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DEPARTMENT OF PRIMARY INDUSTRIES

Horticulturist Margaret E. McKay, of the Redlands Horticultural Research Station, a research worker in cut flowers and nurseries, examines gladioli harvested from one of her trials.

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Freight Rebate to Aid Restocking

THE State Government has granted freight concessions for movement of stock to properties restocking after flood losses earlier this year.

The concessions are similar to those at present available to primary producers under the Government's drought relief scheme.

Announcing approval of the new concessions, the Minister for Primary Industries (Hon. V. B. Sullivan, M.L.A.) said the latest estimates had indicated that the recent floods had caused the loss of around 205 000 head of adult cattle, 256 000 sheep and 3 000 stock horses.

Restocking had now begun in some areas of the State and this activity would increase.

Mr. Sullivan said that a rail freight rebate of 40% would apply.

For road transport, the permit would be 'free' for a journey less than 25% competitive with rail and there would be a concession of 25% of the loaded road journey up to a maximum of 25c a mile for a 10-ton truck, payable on the total road distance, less 40 miles.

Types of movements eligible for concessions were from property to railhead, or return, in addition to full road journeys where rail transport was unavailable or impracticable.

In full road journeys, prior verbal approval of a Stock Inspector was required.

'With restocking after drought, freight concessions normally extend for 6 months after it has ended,' the Minister said.

'Because of the time factor involved in repairing fences and structures, it is considered that a 6-month period in the case of the January floods may be inadequate. The position will be reviewed at the end of October.'

Mr. Sullivan added that, since all properties in a defined area might not have incurred stock losses, the rail and road concessions both would operate on a refund basis.

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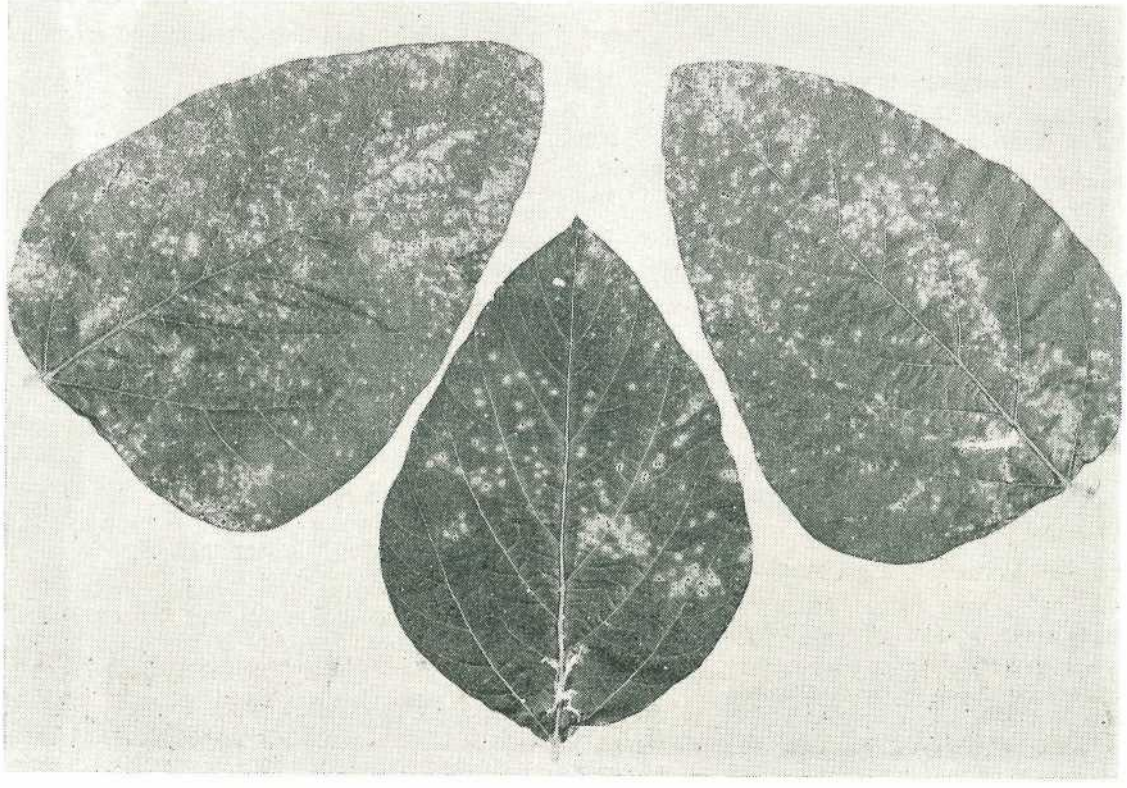
Soybean Diseases

INTEREST in growing soybeans in Queensland has increased strikingly over the past few years.

This can be gauged from the fact that areas sown to this crop have increased from 2 000 ha in 1969 to 26 000 ha in 1973. It has been estimated that, in 1974, the area of soybeans could well exceed 40 000 ha.

Production of soybeans is centred largely in the Darling Downs and West Moreton regions, but the crop is also successfully grown in the Callide-Dawson, the Burnett region, and favoured areas of North Queensland such as the Atherton Tableland.



Bacterial pustule showing the pin-point spots scattered over the leaf surface (plate 1).

The soybean is host to a wide range of diseases, but relatively few of these are as yet present in Australia. The diseases discussed here fall into three categories: those caused by bacteria, those caused by fungi, and those caused by viruses.

BACTERIAL DISEASES

Three bacterial diseases, commonly known as bacterial pustule, bacterial blight and wildfire, occur on soybeans in Queensland. Together, they pose the greatest potential disease threat to the successful growing of soybeans.

By Officers of Plant Pathology Branch.

Bacterial pustule has been present in Queensland since 1933, but the other two diseases are of comparatively recent occurrence. Bacterial blight was first recorded in 1969 and wildfire in 1971.

Recognizing Bacterial Diseases

Bacterial pustule (*Xanthomonas phaseoli* var. *sojense*). Under moist conditions, this disease first appears on the young leaves as pin-point, watersoaked spots with pale-yellow margins.

Within 2 days, creamy-white pustules develop in the centre of these watersoaked spots and the yellow margins become brighter in colour and more diffuse. The pustules are

Bacterial pustule; a close-up view (plate 2).

present mainly on the lower surfaces of the leaves but may also occur on the upper surfaces.

Later, they become light-tan in colour and the surrounding watersoaked areas dry to a light-brown. Later still, the pustules collapse leaving near-circular, brown lesions with bright yellow margins (Plates 1 and 2).

If dry conditions persist after the initial infection, watersoaking is commonly absent and the spots then appear as circular, yellow lesions in the centres of which pustules are formed. Heavy foliage infection frequently results in severe defoliation of affected plants.

Stem and pod infections are rarely seen but, when present, appear as reddish-brown spots.

Bacterial blight (*Pseudomonas glycinea*). Bacterial blight begins as angular, watersoaked spots rather than the circular spots associated with bacterial pustule. As the disease develops, the spots dry to angular, tan-coloured areas with narrow, yellow margins. When viewed from the under-surfaces of the leaves, the spots have a greasy or watersoaked appearance, a property which is retained for some time if conditions are favourable.

When infection is heavy, adjacent spots coalesce to form tan to dark-brown, necrotic areas, covering extensive portions of the leaves including the leaf margins. These necrotic areas may later become torn and puckered, and the leaves take on a ragged appearance (Plate 3). Defoliation usually results when severe symptoms of this type occur.

On the stems and pods, the disease begins as watersoaked spots of varying size which darken with age, sometimes becoming black. If the pods are opened, the seed beneath these spots may be discoloured.

Wildfire (*Pseudomonas tabaci*). Leaves affected by this disease show spots consisting of brown, dead areas of variable size and shape, surrounded by a wide, yellow halo with a distinct margin (Plate 4). Where infection is heavy, considerable areas of the leaves can be damaged.

Evidence indicates that the wildfire organism is able to infect soybeans only when bacterial pustule is present. Hence, if wildfire spots are examined closely, a pustule, or a remnant of a pustule, can invariably be found in the centre of each spot.

Spread

The bacterial diseases are carried from one season to the next either on seed or on undecomposed crop trash in the field. The seed is, by far, the more important, and explains how the diseases have been introduced into previously clean areas.

This carry-over on the seed results largely from the external contamination during the threshing process. However, in bacterial blight and wildfire, the bacteria may also be borne internally in the seed.

The percentage of this internal carry-over is seldom more than 1% except in badly diseased crops, but is more than sufficient to introduce the disease into the new season's crop. Subsequent spread throughout the crop is influenced mainly by wind-driven rain such as commonly occurs in summer storms.

Control

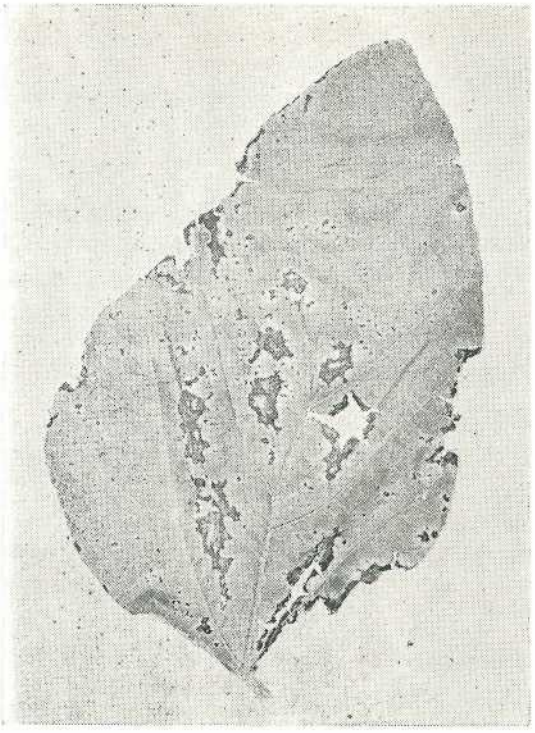
Soybean cultivars resistant to bacterial pustule and wildfire are now available, and growers should always use one of these. Unfortunately, no cultivars are known at present which are completely resistant to bacterial blight.

