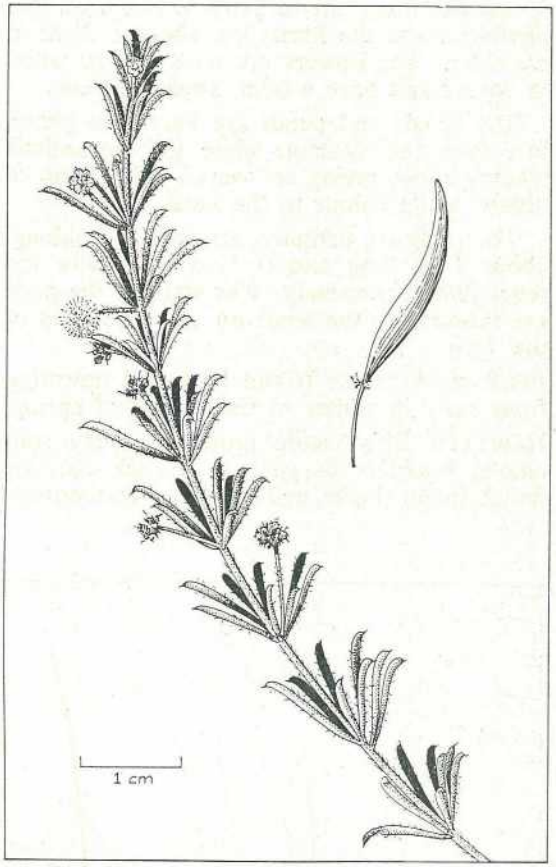
The axillary peduncles are as long as the phyllodes and bear heads with 10 to 20 bright, golden flowers. The heads are less than 0·5 cm in diameter. The pod is falcate, narrowed at each end, about 2 cm long and 0·3 cm broad.

FLOWERING TIME: It flowers spasmodically throughout the year.

HABITAT: This wattle is always found in poor sandy soil, usually on damp wallum heaths, but it also grows in scrub woodland.

DISTRIBUTION: It grows only on the coastal lowlands of New South Wales and Queensland from as far south as Port Jackson to as far north as Noosa on the mainland and Fraser Island offshore. It is not a common wattle and is in danger of extinction in south-eastern Queensland.

by Beryl A. Lebler, Botany Branch



Acacia baueri

Acacia brunioides

Brunia is the botanical name for a genus of South African heath-like shrubs with small, closely overlapping leaves and flowers in globular heads. They were commonly grown in European gardens. In 1828, when Allan Cunningham first found this plant on the rocky hills south of Moreton Bay it evidently reminded him of these plants.

DESCRIPTION: This is an intricately-branched, spreading shrub which can grow to 2 m high but is usually smaller. It has terete stems and twigs which are minutely pubescent. The bright green phyllodes are crowded and either scattered or in irregular whorls. They are terete, 0·4 to 0·8 cm long and end in a short, pointed tip which is slightly curved.

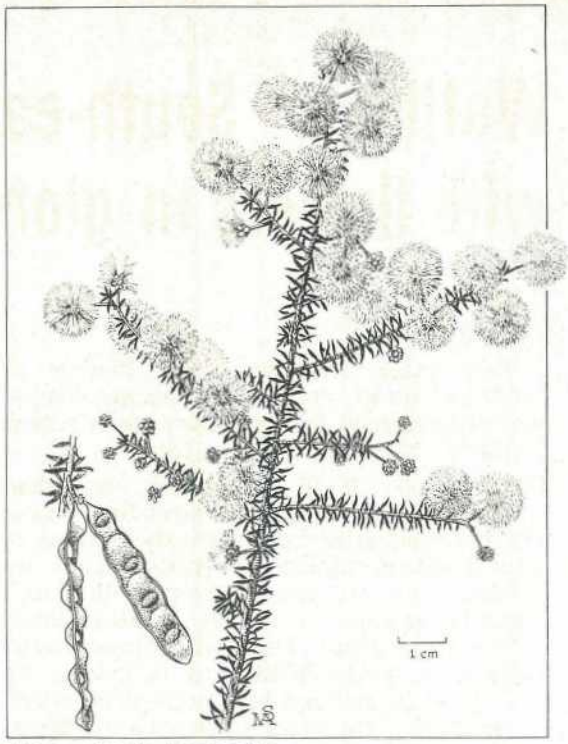
The peduncles are axillary and are scattered in short, lateral twigs at the ends of the branches. They are usually longer than the phyllodes and the heads are about 1·2 cm in diameter. The flowers are pale creamy white in colour and have a faint, sweet perfume.

The sepals and petals are very pale lemon in colour, the filaments white and the anthers lemon-yellow, giving an overall pale cream to almost white colour to the head.

The pods are flattened, straight and oblong, about 4 cm long and 0·7 cm wide with the seeds placed traversely. The walls of the pods are raised over the seeds on alternate sides of the fruit.

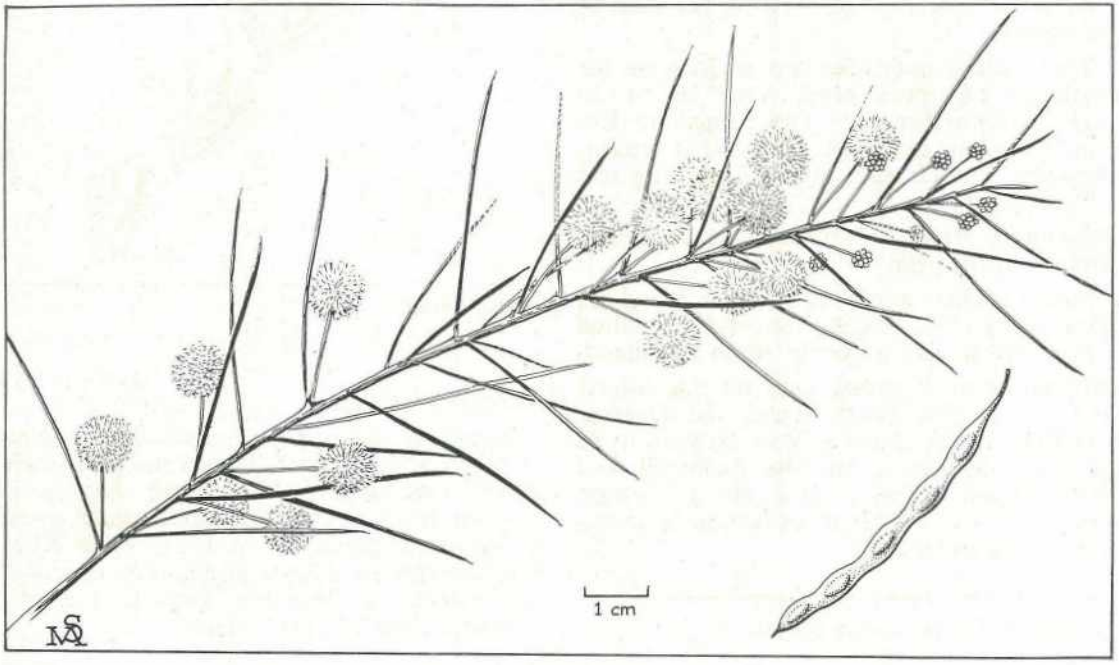
FLOWERING TIME: It can be found flowering from early in winter to the middle of spring.

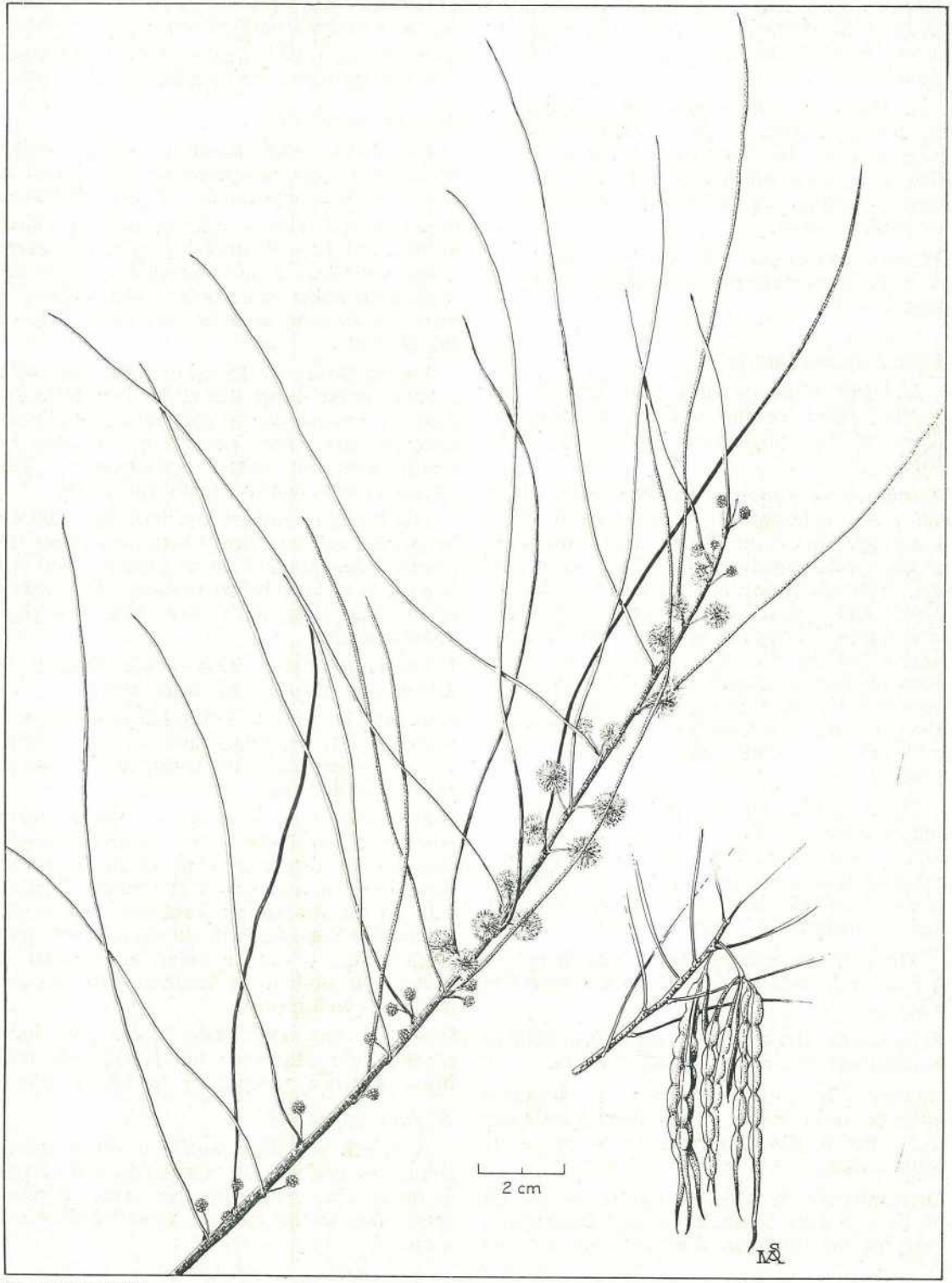
HABITAT: This wattle grows in rocky soil, among boulders in gorges, in rock crevices on mountain slopes, and in rocky watercourses.



Above. Acacia brunioides

Below. Acacia quadrilateralis





Acacia juncifolia

DISTRIBUTION: It is common on the mountain peaks of the McPherson Range and also grows in New South Wales to as far south as the Blue Mountains.

A. brunioides subsp. *granitica* is found on the Darling Downs in the Wybera-Stanthorpe area, and in the Girraween National Park. This is a shrub which forms thickets. It has longer phyllodes (up to 11 cm) and its flowers are golden yellow.

GENERAL REMARKS: Plants are sometimes available from nurseries specialising in native plants.

Acacia quadrilateralis

A Latin word meaning four-sided is the specific epithet for this wattle. It describes the shape of the phyllodes, particularly when dried.

DESCRIPTION: This is a glabrous shrub which can reach a height of 2·5 m. Usually there is a single stem with slender lateral branches which spread divaricately and droop at the tips. The phyllodes are straight or slightly curved and spread from the stem at an angle of about 60°. They are actually terete in cross section but the four-sided appearance of the dried phyllode is caused by four nerves which run from the base of the leaf to its tip. The phyllodes are 2 to 8 cm long and are abruptly narrowed to a short, sharp point. They are bright green.

The peduncles are axillary, about 1 cm long and bear heads 0·8 cm in diameter. These are solitary or in pairs. When two heads are present, each is held out to one side of the phyllode or the other. The heads are pale lemon-yellow and are perfumed.

The pods are flattened, up to 8 cm long and 0·5 cm wide, with the seeds placed longitudinally.

FLOWERING TIMES: Flowering can begin late in autumn and extend to the end of winter.

HABITAT: It is most common on sandstone hillsides or in sandy soil in open eucalyptus forest but it has also been found on sandy wallum flats.

DISTRIBUTION: It is found only in the coastal districts of New South Wales and Queensland from as far south as Port Jackson and the Blue Mountains to as far north as Bundaberg on the mainland, and Fraser Island offshore.

GENERAL REMARKS: This wattle is very attractive and deserves to be brought into cultivation.

Acacia juncifolia

The Latin word meaning with rush-like leaves is the specific epithet for this wattle. It refers to the appearance of the phyllodes.

DESCRIPTION: This is an erect glabrous shrub up to 2 m high with smooth grey-brown terete stems and linear-subulate phyllodes. These are slightly flattened and, with magnification, a vein can be seen as a line on either side of the phyllode.

The phyllodes are 15 cm or more long, with a gland on the upper side about 1 cm from the base. Its position can be seen by a slight thickening at that point. The gland itself can be clearly seen only under magnification. The phyllodes are erect to slightly spreading.

The heads of flowers can be either solitary or paired and are deep buttercup-yellow in colour. They are 0·8 cm in diameter and the flowers have little or no perfume. The pod is up to 10 cm long, and 0·4 cm wide with longitudinal seeds.

FLOWERING TIME: This wattle flowers in winter and through to early spring.

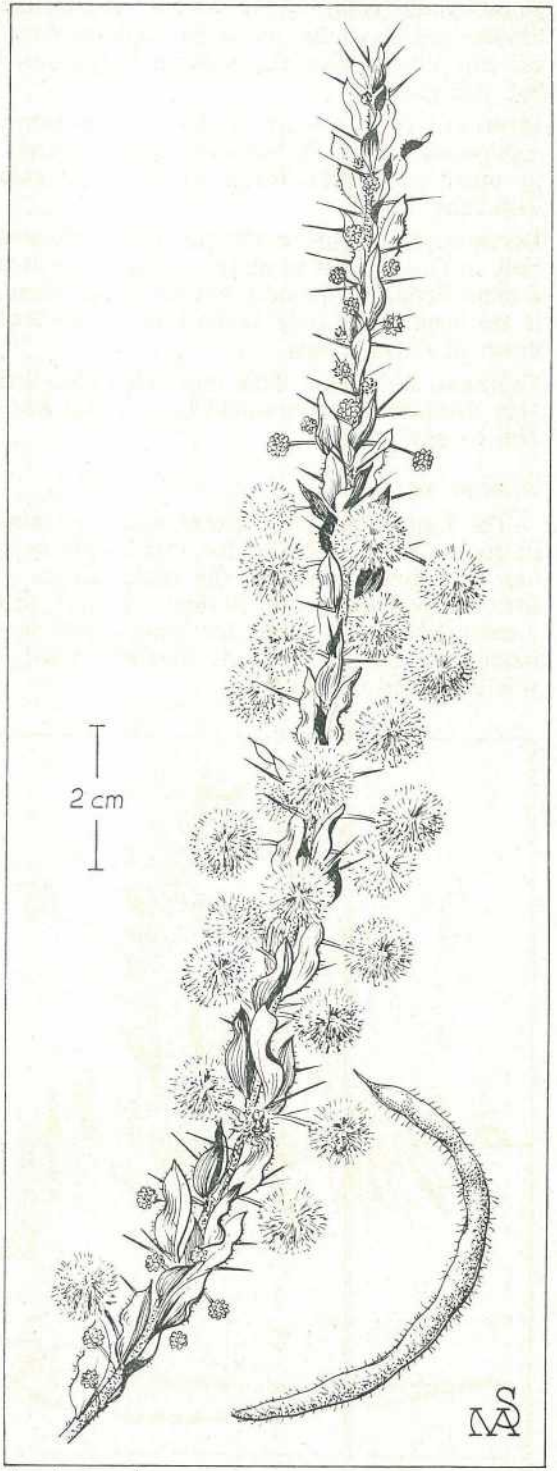
HABITAT: It grows in sandy soil in open eucalyptus forest, on ridges and sandstone hills, and in crevices on rocky ledges at the base of cliffs on mountains.

DISTRIBUTION: It is found on the northern interior of New South Wales and on the coastal lowlands of Queensland to as far north as Bundaberg. It also grows in Central Queensland on the Blackdown Tableland and in the Carnarvon National Park. In the southern part of the State, it can be found as far west as Roma and Bollon. In South-eastern Queensland, it is widespread.

GENERAL REMARKS: This wattle has been brought into cultivation but is available only from nurseries specialising in native plants.

Acacia paradoxa

A Greek adjective *paradoxa* which means strange or contrary to expectation was chosen as the specific epithet for this wattle. It probably refers to the unusual appearance of this wattle.



Acacia paradoxa

DESCRIPTION: This plant is a very spiny, open branching shrub which can grow to 2·5 m in height, and often has long, flexuose branches. The most striking feature is the presence of sharp stipular spines. These spread at an angle on either side of the bases of the phyllodes, and can be up to 1 cm long. The phyllodes are light green and oblong, up to 2·5 cm long and 0·5 cm wide. They taper towards the apex and the lower margins are undulate. The midrib is closest to the upper margin, which is straight and lies close to the stem.

The heads are 1 cm in diameter and are on slender peduncles up to 1 cm long. All parts of the flowers are bright golden-yellow. The flowers are strongly perfumed but the scent differs slightly from the normal wattle perfume.

The pod is linear, up to 10 cm long and can be straight or curved, with longitudinal seeds. Both green and mature pods are very sticky. They can be almost glabrous or have a dense covering of soft hairs.

FLOWERING TIME: Flowers are found from late in winter to midspring.

HABITAT: This wattle is found in open mixed eucalyptus forest growing on soil derived from sandstone.

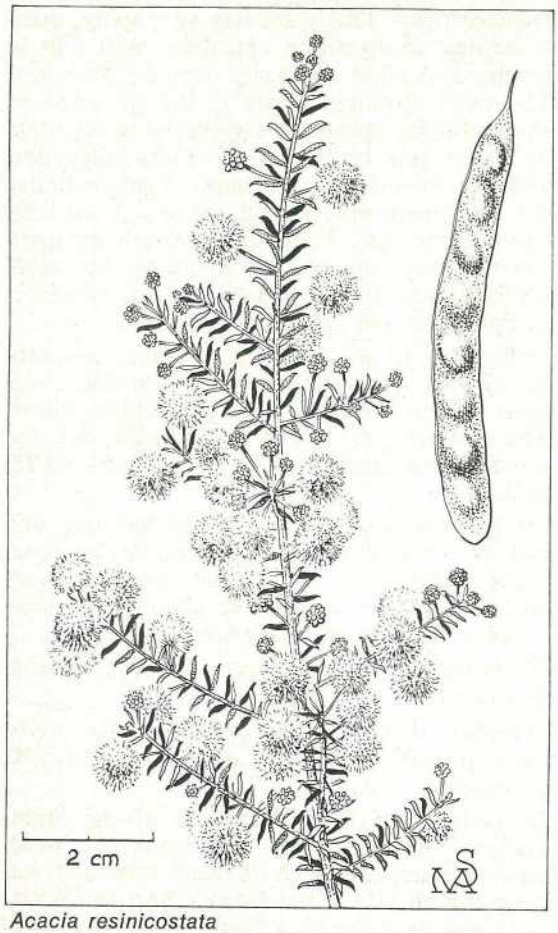
DISTRIBUTION: It is found in all the States except the Northern Territory. In south-eastern Queensland, it is very rare and has been found only in the Crow's Nest to Cooyar area and near the New South Wales border at Fort Buchanan in the Christmas Creek area. It also grows at Stanthorpe.

GENERAL REMARKS: This wattle used to be known as *A. armata.* Recent investigation showed it had been described under the earlier name of *A. paradoxa.*

Acacia resinicostata

In 1938, this wattle was first found on the Carnarvon Range. Later, it was collected west of Warwick and also on the Blackdown Tableland in Central Queensland. It was first described and named in 1974. The specific epithet was chosen to describe the distinctive, yellowish, resinous ribs on the stems.