Volunteer soybean plants from the vicinity of crop areas should be removed, as these can provide a ready source of these diseases.

As the bacterial disease organisms can survive in undecomposed plant trash, a firm crop rotation programme, combined with an attempt to get quick breakdown of crop residues, is advocated for disease control.

FUNGAL DISEASES

Fungal diseases are not usually limiting factors in the production of soybeans in Queensland. The most likely are rust in the high-rainfall, sub-coastal areas, and *Sclerotinia* and *Macrophomina* stem rots in south Queensland.



Bacterial blight. Note the ragged appearance of the leaf (plate 3).

Rust

Rust (*Phakopsora pachyrhiza*) has not yet been serious in the main producing areas, but, in the absence of control measures, may cause appreciable losses in areas such as the Atherton Tableland.

The importance of the disease varies from season to season depending on the stage of growth at which infection first occurs. Outbreaks early in the crop may result in premature defoliation and subsequently reduced yields because of poor pod fill.

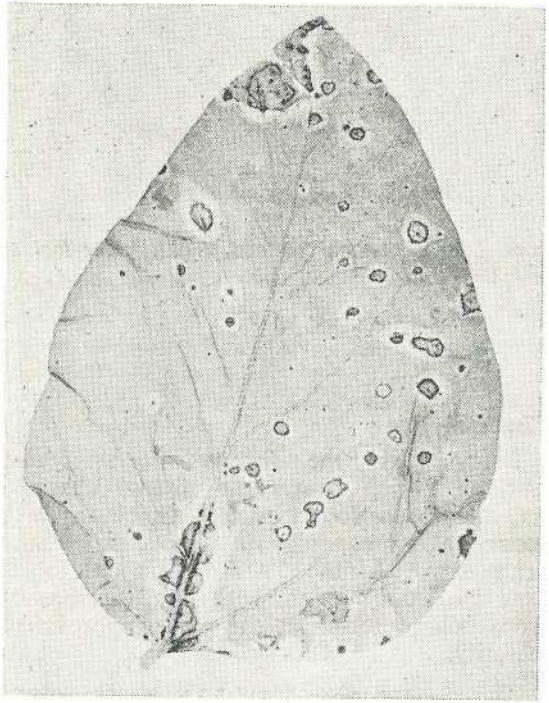
RECOGNIZING RUST. This disease occurs first on the older, lower leaves of the plant but is generally not noticed until the pods are set. Firstly, the upper surfaces of leaves show scattered, small, brown to black, necrotic spots about 1 mm in diameter, typically surrounded by circular yellow halos.

Pustules then form on the lower surfaces of the leaves in positions corresponding with the necrotic spots on the upper leaf surfaces. The pustules are light-brown in colour, and easily seen with the naked eye (Plate 5). With heavy levels of infection, large areas of necrotic tissue develop and defoliation inevitably results.

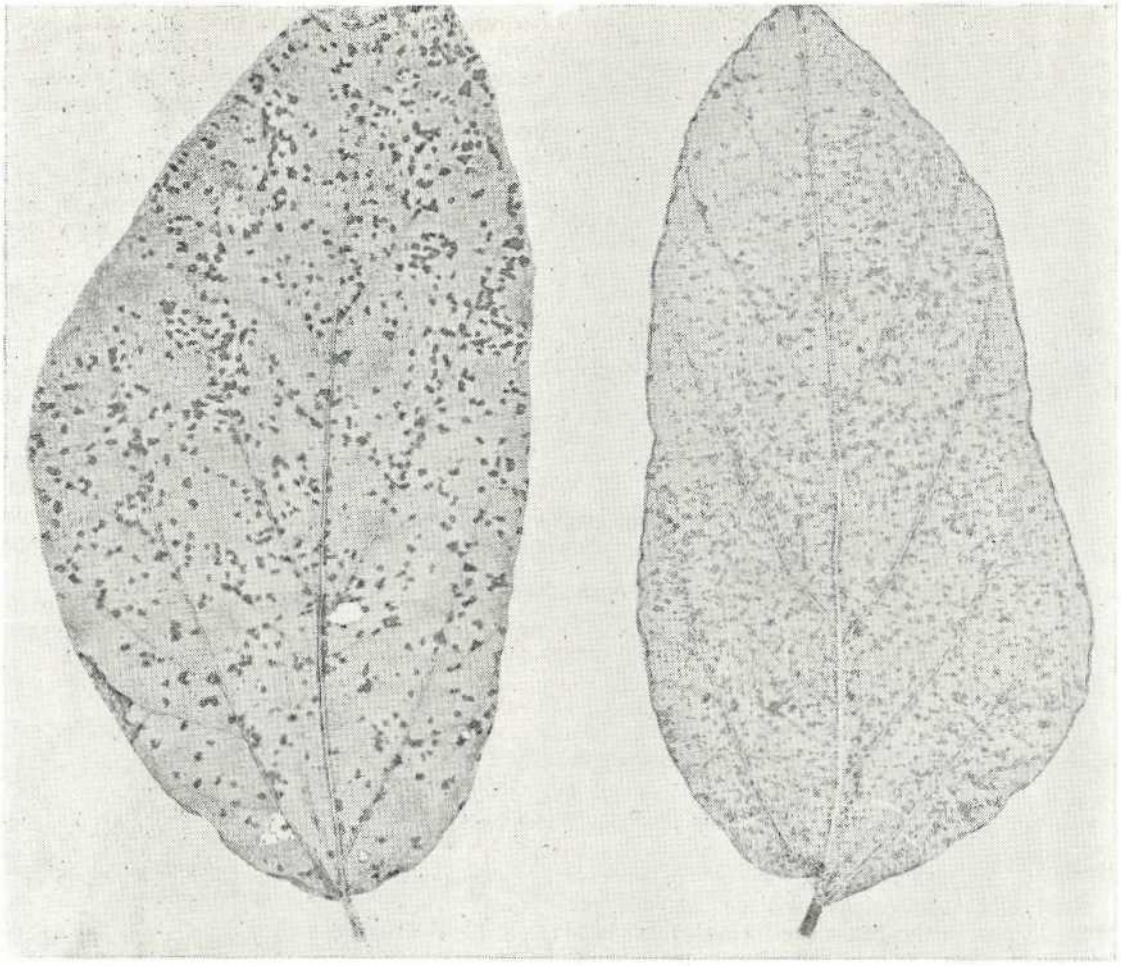
SPREAD AND CONTROL. The spread of the disease is favoured by showery weather, and weather like this is common in coastal districts from December to April. Control measures are necessary in such districts if the disease enters a crop before the pods are filled. A mancozeb spray (1.8 kg active ingredient per ha) at weekly intervals if conditions are favourable for disease development is recommended.

The rust disease may also affect glycine (*Glycine wightii*), a common pasture legume in coastal districts. It is therefore recommended that, wherever possible, soybeans should be grown well away from pastures containing this legume.

There are no soybean cultivars resistant to this disease available in Queensland at present.



Wildfire showing dead areas surrounded by halos with distinct margins (plate 4).



Rust. Left: upper leaf surface. Right: lower leaf surface. Note the pustules on the under-surface of the leaf (plate 5).

Charcoal Rot

Every year, the fungus *Macrophomina phaseoli,* which causes the disease charcoal rot, has been found to be associated with occasional plants dying in almost every soybean crop. In the 1972–73 season, losses were particularly high, with large patches of crops being affected as the plants approached maturity.

This fungus also commonly attacks crops such as sorghum, maize and sunflower where it causes a similar condition. It is considered that this fungus causes extensive damage when stress conditions such as excessive heat or drought follow periods of vigorous crop growth.

RECOGNIZING THE DISEASE. The main effect of the disease in the field is to hasten the maturity of affected plants, and under certain conditions to cause a 'pinching' of the seed in the pods. In the early stages, diseased plants show a light-brown discoloration of the sub-surface tissues of the tap root and basal portion of the stem.

Plants that have been affected for longer periods show a brown, diffuse lesion extending from ground level up the stem. When the stems of such plants are split open, the disease is easily recognized by the large numbers of minute, black, resting bodies of the fungus present in the woody tissues (Plate 6). These bodies may also be present just below the bark of the roots and crown of affected plants.

CONTROL. The organism that causes this disease is widespread in almost every soil. Its effect on the plant can be minimized by avoiding stress conditions. Although little can be done about excessively high temperatures, irrigation can be judiciously used to limit moisture stress.

Sclerotinia Stem Rot

Sclerotinia stem rot (*Sclerotinia sclerotiorum*), as a disease of soybeans, occurs in all areas but is most severe in soils where *Sclerotinia* has been common in other crops such as potatoes, tomatoes and beans. Under conditions favourable for the development of the disease, total loss of the crop is possible. It is most common where excessive top growth has occurred as a result of very good seasonal conditions.

RECOGNIZING THE DISEASE. The first sign is the appearance of a white, cottony growth on the lower stems of the plants, followed in time by the formation of large, black, irregular resting bodies of the fungus. Similar bodies of a more uniform, cylindrical shape may also be found in the pith or centre of the stem.

CONTROL. Control of this disease is not economically possible in soybeans. Soybeans should not be planted in areas where previous crops were known to be affected by *Sclerotinia* diseases.

Seedling Blight

Seedling blight (*Rhizoctonia solani*) is of minor importance, but may cause some problems with plant establishment. Affected seedlings turn yellow, wilt and may collapse. When the plant is pulled from the ground, reddish-brown spots may be seen on the roots and crown. To date, control measures have generally not been justified.

OTHER DISEASES

Diseases caused by viruses and mycoplasma also attack soybean crops in Queensland. Two virus diseases of soybeans warrant consideration. Another disease, formerly thought to be caused by a virus, has recently been shown to be of mycoplasma origin.

Soybean Mosaic

Soybean mosaic (Soybean mosaic virus) occurs in most soybean crops throughout the world. In Queensland, it is widespread, but the incidence is usually negligible. Even in those isolated crops where the incidence is higher than normal, there is no evidence that the disease causes significant yield losses.

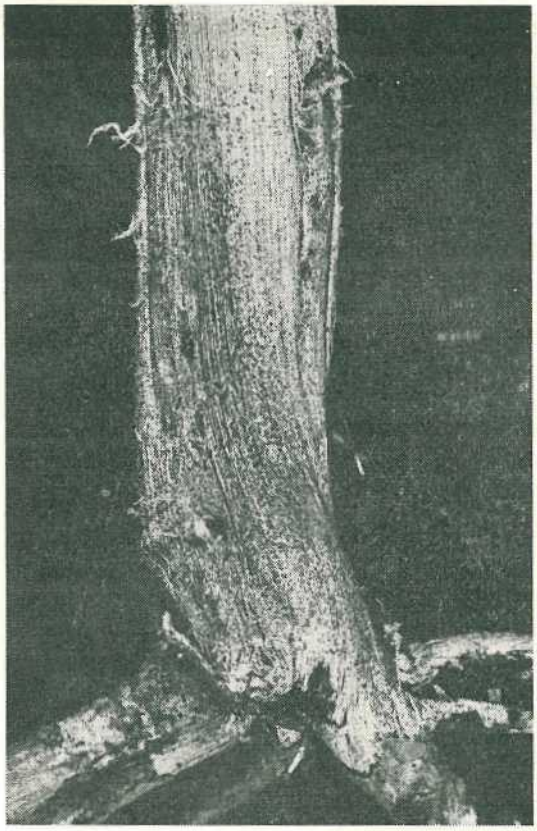
Symptoms vary according to the soybean cultivar and the growth stage of the plant when infected. The first indication of the disease is generally a temporary vein-clearing of the newest leaves. This is followed by a light and dark-green mosaic pattern of varying intensity (Plate 7).

In some cases, this symptom is very noticeable with the leaves showing dark-green, bubble-like areas frequently associated with the veins. Leaves may also be distorted in shape and twisted and crinkled to varying extents. Severe to mild stunting may occur, when the plants produce fewer pods, some of which may be malformed.

Soybean mosaic virus occurs naturally only on soybean, although it can be experimentally transmitted to some other leguminous plants. The initial infections in a crop result from virus carried in the seed, but it is spread from plant to plant by several species of aphids.

These aphids can transmit the virus to healthy plants after a very brief feeding time on a diseased plant, and winged forms can spread the disease over considerable distances. The virus can also be spread in the sap of the plant (for example, by adjacent plants rubbing in winds), but this is unlikely to be an important means of spread.

No control measures are warranted.



Charcoal rot of the stem showing the minute, black, resting bodies embedded in the tissue (plate 6).

Peanut Mottle Virus

Peanut mottle virus disease has recently been detected in diseased soybean plants growing beside peanuts, the natural host of the virus. The diseases caused by this virus are widespread in peanut and navy bean plantings in the South Burnett region, so it is expected that the incidence of the disease in soybeans may increase in the future.

Peanut mottle virus is spread from its other leguminous hosts to soybeans by aphids. There is no evidence to date that it is transmitted through the seed of infected soybean plants.

The symptoms of peanut mottle virus in most soybean cultivars grown in Queensland are easily confused with those of soybean mosaic but, generally, the leaf mosaic patterns produced by peanut mottle virus are brighter and more pronounced, with less leaf distortion. Also, the mottling on the lower leaves is generally duller, and fine etched lines of dead tissue may be apparent.

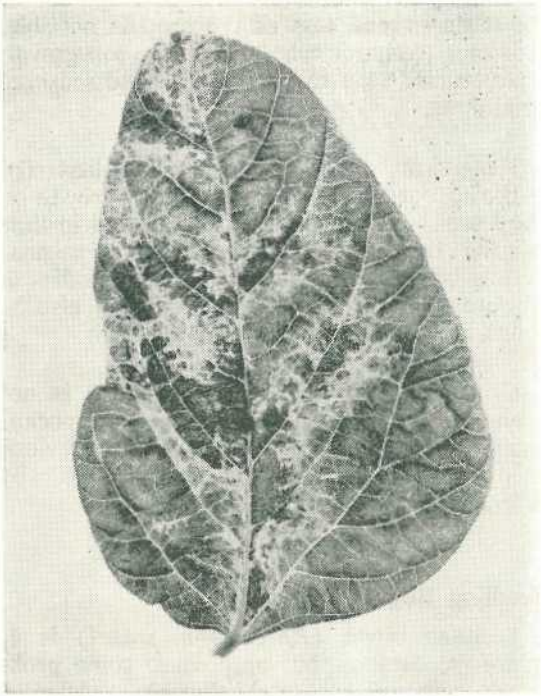
It is recommended that the planting of soybeans adjacent to peanuts or navy beans be avoided.

Big Bud Disease

Although big bud disease or phyllody is common in a wide range of plant species, this disease is of limited occurrence in soybean crops in Queensland.

Symptoms of the disease are proliferation of axillary shoots, reduction in leaf size and, sometimes, stunting of all or part of the affected plant.

The disease is caused by a small organism known as a mycoplasma. This organism is transmitted from plant to plant by a small insect known as the brown leafhopper



Soybean mosaic. Note the very distinct mosaic pattern (plate 7).

(*Orosius argentatus*). The organism is probably transmitted to soybean from the many weeds which act as host to it and which are commonly present throughout soybean growing areas.

No control is warranted.

Control At A Glance

Disease control measures may be summarized as follows:—

1 Use only cultivars known to be resistant to bacterial pustule and wildfire.

2 Use only high quality seed, preferably that which has been harvested from a disease-free crop.

3 Draw up a crop rotation programme and combine it with practices aimed at getting a quick breakdown of crop residues.

4 Use fungicides to control rust if this disease enters a crop before the pods are filled.

5 Avoid areas that are known to have a history of *Sclerotinia* in other crops.

6 Avoid plant stress in irrigated crops by ensuring an even moisture supply.

7 Avoid planting soybeans adjacent to crops such as peanuts, navy beans and glycine, which are alternative hosts for soybean diseases.

Semen from S.A. Poll Hereford

SEMEN from a performance-recorded South Australian Poll Hereford sire, Straun 826, now is available through the Primary Industries Department's Artificial Insemination Centre at Wacol, Brisbane.

The Director of Dairy Cattle Husbandry (Mr. I. H. Rayner) said the recent retirement and later death of the prolific sire, Wahroonga Ian, had left a gap in the supply of cheaper semen of this breed.

Mr. Rayner said that Straun 826, owned by the South Australian Department of Agriculture, would provide Poll Hereford semen for Queensland users of A.I. until new sires began production at Wacol.

Now 6 years old, he had an impressive record under the South Australian beef performance recording and, in pre-weaning trials, was eighth in a group of 31. In post-weaning trials, he was ninth in the same group.

In a feed-lot test, this bull was ranked first in a group of 12. His average daily weight gain while in the feed-lot was a little under 1·4 kilograms.

'Straun 826 should be an ideal bull for use by farmers who like to have the Hereford strain in their bobby calves, or dairy beef,' Mr. Rayner said.

'Used over the lower producers in dairy herds, the resultant beef calves should, through rapid weight gain, return a higher profit in a shorter time than from use of dairy breed sires.'

Mr. Rayner added that quantities of semen from Straun 826 held at Wacol were available for immediate despatch to artificial breeding technicians. The cost was $1 a dose.

Vegetables for July Plantings . . .

by Officers of Horticulture Branch.

CROP	SUGGESTED VARIETIES*					
	Stanthorpe	Lockyer, Fassifern and Beaudesert	Coastal, South of Gladstone	Central Queensland (Gladstone to Mackay)	Bowen to Townsville	Far North Queensland (Tablelands)
Bean						
Fresh Market	..	..	Redlands Pioneer Redlands Greenleaf	Redlands Pioneer	Redlands Pioneer	Redlands Pioneer Redlands Autumncrop
Processing	..	..	Gallatin 50 Apollo	..	..	..
Beetroot ..	..	Early Wonder Detroit strains	Early Wonder Detroit strains	Early Wonder Detroit strains	Early Wonder Detroit strains	Early Wonder Detroit strains
Cabbage ..	Greengold Greygreen Sugarloaf types	Ballhead Hybrid Greygreen Greengold Sugarloaf types	Ballhead Hybrid Greygreen Greengold Sugarloaf types	Ballhead Hybrid Sugarloaf types	Ballhead Hybrid All Seasons Sugarloaf types	Ballhead Hybrid Superette
Capsicum ..	..	..	Yolo Wonder Green Giant Northern Belle	Yolo Wonder Green Giant California Wonder	Yolo Wonder Green Giant California Wonder Long Sweet Yellow	Yolo Wonder California Wonder
Carrot						
Market ..	..	All Seasons Topweight	All Seasons Topweight	All Seasons Topweight Chantenay strains	All Seasons Topweight	All Seasons Topweight Chantenay strains
Processing ..	..	Royal Chantenay King Chantenay Amsterdam Forcing	Royal Chantenay King Chantenay Amsterdam Forcing	..	..	..
Celery ..	Local selections of South Australian strains	..	South Australian White	..	..	..
Choko ..	..	..	..	Smooth Green	Smooth Green	Smooth Green
Cucumber ..	..	..	Marketer Ashley	Green Gem Polaris Ashley Crystal Apple	Green Gem Polaris Ashley Crystal Apple	Green Gem Polaris