DESCRIPTION: This is a rounded shrub, which branches close to the ground and grows to a height of 3 m, with a spread of 3 m. The twigs have a grey appearance and the light green phyllodes look slightly varnished.



Acacia resinicostata

Magnification is necessary to see the tuberculate yellowish ribs on the twigs and the white scurf between the ribs. A few specks of scurf can also be seen on the phyllodes.

These are linear and sessile, less than 0·5 cm long and 0·1 cm wide. They have one main vein but this is difficult to see until the leaves are dried. The phyllodes are crowded and spread widely from the stems. The upper margin curves down abruptly at the tip and the phyllodes end in minute, hooked points.

The peduncles are 1 cm long and are scurfy like the stems. The dense heads are 0·8 cm in diameter, deep lemon-yellow and are perfumed. The styles are longer than the stamens and the linear pods are very sticky, up to 8 cm long and have the seeds arranged longitudinally.

FLOWERING TIME: This wattle comes into bloom late in winter but a few inflorescences are still present when the pods are fully formed but still green.

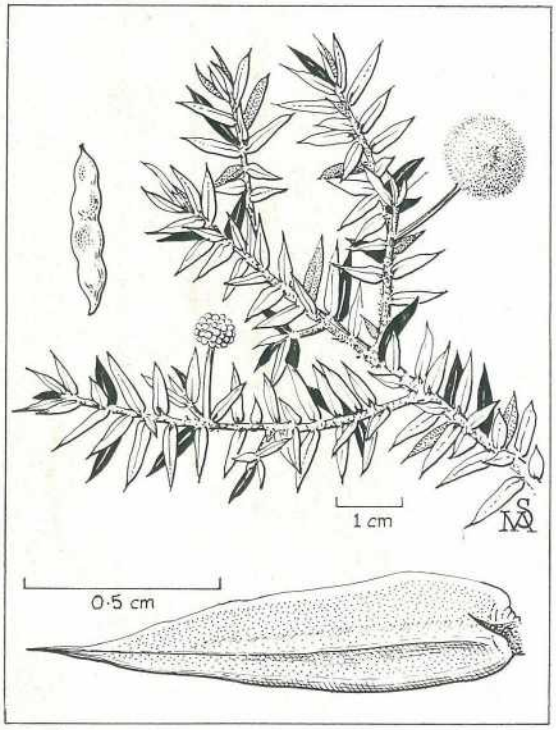
HABITAT: It is always found on sandstone, and grows on ridges, between rocky outcrops, in open eucalyptus forest or in rusty gum woodland.

DISTRIBUTION: This wattle has been collected only in Queensland to as far north as the area around Jericho. In South-eastern Queensland, it has been found only in the Emu Creek area north of Crow's Nest.

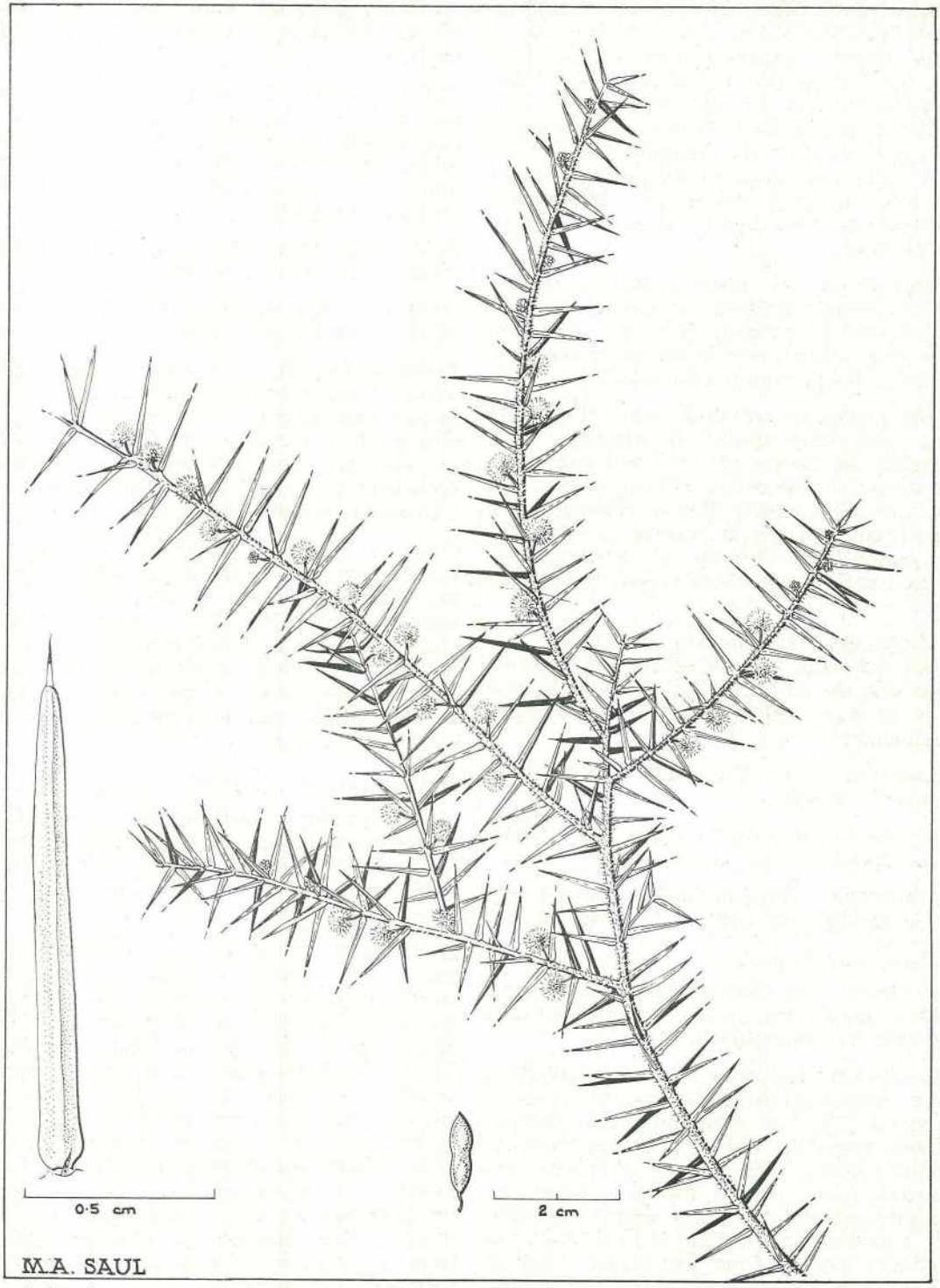
GENERAL REMARKS: This most attractive and very floriferous shrub would be a useful addition to any garden.

Acacia saxicola

The Latin adjective *saxicola* means growing in rocks. It was chosen for this wattle as it has been found only on the rocky slopes of Mt. Maroon south of Boonah. It was first discovered in 1962, but for many years was incorrectly identified as *A. ulicifolia* until it was described in 1969.



Acacia saxicola



Acacia brachycarpa

DESCRIPTION: This is an intricately branched shrub from 1 to 1·5 m high, with firm, woody twigs. Minute, spreading hairs are scattered over the new growth. The phyllodes are dark, glossy green and are rigid, with the midrib produced into a dark brown pungent point 0·1 cm long. They are vertically flattened, up to 1·4 cm long and 0·3 cm wide and more or less narrowly triangular. Microscopic examination shows slightly yellowish dotting in the phyllode.

Because of the close proximity of the phyllode to one another, the manner in which they spread divaricately from the stem and their long pungent points, this is the prickliest wattle in South-eastern Queensland.

The peduncles are stout, more than 1 cm long, and also spread divaricately. Consequently the flowers are held well away from the stems. The heads are 1·3 cm in diameter, and are pale golden-yellow in colour. In the mature bud stage, it is possible to see (with the naked eye) the tip of brown bracts beneath each flower which project beyond the buds.

Microscopic examination shows that the sepals and petals are pale yellow, the filaments white and the anthers bright yellow. The pod is up to 3 cm long with the seeds arranged longitudinally.

FLOWERING TIME: This wattle blooms from autumn to winter.

HABITAT: It grows on the upper rocky slopes in soil pockets in rock crevices.

DISTRIBUTION: This plant has been found only in Queensland and only on Mt. Maroon.

Acacia brachycarpa

A Greek word meaning with little or short fruits is the specific epithet for this wattle. It describes the oblong fruits.

DESCRIPTION: This plant is an erect, compact, much branched shrub which can reach a height of 2 m but is usually much shorter. Minute, spreading, white hairs cover the wiry, reddish stems. The sessile phyllodes are crowded fairly closely together. They are straight and stiff with the midrib produced into a brown pungent point 0·1 cm long. The phyllodes can be from just under 1 cm to 1·5 cm long and are never more than 0·1 cm wide. Magnification shows the midrib as a broad thickening on both sides of the phyllode.

The peduncle is glabrous, tinged with red and about 0·4 cm long and the heads are 0·5 cm in diameter. All parts of the flowers are bright lemon-yellow. The pod is up to 2 cm long and 0·3 cm wide and the seeds are arranged longitudinally.

FLOWERING TIME: Flowering begins in mid-winter and continues to early spring.

HABITAT: This wattle grows on sandstone, often on hill slopes in open eucalyptus forest.

DISTRIBUTION: It is confined to Queensland where it has a patchy distribution. In South-eastern Queensland, it has been found in the hills north of Helidon and at Crow's Nest. It has also been collected from the Blackdown Tableland in Central Queensland, and at the Carnarvon and Isla Gorges.

GENERAL REMARKS: For many years this was confused with *A. ulicifolia,* particularly as the two plants have been found growing in the same locality. When sterile, they are almost identical in appearance. When flowering or in fruit they are readily separated as the colour of the flowers, the size of the heads, the length of the peduncles and the fruits are quite different in each species.

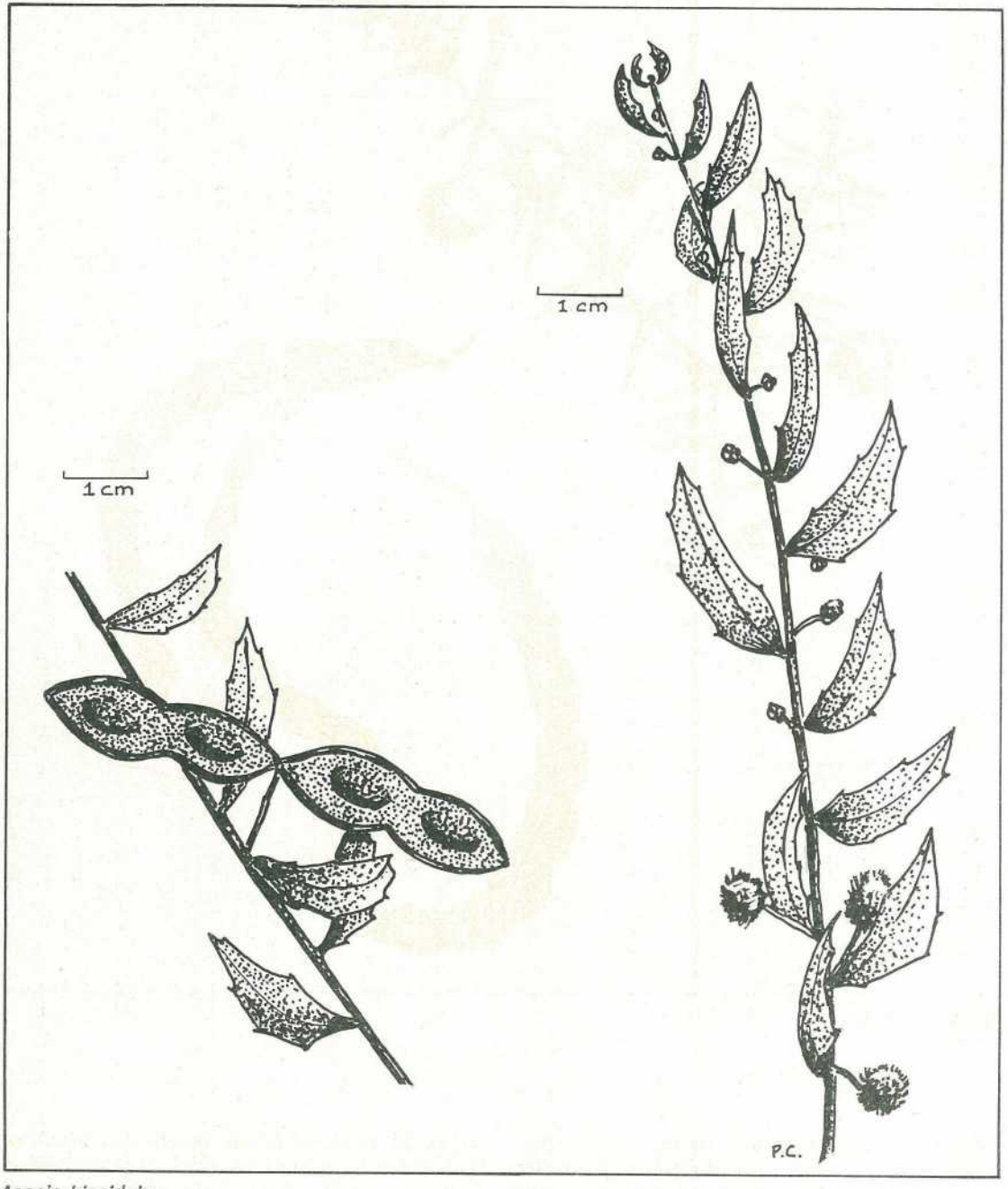
Prickly Moses *(Acacia ulicifolia)*

The specific epithet for this plant means having leaves resembling those of a very spiny evergreen ornamental grown in European gardens called *Ulex.* It has narrow-lanceolate or scale-like leaves.

DESCRIPTION: This is an erect shrub which can grow to a height of 1 to 2 m. It can be erect and intricately but loosely branched but can also be a sprawling plant forming a mat about 1 m in diameter and only 8 cm high. The phyllodes are sessile. They are dark green in colour, very stiff and leathery in texture and end in a rigid dark brown spine. The midrib is the only vein visible and is seen as a line of a different colour down the middle of the phyllode. The lower edge is slightly curved and the phyllodes are less than 1·5 cm long and 0·1 cm wide. Because the phyllodes spread from the stem in all directions, the plant is very prickly to touch.

Acacia ulicifolia

The globular heads are about 1 cm in diameter and are at the ends of slender peduncles which can be as long as the phyllodes or longer. The flowers are pale cream and have no perfume. When green, the fruits are like a string of oval wrinkled beads, bordered on both sides by a smooth, thick thread. Mature fruits are up to 6 cm long and are curved, dark brown to black, and split along both edges releasing six or seven seeds.



Acacia hispidula

FLOWERING TIME: This wattle flowers chiefly in winter and very early spring but occasional flowers can be found at most times of the year except summer.

HABITAT: It grows in sandy soil in eucalyptus forest bordering wallum flats, and in mixed eucalyptus she oak forests.

DISTRIBUTION: This wattle is found in all the mainland eastern States to as far north as Ravenshoe. It also grows on the Blackdown Tableland in Central Queensland.

Acacia hispidula

The specific epithet for this wattle is derived from a Latin adjective *hispidus*. This means spiny, shaggy or rough and refers to the dense, rigid pubescence found particularly on the young stems.

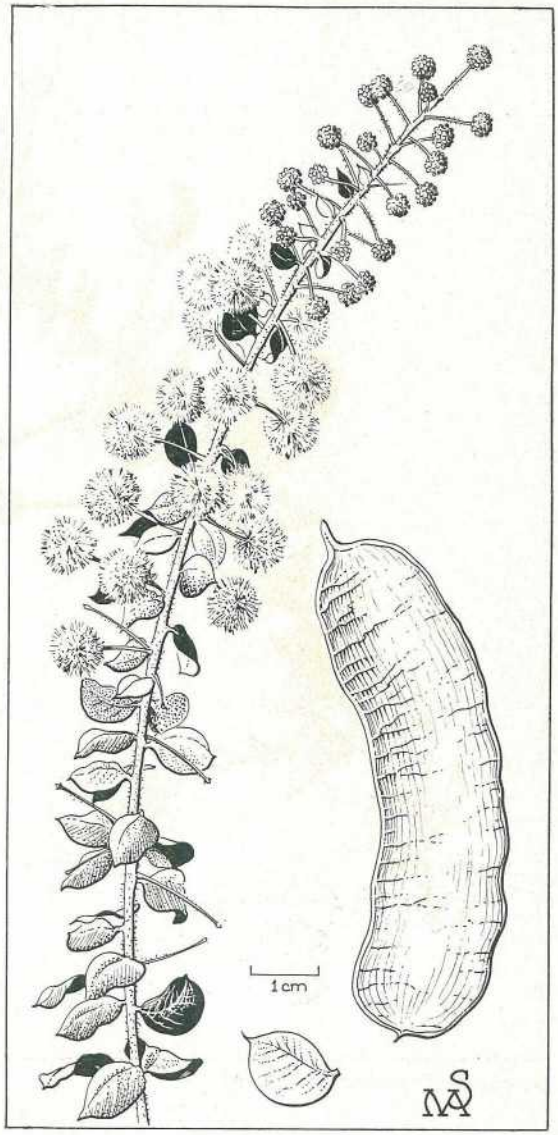
DESCRIPTION: This wattle is an erect, rather dense shrub to 1·5 m high with flexuose branches—many of them arching and drooping. The stems are covered with hairs arising from tuberculate bases and these make the stem rough to the touch. The phyllodes are up to 3 cm long and about 0·5 cm wide. They are dark green and sickle-shaped and curve upwards. The margins are thickened and have a ragged appearance caused by irregularly spaced, tuberculate teeth.

The heads are 0·5 cm in diameter and are on peduncles less than 1 cm long. They contain 12 to 20 flowers which are so pale in colour that the heads appear almost white. There is little perfume. The fruits are ovate, flattened pods with one seed or are oblong and two-seeded. They are up to 2 cm long, 1 cm wide and are very leathery.

FLOWERING TIME: It does not appear to have a definite flowering period but flowers spasmodically throughout the year except in midsummer.

HABITAT: This wattle grows on sandstone ridges and on dry, stony hill sides in open eucalyptus forest.

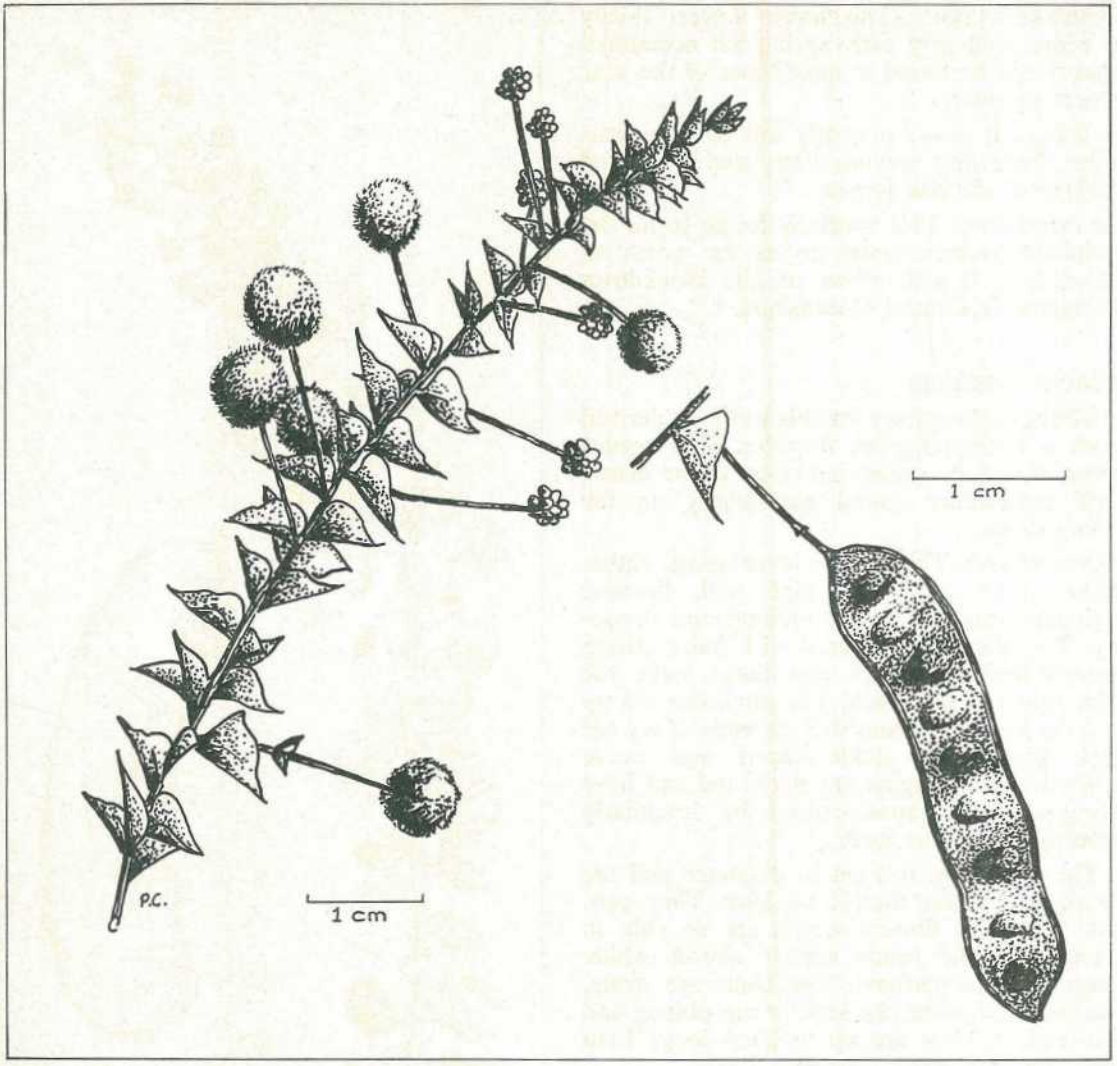
DISTRIBUTION: It is found only in New South Wales, to as far south as Port Hacking, and in Queensland to as far north as Crow's Nest, and as far west on the Darling Downs as Ballandean and Wyerba. This is common in only half a dozen localities in South-eastern Queensland.