Egg Fruit ..	..	..	Market Supreme Mission Belle	Market Supreme Long Purple	Market Supreme Long Purple	Market Supreme Long Purple
Lettuce ..	..	Yatesdale Sunnylake Winterlake	Yatesdale Sunnylake Winterlake	Yatesdale Sunnylake Winterlake	Pennlake Yatesdale	Yatesdale
Marrow ..	..	..	Long White Bush	Long White Bush	Long White Bush	Long White Bush
Zucchini ..	..	..	Blackjack	Blackjack Ambassador	Blackjack Ambassador	Blackjack Ambassador
Melon						
Rock ..	..	..	Conqueror Rio Gold Hales Best	Hales Best Conqueror Saticoy Hybrid	Hales Best Gulfstream Gold Pak	Rio Gold
Water ..	..	..	Candy Red Calhoun Grey Warpaint Mini Melons	Candy Red Calhoun Grey Charleston Grey	Candy Red Crimson Sweet	Candy Red Sunny Boy Charleston Grey
Parsnip ..	..	..	Hollow Crown	..	..	..
Pea						
Fresh Market	..	Massey Gem	Massey Gem Fiesta	..	..	..
Processing ..	..	Freezer strains Frosty	Freezer strains Frosty	..	..	..
Pumpkin ..	..	Queensland Blue Butternut	Queensland Blue Butternut	Queensland Blue Butternut	Queensland Blue Butternut	Queensland Blue Butternut
Rhubarb ..	..	..	Sydney Crimson Local strains	..	..	..
Tomato	..	Floradel Indian River Grosse Lisse strains Strobelee Tropic Walter	Floradel Indian River Grosse Lisse strains Strobelee Tropic Walter	Floradel Indian River Grosse Lisse strains	Walter C 1402 Floradel	Floradel Indian River Tropic
Turnip ..		Purple Top White Globe	Purple Top White Globe	..	..	..

* These suggestions are based on the more important commercial varieties.

Beef Cattle Pastures in the

by J. K. TEITZEL and R. A. ABBOTT, Agriculture Branch; and W. MELLOR, Research Stations Section.

Management of Established Pastures

Probably the most important considerations in managing established pastures are:—

1. The highly seasonal nature of pasture growth.
2. The maintenance of soil fertility.
3. The maintenance of animal health.

Seasonal Production

Growth of existing pastures in the wet tropics follows a very regular pattern. A period of extremely vigorous growth begins in December and continues through to April. Pasture growth then gradually declines to very low levels during July, August and September. The upswing in production begins with the first spring storms in October.

The apparent correlation between pasture growth rate and rainfall is, however, quite misleading, as many factors are responsible for the uneven growth.

The slow winter growth is caused by a combination of many factors. Lower temperatures, lower rainfall and levels of sunlight play a part. The heavy summer rainfall also adds to winter problems through leaching nitrogen beyond the reach of plant roots.

When this is combined with further immobilization of available soil nitrogen and reduced symbiotic activity from legumes, nitrogen deficiency occurs in all pasture plants. Evidence also suggests that, in some soils, potassium is less available during the winter months.

The uneven plant growth poses a very important pasture management problem. A method of controlling the bulk of the pasture produced during the summer and, at the same time, preventing overstocking during the winter must be found.

Guinea grass pastures should not be grazed below 15 cm and preferably not below 30 cm This is especially important in the May, June and July period. It is probably not so important during October and November as more favourable climatic conditions can then be expected and these give the pasture a chance to recover.

Normal practice therefore is to adjust stocking rates according to the pasture's ability to carry animals through the winter and spring.

Slashing

Winter stocking rates are hopelessly inadequate for controlling the bulk of feed produced during summer. Unless this plant growth is controlled by some other means, such as slashing or roller chopping, the pasture becomes coarse and stemmy and, as a consequence, has low feed value.

With tufted tall growing species such as guinea grass, the grazing animals tend to walk around the tall plants even though they could easily push through. The result is that the spaces between the plants tend to suffer more severely from trampling. These spaces are normally where the legume component grows.

Slashing largely removes the effect but pastures should not be slashed below 15 cm and a height of 30 cm would be more desirable. Guinea grass, especially, will not withstand slashing close to the ground.

Boosting Winter-Spring Feed

Slashing is a wasteful process. A better approach to cope with the seasonal fluctuation in pasture growth is to find some method of raising production during the winter and spring months.

Wet Tropics—4

Supplementary feeding has been tried but has not proved popular in the long term. Fair quality hay has been made in the drier southern areas but, even here, the humidity is so high that rapid deterioration takes place.

Good quality silage has been made from a guinea-centro pasture and this is probably a better and more long-lasting approach to fodder conservation than haymaking. Nevertheless, the operation has never become popular and, except possibly for some stud breeders, it is doubtful whether any form of manufactured fodder conservation for feeding to animals on the wet coast can be justified economically.

A better approach to raising pasture production during winter is to use strategic applications of nitrogenous fertilizers on pasture species which have a long growing season.

Applying Nitrogen

Even during the so-called dry season of the wet tropics, there are many periods of adequate soil moisture during which the pasture will respond to nitrogen, thus giving better plant and animal production. Trials have shown that nitrogen applied in the winter-spring period gives best results. Well timed, split applications are preferable to a single heavy dressing.

The use of nitrogen on legume-based pastures should be approached cautiously as there is a very real danger of the vigorous grasses suppressing the valuable legumes. It seems that the place for nitrogenous fertilizer is on pastures consisting of vigorous grasses only, such as pangola or signal grasses which produce large quantities of plant material and are capable of withstanding high stocking rates with little damage.

Annual liveweight gains in excess of 1 100 kg per ha a year can be expected from nitrogen-fertilized rain-grown pastures in the area. This is very good production but it probably will not stand up to an economic comparison with a good grass-legume pasture where liveweight gains in excess of 900 kg per ha a year have been recorded.

Research has shown that small quantities of nitrogen have little effect on pasture protein and, for a worthwhile result, at least 200 kg of nitrogen (580 kg of ammonium nitrate or 930 kg sulphate of ammonia) per ha per year should be applied.

For the really high production mentioned earlier, a dressing of 300 kg of nitrogen (980 kg of ammonium nitrate or 1 600 kg sulphate of ammonia) per ha per year was required. The additional cost of the fertilizer offsets the higher productivity of the grass-bag nitrogen pastures.

Under the present economic conditions, it is therefore not practicable to have grass-bag nitrogen pastures covering the whole farm. Nevertheless, it is useful to have about a quarter of the farm under this pasture type, preferably on the lower paddocks of heavier soil where moisture is less likely to be a limiting factor during winter. These pastures should be used chiefly in winter when production from grass-legume pastures is poor.

Research has shown that over-grazing grass-legume pasture during this period can be very harmful. Moreover, pastures of pangola or signal grasses fertilized with nitrogen will not only support larger cattle numbers but also suffer little ill effect when heavily grazed.

The place of grass-bag nitrogen pastures thus seems to be in taking the pressure off the more vulnerable grass-legume pastures by reducing stocking pressure during their period of slow growth. The grass-legume pastures are then more fully utilized during the summer months when they are highly productive. This also means that nitrogen fertilizer is not applied when it would be washed away by heavy rain.

Extended Growing Seasons

A search for a pasture species with a smaller seasonal fluctuation in its growth could prove a most valuable and rewarding one. In particular, if a legume could be found which gave

A weed-infested pasture.

good winter growth and still retained the ability to survive vigorous competition from grasses during summer, the problem of uneven feed distribution could largely be solved.

A research programme on this problem by Dr B. Grof and Mr W. A. T. Harding from the South Johnstone Research Station has borne fruit. Some new varieties of stylo and centro have given more than twice the yield of commercial varieties during the off-season as well as giving a greater overall production.

These were described earlier as was a new variety of guinea grass which has given higher production than common guinea over the winter-spring period.

Undesirable Effects

There are also problems during the period of rapid pasture growth. The chief of these are related to the extremely heavy rainfalls from January to April. Undesirable features of the wet season include an almost continuous cloud cover which reduces light intensity and therefore plant growth, leaching plant nutrients, especially nitrogen, and waterlogging on flatter, less well-drained country.

Heavy stocking rates will pug the soil and cut up the plants in any wet paddock. Nevertheless, these paddocks are probably the most suitable for pangola or signal grass pastures fertilized with nitrogen which could be used chiefly in the dry season when high soil moisture is an asset rather than a liability.

Another effect of the wet season is unsatisfactory animal liveweight gain. However, close examination of cattle weights measured over a number of years reveals no drop in liveweight or even a reduced liveweight increase

during the wet season when the animals are grazing well-drained, good, grass-legume pastures.

In fact, there does not appear to be any period of reduced liveweight increase during any season of the year provided the animals are grazing good pastures. However, under boggy conditions, the animals congregate on high spots, tend not to graze and, if they do, they foul the pasture. Liveweight increase is consequently reduced.

Another Myth

Another myth concerns the accepted weight loss or lack of liveweight gain which occurs soon after introducing store cattle from drier western properties to the lush pastures of the wet tropical coast.

Again, a close examination of cattle weights measured over a number of years reveals that there is, in fact, no problem as long as the animals are placed on good, well-drained pastures. A carefully-controlled grazing experiment confirms these observations. It shows that animals of any age can be introduced at any time of the year. As long as the pasture is of reasonable quality, there is an almost immediate liveweight increase.

Condition may not improve for the first month or two and, in the past, condition has probably been confused with weight gain. Some animals also scour profusely soon after introduction. Despite these visual signs actual measurements show that beasts introduced on to good pasture are putting on weight. If forced to graze inferior pastures, problems will occur.

Management of Soil Fertility

Fertilizer experiments with pasture plants, together with chemical analyses of soils and plants, have indicated deficiencies of phosphorus, potassium, copper, zinc, sulphur, calcium, molybdenum and boron in certain, but by no means all, areas. Research has progressed to a stage where the fertilizer requirements for establishing good pastures are known. Having established a good pasture, the favourable climate allows vigorous pasture growth and, in turn, high animal production.

Preliminary research has shown that fairly regular dressings of fertilizer are necessary to maintain this high production. Regular dressings of phosphorus and potassium in particular will be required on some soils. Sulphur deficiency is also occurring more frequently on older pastures.

This sounds a warning that care will have to be exercised when using high analysis fertilizers, that is, high phosphorus with low sulphur content. As the pasture ages, the original soil nitrogen status is depleted and previously masked molybdenum deficiencies are beginning to show.

Because other elements are needed to establish pastures in some situations, it is likely that follow-up dressings of these will also be required. The quantity of fertilizer needed and the regularity of the dressing will depend on the behaviour of the elements in the soil, pasture management, animal management and climate. There is also evidence to suggest that animals may respond when plants do not and *vice versa*.

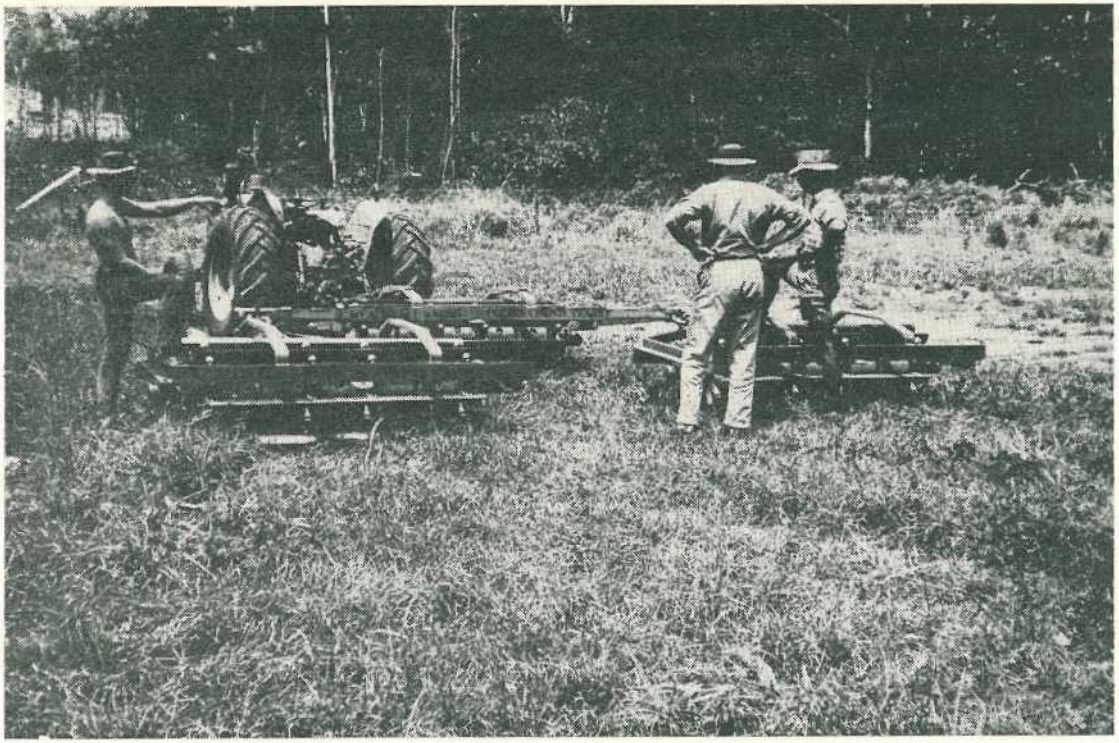
Imbalances caused by applying too much of one particular fertilizer can also cause problems in both plants and animals. There has already been one case of a farmer applying too much nitrogen fertilizer and not enough phosphorus, and getting fairly severe animal health problems.

The effect of all these factors will have to be considered before precise fertilizer recommendations can be made. Meanwhile, enough is known to formulate a fertilizer programme that will at least prevent a marked deterioration of the pasture.

Management of Animal Health

The part played by soil mineral deficiencies and imbalances in animal health has already been mentioned. Poor weight gain or even weight loss plus dietary diseases caused by such factors as bone chewing have been traced to soil problems. Lack of legumes or bag nitrogen also leads to a protein deficiency in the animal's diet.

Other pasture factors which reduce animal productivity include overgrazed or poor quality pastures and waterlogged, poorly drained soils.



Roller-choppers at Tully River Station 20 km south-west of Tully.

Ticks are a major animal health problem in the wet tropics and tick burdens can become immense. Heavy tick infestation can seriously retard animal performance. Numerous deaths of British breed cattle, caused by heavy tick burdens rather than tick fever, have been recorded. A monthly dipping programme is essential in most areas to keep tick burdens down to a low level.

Buffalo fly is also a problem. Some control is obtained when dipping for cattle tick but many farmers also use back rubbers. The C.S.I.R.O. has introduced two types of dung beetle which show some promise in the drier coastal area and may provide effective biological control.

Reproductive diseases such as leptospirosis and vibriosis have been recorded. Farmers cannot afford these problems in an industry with such a high cost structure.

Internal parasites are not a major problem at present. Infestation of lungworm, barber's pole worm, stomach fluke and tapeworm have been recorded but are not widespread. However, under the intensive grazing conditions, they can be expected to increase unless suitable precautions are taken.

Poisonous plants such as lantana and poison peach have given trouble in the area. Most deaths occur when hungry animals are moved from the hinterland to the coast. Animals reared on the coast are rarely troubled. Most plants of this type occur as a result of poor land preparation, overgrazing or under-fertilizing. A healthy, vigorous pasture normally provides too much competition for them to persist.

WEED CONTROL

Weed growth can be extremely rapid and aggressive. Grass-dominant pastures established on the fertile rain-forest are susceptible to weed infestations.

Before 1960, it was considered that effective weed control programmes would be essential to maintain productive pastures, but an intensive research programme by Mr D. R. Bailey, of the Department of Primary Industries, showed that, provided a vigorous dense stand of pasture plants is established quickly, weeds are of little consequence. Poor agronomic procedures or poor weather conditions during establishment can, however, result in a weak pasture stand and heavy weed infestation.

Cultural procedures such as timely grazing and slashing or roller chopping can sometimes be employed but they are of limited use against a vigorous weed stand. Consequently, the research programme paid most attention to the evaluation and further development of chemical weed control methods aimed at minimizing damage to the sown pasture but effectively controlling weed species.

It was recognized that damage to the legume component in particular would reduce potential pasture productivity. The susceptiability of the more important of tropical pasture legumes to a range of herbicides and also the effectiveness of the weed control measures was subsequently determined.

Regrowth of pest timber, particularly wattle (*Acacia flavescens*) was a problem in areas of open (sclerophyll) forest. This was thoroughly investigated and, although suitable chemical control methods were developed, it was found that with the correction of soil mineral deficiencies and the establishment of a vigorous improved pasture, regrowth was of little consequence.

One or two slashings followed by a period of pasture spelling, which allows the pasture species to suppress the regrowth, are sometimes required. Spot spraying with 2,4,5-T at 1·1 to 2·2 kg acid equivalent per ha in water is also effective.

The weed problem at this stage can be summarized thus: a well-established, well-fertilized, well-managed pasture provides too much competition for most weed species to survive. However, if a weed problem is encountered, suitable control methods are available.

The more important weeds and their control measures are:—

BLUE TOP (*Ageratum* spp.) This annual weed can be controlled with 2,4-D as a foliage spray at 2·2 kg a.e. per ha or with 2,4,5-T at 0·5 kg a.e. per ha in the young stages of growth. If 2,4,5-T is used, additional wetting agent is required. Foliar spraying of mature plants is not recommended as results are inconsistent.

CHINESE BURR (*Triumfetta bartramia*). This perennial weed is killed with 2,4,5-T at 0·5 kg a.e. per ha at all stages of growth.

CHINESE BURR (PINK FLOWERED BURR, PINK BURR, URENA) (*Urena lobata*). This annual weed is killed at all stages of growth with 2,4-D at 2·2 kg a.e. per hectare.

DEVIL'S FIG (*Solanum torvum*). Devil's fig is a perennial weed which, when young and actively growing, can be controlled with 2,4-D at 1·1 kg a.e. per ha. Devil's fig can be controlled at all stages of growth with 2,4,5-T at 0·5 kg a.e. ha. Other control measures when plants are actively growing are: basal bark painting or butt swabbing after brushing with 1% 2,4-D/2,4,5-T mixed esters in oil; and misting with 2·5% 2,4-D/2,4,5-T, mixed esters.

GUAVA (*Psidium guajava*). Guava is a woody perennial difficult to control, but repeated basal bark applications of 2% 2,4,5-T in diesel fuel or distillate are suggested.

INK-WEED (*Phytolacca octandra*). This perennial weed is killed with 2,4-D at 2·2 kg a.e. per ha when young and actively growing but it becomes less susceptible with age.

KNOBWEED (*Hyptis capitata*). Knobweed is a perennial weed that can be easily killed before flowering with 2,4-D at 2·2 kg a.e per ha. It is generally difficult to kill after flowering.

LANTANA (*Lantana camara*). Lantana is a woody perennial. It is usually killed by brushing the tops and grubbing out the roots, or the cut stump may be swabbed with arsenical poison. The bushes are sometimes pulled out by tractors without any cutting.

High volume spraying (above 670 litres per ha) with 2,4-D at 2·2 kg a.e. per ha will kill most plants in the wetter districts. In the drier districts, the tops should be brushed in March and the young regrowth sprayed with 2,4-D in April. Swabbing freshly cut stumps with 1% 2,4-D is also effective. Spraying of stems above ground level with 2% 2,4,5-T in diesel oil is also satisfactory. Spraying should be carried out during cool, moist weather.

MOLUCCA BRAMBLE AND GIANT BRAMBLE (*Rubus* spp.). Both of these perennial weeds are susceptible to 2,4,5-T at 0·8 kg a.e. per ha when actively growing in summer and early autumn. Additional wetting agent is essential.

POISON PEACH OR PEACH-LEAF POISON BUSH (*Trema aspera*). This woody perennial weed is susceptible to 2,4-D sprays of 0·2% a.e. concentration when the plant is young. The sprays are applied as an overall spot spray until the plants are thoroughly covered (approximately 11 kg a.e. per ha).