Acacia uncinata

Acacia uncinata

The Latin adjective *uncinata* means hooked at the end. The name describes the manner in which the midrib is produced into a slightly hooked point at the end of the phyllode. This wattle was first discovered by Allan Cunningham in New South Wales on the sandstone ridges near the Hunter River.



Acacia hubbardiana

DESCRIPTION: It is an open shrub to 3 m high with long, arching branches. Minute, spreading hairs cover the twigs and the phyllodes are blue-green in colour and leathery. They are broadly ovate, or broadly elliptical, up to 2·5 cm long and 1·8 cm broad and have thickened margins. The prominent midvein is closer to the upper margin and is produced into the slightly hooked point which gives the plant its name.

A gland is near the midvein, at the base of the upper margin. The margins can be perfectly glabrous or a few hairs may be present. Since the lower margin curves from the vein closer to the stem than the upper margin the phyllodes are assymmetrical at the base. The peduncles are more than 1 cm long and sometimes have a few hairs scattered over them. On the flowering branches, the phyllodes are usually much reduced in size.

The heads are just under 1 cm in diameter and are very dense. They are bright golden-yellow and have a faint, sweet perfume. The pods are flat, oblong, up to 6 cm long and 2 cm broad and the seeds are transverse.

FLOWERING TIME: This wattle has two flowering flushes, one in late winter and early spring, the other in midsummer.

HABITAT: It is found in sandy soil in open eucalyptus forest.

DISTRIBUTION: This can be found in New South Wales to as far south as the Blue Mountains and in Queensland. Here it is not a common plant, and grows on the Darling Downs to as far west as Barakula. Until recently, it was believed to grow only in the Darling Downs district but has now been found at Pierce's Creek, north-east of Crow's Nest.

Yellow Prickly Moses *(Acacia hubbardiana)*

This wattle was named in 1969 in honour of Charles Edward Hubbard, a British botanist who travelled extensively in Queensland collecting specimens for the Royal Botanic Gardens at Kew in London. It had been incorrectly known as *A. plaigiophylla* for many years.

DESCRIPTION: It is a spreading shrub to 2 m in height with reddish branches covered with a fuzz of minute, white hairs. The phyllodes are dark green and are obliquely truncate at the base, up to 0·7 cm long and almost as wide at the base. The lower edge is straight and ends in a spiny pungent point up to 0·1 cm long. The upper edge is curved and the single vein curves from the base up towards the upper edge and then down again towards the spiny point.

Usually, the heads of flowers are solitary and on peduncles up to 1·5 cm long and are 0·5 cm in diameter. Microscopic examination shows the petals are creamy-yellow, the filaments white and the anthers lemon-yellow giving the heads an overall appearance of pale creamy-yellow. The flowers have a faint, sweet perfume.

In some plants, the solitary heads are replaced by a raceme of up to 15 heads. The pod is stipitate, flat and oblong, 4 cm long and 0·5 cm wide, with transverse seeds. The pod has an undulate appearance since the walls are raised over the seeds on alternate seeds of the pod.

FLOWERING TIME: The main flowering period is spring time but flowers can be found spasmodically at other times.

HABITAT: It is common on the slopes of mountain peaks, in crevices on rocks, and on sandy ridges in dry sclerophyll forests. It also grows on the coastal lowlands in wallum swamps, and on the margins of tea-tree swamps.

DISTRIBUTION: This wattle is found only in Queensland and is confined to the coastal lowlands and the mountain peaks to as far north as Bundaberg.

New Rural Reconstruction Board

THE Minister for Primary Industries, Mr V. B. Sullivan, has announced some changes to the Rural Reconstruction Board. In doing so he paid a tribute to Mr J. A. Barton, the retiring Chairman and Mr I. H. Suter, both of whom had been members since the inception of the Board 9 years ago. In that time, the Board had provided financial help to some 5 000 primary producers.

Mr Sullivan said the new chairman was Mr W. F. Mawson, Assistant to the Director-General of the Department of Primary Industries. Mr Mawson has been a Board member since 1974 and was presently Deputy Chairman.

Soybean varietal guide 1979-80

compiled by S. R. Walsh, Agriculture Branch

SOYBEAN varieties recommended for planting in Queensland in the 1979–80 season are listed in this article.

December is the main planting time but in some districts and situations this period may be extended from November to January. The crop has critical requirements for cultivation, nutrition, moisture, and weed and insect control.

Plant maturity and plant height are decreased by shortening day length. To compensate for these factors, the planting rate should be increased and the row width reduced in late sown crops.

The planting rate should aim at establishing a plant stand of 250 000 to 350 000 plants per ha for rain-grown crops. The rate should be increased when sown under irrigation to 400 000 to 450 000 plants per ha.

The planting rate will be governed by the time of sowing, soil type, variety and local conditions—the lighter rates for early sowing and the heavier rates for late sowing. Your Agricultural Extension Officer should be consulted if further information is required.

Late January plantings in coastal regions should be avoided because of the possibility of severe losses from rust.

Although Semstar is recommended in certain situations, it is susceptible to bacterial pustule and wildfire; these diseases may cause reductions in yield. Semstar may also be affected by some root rot diseases particularly on heavy soils.

Limited seed supplies of two soybean varities, Fitzroy and Canapolis, will be available for the coming season.

Canapolis, a slow maturing variety, is more suited to the central and northern Queensland regions. It was introduced from Brazil by a private seed company.

Fitzroy, a medium slow maturing variety, was developed and released by the Queensland University in 1979. This variety was previously tested as P25.

Region	Planting Time	Varieties
Far North Queensland— Cook, Mareeba, Atherton, Eacham, Herberton, Mulgrave, Johnstone, Cardwell, Douglas, Hinchinbrook Shires	Dec.–mid Jan.	Ross, Improved Pelican, Daintree
North Queensland— Dalrymple, Thuringowa, Ayr, Bowen, Proserpine Shires	Dec.–mid Jan. *For trial:* Dec.–mid Jan.	Ross, Gilbert Fitzroy
Capricornia— Livingstone, Fitzroy, Calliope, Broadsound Shires	Dec.–early Jan. *For trial:* Dec.–early Jan.	Davis, Wills Fitzroy, Canapolis

Region	Planting Time	Varieties
Capricornia—continued		
Pioneer, Mirani, Sarina Shires ..	Dec.–early Jan.	Davis, Willis, Ross
	For trial:	
	Dec.–early Jan.	Fitzroy, Canapolis
Emerald Shire	*Irrigated:*	
	early Dec.–mid Jan.	Davis, Wills
	mid Dec.–mid Jan.	Canapolis
	late Dec.–Jan.	Fitzroy
	Rain-grown:	not recommended
Banana, Duaringa Shires	*Irrigated and rain-grown:*	
	mid Dec.	Davis, Flegler
	late Dec.–Jan.	Canapolis, Davis, Flegler
	For trial:	
	late Dec.–Jan.	Fitzroy
Burnett—		
Miriam Vale, Kolan, Gooburrum, Woongarra, Isis, Perry, Biggenden, Hervey Bay, part Tiaro, Woocoo Shires	Dec.–early Jan.	Davis, Bragg, Wills
	For trial:	
	Dec.–early Jan.	Flegler
Gayndah, Mundubbera Shires ..	Dec.–early Jan.	Davis, Semstar, Flegler
	For trial:	
	Dec.–early Jan.	Canapolis, Fitzroy
Monto, Eidsvold Shires	Dec.–early Jan.	Davis, Bragg, Flegler, Collee
	Jan.–early Feb.	Davis, Semstar
	For trial:	
	Dec.–early Jan.	Canapolis, Fitzroy
South Burnett—		
Kingaroy, Nanango, Wondai, Murgon, part Kilkivan, part Rosalie Shires	Dec.	Davis, Bragg, Semstar, Flegler
	early Jan.	Davis, Semstar, Hill
	For trial:	
	Dec.–early Jan.	Fitzroy
Near North Coast—		
Widgee, Noosa, part Tiaro, Maroochy, Landsborough, part Kilkivan Shires	late Nov.–late Dec.	Wills, Bragg, Flegler
	late Nov.–end Jan.	Davis, Semstar
	For trial:	
	mid Dec.–Jan.	Fitzroy
Moreton—		
Caboolture, Pine Rivers, Redlands, Albert, Logan, Moreton, Esk, Kilcoy, Boonah, Gatton, Laidley, Beaudesert Shires	*Irrigated and rain-grown:*	
	mid Nov.–mid Jan.	Davis, Bragg, Wills, Collee, Flegler
	mid Jan.–late Jan.	Davis
Darling Downs—		
Wambo, Chinchilla Shires	*Irrigated:*	
	Nov.–Dec.	Davis, Bragg, Collee, Flegler
	Jan.	Davis
	For trial:	
	Dec.–Jan.	Fitzroy

Region	Planting Time	Varieties
Darling Downs—continued		
Wambo, Chinchilla Shires—continued	*Rain-grown:*	
	Nov.–Dec.	Collee
	For trial:	
	Nov.–Dec.	Fitzroy
Pittsworth, Millmerran, Jondaryan, Crows Nest, part Rosalie, Cambooya Shires	*Irrigated:*	
	Nov.–Dec.	Davis, Bragg, Flegler
	early Jan.	Davis
	For trial:	
	Dec.–early Jan.	Fitzroy
	Rain-grown:	
	Nov.–Dec.	Collee
	For trial:	
	Dec.–early Jan.	Fitzroy
Clifton, Allora, Rosenthal, Glengallan Shires	*Irrigated:*	
	late Nov.–Dec.	Davis, Bragg, Collee, Flegler
	Rain-grown:	
	late Nov.–Dec.	Davis, Bragg, Collee, Flegler
	early Jan.	Davis
Stanthorpe Shire	Nov.	Davis, Wills, Collee
	Dec.	Davis, Collee
Inglewood Shire	*Irrigated:*	
	late Nov.–Dec.	Davis, Bragg, Collee, Flegler
	early Jan.	Collee
	For trial:	
	mid Dec.–early Jan.	Fitzroy
	Rain-grown:	Not recommended
Near South-west—		
Balonne Shire	*Irrigated:*	
	Nov.–early Jan.	Davis, Wills, Flegler
	For trial:	
	mid Dec.–early Jan.	Fitzroy
	Rain-grown:	Not recommended

SUMMARY OF SOYBEAN VARIETAL CHARACTERISTICS

Characteristics	Davis	Bragg	Wills	Semstar	Collee	Flegler	Hill	Ross	Improved Pelican	Daintree	Gilbert	Fitzroy	Canapolis
Maturity Rating ..	6	6	8	7	5	7	5	9	9	9	9	8–9	9
Growth Habit	Erect	Erect	Erect	Erect	Erect	Erect	Erect	Erect	Erect	Erect	Erect	Erect	Erect
Resistance to Lodging ..	Good	V Good	Fair	Poor	V Good	Good	Good	Good	Fair	Good	Good	Fair	V Good
Average Height (cm) ..	75	75	85	90	70	75	70	70	100	70	70	100	90
Average Height to Lowest Pods (cm)	12	10	16	13	8	12	10	10	12	10	10	12	12
Flower Colour	White	White	Purple	White	Purple	Purple	White	Purple	Purple	Purple	Purple	Purple	White
Pod Hairs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pod Hair Colour ..	Grey	Tawny	Tawny	Grey	Tawny	Tawny	Tawny	Tawny	Grey	Tawny	Grey	Grey	Tawny
Resistance to Bacterial Pustule (**)	Yes	Yes	Yes	No	Yes	Yes	Yes	LL	No	Yes	Yes	Yes	Yes
Seed Colour	Straw Yellow	Yellow	Yellow	Straw Yellow	Straw Yellow	Dark Yellow	Straw Yellow	Mottled Yellow	Light Yellow	Mottled Yellow	Mottled Yellow	Straw Yellow	Dark Yellow
Hila Colour	Buff	Black	Black	Buff	Black	Black	Brown	Brown	Brown	Black and Brown	Brown	Imperfect Black	Brown
Plant Growth Habit (*)	D	D	D	ID	D	D	D	D	ID	D	D	ID	D
Pod Shattering	Yes	No	No	No	No	No	Yes	No	Yes	No	No	No	No
Approximate Number of Seeds per kg	5 500	5 200	6 100	5 900	5 700	5 200	6 000	10 000	8 300	10 000	10 000	5 700	6 000

* D = Determinate ID = Indeterminate

Varietal descriptions relate to the district of recommendation.

** LL = Low Level

Soybean Yields Shown as Percentage of Davis Yield

	Darling Downs				St. George		W. Moreton		S. Burnett		Kingaroy late planted		Monto		C. Queensland	
	Irrigated		Raingrown		Irrigated		Irrigated		Raingrown		Raingrown		Irrigated		Irrigated	
	%	No. of Trials	%	No. of Trials	%	No. of Trials	%	No. of Trials	%	No. of Trials	%	No. of Trials	%	No. of Trials	%	No. of Trials
Davis ..	100	27	100	26	100	7	100	24	100	18	100	6	100	6	100	16
Bragg ..	104·4	27	98·7	26	113·2	7	97·1	23	94·8	17	92·5	6	92·1	6	91·3	16
Wills	96·6	25	95·1	23	121·4	7	96·7	24	92·2	17	92·8	6	89·4	6	96·9	16
Semstar ..	98·2	24	103·4	26	110·7	7	91·8	24	97·6	18	90·4	6	94·0	6	90·3	16
Collee ..	88·5	19	94·6	16	93·5	6	92·4	18	88·5	15	87·6	6	84·5	4	85·0	13
Flegler ..	102·8	19	102·3	16	104·6	7	105·6	18	101·5	13	90·5	6	93·0	5	105·8	13
Hill	91·6	26	90·9	26	84·3	7	86·9	24	90·6	18	86·4	6	83·3	6	85·3	15
Fitzroy ..	90·5	10	97·2	6	114·4	4	93·8	9	100·4	11	95·1	3	90·4	2	98·0	10
Canapolis ..													88·9	3	103·7	9

This table provides a comparison of yield performance in the main districts where soybeans are grown.
The yields shown as a percentage of the yield of the variety Davis in which both Davis and the particular variety both appeared.
The greater the number of trials used to calculate the average the greater the reliability of the results.
This table should be used in conjunction with the guide to varietal characteristics.

Onion thrips

by P. D. Rossiter, Entomology Branch

Typical leaf injury symptoms caused by onion thrips feeding.

INFESTATION by thrips (*Thrips tabaci* Lindeman) is a regular feature on onions during late winter and spring months in South Queensland production areas.

The immature onion thrips is a small, creamy-yellow, elongate insect which lives and feeds within the shelter of the leaf bases until the prepupal stage is reached. It then moves to the soil to pupate. On emergence from the pupa, the adult returns to the plant to feed and deposit eggs in the onion leaves.

The total development period from egg to adult is less than a month. The adult insect is darker than the immature, nymphal stage, about 2 mm in length and carries two pairs of narrow, fringed wings.

Although called the onion thrips, it inhabits a wide variety of plants including numerous weeds.

Thrips feed by rasping on surface tissues and sucking up the exuded plant juices. With continuing leaf growth, these feeding points elongate to give the typical onion thrips symptoms—whitish spots and streaks on the leaves. Intensive feeding results in a silvery-white stippled appearance in infested plants. Seedlings may be killed if large numbers of thrips are present at that stage.

In well-managed irrigated crops, plants can tolerate high populations of thrips without yield reduction. However, bulb size can be reduced if populations greater than 50 thrips (adults and nymphs) per plant are allowed to develop and persist. Damage may be accentuated in crops suffering any stress which retards growth.

The development of an infestation is influenced by seasonal conditions. The pests breed most rapidly when a mild, dry winter is followed by a hot, dry spring. Consequently, early planted crops are usually harvested before damaging populations of thrips develop. It may be necessary to use an insecticide to control infestations in later crops.

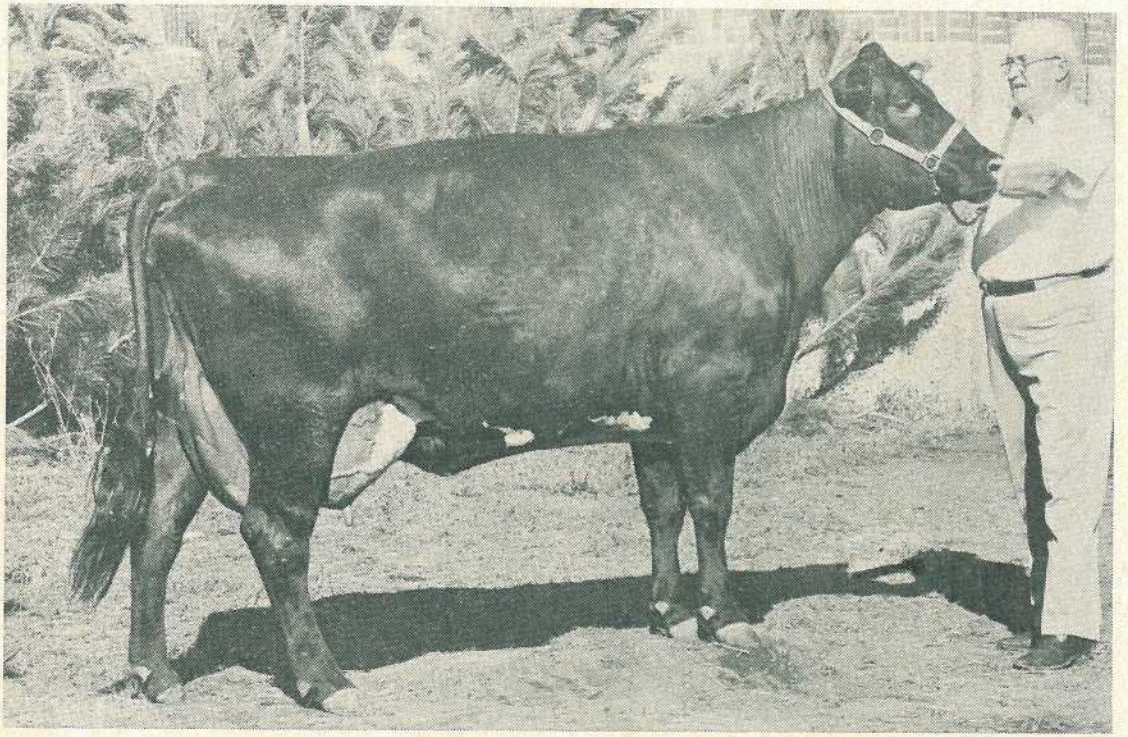
The recommended insecticides and dosages for control of onion thrips are methidathion at 300 g per ha or omethoate at 560 g per ha. Supracide contains 400 g of methidathion per L and therefore 750 ml per ha would be required to achieve the required dosage. Similarly Folimat containing 800 g of omethoate per L would be used at 700 ml per ha.

These should be applied in sufficient water, preferably not less than 600 L per ha, to ensure thorough plant coverage, particularly in the throat of the plant where the nymphal thrips reside. The addition of a suitable wetting agent may assist to achieve better coverage.

A repeat application 5 to 7 days later may be required to ensure eradication of those thrips which were in the pupal stage in the soil at the time of the first application.

Neither insecticide should be applied within 7 days of harvest.

A. I. S. bulls sire champions in America



CLAYSIDE PENELOPE

Born 3 January 1974

Grand champion and best-uddered aged cow American Milking Shorthorn National Show, Wisconsin, August 1979

Sire: Sunny View Princess Reunion

Semen exported through Wacol A.I. Centre

Owner: Elmer Von Tungeln, Verden, Oklahoma, U.S.A.

Production to Date

Age	Milk Litres	Test %	Fat kg	Days
2·1	5 273	3·9	209	305
3·3	5 995	4·1	255	305

Intensive piggery hygiene

DISEASES flourish in unhygienic conditions in overcrowded cities. These cities and dirty, overcrowded piggeries are much the same.

Intensification of the pig industry has lead to more and more pigs being kept in large numbers in close contact with each other. In intensive piggeries, sound hygiene is most important otherwise they will become 'pig slums'.

As well as causing obvious disease, poor hygiene is likely to reduce productivity and lower profitability. Some piggeries with bad hygiene may survive with poor production, but good hygiene is vital for long term viability under intensive conditions.

Good hygiene is particularly important in farrowing and weaner accommodation as piglets are most susceptible to infections soon after birth (especially scouring.)

All pigs carry potential disease-causing germs (micro-organisms) even when they show no signs of illness. Micro-organisms are passed out in the dung, urine, saliva, expired air, on the skin and in discharges. Hygiene programmes aim to reduce the level of infection in a piggery, to reduce the transfer of micro-organisms from pig to pig and to make the environment in the piggery unsuitable for the survival of micro-organisms.

by D. O. Francis, Pig and Poultry Branch and W. R. Webster, Veterinary Services Branch

The ease of operating an effective hygiene programme is largely determined by the design of the piggery. Floors, walls and ceilings should be free from cracks and ledges to enable thorough cleaning and disinfection. These surfaces should ideally be constructed of materials which are resistant to chemical action, are impervious to moisture and do not corrode.

Cleaning and disinfection are two phases within a hygiene programme. Disinfection without thorough cleaning first is unlikely to be effective, as organic matter (dung, other discharges and bedding) partially inactivates most disinfectants. Thorough cleaning and washing to remove organic matter left by the previous occupants of the pen is therefore essential before disinfection.

Cleaning procedures

The following points will aid in the cleaning process:

- Remove all portable equipment and fittings and clean them away from the pen.
- Remove the larger deposits of organic matter from pen surface by dry scraping.
- Soak surfaces caked with manure with water for a few hours so it can be removed easily.
- Thoroughly clean all surfaces and equipment using a scrubbing brush and a 4% solution of washing soda, or a 1 or 2% solution of caustic soda (extreme care needed when handling; avoid continued use because of its corrosive nature).
- The final stage of cleaning can be done with a high pressure hose.

High pressure hosing is very effective and quick especially when hot water is used. However, it cleans rather than disinfects. A common criticism of high pressure washing is that it merely relocates the micro-organisms from one place to another. Steam cleaners are useful for cleaning greasy surfaces, especially when detergents are added. They are not very effective as a means of disinfection because the temperature of the steam jet drops very rapidly once it leaves the nozzle.

Disinfection procedures

After thorough cleaning, disinfectants should be applied especially on the most contaminated surfaces. Spraying is the most convenient means of application. Some disinfectants are irritant and so pens should be rinsed with water before being re-occupied.

Some proprietary products contain both disinfectants and detergents and appear to be effective. However, as some disinfectants are inactivated by detergents and soaps, they should not be blended together on the farm.

Flame-throwers are used in some piggeries. They achieve a degree of disinfection and leave surfaces warm and dry. They should not be used in sheds insulated with polyurethane foam and the fire risk must always be considered.

Choosing a disinfectant

There are many factors to be considered in choosing a disinfectant. These include cost, effectiveness, effect on effluent disposal systems, corrosiveness to building materials, irritancy to both humans and pigs, ability to act in the presence of organic matter and the spectrum of activity.

When used at the correct concentration (not always that recommended by the manufacturer —consult your D.P.I. Pig Section Advisor for details) most commercially available disinfectants have a broad enough spectrum of activity (that is range of micro-organisms they are effective against) for routine piggery use.

Table 1 summarizes the advantages and disadvantages of most commonly used types of disinfectant.

Fumigation by formaldehyde gas produced by adding formalin to potassium permanganate crystals (extreme caution needed) is more effective on smooth surfaces as the gas fails to penetrate dirt and cracks in concrete and wood. There is also a fire risk.

Design considerations

The rate of transfer of germs from pig to pig in the same pen and in the same building is largely determined by the design of the accommodation. In well designed farrowing pens, piglets dung and urinate over slats away from the creep area and the sow's trough. To encourage proper use of slats, the creep area should be warm and dry. Drainage should be arranged so that the spillage from the sow's waterer will not wet the pen or creep area. Heating and ventilation, siting and type of waterers, and the type of slat all influence the dunging patterns of the piglets. In well-designed pens, only a minimum of cleaning should be needed.

In the 'all in—all out' system, separate rooms (usually with 8 to 16 farrowing pens per room) hold a week's farrowings. Similarly, separate weaner rooms hold a week's weanings Each room is completely depopulated between batches. Cleaning and disinfection are easier and can be very thorough without disturbing other litters. The criticism that high pressure hosing relocates micro-organisms is not relevant in an unstocked room.

'All in—all out' systems should be designed so that each room can be sealed and individually fumigated, if necessary. Another advantage of the system is that fewer pigs are in the same air space. As air currents transfer micro-organisms from one pen to another, reducing the number of pigs in any particular air space can slow the spread of disease.

Inadequate ventilation in any building adversely affects hygiene. By increasing the ventilation rate, fewer micro-organisms will be transmitted from pig to pig. Many micro-organisms including those causing scouring and pneumonia are spread in the air. Inadequate ventilation can lead to high humidity which favours the survival of micro-organisms. Overcrowding, especially in hot, humid weather, lowers the hygiene standard.

Satisfactory hygiene in grower pens is also largely determined by their design. Most grower pens are never cleaned or disinfected. From a hygiene viewpoint, fully slatted pens are best followed by partly slatted pens, solid floor pens with a separate drain, and worst of all solid floor pens with a common drain. Good design will encourage pigs to dung and urinate in the right place—this contributes to hygiene in the pen. Partly slatted pens should be long and narrow with slats at one end. A pig should be able to see other pigs in adjacent pens only when standing on the slats. The waterer should also be over the slats.

From a hygiene viewpoint, trough feeding is better than floor feeding especially if the trough design prevents the pigs walking, lying, urinating or dunging in the trough. Trough feeding of weaners is strongly recommended.

TABLE 1

Disinfectant	Corrosiveness	Irritancy	Effect on Effluent	Cost	Reduction of efficacy due to Organic Matter*	Bacterial spectrum of activity	Other Comments
Phenolic compounds e.g. Lysol	Slight	Skin reactions in humans and pigs	May cause problems	Fairly expensive	Slight	Broad	..
Quaternary ammonium compounds (quats) e.g. Germidet	Slight on galvanized iron	No	Problems unlikely	Fairly expensive	Substantial	Narrowest spectrum	..
Quaternary ammonium compounds with Biguanides, e.g. Savlon, Hy-dab	Slight on galvanized iron	No	Problems unlikely	More expensive than quats	Substantial	Spectrum increased	..
Iodophors e.g. Redene ..	Corrosive on iron and aluminium	Occasionally	May cause problems	Fairly cheap	Slight	Broad	..
Formalin	Corrosive	Pungent	May cause problems	Cheap	Substantial	Broad	Unpleasant to use
Chlorine releasers, e.g. Halamid, Dairy Chlor, Chlorsan XL	Corrosive on most metals	No	Problems unlikely	Fairly cheap	Substantial	Broad	..
Sodium Hydroxide (Caustic soda)	Extremely Corrosive	Very Harmful	May cause problems	Cheap	Slight	Broad	Very unpleasant to use

* All disinfectants are inactivated by organic matter. The degree of inactivation is determined by the amount of contamination and which disinfectant is used.

The slats of dry sow stalls should be designed so that dung does not accumulate behind the sows and urine does not form puddles. If there is a common feeding and watering trough, for hygiene reasons, the stalls should be narrow enough to prevent gilts and thin sows turning around and urinating or dunging in the trough.

Footbaths

Some piggeries provide disinfectant footbaths, but their effectiveness is questionable and their usefulness may be only psychological. Criticisms are that there is often organic matter on boots that renders the disinfectant ineffective and that even under good conditions disinfectants require several minutes to act and there is insufficient contact time between the footwear and the disinfectant. Very often, a footbath system breaks down because either the disinfectant solution is not replaced regularly or a convenient stepping stone is placed in the bath.

Good housekeeping

Good housekeeping also contributes to the hygiene of the piggery. Before being moved into the farrowing section, sows should be washed down with soapy water. Particular attention must be paid to the udder and the vulva. Laneways should be cleaned after pigs have been moved.

Rodents, flies and other insects should be controlled. Insects can transfer micro-organisms from pen to pen and from piggery to piggery. Rodents can be infected with leptospirosis and spread it in their urine. Mowing the grass around buildings reduces the fly population and reduces the chances of rats finding their way into piggeries.

Scours should be removed from the pen as soon as possible. This can be done by hosing, but this may spread the micro-organisms throughout the whole building. It also increases the humidity favouring the survival of micro-organisms in subsequently voided scours. Hosing leaves a wet floor that can chill the piglets and make them more susceptible to scouring and other diseases.

Removing the scour without hosing is preferable. Sawdust or lime (slaked or quick lime) placed on the scour will absorb it and then it can be removed with a shovel. Lime also has some disinfectant properties. The shovel should be hosed off and left in a disinfectant solution. Care should be taken when cleaning occupied pens that organic matter is not transferred from pen to pen on the cleaner's boots. Occupied pens should be cleaned if necessary, but disinfection of pens while they contain pigs is generally not worthwhile.

Conclusion

In intensive piggeries, sound hygiene is necessary for good production and to minimize disease problems. A good standard of hygiene depends largely on the design of the piggery, good management, routine cleaning and disinfection, and good housekeeping.

Acknowledgement

We wish to thank Mr. T. Smeltzer of Pathology Branch, Animal Research Institute and Mr. C. Macrae of Engineering Services Section, Toowoomba for their assistance in the preparation of this article.

Bovine brucellosis accredited-free herd scheme

THE following list contains all herds which have been given accredited-free status under the Bovine Brucellosis Accredited-Free Herd Scheme as at 30 September, 1979:

J. L. & S. E. Abraham, 'Kaho' Stud Farms, M.S. 892, Meringandan.	AIS, JS, SM
C. P. Adams, 'Warwick Park' Stud, 'Warwick Park', M.S. 422, Clifton.	MG
Agar Pastoral Co., P.M.B. 3, Murgon.	SG
D. A. N. Agnew, Mikobe Poll Hereford Stud, Imbil.	PH
M. Ahern, 'Bandon', Gayndah.	BS
Alcheringa Pastoral Co., 10 Coomber Street, Bundaberg.	CH
R. N. Alexander, 'Trefoil Park', Warra.	HF
Allawah Stud Partnership, 'Allawah', Theodore.	BM
Ambrose, H. J., Lime Quarries Brahman Stud, Marmor.	BM
J. H. & B. J. Amor, 'Carinya', Dulacca.	BF
F. Anderson, 'Castle Mitchell', Clifton.	MA
F. J. & M. I. Anderson, Currumbin Creek Road, Currumbin.	JS, FS, JSX
J. W. Anderson, 'Austral' and 'Acme' Studs, 'Talawah', Chinchilla.	SG
Anderson Past. Co., 'Inverary', Yandilla.	PH
R. M. & B. Anderson, 'Balinga', Millmerran.	SG
E. R. Andrew, Woodford Road, Peachester.	FS
Animal Husbandry Research Farm, Dept. of Primary Industries, Rocklea.	MIXED
H. R. Arthy, 'Beauvale', Laravale via Beaudesert.	JS
Artificial Breeding Centre, C/- Dept. of Primary Industries, Grindle Road, Wacol.	MIXED
W. J. Atkin, 'Sandoan', Durah Road, 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 Road, Redland Bay.	MG
N. D. Bahnisch, 'Brafield' Stud, 'Orchard Vale', Guluguba.	BF
D. Baker & R. & S. Wool, 'Nympton' and 'The Diamond' Studs, Hollymount, Miles.	DV, PD, SH
H. A. Balke, 'Balhaven', Westbrook.	JS
I. K. & D. A. Barlow, 'Lyndoch', M.S. 150, Pittsworth.	MG
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 Past. Co., Yabba, Junica, Via Kilcoy.	SG
A. D. Bassingthwaite, 'Waco', Wallumbilla.	SG
E. Bassingthwaighte, 'Woodlands Stud', Greenmount.	PH
A. V. Bauer, 'Warralea' Droughtmaster Stud, M.S. 825, Ipswich.	DM
W. R. & G. W. Bauer, 'Grampians' and 'Amaroo', Cannon Creek, M.S. 484, Boonah.	BM
W. R. & G. W. Bauer, Cannon Creek, M.S. 484, Boonah.	BM
D. E. Bayliss and Co., 'Delspring', M.S. 537, Kingaroy.	MG
C. R. & V. M. Beak, Mt. Miller, Yarwun.	BM
D. J. & E. M. Beal, 'Tara Park', Gowrie Junction.	MG
G. W. Beck, 'Banbeck', Blenham Road, Laidley.	DM
C. H. Beckingham, Cosme Jersey and Hereford Stud, 'Bridgeman Downs', Darien Street, Aspley.	JS, HF
N. R. & E. A. Beckman, 'Glandra 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
A. G. Bell, 'Aroo', Boonah.	HF
A. J. & M. A. Bell, 'Belheath' Stud, 'Karingal', M.S. 1231, Millmerran.	PH
G. P. & D. I. Bell, 'Ment More', Dulacca.	BF
L. G. Bell, 'Del Gowrie', Jimbour.	BF
M. G. Bell, 'Heatherlea' Stud, Dulacca.	BF
Bell Partnership, 'Camboon Stud Holding', 'Camboon', Theodore.	HF
W. H. Bell, 'Bilandra', Jambin.	BM
Bellreen Pty. Ltd., 'Coolalinga Stud', Hunchy Road, Palmwoods.	DM
J. Bennett & S. A. Wells, Box 3202, Townhall, Toowoomba.	FS, HF
H. G. & C. M. Benstead, 'Analwon', Wonglepong via Tambourine.	AIS
E. J. & P. A. Bentley, 'Jedda Park', No. 1 Pope Road, Mother Mountain, Gympie.	AG
Berajondo Past. Co., 'Glenmore', Berajondo.	BM
B. & E. Bergstrom, 'Chrisaelgy' Brahman Stud, 'East End', Mt. Larcom.	BM
J. W. & J. K. Best, 'Idlewild' Stud, 'Idlewild', Warwick.	CL
Bidson Pastoral Co., C/- K. C. Johnson, 'Bidson', Dulacca.	SM, HF
R. Biggs and Sons, Dulong, P.S. 1096, Nambour.	FS
Big White Cattle Co., 'Big White', Nobby.	CH
Binda Brae Pastoral Co., 'Binda Brae', P.O. Box 2, Jimbour.	BF, HF
N. J. & J. F. Birch, 'Bonny J' Stud, River Road, Peachester.	BF
L. R. & C. A. Bischoff, 'Taminnis' Stud, P.S. 1978, Beaudesert.	FS
P. R. Bishop, Garglen, Southside, Gympie.	BM
A. E. & C. S. Black, 'Ventnor', M.S. 90, Kingaroy.	AIS
T. G. & M. K. Black, 'Hazeldean' Stud, M.S. 692, Nanango.	SG
C. J. H. & M. E. Blackley, 'Alcheringa', M.S. 851, Wandoan.	BF
P. G. & C. A. Blanche, 'Blanson' Stud, Stock Route Road, Fernvale.	BF
L. Blank, Running Creek via Rathdowney.	SG
D. R. Bleakley, Tumbeelluw Stud, Maleny.	MG
R. G. & M. C. Bligh, 'Mirrabooka', Millmerran.	AIS
N. J. & E. B. Blumel, 'Willow Glen Farm' Stud, Farm Road, Bunya.	DM
Bolingbroke Pastoral Co., 'Bolingbroke', via Sarina.	SG
G. C. & L. D. Bond, 'Willow Valley', Kings Scrub, Dayboro.	AIS
A. R. & V. H. Bondfield, 'Palgrove', Dalyeen.	CL
J. S. & S., & W. N. & P. M. Bonthrone, Ingaby Station, St. George.	SG
Boreview Past. Co., 'Boreview', Wallumbilla.	PH
R. Boshammer, 'Glenock', Angus Stud, 'Sandon', Durah Road, Chinchilla.	AG
Estate of W. Bourke, 'College Green', M.S. 422, Clifton.	AIS
R. R. & I. A. Bowen, 'Pine Tree Farm', Roma.	HF
F. H. & F. Boyd, Robinvale Stud, Neusa Vale, Via Gympie.	JS
J. C. Brandon, Boomerang Park, Hill Road, Yangan.	MG

M. J. & G. E. Branson & Sons, 'Alma Park', Jandowae. **MG**

L. J. Breen, 'Tarrawatta', Eukey via Stanthorpe. **AG**

J. T. Breydon, 'Brooklyn', Haden. **HF**

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. Brimble Combe, 'Wyalong', Jimbour. **BF**

Broadlea Partnership, 'Broadlea', Box 35, Theodore. **BM**

A. & A. J. Brown, Kidman Creek, Obi Obi, Maleny. **AIS, HF**

E. R. & M. E. Brown, 'Benalla', Roma. **JS**

H. D. & P. R. Brown, 'Westerngales' Stud, Wight's Mountain Road, Samford. **PH**

M. J. & M. P. Brown, 111 Lemke Road, Taigum. **SG**

W. L. & J. M. Brown, 'Acedale' Stud, P.O. Box 18, Southbrook. **HF**

J. M. Browne, 'Achil' Stud, 'Achil', M.S. 660, Proston. **AIS**

T. J. Brownlie, 'Thornton', Columboola. **HF**

G. A. & J. L. Buchanan, 'Airdrie' Brahman Stud, 242 Holmes Street, Brighton. **SG**

Buchanan and Wagner, 'Strathgarve ' and 'Wahroongah', Dalveen. **BM**

K. & C. Buchbach, 'Dingalee Dell', Wootha Road, Maleny. **SM**

C. E. Buchholz, 'Baron Downs', P.O. Box 175, Maryborough. **FS**

Estate of Dr. S. A. Buckingham, 'Banyak-Suka', D'Aguilar. **SG**

Bundaberg Sugar Co., 'Avondale' Brahman Stud, Marlborough Station, Marlborough. **BM, CL**