RATTLEPODS (*Crotalaria* spp.). All these annual weeds are susceptible to 2,4,5-T at 0·5 kg a.e. per ha. Additional wetting agent is recommended.

SIDA RETUSA (*Sida* sp.). This perennial weed can be killed with 2,4-D at 2·2 kg a.e. per ha when in the seedling stages. Older plants are resistant and must be controlled by mechanical means.

SNAKEWEED (*Stachytarpheta* spp.). Snakeweeds are woody, perennial weeds. They can be killed with 2,4-D at 2·2 kg a.e. per ha. (Thorough spraying is necessary).

WILD TOBACCO TREE (*Solanum auriculatum*). A woody perennial, wild tobacco is usually controlled by brushing the bushes and swabbing the stumps with arsenical solutions or with 1% 2,4-D/2,4,5-T mixed esters in oil.

Small plants can be killed with 2,4-D at 2·2 kg per ha when growing vigorously. Additional wetting agent is essential. For further details on weed control, consult the article by D. R. Bailey, "Weedkillers for Tropical Pastures." *Queensland Agricultural Journal,* September 1969.

PESTS AND DISEASES

The most serious pasture pest and disease problems are related to pangola grass. During the last two very wet summers and dry winters, pangola grass pastures have suffered severe damage from a range of pests and diseases. Aphid (*Schizaphis* sp.) and rust (*Puccinia oahuensis*) damage has been particularly prevalent but because they have been unusual years, the significance of these problems is not yet clear.

Possibly the next most serious pest problem is pod borer (*Maruca testulalis*) in puero. Because of this insect, seed crops of puero are virtually unobtainable unless strict spraying is imposed. A fungus disease (*Botrytis* sp.) has also caused damage in some stylo seed crops.

A few other pests and diseases such as armyworm, red spider, a variety of fungus diseases and a few others occasionally cause damage. However, most of the important grasses and legumes are remarkably free from pests and diseases. Nevertheless, care must be taken when planting new or relatively unknown species as the area has an extremely favourable climate for the build up of pests and diseases. Many new varieties, which were once thought very promising pasture plants, have been wiped out by pests and/or disease.

FUTURE TRENDS

Where good pastures have been established, they have proved to be highly productive provided that proper attention is paid to the management problems outlined. Possible ways of increasing productivity to even higher levels are also outlined. The quantity and quality of feed presented to the animal can be increased by having portion of the property under a grass pasture fertilized with bag nitrogen, using pasture species with an extended growing season, and by improving soil fertility.

On high quality pasture, liveweight gains exceeding 1 kg per animal per day have already been recorded. As mentioned earlier, per hectare liveweight gains of 900 to 1 100 kg per annum are possible. All this augurs well for a bright future. However, the importance of good management cannot be overstressed as any mistakes are far more drastic in this highly intensive system than in most other grazing enterprises.

Insecticides Going Metric

APPLICATION rates of insecticides will in future be expressed in metric units of measurement, not imperial. The conversion will not apply from a set date, as happened with fertilizers, for example, but a gradual transition will be made from the old to the new system of measurement.

by P. D. ROSSITER, Entomology Branch.

This article, which deals with calculating concentrate needs, calibrating a sprayer and mixing the spray, is intended to help farmers avoid some of the pitfalls in this tricky business and so make a smooth transition.

As part of the transition, the directions printed on the labels of agricultural chemicals are now being converted to the metric system. Initially, some labels may provide directions in both imperial and metric units.

In the metric system, insecticide dosage rates will be specified as grams of active constituent per hectare in place of pounds or ounces per acre. Similarly, spray application rates will convert from gallons of spray per acre to litres per hectare.

The recommendation specifying a percentage of active constituent in the spray will remain unchanged although some changes in calculations may be required when using metric units.

Transitional Conversion Units

During the period of conversion, it is evident that both metric and imperial terms will be encountered. The points of greatest concern to farmers will be the insecticide dosage, spray application rate and volume of the spray tank.

Much of the literature on pest control will have to be revised to incorporate metric terms. This could be a lengthy process. Consequently, a farmer who has taken the trouble to calibrate his sprayer in metric units may require to convert imperial dosage rates to metric rates before he can begin mixing the spray. A suitable conversion factor is shown in equation 1 at the end of this article.

To obtain maximum benefit from the metric system, the numbers obtained by conversion from the imperial system may be rounded off. This may be done after converting the dosage of active constituent, or after calculating the requirements of insecticide concentrate (which may be preferable). The main restriction to rounding off is that the resultant dosage of active constituent does not vary by more than 5% from the prescribed requirements. Any greater variation may alter the efficiency of the product. Groups dealing with the sale and registration of agricultural chemicals have agreed to a set of guidelines which are recommended as a basis in the conversion of label directions to the metric system. These are too lengthy for inclusion in this article.

A farmer's first encounter with a metric dosage recommendation will require conversion of his sprayer calibration from imperial to metric units. Equation 2 provides a suitable factor, assuming that an accurate imperial calibration has been performed previously.

If the gallonage of the spray tank is known, either of the factors shown in equation 3 may be used to convert to litres.

Calculating Concentrate Needs

The quantity of insecticide concentrate required to obtain a recommended dosage of active constituent must be determined. Some insecticide labels may indicate the appropriate quantity to be used for specific purposes. If this information is not provided, a calculation involving the percentage of active constituent, which must be shown on the labels of registered insecticides, will be required.

If the concentrate is a liquid, the percentage has been expressed on a weight for volume basis (w/v). In powder concentrates, it has been expressed on a weight for weight basis (w/w). Calculations from these will result in measuring liquids by volume (litres) and powders by weight (kilograms). Occasionally, strengths of liquid concentrates are shown on a weight for weight basis. If this figure is used in calculations, the result will be in terms of weight.

A suitable formula for calculating the quantity of insecticide concentrate per hectare is shown in equation 4.

Calibrating the Sprayer

The sprayer is calibrated by measuring the output of spray over a known area. For the purpose of the calculation shown in this article, the test area will be determined by a travelling distance of 100 metres and the swath width of the sprayer.

The effective swath width of a standard boom sprayer is determined by measuring the distance between nozzles and multiplying by the number of nozzles. In row crop spraying, the distance between rows may be measured and multiplied by the number of rows covered by the sprayer in a single passage. The swath width of other types of spray units may be measured directly. This may be facilitated by the distribution of small glass sheets over the sprayed surface to indicate where spray droplets have fallen.

The measurement of swath width should be expressed in metres.

Having defined the dimensions of the test area, the output of the sprayer may now be measured. In conducting the test, it is important to have all controls in the positions required for field spraying. The volume of spray used over the test area may be measured in either of two ways.

One method involves marking the water level in the spray tank at the beginning of the test and measuring the volume of water required to refill to this mark at the end.

The second method can be used with only certain types of sprayers. This involves measuring the total volume of spray collected in suitable containers suspended below the nozzles.

The unit of volume in these measurements is the litre.

From the above measurements, it is possible to calculate the spray application rate in litres per hectare using equation 5.

Mixing in the Spray Tank

The ultimate calculation in insecticide usage determines the quantity of insecticide concentrate to be added to the spray tank.

Having determined the quantity of insecticide concentrate per hectare and the application rate of the sprayer per hectare and, with a knowledge of the total volume of spray to be mixed, the quantity of concentrate to be added to the spray tank may be calculated using equation 6a.

Alternatively, where an actual knowledge of the units of quantity of concentrate per hectare and application rate per hectare are not essential, the quantity of concentrate to be added to the spray tank may be calculated directly from the basic units which were determined for these calculations. In this way, although the same tests and measurements must be conducted, only one final calculation is involved as shown in equation 6b.

Equation 6c is presented to assist in mixing sprays where the dosage is set out as a percentage of active constituent.

The result of these calculations will be the volume of liquid concentrate in litres or the weight of powder concentrate in kilograms to be added to the spray tank.

This article has been designed to overcome the initial confusion that may occur with the use of metric measurements in insecticide usage. Specific problems on this subject may be referred to your local extension officer of the Department of Primary Industries.

Equations For Insecticide Usage

TRANSITIONAL CONVERSION

1 Dosage rate: 1 ounce per acre = 70 grams per hectare

2 Spray application rate: 1 gallon per acre = 11·23 ($11\frac{1}{4}$) litres per hectare

3 Volume—(a) 1 gal. = 4·546 litres
(b) 22 gal. = 100 litres

METRIC CALCULATIONS

4 Quantity of concentrate per hectare: $Q = \frac{D}{10xP}$

5 Spray Application rate: $C = \frac{Ux100}{S}$

6 Quantity of concentrate in spray tank:

(a) $R = \frac{QxV}{C}$

(b) $R = \frac{DxSxV}{PxUx1000}$

(c) $R = \frac{dxV}{P}$

In the above equations, the following abbreviations are used—

C = spray application rate (litres per ha)
d = dosage rate (percentage active constituent in spray)
D = dosage rate (g of active constituent per ha)
P = strength of concentrate (percentage active constituent, w/v liquid; w/w powder)
Q = quantity of concentrate per hectare (litres of liquid, kg of powder)
R = quantity of concentrate in spray tank (litres of liquid, kg of powder)
S = swath width of sprayer (metres)
U = output of sprayer per 100 m (litres)
V = volume of spray tank (litres)

Bands from Welcome Swallows

QUEENSLANDERS are being asked to help in a bird banding project on the welcome swallow (*Hirundo neoxena*).

The organizer of the Welcome Swallow Banding Project (Mrs. P. Park) has appealed to Queenslanders to watch for dead welcome swallows and, if they are banded, to return the leg band to the C.S.I.R.O., Canberra. The complete address is: Australian Bird Banding Scheme, P.O. Box 84, Lyneham, A.C.T., 2602.

Finders are also asked to send a letter with the leg band. The letter should say where the bird was found and give the finder's opinion of the cause of death.