Burnett Downs Pastoral Co., 'Burnett Downs', P.O. Box 11, Brigalow. **BM**

B. A. & B. J. Burnham, Bimbadeen Brangus Stud, 'Upson Downs', Abercorn. **MG**

H. E. Burnham, 'Boolgalgopal', Abercorn. **BS**

J. A. & A. W. Butler, 'Coochin', Old Gympie Road, Beerwah. **BM**

R. V. & L. M. Cahill, 'Carinya', Lamington via Beaudesert. **BF**

R. J. & G. E. Callaghan, 'Canowindra', Upper Camp Mt. Road, Samford. **HF, HFX**

Calliope Cattle Co., Calliope Station, Gladstone. **DM**

F. & E. L. Cameron, Evelor A.I.S. Stud, M.S. 767, Yarraman. **HF**

R. B. & J. P. Cameron, 'Belconnen', McDougall Street, Warwick. **AIS**

J. D. & H. Campbell, 'Hilden', Burpengary Road, Narangba. **MG**

M. P. Campbell, Tiaro Park, Tiaro. **MG, LM**

J. Cardillo, 'Oena', Springs Road, Mareeba. **BM**

D. I. & J. C. Carlyle, 'Wonga Hills' Stud, M.S. 355, Chinchilla. **DM**

F. & J. M. Carrington, 'Raelee Downs', Corfield. **PH**

C. J. Chambers, 'Marbett Park', Goombi. **SG**

G. F. & J. M. Chandler, 'Benandu', M.S. Texas. **BF**

H. Cherry, 12 Davidson Street, Oakey. **BF**

L. A. & C. M. Chesworth, 'Willette', Crynard, Beaudesert. **HF**

E. & A. B. Childs, 'Glenlands' and 'Valuce', Bouldercombe Road, Rockhampton. **FS, AFS**

B. L. & M. O. Christensen, 'Elavesor' Poll Hereford Stud, Rosevale Via Rosewood. **DM**

G. E. Christensen, 'Double E', Moorang Via Rosewood. **PH**

T. & W. Christensen, 'Omaha', Tarome, Via Kalbar. **SG**

E. M., C., & G. W. Ciesiolka, 'Valley View', M.S. 212, Oakey. **PH**

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

B. H. Clancy, Callagan Road, Narangba. **AIS**

N. & L. C. Clark, Mt. Alice Stud, M.S. 863, Maclagan. **SW**

C., Cho, S. H. Clarke, M/S 825, Peak Crossing, Via Ipswich. **FS, JS, AIS**

I. E. & J. E. Clarke, 'The Shanti', Chinchilla. **JS, FS**

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

Colanya Cattle Co., 'Narlagoon', M.S. 902, Dalby. **BF**

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

B. K. Coleman, 'Green Stock', P.O. Box 37, Goombungee. **FS**

W. A. Collard & Sons, 'Cedar Park', M.S. 16 Witta Road, Maleny. **JS**

K. J. & G. J. Colley, 'Mirondi', Kiamba. **FS, GS, AFS**

N. A. Collins, (R.J.) Kuloe, Ocean View Via Dayboro. **PH**

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

C.S.I.R.O., Narayen Research Station, Mundubbera. **BR**

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

B. M. Conroy, 'Logan View', Via Coominya. **JS**

Coombe Bros., 'Roxborough', Greenlake Road, Rockhampton. **CL**

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

W. D., A. V. J. & I. G. Cormack, 'Fourex' Stud, 'Burnside', Wallumbilla. **BF**

T. J. Cottee, 'Tallegalla Stud', 1 Bygott Road, Samford. **BF**

C. & G. Cotter, 'Adina', Upper Widgee via Gympie. **CL**

C. V. & J. R. Cotter, 'Narrabri', P.S. 1030, Gympie. **BF**

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

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

T. W. & M. J. Crank, 'Gracelyn', Mt. Tyson. **PH**

G. L. Crawford and Sons, 'Glenvillan', Mannuem Road, M.S. 90, Kingaroy. **AIS**

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

J. Crombie, Woodlyn Properties, 'Woodlyn', Glen Esk Road, Esk. **HF**

J. Crombie, 'Woodlyn Stud', 'Mellara', Blackbutt. **DM**

Mrs. M. Crombie, Old Hidden Vale Santa Gertrudis Stud, No. 49, Old Hidden Vale, Grandchester. **DM**

L. C. & S. G. Cronk, 'Beltana', M.S. 1073, Crows Nest. **SG**

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

Culloden Pastoral Co., 'Lingi', Chinchilla. **FS**

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

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

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

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

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

J. J. E. Davies, 'Glenwyn Park Stud', Charker Street, Toowoomba. **PH**

B. H. Davis, Petrie Creek Road, Nambour. **HF**

K. W. Davis, 'Walkah', Carpendale via Helidon. **MG**

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

G. F. & A. M. Dean, 'Gadfield' Stud, Home Creek, Wootoolin. **AIS**

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

L. De Landelles, 'Cherokee', Tanby via Yeppoon. **BM**

M. D. & D. J. Delroy, Old Mt. Alford Road, Boonah. **BM**

D. V. Dent, 'Rosemount' Stud, M.S. 16, Conondale Road via Maleny. **SM**

E. & H. C. Denton, 'Narraburra', M.S. 619, Roma. **MG**

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

C. & V. N. Devine, Wolsely Stud, Euston Road, Toowoomba. **FS, AIS**

Mr. Dieckmann & Son, 'Keystone', Stud, Running Creek, Rathdowney. **SG**

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**

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

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

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

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

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

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

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

H. L. Douce, 'Cleveland', Alpha. **BM**

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

R. W. & J. A. Downes, 'Roweena Charolais Stud', M.S. 285, Bauple. **CL**

D. C. Doyle, 'Aspel', Lacey's Creek, Dayboro. **FS**

N. J. Drabsch, 'Erinbrook', Pelican via Chinchilla. **BM**

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

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

W. H. Dunn, 'Ranorwen', New Country Creek, Kilcoy. **MG**

D. J. & E. C. Dwyer, 'Avoca', Peak Crossing via Ipswich. **FS, AFS**

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

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

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

Estate W. J. Elder, 'Alamby Stud', 'Trevilla', Jackson. **PH**

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

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

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

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

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

G. N. Fairbrother, 'Orion' Stud, Pierce's Creek, M.S. 26, Crows Nest. **BM**

G. Falls, Karinga Valley, M.S. 1096, Nambour. **JS**

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

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

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

G. L. & M. I. Ferguson, 'Glenview', Nobby. **CH**

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

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

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

G. C. Fisher, 'Karalee' Murray Grey Stud, 68 Hume Street, Pittsworth. **MG**

J. W. Fisher & C. R. Bond, 'View Fair', River Road, Peachester. **JS**

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

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

B. H. Ford, 'Aldersyde' and 'Old Cameby' Studs, 'Aldersyde', Old Cameby Road, Miles. **PD, HF**

B. H. Ford & I. Richardson, 'Old Cameby' Stud, 'Hillcrest', Drillham. **HF**

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

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

V. & S. Forman, Laguna Jersey Stud, Gympie. **JS**

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

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

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

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

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

French Bros. And Co., 'Riverdale', Mt. Pleasant via Dayboro. **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 Past. Co., 'Corolla' Stud, M.S. 29, Clifton. **HF**

I. E. Frohloff, 'Charland Stud', M.S. 648, Yarraman. **CL**

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

Gayway Past. 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**

A. J. & E. M. J. Gill, 'Bramston', Tara. **PH**

K. J. & M. S. Gilmour, 'Ridgegrove', Oakey Creek, Kenilworth. **HF**

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

J. & N. Golding, 'Manuka' Stud, Smithfield Road, Gatton. **JS**

T. H. & D. D. Gooding, 'Booboogan' Stud, 'Merrimac' via Nerang. **PH**

R. T. Goodrich, 'Glenhome' Stud, Perwillowen Road, Nambour. **DM**

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

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

N. J. & G. E. Gossow, 'Oaken Pine', Crows Nest. **CH**

B. B. Gotke, Reynold Valley Jersey Stud, M.S. 461, Kalbar. **JS**

G. B. Gould, 'Guluguba' Stud, 'Waitangi', Guluguba. **PS**

R. A. & T. M. Gould, 'Shannonvale', Lot 6, Coominya. **DM**

L. M. Graham, 'Glenmore' and 'Glenlea' Studs, P.S. 1494, Nanango. **BF, HF**

R. N. & L. M. Graham, 'The Homestead' Stud, Couper's Road, Westbrook. **FS**

L. R. Granzien, 'Caboonbah' Jersey Stud, Kalbar. **JS**

G. T. Green, 'Woodridge', M.S. 371, Greenmount. **GS**

W. J. Grayson, 'Lindavale', Killarney. **DV**

Green Global Trading Co., 'Global' Belmont Red Stud, 'Daisy-Dell via Bororen. **BR**

E. R. Greenhalgh, 'Chianti' Stud, 'Tallundilly', Emmet via Isisford. **CH, HF**

G. A. Greenup and Co., 'Benroy', Kingaroy, C/- 'Rosevale', Jandowae. **SG**

G. A. Greenup and Co., 'Rosevale', Jandowae. **SG**

K. F. & K. P. Greiss, 'Glendon Friesian Stud', The Caves. **FS**

E. G. & E. O. Grice, 'Carawatha' Stud, 'Mirrabooka', via Millmerran. **CH, MA**

J. R. & R. Grieve, 'Invernaion', Yandilla. **PH**

J. C. Grigg, 'Bethonga' Braford Stud, P.O. Box 4, Wamuran. **BF**

K. W. & K. M. Groves, 'Groveleigh', 17 Sorensen Road, Southside, Gympie. **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. & S. M. Guppy, 'Lynstarr', M.S. 956, Nambour. **FS**

A. C. & R. Haigh, 'Lagoonside', M.S. 979, Monto. **GS**

N. D. & A. V. Hams, 'Shandah', P.O. Box 89 Nanango. **SG**

B. & M. Hannant, 'Croalah' Stud, M.S. 243, Kingaroy. **PS**

D. & P. F. Hardgrave, 'Arrawatta', M.S. 650, Biggenden. **FS**

D. & P. E. Hardgrave, 'Arrawatta Stud', Sharon via Bundaberg. **FS**

D. A. Hardie, Bromelton House, Beaudesert. **HF**

C. R. Hardwick, 'Charlyn', Marlborough. **BM**

B. M. & J. R. Hare, 'Wahpunga', Kin Kin. **BF**

N. J. Harrington, 'Winnington Stud', 93 Sorensen Road, Southside, Gympie. **CH**

H. R. Harris, 'Temora Park' Stud, M.S. 33, Cedar Creek via Samford. **PH**

N. & F. M. Harrison, 'Oakridge Stud', Bartholomew Road, Elimbah. **BS**

I. & B. J. Hart, Trahni, M/S 1867, Greenmount. **HF**

N. P. Hartwig, 'Ky-Lew', Goombungee. **GS**

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 Street, Drayton. **PS**

C. R. & M. Hemming, 'Birra Birra', Thallon. **SG**

M. F. Hemmings, 'Bileena', Canningvale Road, Warwick. **AIS**

V. A. Henderson, Barkala Stud, Greenmount Road, Cambooya. **HF**

A. W. Henry & Son, 'Green Valley', The Gums. **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**

A. T., R. E. & J. A. Herron, M.S. 16, Conondale via Maleny. **FS, AFS**

W. F. Herron, 'Bundaleer Stud', Herron Road, Closeburn. **FS**

R. S. & E. M. Heslip, Shamrock Friesian Stud, Sommerville Road, Beechmont. **FS**

H.M. Prisons, Etna Creek via Rockhampton. **MIXED**

H.M. State Farm, Numinbah Valley, Numinbah, via Nerang. **FS**

H.M. State Farm, Palen Creek, Rathdowney. **JS**

H.M. Prisons, 'Wolston' Stud, Station Road, Wacol. **FS**

Superintendent, Her Majesty's Prison, Neurum Road, Woodford. **JS**

C. J. Hewitt, 'Judel' Friesian Stud, Delaney's Creek via Caboolture. **FS**

K. A. Hickey, 'Limerick' Stud, Bunya Road, Bunya. **FS**

H. L. Higgs, 'Bangalla', River Road, Tinana. **BR**

Hindmarsh & Son, 'Wingfield', Monto. **HF**

Estate H. & F. H. Hinz, 'Glenmoya', Rossmoya Road, The Caves. **BF**

F. J. Hirn & Sons, 'Glen Avon', Peachester Road, Beerwah. **JS**

A. Hobbs, Birkdale, Dartmouth. **CL, CH, SG**

R. H. Hodby, 'Hurstview Stud', 100 Ewing Road, Woodridge. **JS**

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'' and '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 Road, Tamborine. (Mt.) **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**

A. E. Horton, 'Springfair', M.S. 1382, Wondai. **JS**

J. W. Hudson, 'Wesslings', Gatton. **DM**

I. C. & S. D. Huey, 'Ashview', M.S. 918, Toowoomba. **JS**

M. E. & V. E. Hughes, 'Mi-Von', Hopelands via Chinchilla. **HF**

S. E. Hunt and D. J. & M. Doyle, 'Kudo' Stud, 'Komirra Pastures', Glasshouse Mountains. **PH**

T. M. Hunt, Bald Knob Road, Peachester. **AIS, FS**

R. B. & S. R. Huth, M.S. 23, Moorang via Rosewood. **JS**

W. J. & J. T. Hynes, 'Billagal', Riverton via Texas. **HF**

P. J. & R. Ibbott, 'Buffel Vale', M.S. 1132, Mundubbera. **JS**

G. C. & A. J. Iker, 'Illangi', M.S. 448, Monto. **BM**

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, 'Towertown' Stud, Glenwood, Gunalda. **FS**

K. E. & E. J. Jeppeson, 'Taranga', Bloomsbury. **BM**

G. R. Jess, 'Adnamira Stud', Old North Road, Strathpine. **DM**

Jimora Grazing Co., C/- G. N. & K. Brandon, 'Morden', Toogoolawah. **BM**

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**

G. W. Johnston, 'Westquarter Stud', 'Westquarter', Tambo.	SH
R. W. Johnston, 'Wallum Hills', Santa Gertrudis Stud, Franks Lane, Wamuran.	SG
S. K. Johnston, Bondoon Charolais Stud, Toowoomba.	CL
C. H. & D. N. Jones, 'Glen Wilga', M.S. 423, Hopeland via Chinchilla.	HF
R. L. & S. S. Jones, 'Valley View' Stud, Samford Road, 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. Jakewski, '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, 'Bunyaville', M.S. 222, Oakey.	CL
Kengoon Pastoral Co., 'Kengoon' Studs, Kengoon, Kalbar.	BM, CL, DM, AF, PH
G. D. Kenman, 'Corang' Armstrong Creek via Dayboro.	FS
D. D., P. E. & M. H. Kennedy, 'Bellwood', M.S. 1550, Cootharaba via Pomona.	MG
B. W. & M. A. Kenny, 'Abernethy' Braford Stud, M.S. 1256, Gayndah.	BF
W. T. & G. M. Kenny, Shirley, Meson Street, 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 Past. Co., 'Argyle', Kingsthorpe.	SG
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
C. G. P. King, 'Bonnington', Goombungee.	SM
E. W. King, C/- Kengoon Pastoral Co., Dingley Dell, M.S. 1017, Biloela.	DM, AF, BM
J. L. King, Ridley Park, 79 Bridgeman Road, Bridgeman Downs, Aspley.	PH
King Ranch (Aust.), Ltd., 'Macquarrie Downs', Leyburn.	SG
King Ranch Development Co. P/L., 'Elgin Downs', Clermont.	SG
King Ranch Development Co. P/L., Tully River Station, Euramo.	SG
L. B. & M. Kirby, 'Kalanga' Stud, Wesley Road, Kallangur.	CL
E. Kirk & Co., 'Mt. Lawless' and 'Hazelton', Gayndah.	BM
D. V. Knight, Bonnieview, Old Fernvale Road, Vernor via Lowood.	JS
K. R. & M. S. Knight, Mt. Mee via Dayboro.	FS, AFS
S. G. Knight and Co., 'Baalgammon', Manumbar Road, Nanango.	AIS
S. S. Knitter, 'Charnu' Stud, M/S. 546, Forest Hill.	FS, JS
J. W. & M. J. Koehler, 'Wattleview', Yamsion.	HF
A. F. Krinke, 'Plainview', C/- Box 92, Pittsworth.	HF
B. R. & J. H. Kummerfield, 'Lonley', C/- P.O. Box 7, Goovigen.	GS
L. H. Kunst, 'Sunnyside', Miva.	BS
B. G. & R. M. Lamb, North Kolan, M/S 311, Avondale.	BM
Lambert Pastoral Co., 'Lambert', Charleville.	HF, PH
P. A. & J. L. Lange, 'Cerana', M.S. 222, Oakey.	AIS
K. J. & M. Lau, 'Rosallen', Goombungee.	JS
K. R. & E. A. B. Lawler, 'Coolibah' Stud, M.S. 292, Marburg.	AIS
A. E. Lawley, 'Arley A.I.S. Stud', Reesville Road, Maleny.	AIS
D. C. Lawrie, 'Croxley', M.S. 918, Toowoomba.	DM
F. Lax and Sons, 'Wyroona', M.S. 212, Oakey.	FS
C. F. Leacy, Coominga Droughtmaster Stud, 93 Summit Road, Pomona.	DM
Leacy and Pavan, 'Calmrancho', 93 Summit Road, 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
D. K. & J. A. Leeds, 'Murweh', Murweh Siding.	SH
N. F. & J. A. Leeson, 'Janel Park', Gowrie.	FS
Lenorco Past. Co., Pierce Avenue, P.O. Box 143, Caloundra.	CL
Lenroy Pastoral Co., 'Lenroy', Roma.	PH
W. M. Leonard & Sons, 'Welltown', Goondiwindi.	SH
Lester Brothers, 'St. Andrews' Stud, M.S. 623, Warwick.	AIS
R. K. Lethbridge, 'Warren Point Stud', Warren Point, Mitchell.	PH
C. J. & W. T. Lewis, 'Medland', Toowoomba Road, 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 Street, 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 Road, Dalby.	FS
G. W. Little, 'Glengarry', Jimbour.	MG
K. D. & J. K. Little, 'Woodleigh' Stud, Beaudesert.	JS
R. & M. Little, Lauroy Past. 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 Farmlands Pty. Ltd., 'Lagoon Park', Wallaville.	BF
G. L. & A. E. Lobegeiger, 'Sunny Grove' Jersey Stud, Moorang via Rosewood.	JS
N. E. Lobley, 'Neoby', Mt. Pleasant via Dayboro.	FS
D. D. Logan, 'Pine View', Kilcoy.	BS, BM
D. D. Logan, 'Glen Maurie', Kilcoy	BF, HFX
G. M. Logan, 'Neara Stud', Pineview, Kilcoy.	CL
Mrs. J. Logan, 'Jay-El' Stud, 'Callemondah', Tarome, M.S. 21, Kalbar.	BM
P. G. & P. E. Logan, M.S. 305, Innes Park, Bundaberg.	BM
W. M. & A. Logan, Logan Hereford Stud, 'Rose Farm', Gatton.	HF
L. K. Lostroch, 'Shamrockvale', M.S. 212, Oakey.	AIS
R. H. & B. M. Lostroh, 'Springlands' Stud, M.S. 366, Rosewood.	FS
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
R. L. & J. H. Lucas, 'Aeroview', M.S. 243, Kingaroy.	JS
K. D. & D. R. Ludwig, 'Sun Valley', Tarragalba, M.S. 411, Beaudesert.	FS
L. H. Ludwig, 'Riverview', Boyland, via Tamborine.	FS
S. H. & R. L. Ludwig, 'Glenvale', Boyland, via Tamborine.	GS

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

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

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

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

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

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

J. S. & E. M. MacQueen, 'Anembo', Highfields. **RP**

D. C. & A. G. MacTaggart, Kilkivan Brahman Stud, 7 Mile Lagoon Road, Coominya. **BM**

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

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

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

J. D. & D. B. McDonald, 'Kalonga', M.S. 656, Habana, via Mackay. **BS**

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

A. & M. McDowall, 'Teebone' Stud, 'Iona', Meandarra. **PH**

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

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

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

M. M. & G. E. McGuire, 13 Burton Street, 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 Road, Gympie. **AIS**

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

A. & R. D. McLaughlan, 'Brightview' and 'Akubra' Stud, Old Rosevale Road, Warrill View, Harrisville. **BF**

C. A. McMillan, 'Pine Avenue Stud', Rockhampton. **BM**

B. F. McNamara, Woodford Road, Peachester, via Woodford. **PZ**

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**

N. J. McNamara & Sons, 'Strathgyle', Bell. **BF**

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

M. & G. J. Major, 'Rosewood Downs', Limevale. **PH**

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. G. Margrie, 'Redvale', M.S. 767, Yarraman. **CL**

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

A. G., E. B. & L. G. J. Marshall, 'Yurunga', 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, 'Mioko', Owanyilla, M.S. 221, Maryborough. **DM**

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

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

J. L. & A. M. May, Gracemere. **BM**

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 Road, Rockhampton. **BM**

R. G. & M. D. Miller, 'Mt. White Stone', M.S. 428, Grantham. **BF**

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

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

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

P. A. Moore, 'Bell Tower', South Isis, Childers. **BF**

J. P. & G. E. Moran, 'The Belahs', Kumbarilla, M.S. 902, Dalby. **HF**

I. J. Morgan, 'Wannanong', Emu Vale. **MG**

A. E. Morris, 'Hillsdale', Gowrie Junction. **JS**

R. Morris, Piccadilly Past. Co., 'Cotswold Hills Stud', Gowrie Road, Toowoomba. **CL**

P. Mort, 'Franklyn Vale' Braford Stud, Franklyn Vale, Grandchester. **BF**

Moulton Pastoral Company, Noosa Charolais Stud, Old Tewantin Road, Cooroy. **CL**

G. W. Mowat, 'Town View', Jame Street, Yarraman. **AIS**

H. A. Muir, Church Road, 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**

L. J. Muller Pty. Ltd., 'Illoura', M.S. 21, Kalbar. **SG**

J. T. Mundell, 'Redmarley Stud', 'Redmarley', Condamine. **SH**

H. J. Mungall, 'Llagnum Acres', Ballandean. **FS**

K. J. Murphy, 'Ka-Amm' Stud, 'Homeleigh', Mt. Walker, via Rosewood. **BF**

J. D. & R. P. Murray, 'Bonnie Hills', Yamsion. **PH**

M.V. Pastoral Development, 'Noora Munga', Mutdapilly. **MG**

Naree Pastoral Co., c/- H. A. & N. E. Bloodworth, 'Merriwin', Longreach. **BF**

K. E. & D. M. Nauschutz, 'Gold Park', M.S. 118, Warra. **SM**

J. C. & A. Newton, 'Merryvale Stud', M.S. 2132, Upper Caboolture. **JS**

M. Newton, 'Malland', Kaimkillenbun. **PH**

M. R. & D. E. Newton, 'Royell', Kaimkellenbun. **PH**

D. J. & E. M. Nielson, 'Kintyre', Mt. Tyson. **MG**

S. E. Nielsen, 'Rosendale', Biloela. **DM**

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**

D. G. Noller P/L, 'Cunnadoo', Oakey. **CL**

J. D. & K. F. Noonan, M.S. 182, Laidley. **GS**

M. J. & B. F. Norgaard, "Yarrabine", Box 61, Post Office, Yarraman. **FS**

Norolle Past. Co., 'Norolle', P.O. Box 138, Roma. **PH**

A. F. & J. E. North, 'Northbrook', Millman. **BM**

North Bindango Pastoral Co., 'Naganimp' Stud, 'North Bindango', Roma. **PH**

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 Road, Yandina. **BF**

A. O'Dwyer, 'Mt. Manning Past. 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
Old Talgai Pastoral Co., 'Old Talgai', M.S. 422, Clifton.	SM
A. Olive, 'Nullegai', Marlborough.	BM
G. & K. G. Orphant, 'Westbank', Paterson.	HF
D. A. & M. Osbourne, 'Granville', M.S. 588, Alton Downs.	BF
J. D. O'Sullivan, Navilloween, M.S. 371, Greenmount.	PH
P. W. O'Sullivan, 'Navleigh' A.I.S. Stud, M.S. 371, Greenmount.	AIS
R. J. O'Sullivan, 'Beenbah' Stud, Killarney.	HF
B. W. Overton, Galaxy Stud, 5 Gap Road, Cedar Pocket, via Gympie.	CL
E. I. & S. Pacholke, 'Sunnylawn', M.S. 74, Clifton.	BF
Pagel and 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
(N. Rose) Palahra Farming Pty. Ltd., P.O. Box 19, Grantham.	BF
Paringa Grazing Co., 'Acacia' and 'Narringa' Studs, 'Paringa', Charleville.	AG, MG
L. S. Park & Co., 'Parklands', Maclagan.	MG
T. P. D. & P. M. Parker, 'Grazzi', M.S. 656, Barcoo, via Mackay.	BS
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 Past. Co., 'Sherglen Stud', 'Wallanba', Meandarra.	SG
K. S. R. & E. M. Patrick, Boyland, via Tamborine.	GS
S. & S. M. Paulger, 'Adadale', Kenilworth.	JS
Pearce Grazing Co., 'Pleystowe', P.S. 1494, Nanango.	BM
M. C., R. C. W. & I. M. Pearce, M.S. 582, Toowoomba.	JS
Pearson Bros., M.S. 1184, Murgon.	COM
A. J. Peden, 'Warroolaba Stud', Warrill View, via Harrisville.	AIS
J. N. Penglis, 'Pendale' Poll Hereford Stud, Westbrook Road, Wellcamp.	PH
M. J. & E. M. Perkins, Byce Jersey Stud, M.S. 692, Nanango.	JS
Perrett Grazing Partnership, P.O. Box 181, Kingaroy.	PH
K. J. & D. M. C. Perrett, 'Kerralea', Goomburra.	MG
Perrin Enterprises Pty. Ltd., 'Mascott Park' Stud, Gilston, via Nerang.	BM
A. V. Peters, Gladwyn Angus Cattle Co., M.S. 892, Meringandan.	AG
L. W., M. J. & G. F. Peters, 'Wilmington' AIS Stud, M.S. 212, Oakey.	AIS
P. J. & V. R. Peters, Ripple Vale Angus Stud, M.S. 583, 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 and Sons, 'Sunny View' Stud, M.S. 90, Kingaroy.	DM
Pickering Bros., 'Granite Vale' Stud, Sellins Road, Mt. Mee, via Dayboro.	FS
J. R. & R. E. Pickles, 'Saldanha', Coolabunia, via Kingaroy.	PH
J. F. Porter, Westwood Jersey Stud, M.S. 16, Maleny.	JS
C. J. & J. Potter, 'Uandi', Inglewood.	MG
N. R. Potter & Sons, 'Acton Vale' Stud, Wellcamp.	PH, AIS
W. T. & E. A. Potter, 'Derrymore', Texas.	CL
D. A. Price and Co., 'Deloraine', P.O. Box 7, Jimbour.	CL
G. D. & P. L. Price, 'Golden Pines Stud', Yabba Road, Imbil.	PH
C. & E. L. Prosser, 'Thuruna' Stud, Tara.	HF
H. D. N. & C. K. Quast, 'Lincolnfield', P.O. Box 150, Beaudesert.	SM
Qld. Sub-Normal Children's Welfare Assoc., P.O. Box 10, Gympie.	BM
E. R. & H. G. Quilty, 'The Grange', Nanango, c/- P.O. Box 7, Nanango.	SG
B. P. & M. Quinlan, 'Home Valley', Meringandan.	SW X CH
G. R. Radel, 'Happy Valley Stud', Coalstoun Lakes, Biggenden.	AIS
R. G. & G. R. Radunz, 'Cool Hill', Wooroolin.	SG
D. G. Raff, 'Forres', Karara.	AG
Rahane Patsoral Co., c/- A. O. Clark, Innisplain, via Beaudesert.	SG
O. A. Raine, 'Raine Drops Poll Hereford Stud', 43 Dunbeath Drive, Burpengary.	PH
J. L. & L. R. Ramsay, 'Binowee', Currawong Place, Caboolture.	CL
A. W. Rasmussen Pty. Ltd., 'Praguelands', Alligator Creek, 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
I. H. & J. P. Reck, 'Robynlea', Laidley.	GS
F. S. & J. V. Regan, 'Iluiga' Stud, 10 Gilbert Cres., Warwick.	MG
K. R. & G. A. Reid, Goomeran, Thane, via Warwick.	HF
Reid & Sons, 'Bundarra Hereford Stud', 'Gregmore', Malakoff Road, Dalby.	HF
A. Reilly, 'Lennie Brae Stud', Coongarrie, Condamine.	HF
R. L. & L. R. Reimers, Hills Road, Oakey.	PH
K. G. Reinhardt, 'Kenway' Red Poll Stud, M.S. 906, Mapleton.	RP
A. I. Reis, Marlan Past. Co., Marlan, Condamine.	HF, SM
B. W. & R. A. Reisenleiter, 'Viscount', M.S. 149, Gatton.	HF
D. J. & G. W. Reisenleiter, Qugee Grazing Partnership, M.S. 149, Gatton.	PH
Research Station, Biloela.	FS
S. B. & L. W. Reynolds, 'Moorlands', M.S. 918, Toowoomba.	HF
N. E. & B. G. Richardson, 'Mattaranka' Friesian Stud, Mt. O'Reilly Road, Samford.	FS
L. E. & R. E. Rider, 'Opal Stud', Jimbour.	BS
E. G. & B. Roach, 'Omaru', Bellmere Road, Caboolture.	CL
K. O. Roberts, Purga Pastoral Co., 9 Woodgate St., Churchill.	CL
J. & E. Robinson, 'Pinora Hereford Stud', Railway Street, Jackson.	HF
Rockton Nominees Pty. Ltd., 'Guijar' Stud, c/- Austral Industries P/L, P.O. Box 109, Ipswich.	CL
W. E. & R. M. Rose, 'Rosevale' Friesian Stud, M.S.I. 1184, Murgon.	FS
A. J. T. & I. M. Ross, 'Rosdale' Stud, Dayboro Road, Samford.	FS
W. Ross & Co., 'Starview' Stud, M.S. 23, Rosewood.	AIS
Mrs M. A. Rostedt, M.S. 1916, Cryna Road, via Beaudesert.	HF

F. T. Rowe, 'Green Acres', Banana. **BM**

H. G. & B. Rowe, 'The Hollow', Mirani. **BS**

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

F. & G. Ruckman, 'Sarabah', M.S. 413, Beaudesert. **BF**

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

H. L. Rutledge and 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**

K. W. W. & V. J. Schlodfeldt, 'Wyandah', Kargorum Road, 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 Road, Mt. Samson, via Dayboro. **FS**

N. F. Schmidt, 'Pampoola Stud', 'Avondale', Cunnamulla. **SG**

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 Road, via Nanango. **FS**

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

E. I. Scott, J. S. Edwards and L. M. Randall, 'Auchenflower', Glenore Grove, via Forest Hill. **AY, FS**

V. G. Scott, 'Wiluna Friesian Stud', 'Wiluna', Wowan. **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**

L. & E. F. Sellin, 'Pasture Glen', Kings Scrub, Dayboro. **FS**

J. H. Semple, 'Braeview', Biloela. **SG**

A. G. Seppanen, 'Roena—Amarylis' Stud, M.S. 371, Greenmount. **CL, SM**

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

D. R. & R. J. Sharp, 'Khancoban', Newspaper Hill Road, Belli. **SG**

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**

J. Simon, 'Broshami' Stud, Maleny. **BM**

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

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

Dr C. N. Sinnamon, 'Brora Stud', Oakey. **DM**

R. L. Sinnamon, 'Robenlea' Stud, Robenlea, Harlin. **SG**

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

A. W. & M. J. Skerman, 'Ar-Dee' Braford Stud, 'Rossman Downs', M.S. 590, Wandoan. **BF**

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

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

W. R. Slatter & Sons, Berry Glen 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 Road, M.S. 1096, Nambour. **AG**

J. M. & G. M. Smith, 'Smith's Brahman Stud', 'Rangeview', M.S. 150, Pittsworth. **BM**

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

L. D. & G. L. Smith, 'Sweetacres A.I.S. Stud', Lot 6, Rossmore Road, Kingston. **AIS**

J. W. & K. J. Smith, 'Jude-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**

N. D. Solomon, 'Springwood', Kureelpa, Mapleton. **GS**

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

A. N. & S. L. Sorley, 'Alma', Bell. **BM**

A. W. P. & R. A. Sorley, 'Alma', Bell. **BM, BF**

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

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

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

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

Stanley County Properties Pty. Ltd., 'Alkira Regis', Landsborough Road, Maleny. **SM, HFX**

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

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

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

Dr M. E. Stevens, 'Wyalla', North Branch, Maryvale. **SG, HF**

S. R. & I. B. Stevens, 'Lasswade' Stud, Peak Crossing. **RS**

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

N. L. Stiller, 'Vine Veil', Guluguba. **PH, HFX, CH**

M. Stitz, Ocean View, Dayboro. **BF**

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

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

J. G. Stubbings, 'Stratton Vale', Lacey's Creek, Dayboro. **FS**

E. A. Stubbs, 'Baroona Park', Canaga Road, Chinchilla. **BF**

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

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

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

K. Sutton, "Startwell', Basin Road, Wamuran. **BM**

Swan Hill Pastoral Co., 'Swan Hill', Blackall. **SG**

Talana Pastoral Co., 'Talana', M.S. 960, Roma. **PH**

Tantallon Grazing Co., 'Tantallon', Darlington, via Beaudesert. **HF**

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

J. & B. J. Teese, 'Lyndith Stud', Veresdale, via Beaudesert. **AIS**

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

H. R. & D. M. Thomas & Son, 'Eurangatuck', Jandowae.	HF
W. D. J. & K. Thomas, 'Bryn', M.S. 720, Millmerran.	HF
C. Thompson, 'Kingston', Dulacca.	BF
W. H. & D. M. Thompson, P.O. Box 20, Nanango.	AIS
J. R. H. & R. V. Thomson, 'Dewrang', Natural Bridge, via Nerang.	JS, AIS, GS
M. A. S. Thomson & G. J. Michael, Meltowia Stud, M.S. 335, Toogoolawah.	FS
H. G. M. & B. V. Thorne, 'Dewhurst Stud', Hatton Vale, via Laidley.	JS
H. A. Thornton & Sons, 'Bellmore', Noolmar Road, Kilcoy.	JS
T. L. & V. J. Tidcombe, 'Wallumlands A.I.S. Stud', M.S. 483, Bells Bridge, Gympie.	AIS
I. G. & D. E. Tidswell, Lake View, via Tewantin.	CL
A. J. & E. A. Tigell, 'Avondale', Googa Creek, Blackbutt.	MG
J. R. Todd, 'Aberfoyle', Laravale, via Beaudesert.	JS
Tomkins Pastoral Co., Stuart's Creek, Roma, P.O. Box 479, Roma.	HF
A. C. Toney, Flagstone, M.S. 411, Beaudesert.	GS
Mrs B. Tout, 'Berrima', Elbow Valley, Warwick.	AG
N. R. & M. A. Towner, 'Poinciana Stud', Sister Tree Creek Road, Kin Kin.	FS
R. N. & C. M. Towner, Par Deux Droughtmaster Stud, Thornton, M.S. 182, Laidley.	DM
N. C. Tranberg, Loloma Brahman Stud, Upper Pin Barren Road, 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
T. J. & A. C. Tutton, Hopkins Street, Beaudesert.	COM
University of Queensland, Vet. Science Farm, Moggill Road, Pinjarra Hills.	MIXED
L. M. & R. G. Vandersee, 'Rovan', M.S. 26, Crows Nest.	SG
M. Vandoren, 'Glen-Aero' Stud, P.O. Box 46, Applethorpe.	MG
R. Van Ee, 'Sheaveen Downs', Ranger Road, Gatton.	BM
P. & B. H. Van Popering, 'Brunetta' Jersey Stud, Coominya Road, 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
E. Volker, 'Mt. Rascal' Stud, P.S. 1497, Toowoomba.	RP
S. A. & J. A. Volker, 'Mt. Rascal' Stud, M.S. 371, Greenmount.	RP
W. T. & L. Voss, Mt. Vista Stud, M.S. 292, Glamorganvale, Ipswich.	AIS
P. F. Wadley, Nindethana and Bendemeer Studs, M.S. 21B, Kalbar.	JS, FS
D. V. Wagner & Co., 'Aranbanga Braford Stud', 'Barncleuth', Gayndah.	BF
Wal-Anne Pastoral Co., 'Wal-Anne' Stud, P.O. Box 2, Haden.	PH
I. E., M. A. & P. L. Walker, Strathmore Santa Gertrudis Stud, No. 65, 'Strathmore', Longreach.	SG
I. L. & M. R. Walker, Menlo Park Stud, M.S. 1573, Southbrook.	DM
Sir James Walker, 'Cumberland', Longreach.	SG
Sir James Walker, 'Camden Park', Longreach.	SG
M. Walker, 'Avoca', Barcaldine.	SG
R. A. & M. L. Walker, Rosewood.	SM
Walloon Pastoral Co., 'Walloon', Banana.	AF, X BR
R. & M. Walther, 'Roseborough', P.S. 1790, Lowood.	BM
D. L. Ward, 'Willow Valley' Stud, Barambah Road, Nanango.	JS
G. I. Warfield, 'Dernan Court', M.S. 223, Nobby.	PH
R. C. & S. A. Warren, 'Garrendenny', 77 Hope Street, Kilcoy.	FS, AFS
P. R. & H. D. Watters, 'Lynford' Stud, Callemondah, Ballandean.	JS, HF
G. C. & C. A. Webster, Gympie.	BF
M. G. & G. E. Weier, 10 Wickham Street, Laidley.	PH
B. G. & B. Wells, Bundilla Murray Grey Stud, Thorton, M.S. 182, Laidley.	MG
N. R. & G. Wenzel, 'Gwen Ray Stud', M.S. 342, Roadvale.	AIS
E. E. W. West, 'Belmadochie' Friesian Stud, 19 Oatlands Court, Samford.	FS
R. West, 'Boxmoor' Stud, 'Boxmoor', Grantham.	BF
H. L. F. Westcott, 'Olympus', Munbura, via Sarina.	BM
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 Past. Co., Wharton Creek, Springsure.	BF
K. Wheildon, 'Good Luck', Lower Cressbrook, Toogoolawah.	FS
E. D. & H. White, 'Wombbalano' Stud, 29 School Road, Logan Reserve.	SG
R. T. & B. A. White, 'Wilangi' Brahman Stud, Wumalgi.	BM
Whitney Past. Co., Claverton Stud, Wyandra.	SH
C. I. & G. J. Wieland, 'Alhaven', Allandale, via Boonah.	MG
Wilga Park P'ship, 'Wilga Park', M.S. 658, Texas.	BF
F. A. Willey, 'Mar-sel Stud', M.S. 292, Lowood Road, Glamorgan Vale.	AIS
I. G. R. Williams, 'Spion Kop', M.S. 1136, Toogoolawah.	FS, AFS
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
D. P. & E. A. Wilson, 'Winbirra', M.S. 852, Hodgson Vale.	AIS, HF
J. C. Wilson, 10 William Street, Buderim.	SM
J. N. Wilson & Son, 'The Valley', Blackbutt.	DM, BM
R. A. & M. R. Wilson, 'Oneden Stud', Oneden Road, Proston.	GS
W. G. Wilson, 'Tarko', M.S. 444, Jondaryan.	RP
B. J. & I. M. Winkel, 'Gibba' Stud, Sellins Road, Mt. Mee.	FS
J. & L. M. Winks, Allanbrae, Laidley.	HF
S. J. & N. E. Wippell, 'Morocco', Roma.	HF
P. W. Wiseman, 'Clover Grove', P.S. 1973, D'Aguilar, via Woodford.	JS
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
I. S. & E. J. Woodside, 'Go-a-Long' Stud, 'Wallace Brae', Guluguba.	MG
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 Road, M.S.F. 956, Montville.	FS
Wyalla, T.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
Yarra Yarra Braford Stud, c/- F. M. Hendy, 2 State Farm Road, Biloela.	BF
Dr B. R. Yeates, 'Ugarapul', Boonah.	DM
A. J., C. J., I. G. & J. E. York, Yorkaringa Stud, 'Grain Farm', Wallumbilla.	PH
A. J., C. J., I. G. & J. E. York, Yorkaringa Stud, 'Taunton', Wallumbilla.	PH
York Bros., 'Mount Leigh' Stud, 'Mount Leigh', Wallumbilla.	PH
N. W. York, 'Mt. Leigh', 'Wonga Park', Wallumbilla.	HF
N. W. & B. E. York, 'Yorkaringa Stud', 'Kundabung', Wallumbilla.	PH
V. & R. York, 'Victory Downs', P.O. Box 127, Dalby.	HF
G. S. Young & M. J. Cooper, 'Coograli', North Maleny Road, Maleny.	BF
A. R. Ziebarth, 'Lynton Brahman Stud', 35 Campbell St., Laidley.	BM
L. W. & H. M. Zirbel, 'Lacewood', Derrymore, via Helidon.	PH
R. & J. Ziesemer, Belbar Stud, Bell.	HF
E. F. & I. M. Zischke, 'Lynview' Jersey Stud, M.S. 231, Laidley.	JS

INDEX

AF—Afrikaander
AG—Angus
AIS—Australian Illawarra Shorthorn
AMZ—Australian Milking Zebu
AY—Ayrshire
BR—Belmont Red
BF—Braford
BM—Brahman
BS—Brangus
CL—Charolais
CH—Chianina
COM—Commercial
DM—Droughtmaster
FS—Friesian
GS—Guernsey
HF—Hereford
JS—Jersey
LM—Limousin
M—Mixed
MG—Murray Grey
PH—Poll Hereford
PS—Poll Shorthorn
RP—Red Poll
SW—Sahiwal
SG—Santa Gertrudis
SH—Shorthorn
SM—Simmental
MA—Marchigina
DV—Devon
PD—Poll Devon
RS—Red Sindhi
PZ—Pinzgauer
AFS—Australian Friesian Sahiwal

The following herds have been withdrawn from the Scheme:

Australian Estates, Eurella, Mitchell.	SG
K. & L. Bredhauer, 'Caranna', Charleville.	PH
Mrs E. B. Corden, 'Currajong Angus Stud', 'Netherby', Warwick.	AG
L. T. & T. O. Christensen, 'Coolaroo Jersey Stud', Moorang, via Rosewood.	JS
Ford Holdings, Maraja Stud, P.O. Box 238, Caloundra.	BM
Sir A. Hulme, 'Alcheringa Stud', Highlands Road, Eudlo.	DM
R. B. & S. R. Huth, 'Crestview', Roadvale.	FS
M. R. Juster, 'Ferndale', Kandanga.	BF
F. W. & E. M. Kiepe, M.S. 223, Nobby.	FS
Mindaribba Pastoral Co., c/- W. H. Perkins, P.S. 1608, Nanango.	SG
H. J. Murray, 'Greydale' Murray Grey Stud, Upper John Street, Rosewood.	MG
Dr & Mrs R. H. Parker, 'Little Sussex Charolais Stud', Charleville.	CL
V. V. & G. R. Parker, 54 Rifle Range Road, Gympie.	AY
A. J. & M. T. Peters, 'Ashwell', M.S. 366, Rosewood.	FS
Dr S. M. Piaggio, Natural Arch Farm, Natural Bridge, Numinbah Valley, via Nerang.	FS
R. J. Pontifex, Roburn Friesian Stud, M.S. 212, Oakey.	AIS
A. A. & M. I. Ranger, 'Glenoyra', M.S. 222, Oakey.	