Mrs. Park said Tasmania had now joined the Welcome Swallow Banding Group. This was part of the Australian Banding Scheme and operated through the C.S.I.R.O. Division of Wildlife Research.

The aim of the project was to find out something about the migratory movement of the welcome swallow from Tasmania to the mainland. So far, no welcome swallows banded in Tasmania had been picked up on the mainland. Birds banded on the mainland had not been picked up in Tasmania either.

Mechanized Stall Feeding for

STALL feeding a dairy herd of 400 cows twice a day is a mammoth task if the facilities are inadequate. Mr. R. Gills, of Northgate, Brisbane, has installed a system that makes the task easy work for one man.

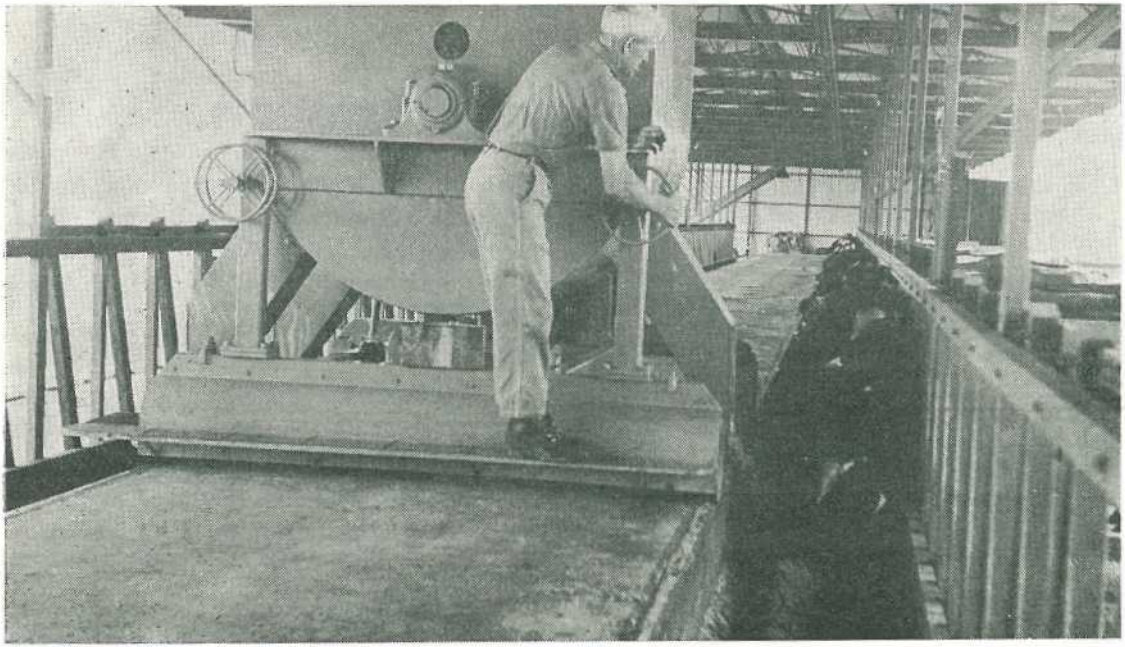
Mr. Gills' herd produces milk which is pasteurized and bottled on his own dairy for distribution in Brisbane. Feeding the herd adequately to maintain a regular supply of milk for his milk trade is a major exercise in farm management.

As herd size has grown over the years as the result of an expanding milk business, so has the problem of stall feeding the herd. Cows are not given any feed during milking in the nine-a-side low-line herring-bone milking shed. Production averages about 14 litres per cow per day throughout the year. The grazing area consists of 200 ha of low-lying flat country on which the dominant grass is paspalum.

Shed Design

After inspecting several large stall feeding facilities, Mr. Gills built a 100-a-side cow feeding shed with a platform down the centre on which the feed mixer travels and distributes the mixed feed into troughs on each side of the platform (plate 1). The ration given to the cow is brewer's grain, pineapple pulp from the cannery, cotton seed hulls from the ginnery, meat-and-bone meal and salt.

The shed is 61 m long, the floor area is 11 m wide and the roof is 3 m high. The platform in the centre is 2 m wide and 75 cm above the feeding floor.



A general view of Mr. Gills' feeding stalls. The operator is adjusting the quantity of feed delivered to the feed troughs from the mixer (plate 1).

Large Herds . . .

by P. McCALLUM, Division of Dairying.

Each set of 100 stalls is divided by gates into four bays, each holding 25 cows. The feed troughs are concrete covered with epoxy resin. The bottom of the troughs is saucer shaped and 10 cm above the floor. The concrete base on which the bail sections rest is 36 cm high and the platform side 75 cm high. The bail for each cow is built of hardwood timber and is 60 cm wide, and 1 m high (plate 2). Mr. Gills decided on timber bails to eliminate the noise associated with metal.

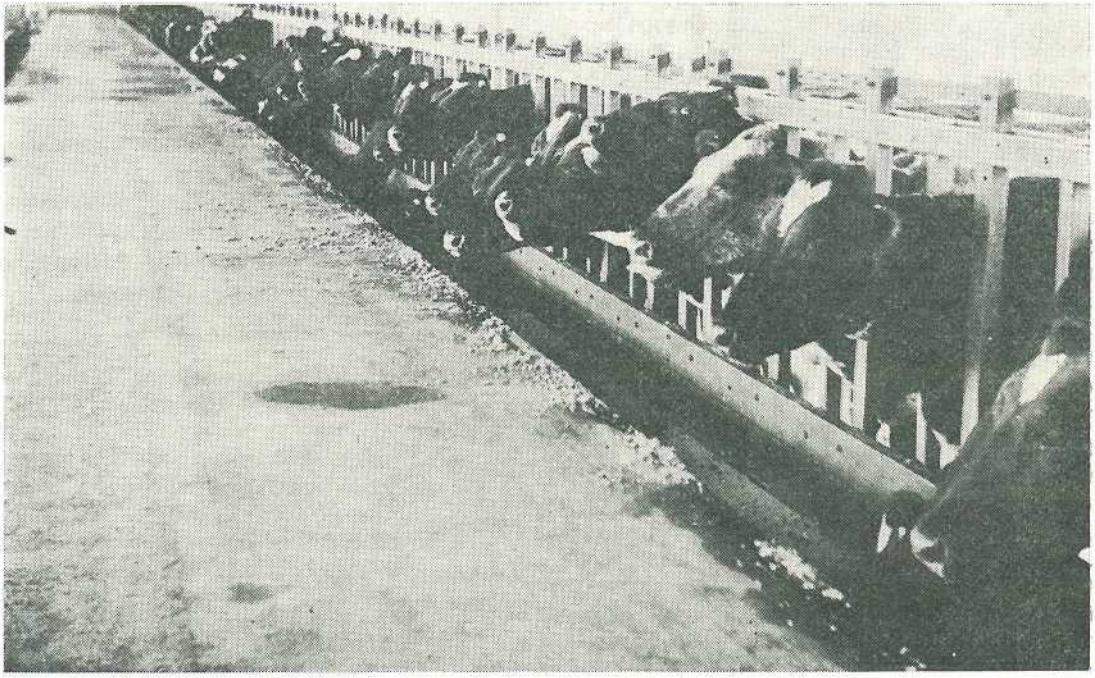
Twenty-five cows at a time can be securely bailed up by pulling a wire rope in the stall area. In practice, it has been found that a stall space of 60 cm per cow is ample, even for Friesian cows. The cow area is 4 m wide from the trough to the low brick wall at the rear of the cows.

A drain 35 cm wide and 30 cm deep runs the full length of the shed at the foot of each brick wall. The whole floor area is hosed with a pressure hose after each feeding. All drainage runs into a circular concrete pit which is fitted with a 50 mm manure pump and 3·7 kW electric motor. The effluent is pumped onto the pasture through a 400 m length of 50 mm black polythene piping.

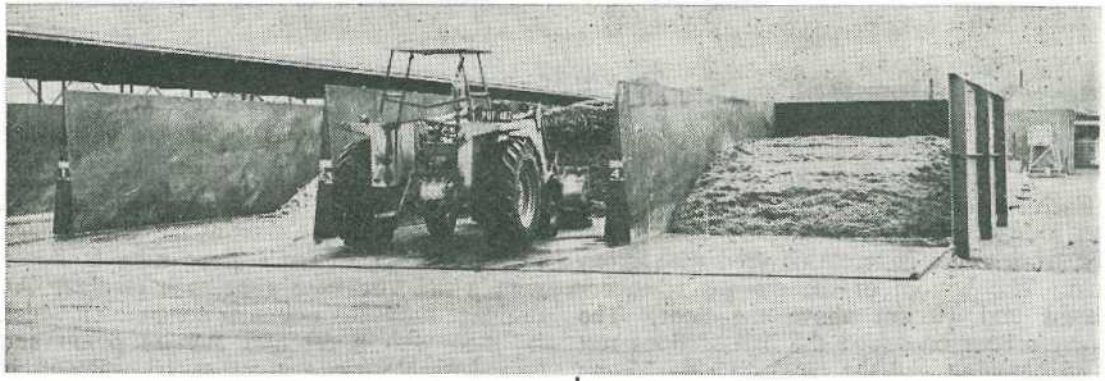
A feed storage area extension is fitted at one end of the cattle stalls and is of steel and galvanized iron. Its dimensions are: 12 m long, 13 m wide, and 4 m high.

Mechanization

Mechanization begins with the delivery of the brewer's grain and pineapple pulp in approximately 10 tonne loads. These industry by-products are dumped into heavy gauge steel



Cows in 60 cm wide stalls feed contentedly from the troughs (plate 2).



Metal bins used to store the pineapple pulp and brewer's grain are emptied by a front-end loader (plate 3).

bins. There are four such bins. The dimensions of each bin are 8 m long, 3·5 m wide and 2 m deep. The floor of the bins is also heavy gauge steel plate. Excess moisture from the grain and pulp drains into a drainage channel and then to a sump of 3 200 litres used for liquid manure disposal.