CHANGING YOUR ADDRESS?

Please let us know as soon as possible if you intend changing your address.

Because the addressed wrappers and journals are printed separately, changes cannot take effect until the next batch of wrappers is printed.

This means that, in some cases, subscribers will receive the next issue at their old address.

If possible, 2 months' notice should be given to ensure your journal is sent to the correct address.

Maize planting guide 1979-80 season

MAIZE hybrids recommended for planting in the 1979–80 season are listed below.

The hybrids have not been ranked in order of preference. Those listed 'for trial' should only be sown in limited areas to evaluate their performance.

Two or more hybrids should be sown on each farm to minimize the risk of loss through adverse seasonal and other conditions.

Plant populations

The planting rate will be governed by factors such as soil type, hybrid, climatic conditions, district, planting time and soil moisture. The plant population for rain-grown crops will vary between 20 000 and 30 000 plants per ha. The rate should be increased to establish about 50 000 plants per ha when the crop is grown under irrigation.

Seed is available commercially in a range of shapes and sizes. Selection from this range can be made to suit the type of planting machinery being used. The size usually ranges between 2 600 to 4 500 seeds per kg. Most commercial seed companies mark the seed count per kilogram on the container.

Disease

The main diseases affecting maize are illustrated in the *Handbook of Plant Diseases* (Volume 2) published by the Department of Primary Industries.

compiled by S. R. Walsh, Agriculture Branch

The more important diseases are:

COMMON LEAF BLIGHT. The fungus *Drechslera turcica* produces grey or light-brown, large, spindle-shaped leaf spots commonly up to 15 x 2 cm in size. This disease may be serious in susceptible hybrids.

MAYDIS LEAF BLIGHT. Maydis leaf blight (*Drechslera maydis*) is restricted to North Queensland. The change by seed producers from T cytoplasm to N cytoplasm has effectively controlled this disease in South Queensland.

HEAD SMUT. In North Queensland and certain areas of the South Burnett region, head smut caused by *Sphacelotheca reiliana* is prevalent. Grain yields may be seriously reduced in crops with a heavy infection because the grain is replaced by a mass of fungal spores.

Seed treatments may destroy externally-borne spores on the seed but will not protect a crop against infection from smut in infested soil. This disease may be serious in susceptible hybrids in North Queensland; it is a minor disease in South Queensland.

MAIZE DWARF MOSAIC. This is a major disease in South Queensland maize crops if susceptible hybrids are grown. Maize dwarf mosaic is caused by infection with the Johnson grass strain of sugarcane mosaic virus which is transmitted by aphids.

Infected plants of susceptible hybrids show conspicuous stripes or mosaic and ringspot patterns. Severe stunting may result, particularly when plants are infected early. The virus is maintained between seasons in Johnson grass and stand-over fodder sorghum.

Disease control cannot be effectively achieved with insecticides and Johnson grass cannot be economically eradicated in all situations. Control of the disease is achieved by sowing resistant hybrids.

WALLABY EAR. This disease is a major disease in late coastal crops. It is associated with infestation by a small, pale-coloured leafhopper and is generally more severe in late plantings in coastal districts.

Affected plants are dark green and stunted. The leaves stand out stiffly at sharp angles to the stalk and the veins on the under surface are very prominent. Ear development on severely affected plants is very poor.

COMMON RUST. This is a common but minor disease.

DIPHODIA ROTS. Ear rot may be serious in North Queensland.

GIBBERELLA ROTS. These rots may be serious in North Queensland but are only of moderate significance in South Queensland.

A number of other stalk and ear rots have been recorded; infection is usually minor but may vary in intensity between districts and seasons.

Maturity

Hybrids may vary in maturity depending on the environment in which they are sown.

The recommendations are basic information only and further details should be sought from your local Agricultural Extension Officer.

A summary of the characteristics of maize hybrids is shown in the varietal planting guide.

VARIETAL PLANTING GUIDE

Region	Planting Time	Hybrids
Far North Queensland—		
Cook, Mareeba, Atherton, Eacham, Herberton, Mulgrave, Johnstone, Cardwell, Douglas, Etheridge, Hinchinbrook Shires	Dec.–mid Feb.	VS: QK413 S: QK690, QK694, QK231, QK217 MS: QK487 (QK231, QK217 should NOT be sown in head smut areas)
North Queensland—		
Dalrymple, Thuringowa, Ayr, Bowen, Proserpine Shires	*Irrigated:* Mar.–July	MS: XL99, XL399 M: XL81
	For trial: Mar.–July	M: Sergeant
Capricornia—		
Livingstone, Fitzroy, Calliope, Broadsound Shires	Dec.–Jan. *For trial:*	M: XL81, Sergeant
	Dec.–Jan. end Dec.–end Jan.	M: Captain, GH5004 S: GH390 MS: XL99 M: XL81, Sergeant
Burnett—		
Miriam Vale, Kolan, Gooburrum, Woongarra, Isis, Perry, part Biggenden, Hervey Bay, part Tiaro, Woocoo Shires	late Aug.–early Sept.	S: Q1280, GH128, GH390 MS: XL99 M: XL81
	For trial: late Aug.–early Sept.	M: Sergeant
Gayndah, Mundubbera, Part Biggenden Shires	mid Nov.–early Jan. *For trial:*	M: Sergeant
	mid Nov.–early Jan.	M: Captain, GH5004
Eidsvold, Monto Shires	mid Nov.–early Jan.	MS: XL99, XL399 M: XL81, Sergeant
	For trial: mid Nov.–early Jan.	M: Captain, GH5004

Region	Planting Time	Hybrids
South Burnett—		
Kingaroy, Nanango, Wondai, Murgon, part Kilkivan, part Rosalie Shires	mid Nov.–Dec.	MS: XL99 M: XL81, Sergeant
	For trial: mid Nov.–Dec.	MS: Major M: GH5004
Near North Coast—		
Widgee, Noosa, part Tiaro, Maroochy, Landsborough, part Kilkivan Shires	Nov.–Jan.	S: GH390 MS: XL99, XL399 M: XL81, Sergeant, GH5004
	For trial: Nov.–Jan.	MS: Major
Moreton—		
Caboolture, Pine Rivers, Redlands, Logan, Albert, Beaudesert, Moreton, Esk, Kilcoy, Boonah, Gatton, Laidley Shires	Sept.–Dec.	S: Q1280, GH128 MS: XL99, XL399 M: XL81
	For trial: Sept.–Dec.	M: Sergeant, Captain, GH5004
Darling Downs—		
Wambo, Chinchilla Shires	Sept.–Nov.	MS: XL99, XL399 M: XL81, Sergeant
	Oct.–Dec.	M: XL81
Pittsworth, Millmerran, Jondaryan, Crows Nest, part Rosalie Shires	Oct.–Dec.	MS: XL99, XL399 M: XL81, Sergeant
	For trial: Oct.–Dec.	Q: XL66
Clifton, Allora, Cambooya, Rosenthal, Glengallan Shires	Oct.–Dec.	MS: XL99, XL399 M: XL81, Sergeant
	For trial: Oct.–Dec.	Q: XL66
Stanthorpe Shire	Nov.–Dec.	M: XL81, Sergeant
Darling Downs—All Shires except Inglewood	*Irrigated:* Oct.–Dec.	MS: XL99, XL399 M: XL81, Sergeant
	For trial: Oct.–Dec.	Q: XL66 MQ: XL77 M: Captain, GH5004
Inglewood	Oct.–Dec.	M: XL81, Sergeant
Near South-west—		
Balonne Shire	*Irrigated only:* Oct.–Dec.	MS: XL99, XL399 M: XL81
	For trial: Oct.–Dec.	M: Sergeant

Guide to Maize Characteristics

Company/Hybrid	Maturity	Plant Height	Cob Height	Suckering	Number of Cobs	Husk Cover	Reaction To				
	Sown Oct.–Nov.						Turcica Leaf Blight	Maydis Leaf Blight Race O	Head Smut	Maize Dwarf Mosaic	Wallaby Ear
Annand Robinson & Co											
RX220	M	M	M	M–H	M	L	N.A.	N.A.	N.A.	N.A.	N.A.
RX204	M	M	M	M	M	T	N.A.	S	N.A.	MR	R
De Kalb Seed Co.											
XL45	Q	S	S	L	S	O	N.A.	N.A.	N.A.	S	S
XL66	Q	MS	MS	N	S	L	N.A.	N.A.	N.A.	S	N.A.
XL361	MQ	MS	MS	N	S	L	N.A.	N.A.	N.A.	S	R
XL77	MQ	M	M	N	S	L	R	S	N.A.	MR	R
XL81	M	M	M	N	S	T	*S	I	MR	MR	R
XL99	MS	MT	MT	L	S	T	R	MR	MR	HR	S
XL399	MS	MT	M	L	S	T	HR	I	MR	MR	I
Northrup King											
PX48	MQ	M	M	L	S	T	N.A.	N.A.	N.A.	N.A.	N.A.
PX74	M	MT	M	L	S	T	N.A.	N.A.	N.A.	N.A.	N.A.
Pioneer											
Sergeant	MQ	M	M	L	M	L	R	S	N.A.	MR	S
Captain	M	M	M	L	M	L	N.A.	N.A.	N.A.	N.A.	N.A.
Major	MS	M	M	N	M	L	N.A.	N.A.	N.A.	N.A.	N.A.
QK GROUP											
Q1280	S	T	T	L	S	T	R	I	R	HR	I
QK217	S	T	T	N	S	T	I–MR	S	**HS	HR	N.A.
QK231	S	T	T	N	S	T	MR	MR	S	HR	N.A.
QK413	VS	VT	VT	N	S	T	R	R	HR	N.A.	N.A.
QK487	MS	MT	MT	L	S	L	MR	HS	R	S	N.A.
QK690	S	T	T	N	S–M	L	N.A.	N.A.	N.A.	N.A.	N.A.
QK694	S	MT	MT	N	S–M	L	N.A.	N.A.	N.A.	N.A.	N.A.
GH Group											
GH128	L	T	T	L	S	T	R	I	R	HR	I
GH390	L	T	T	L	S	T	R	I	S	MR	I
GH5004	M	M	M	M	S	M–T	N.A.	R	N.A.	HR	R

Maturity
Q = quick
MQ = Medium quick
M = medium
MS = medium slow
S = slow

Plant Height and Cob Height
T = tall
MT = Medium Tall
M = medium
MS = medium short
S = short

Suckering
N = nil
L = light
M = medium
H = heavy

Number of Cobs
S = single
M = Multiple
S–M = single, some multiple

Reaction to Disease
HR = highly resistant
R = resistant
MR = moderately resistant
I = intermediate
S = susceptible
HS = highly susceptible
N.A. = no information available

* XL 81 contains the Hooker gene resistance and was previously resistant to the common race of turcica leaf blight. A new race which has overcome this resistance is now found in South-east Queensland. This loss of resistance may not seriously reduce yields in all circumstances.

** Reaction of some hybrids may vary with the location for example, QK217 is susceptible in North Queensland but resistant in South Queensland.

The wax flowers of South-eastern Queensland

by Beryl A. Lebler, Botany Branch

THE common name 'wax-flower' is usually applied to plants belonging to the genus *Eriostemon*. In these plants, the flowers of most species have petals which are waxy and thick in texture.

The British Botanist Sir James Edward Smith described the first wax-flower in 1798 and gave it a name formed by combining two Greek words which meant woolly stamen. In wax-flowers, the staminal filaments are flattened and have prominent marginal fringes of fine, white hairs.

Eriostemons are closely related to boronias. Both genera have flowers with free, spreading petals. The stamens in both are twice the number of the petals and both have aromatic leaves due to the copious oil glands found either in the leaf tissue or on the surfaces of the leaves. In boronias the leaves are opposite, but eriostemons have alternate leaves.

Wax-flowers are always woody shrubs. They can be glabrous or slightly hairy. One of the more obvious features is the presence of glandular warts on the stems and sometimes on the leaves. The flowers can be axillary, or terminal and solitary. If axillary, they may be solitary and on long slender pedicels, but in one species there is an inflorescence with three or more flowers.

Individual flowers have five sepals, five petals and ten stamens. The stamens opposite the petals are shorter than the others. The staminal filaments curve over the ovary and are arranged like a pyramid. They end in versatile anthers with a heart-shaped base and the connective is produced beyond the anther into a small point. A fleshy-lobed disc lies inside the base of the filaments and surrounds the ovary which is embedded in it.

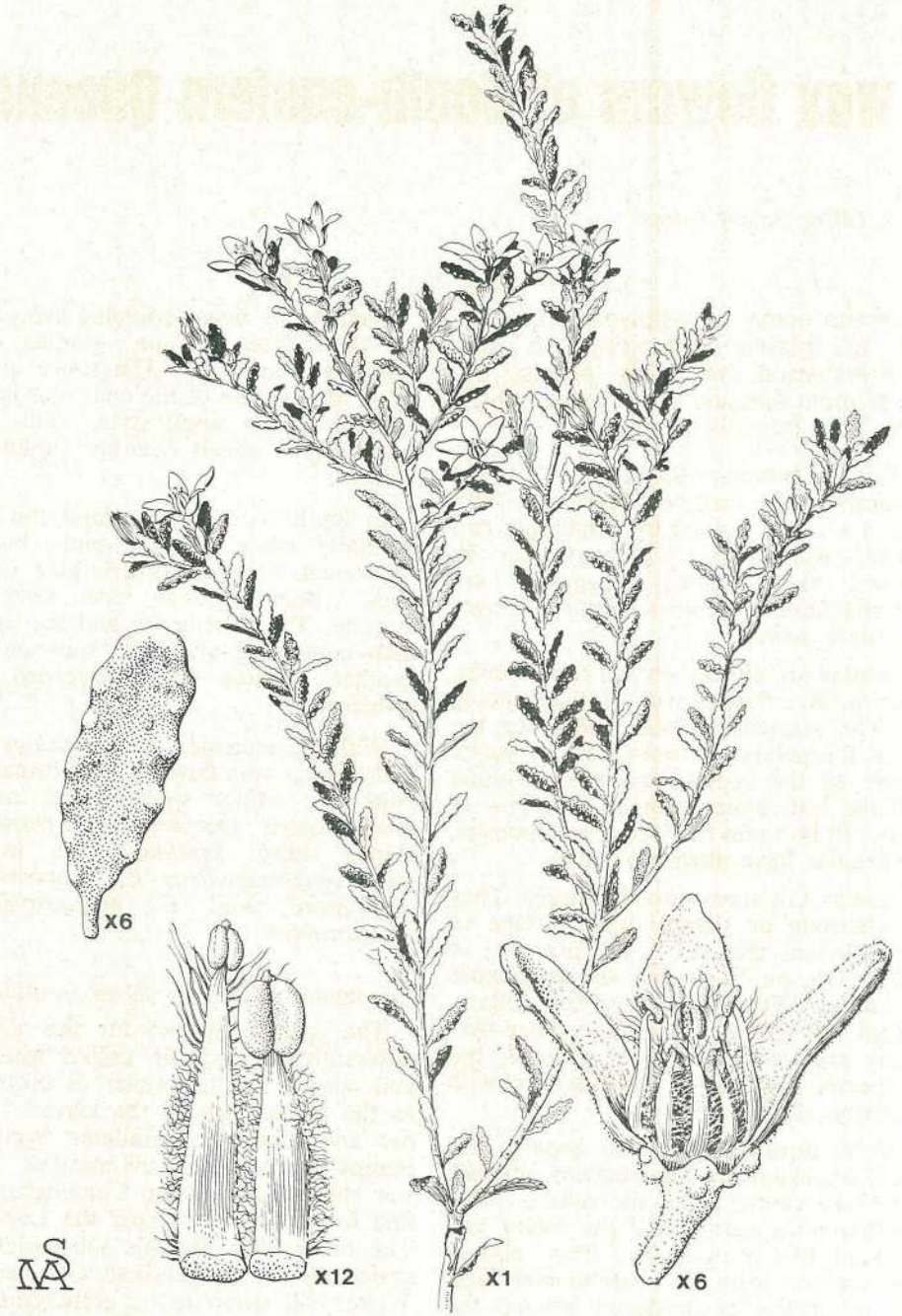
Usually the ovary contains five cells. These are either free from one another or slightly joined at the base. The styles are inserted below the middle of the cells and immediately join to form a single style. This ends in a small stigma which is either capitate or five-lobed.

In South-eastern Queensland, the flowers are normally white or pale pink, but Western Australian wax-flowers are blue or lavender pink. Some species have sweetly-scented flowers. The fruit is dry and the ripe carpels, each containing one seed, separate from one another. These dry, one-seeded fruits are called cocci.

With the exception of one species from New Caledonia, wax-flowers are found only in Australia. Four species grow naturally in South-eastern Queensland: *Eriostemon difformis* subsp. *smithianus, E. myoporoides* subsp. *queenslandicus, E. myoporoides* subsp. *leichhardtii,* and *E. myoporoides* subsp. *myoporoides.*

Eriostemon difformis subsp. *smithianus*

The specific epithet for this plant means differently formed, or unlike what is usual and normal for the genus. It probably refers to the appearance of the leaves. These are flat and thin with glandular warts giving a bumpy appearance to the margins. This name was suggested by Allan Cunningham when he first found this plant near the Lachlan River. The name used for this subspecies was suggested by the Queensland Colonial Botanist, Walter Hill, when he first collected this plant in the Wide Bay District and sent it to Melbourne for identification. The reason for his choice of name is not recorded.



Eriostemon difformis subsp. *smithianus*

DESCRIPTION: This is usually a densely-branched, compact shrub. It can grow to a height of 2 m but is often less than half that size. Glandular warts are scattered over the stems, but are so sparse that the stem is almost smooth. Magnification shows the presence of very minute, erect hairs—particularly on the young twigs. The most striking feature of this wax-flower is the presence of large glandular warts on the margins of the flat leaves which give them a bumpy appearance. In most plants, the leaves are dark green. The petioles lie flat against the stems and the leaves are relatively thin in texture, oblong to broadly elliptic and up to 0·8 cm long and 0·2 cm wide.

This wax-flower differs from all the others in South-eastern Queensland in having its flowers predominantly at the ends of the branches. Some of the flowers may appear to be axillary but are actually terminal on very short lateral branches.

Usually the petals are white, but pink flowers have been found in some localities. The pedicels are stout, about 0·5 cm long and are minutely hairy. Short, triangular, fleshy sepals alternate with the petals. These are not smooth and waxy, but have a dense covering of matted, short, woolly hairs on both surfaces. The white, flattened staminal filaments have a dense fringe of long, white hairs on both margins. Orange-coloured pollen is released from the heart-shaped anthers. When some of the stamens are removed, the conical green ovary can be seen. It ends in a short style with globular stigmas.

FLOWERING TIME: The main flowering period is in autumn but a secondary flush occurs in early spring.

HABITAT: This wax-flower is usually found growing in rock crevices on the upper slopes of mountains or on cliffs. It has also been collected from a river bank and from poorly-drained clay in tea tree eucalyptus forest.

DISTRIBUTION: This plant grows only in the north-eastern coastal plains of New South Wales to as far south as the Macleay River, and in Queensland to as far north as the Burrum River.

Eriostemon myoporoides subsp. *queenslandicus*

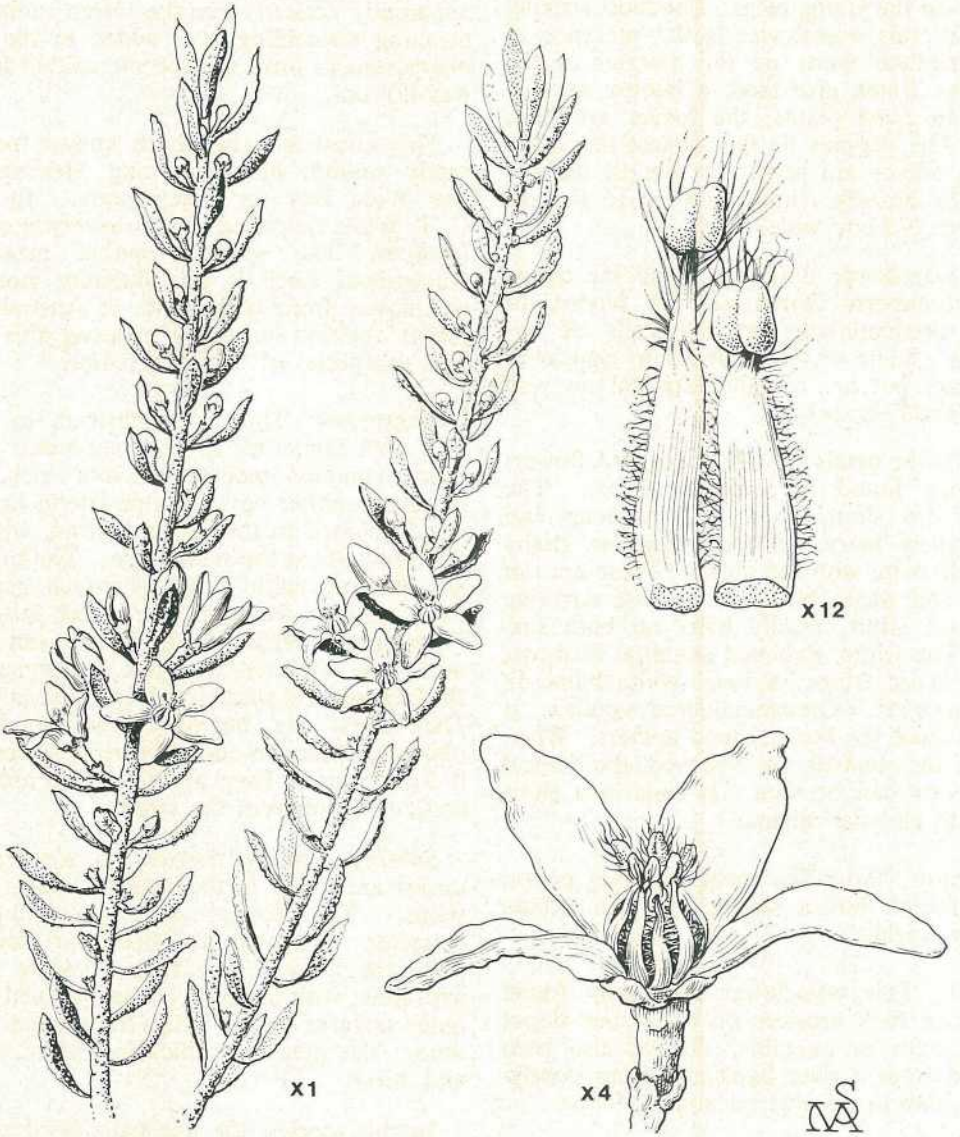
Myoporum is a genus of Australian evergreen trees and shrubs with transparent spots in the leaves. These plants had been known for many years before this wax-flower was found. A similarity between the two was apparently noticed since the Green suffix *oides* meaning resembling, was added to the name *myoporum* to form the specific epithet for this wax-flower.

This eriostemon had been known from the sandy wallum flats bordering Moreton Bay and Wide Bay for many years. In 1941, C. T. White described it as *Eriostemon queenslandicus*. The specific epithet means of Queensland since it was different from any wax-flower from other parts of Australia. A recent revision has now reduced this name to a subspecies of *E. myoporoides*.

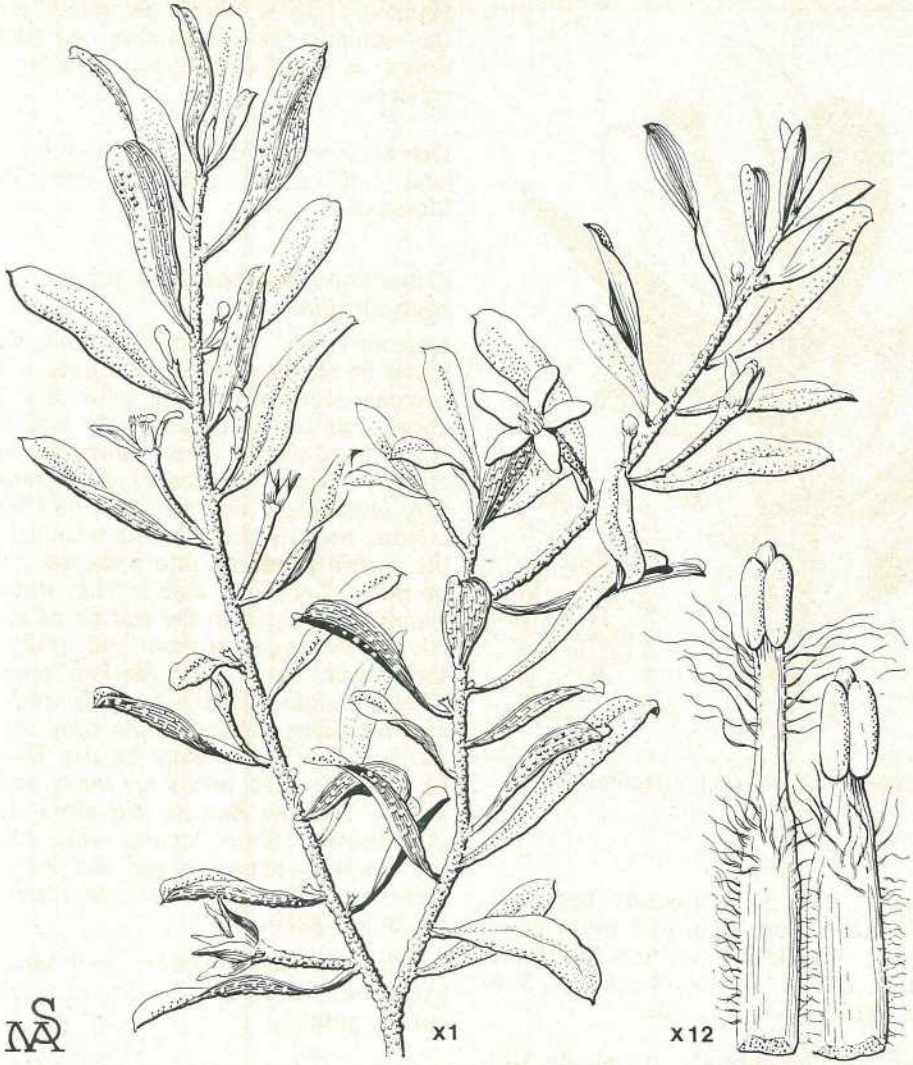
DESCRIPTION: This is a subshrub to 0·5 m high with numerous short, erect stems arising from a common underground root stock. These stems can either be simple or lateral branches are developed in the upper portion, with several branches at the same node. The branches are glabrous with a few scattered glandular warts, and the leaves are very thick in texture. Their upper surfaces are smooth but raised warts are scattered over the lower surfaces. Both leaves and stems are blue-green in colour. The leaves are narrow-elliptic to narrow-obovate, obtuse to acute, up to 3 cm long and 0·5 cm wide. They are sessile or almost so and curve out from the stem.

Solitary axillary flowers on slender peduncles are found in the upper portions of the stems. The flowers are almost 2 cm in diameter. Although the buds are pale rose-pink, the flowers soon fade to white flushed with pink, with the pink colour retained on the outer surfaces on the petals for a much longer time. The petals are thick in texture, smooth and waxy.

In this species, the fine hairs bordering the staminal filaments are very short and straight. The anthers are white and release pale-coloured pollen. Immediately beneath the anthers are hairs which are twice as long as the anthers.



Eriostemon myoporoides subsp. *queenslandicus*



Eriostemon myoporoides subsp. *leichhardardtii*

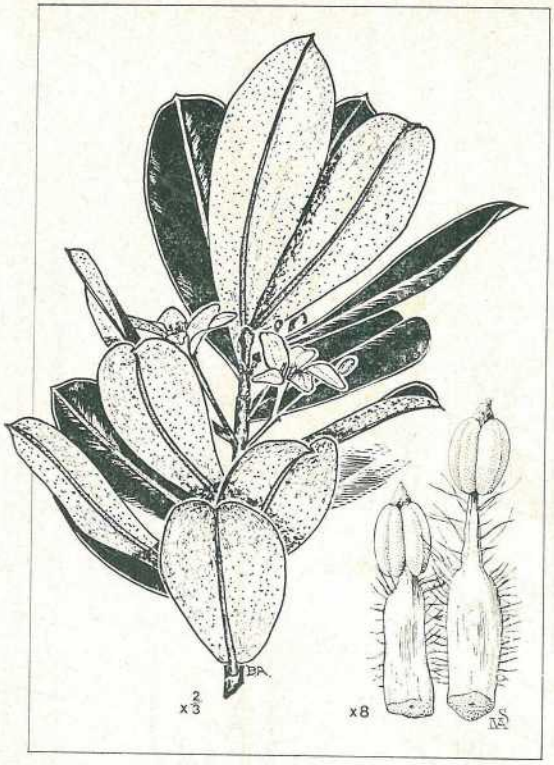
FLOWERING TIME: Although flowers can often be found throughout the year, the main flowering periods are autumn and spring.

HABITAT: This wax-flower is usually found in sandy wallum flats.

DISTRIBUTION: It grows only in Queensland on the coastal plains to as far north as the Cooloola National Park.

Eriostemon myoporoides subsp. *leichhardtii*

Leichhardt, the famous explorer and botanist, was the first person to collect this wax-flower. He probably found it in the Glasshouse Mountains on Mt. Beerwah. It was later named in his honour.



Eriostemon myoporoides subsp. *myoporoides*

DESCRIPTION: This is a sparsely branched, diffuse shrub to 1·5 cm high, with many warts on the stems. The leaves are firm in texture, blue-green in colour, oblong-obcuneate, 3 to 4 cm long and up to 1 cm wide.

They are usually abruptly acuminate with the pointed tips curving down. Deep rosy-pink buds which open to pale pink flowers are on rather slender peduncles about 1 cm long. The flowers are up to 1·8 cm in diameter with smooth, usually waxy petals. Long, fine, crinkly hairs border the staminal filaments, which end in a tuft of very long, straighter hairs beneath each other.

The cocci are spreading, and each ends in a prominent beak about 0·3 cm long.

FLOWERING TIME: This wax-flower also flowers spasmodically with the best displays in autumn and late winter to mid spring.

HABITAT: It is found on rocky cliffs near the summits of mountains, on the upper slopes in low open forest, growing in rock crevices.

DISTRIBUTION: It is confined to Queensland and grows only in the Glasshouse Mountains.

Eriostemon myoporoides subsp. *myoporoides*

DESCRIPTION: The form of this subspecies found in South-eastern Queensland is an erect, compact shrub which can grow to a height of about 2 m but is usually only half that size. It has firm, woody stems which are only moderately warty. The leaves are arranged in a very close spiral and are thick and leathery in texture, broadly obovate with rounded tips, and the midrib produced into a mucro. They can be up to 7 cm long and 3·5 cm wide. Many glands are present in the leaf tissue and can be felt on the upper surface and easily seen on the lower surface as darker green spots. Sweetly-scented, white or pale pink flowers are in axillary inflorescences near the ends of the branches. As many as five flowers may be present. The petals are waxy and firm in texture and the flowers are more than 2 cm in diameter. Short, sparse, white hairs fringe the staminal filaments and the long, straight hairs beneath the anthers are fewer than in the other species.

When the fruits mature they separate into five brown cocci each ending in a fairly long, curved point.

FLOWERING TIME: Flowers can be found from midwinter to late in spring.

HABITAT: This wax-flower is always found on the upper mountain slopes, growing on ledges or in rocky crevices.

DISTRIBUTION: Although the subspecies is widespread in the eastern mainland States, the South-eastern Queensland form is found only in Queensland and grows on some of the isolated peaks in the McPherson Range. A different form found on the Darling Downs is more floriferous and has leaves which are thinner in texture and longer and narrower.

Field Key to the Wax-flowers of South-Eastern Queensland

1. Flowers terminal; petals densely pubescent on both surfaces. Stems almost smooth, only sparsely warty; young growth minutely hairy. Leaves flat and thin, oblong to broadly elliptical, about 0·8 cm long, margins with large glandular warts.....
Eriostemon difformis subsp. *smithianus*

Flowers axillary; petals glabrous. Stems smooth, or sparingly to densely warty.....2

2. Stems with a few scattered warts. Flowers solitary, on slender peduncles. Leaves narrow-elliptic to narrow obovate, obtuse to acute up to 3 cm long, 0·5 cm wide.....
Eriostemon myoporoides subsp. *queenslandicus*

Stems densely to moderately warty. Flowers solitary or peduncles with more than three flowers. Leaves oblong-obovate and abruptly acuminate or broadly obovate with rounded tips.....3

3. Stems densely warty. Flowers solitary on slender peduncles. Hairs on staminal filaments dense, long and crinkly. Leaves firm in texture, up to 4 cm long, 1 cm wide.....*Eriostemon myoporoides* subsp. *leichhardtii*

Stems only moderately warty. Inflorescence with more than one flower usually three to five. Hairs on staminal filaments sparse, short and straight. Leaves leathery in texture, up to 6 cm long 3 cm wide.....*Eriostemon myoporoides* subsp. *myoporoides*

New citrus industry publication

'CROP PROTECTION' is the fourth volume in the revision of 'The Citrus Industry'—the classic reference work and practical guide to citriculture, the original edition of which has been out of print for many years.

These volumes of 'The Citrus Industry' are designed to present a comprehensive view of all phases of citrus technology except processing and marketing.

The first volume, published in 1967, covered history, world distribution, botany and varieties of citrus. The second volume, published in 1968, dealt with anatomy, physiology, genetics and reproduction. The third volume encompassed propagation, planning and planting of orchards, weed control, soil management, fertilization, leaf analysis, pruning, irrigation, climate and citrus behaviour, and frost protection.

The fourth volume 'Crop Protection' covers diseases (including viruses) and injuries, registration, certification, and indexing, regulatory measures, vertebrae pests, biological control and nematodes.

Volumes 1, 2, 3 and 4 are available from Agricultural Sciences Publications, 1422 Harbor Way South, Richmond, CA 94804, U.S.A.

The prices for the volumes are: Vol. 1 $(US)10, Vol. 2, $8, Vol. 3 $10 and Vol. 4 $20.

New look for hot breads

Recipes provided by the Dairy Foods Advisory Bureau

HOT garlic bread is a favourite—there is no doubt about that.

Remember how its delicious buttery flavour goes with everything from soups, casseroles or pasta to those barbeques where it crisps over the hot coals to accompany sizzling steaks and sausages.

But, there is much more to hot bread than garlic.

We have decided to introduce the 'new' hot breads—a selection of superb filling alternatives as well as a choice of different ways to serve it. Simply make your choice from the variety of butter fillings we have below and use it in any of the ways we suggest. Just think how many interesting combinations you can create.

A few hints

- Butter blends best at room temperature, so remove it from the refrigerator in time to soften.
- Use fresh garden herbs if you have them on hand, but double the quantity as they are less concentrated in flavour than the dried varieties.
- Savoury butters freeze well. Simply roll the butter into long sausage shapes, then wrap in foil or plastic. Freeze and slice off portions as required. Or, you can press the butter into ice cube trays, freeze lightly, then pop the blocks into a plastic bag and refreeze. Use the blocks for pan frying all kinds of meats, fish or vegetables, saucing baked potatoes, barbequed or grilled foods, or tossing as an instant sauce through noodles.
- Savoury buttered breads can also be frozen successfully. Wrap the bread securely in foil and freeze for any time up to about 1 month. Longer freezing may cause the bread to dehydrate and alter the flavour of the savoury butter.
- For a crispy loaf, loosen the foil for the last 10 minutes of cooking. For a moist loaf, keep it enclosed.

Savoury butters

Standard 250 ml measuring cup and 20 ml tablespoon are used. All measurements are level.

Take 125 g butter and beat till smooth and creamy. Add salt and pepper to taste and blend with one of the following combinations.

- 1 onion, finely chopped or grated
  1 teaspoon dried sage leaves
- 1 cup grated Australian pepato or parmesan cheese
- 2 teaspoons lemon juice
  2 teaspoons dried mixed herbs
  2 tablespoons toasted flaked almonds

- 1 tablespoon finely chopped red pepper
  1 tablespoon finely sliced spring onions
  2 teaspoons dry mustard
- 2 tablespoons fruit chutney
- 1 teaspoon caraway seeds
  finely grated rind of one orange
- 1 tablespoon finely chopped stuffed olives
  1 clove garlic, crushed
  few drops tabasco sauce (optional)
- 30 g Australian blue vein cheese, crumbled
  1 tablespoon chopped chives or parsley
  1 teaspoon worcestershire sauce

Use these butters in any of the following hot bread suggestions.

- Cut a bread stick into chunky diagonal slices three-quarters of the way through. Spread with your favourite savoury butter or a selection of two or three butters spread between alternative slices. Wrap in foil and bake at 200°C for 15 to 20 minutes.
- Remove the crusts from sliced bread and sandwich together with a savoury butter. Spread over top of sandwich. Cut into three fingers. Place on a baking tray and bake at 200°C for 10 to 15 minutes.
- Cut three or four incisions three-quarters of the way through individual round or long rolls. Spread each incision with a different savoury butter. Bake at 200°C for 10 to 15 minutes.
- Cut a circle from the top of a round hamburger bun. Place a heaped teaspoon of the mixture inside the bun. Replace lid. Spread a little remaining butter on top of bun. Bake at 200°C for 20 minutes.
- Spread a crumpet liberally with savoury butter and bake at 200°C for 15 minutes.
- Thinly slice rye or white bread spread on both sides with savoury butter. Cut into triangles or fingers and bake at 200°C for 15 minutes.
- Cut a long poppy seed roll lengthwise into six wedge-shaped sticks. Spread savoury butter over cut surfaces. Bake at 200°C for 15 minutes. Sprinkle with parsley.

New publication on care and management of farm animals

'The Care and Management of Farm Animals' is a practical textbook in which the case for the humane treatment of such animals is emphasized.

It is published under the aegis of the Universities Federation for Animal Welfare. This organization has always believed that one of the best ways to promote animal welfare is by education.

This book deals with all the new intensive systems of production and husbandry and also with older systems. It has become established as a standard textbook for British veterinary and agricultural students, all of whom require to have access to the up-to-date and comprehensive information which is supplied by the new edition of this book.

This publication retails for $23.95 in Australia. It can be ordered through normal retail booksellers or from Collier Macmillan (Aust.), 1 Wickham Tce., Brisbane, Q. 4000.

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Some Queensland wildflowers

by Beryl A. Lebler, Botany Branch.

Acacia saxicola

This wattle has been found only in Queensland, where it grows only on Mt. Maroon, south of Boonah. It is the prickliest wattle in South-eastern Queensland, and is about 1 m high with pale golden-yellow flowers in large heads which are produced from autumn to winter.

Acacia brahycarpa

From midwinter until early in spring, this unusual wattle with its stiff, narrow phyllodes and lemon-yellow flowers can be seen growing in open eucalyptus forest on sandstone.

It is found only in Queensland, at Crows Nest and in the hills north of Helidon. In central Queensland, it is found on the Blackdown Tableland, and in the Carnarvon and Isla Gorges.

Acacia bakeri

This wattle (commonly called marble wood) is the largest of the three species which grow in or on the margins of rain-forest from Brunswick Heads in New South Wales to the Barron River. It is a distinctive tree with pendulous branches and dark green phyllodes with three prominent veins and pale creamy-yellow flowers in springtime.

Leptospermum phylicoides

This showy plant can be seen flowering during summer on rocky hillsides in the McPherson Range. Although the flowers are relatively small, they give the plant a distinctive fluffy appearance because of the long staminal filaments of different lengths spreading from the flower.

Some Queensland wildflowers

Acacia saxicola.

Acacia brachycarpa.

Acacia bakeri.

Leptospermum phylicoides.