To prepare a feeding mix for the herd, a tractor with a front-end loader scoops up the brewer's grain, pineapple pulp and cotton-seed hulls and then travels up a wooden ramp to load the feed mixer (plate 3). The feeds are mixed in the proportion of 27 kg of pineapple pulp, 23 kg of brewer's grain, and approximately 2 kg of cottonseed hulls per cow a day. The meatmeal and salt are added directly to the feed mixer. The quantity of meatmeal fed per cow ranges from 900 g a day down to 230 g a day depending on grazing available. Filling the mixer takes about eight loads with the front-end loader.

The feed mixer was made in Sydney and is fitted with two electric motors. A 7·5 kW motor drives the blades in the mixer for final mixing of the feed, and a 1·5 kW motor moves the mixer up and down the centre of the feed stalls. Power for this drive motor comes fron an electric bus bar that runs the length of the shed. By simply pressing a button the mixer proceeds slowly up the length of the stalls and distributes the feed evenly along the trough, on one side of the platform. On reaching the far end of the feeding stalls, another switch is operated and the mixer automatically returns to its original position for refilling. The mixer holds 2 to 3 tonnes which is enough to feed 100 cows. The time taken to travel the length of the shed is 10 minutes each way. After refilling, the trough on the other side is filled.

Costs

The cost of the major items is as follows:—

	$
Buildings	34 000
Feed mixer	13 000
Storage bins	7 000
Electrical work (bus-bar, etc.) ..	2 500
Manure pump, etc.	1 000
	$57 500

No doubt the cost of such an elaborate feeding system is beyond the means of the average farmer, but then Mr. Gills is not an average farmer. Suitable labour is a major problem on most farms and unless the work is attractive, the problem is worse. Feeding the 400 cows on this dairy is a one-man operation and can be done with ease.

Against this cost must be balanced the savings in wages for labour, the reduction in feed wastage and the more efficient use of the feed ration.

Identifying Insects . . . Part I

CONTROL of insect pests has never been simple. This is especially so in Queensland where we have at least 300 major insect pests, an even greater number of minor pests, and many others with pest potential.

Our problems are further aggravated if the insect we wish to control is not correctly identified. Recognizing a pest species at its various stages of development is the starting point of any control programme.

The life histories and habits of even closely related insects differ so widely that the methods employed for the destruction of one may be of little use against another. Within a single species, the various life history stages can differ in their relative susceptibility to a control measure.

by I. D. GALLOWAY, Entomologist.

To attempt a control without knowing the identity or stage of development of the pest involved is extremely hazardous and may create side-effects more serious than the original problem, particularly when modern, highly toxic insecticides may be involved.

We should therefore be able to recognize our major pests in all their various stages of growth. An understanding of insect relationships in the animal kingdom, and the growth and development stages of pest species is therefore implied.

This is the first of an intended series of articles on identifying our major insect pests. The aim is to present illustrated descriptions written in non-technical language, so that most insect pests can be readily distinguished. Inevitably, difficulties will still arise and expert assistance will be required. This can be readily obtained from the insect identification service provided by the Entomology Branch of the Department of Primary Industries.

Insects in the Animal World

When speaking of insects, we rarely refer to them as animals, as this term is popularly restricted to groups of larger creatures with backbones. Insects do, however, belong to an extremely important group of the animal kingdom known as the Arthropoda. This name Arthropoda is derived from the Greek terms 'arthron' a joint, an 'pous' a foot; hence all Arthropods possess jointed appendages.

The Arthropoda accounts for approximately 80% of all known animal species. About 90% of Arthropods are insects, the remainder include, among others, lobsters, crabs, centipedes, scorpions, spiders and mites. From this we can appreciate that, in terms of variety and sheer weight of numbers, insects play a dominant role in the animal kindgdom.

Insect Growth and Development

In common with all other animals, insects begin life from a single cell known as the egg. Before development can begin, it is usually necessary for the insect egg to be fertilized by union with a sperm from the male insect.

In some insects, however, development does not depend on fertilization. The female insect is capable of producing normal offspring without first mating with a male. This is known as parthenogenesis.

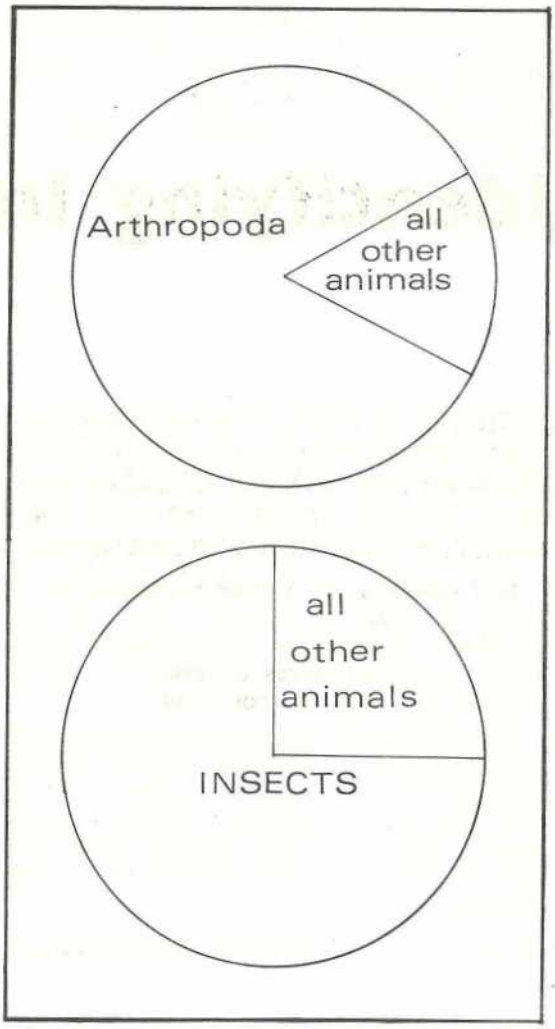
A parthenogenetic species has a greater pest potential than one in which mating is necessary, because the hazards involved in finding a mate are removed. Hence reproduction is assured and vast numbers of offspring can result.

Broadly speaking, development and growth is everything that takes place between the fertilization of the egg and the perfection of the full-grown insect. Hatching of the egg sharply divides growth and development into two phases. That part of the development that occurs before hatching is called embryonic development and all that takes place after hatching is post-embryonic development.

In this study, the complex phases of embryonic development are omitted.

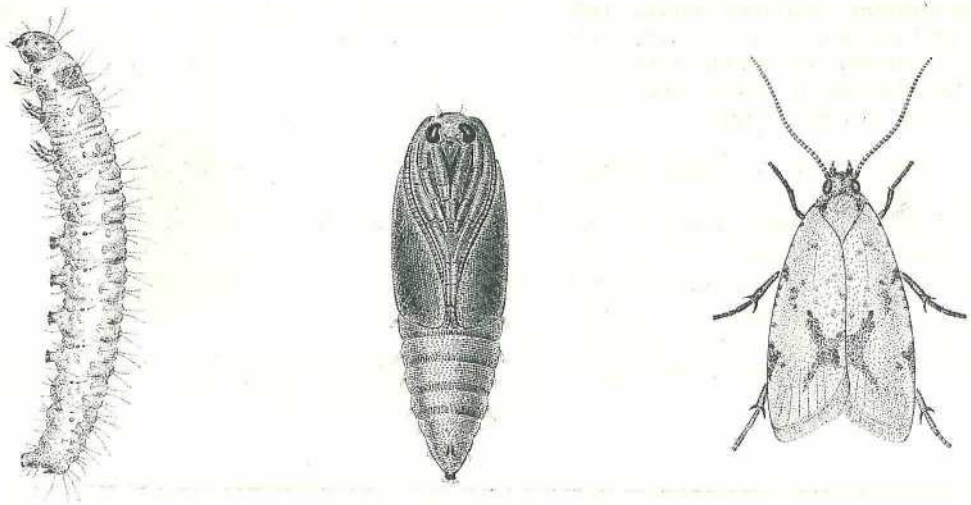
During their development to maturity, insects pass through a number of distinct stages or forms. This is known as metamorphosis. Some insects pass through what is known as complete metamorphosis, but, in others, it is incomplete.

In complete metamorphosis, the life of the insect may be divided into four distinct and well-marked stages: the egg, larva, pupa and adult. When metamorphosis is incomplete, the young insect on emerging from the egg is in all essentials a miniature replica of its parents. Where the adult bears wings, small wing pads make their appearance in the young and increase in size with growth of the insect. There is no resting or pupal state, but the insect remains active throughout its life. As the insect grows, its skin is moulted or shed to permit further expansion and, with the casting of its last nymphal skin, the insect becomes fully mature and able to reproduce.



TOP. Relative abundance of Arthropods and other animals (figure 1).

BOTTOM. Relative abundance of insects and other animals (figure 2).



Lucerne leaf roller: complete metamorphosis. Left, larva (magnified about six times); centre, pupa (magnified about seven times); right, adult (magnified about five times). (Figure 3).

No insect can grow once it has emerged from the pupa or has shed its final nymphal skin. In spite of the popular belief, little flies do not grow into big ones.

Insect Classification

Most people recognize an insect when they see one, but many find it difficult to provide an adequate definition.

An insect may be first defined as an invertebrate animal with a segmented body and paired jointed appendages. It possesses no internal skeleton but its skin is reinforced by a substance called chitin so that it is encased in a suit of light but strong armour.

Its body is divided into three separate and distinct regions: the head, which bears the principal sense organs and the mouth parts; the thorax, which bears the appendages for locomotion, that is, the legs and the wings; and the abdomen, which contains the organs of digestion and reproduction.

All insects have six legs. Spiders and their allies, which are not insects but Arachnids, have eight legs.

The insect world has been divided by scientists into a number of groups or orders, all the individuals of which have some character or characters in common. Each order is divided into families; each family into genera; and each genus into species. Since insects related by descent share many common structural features, insect classification also reflects degrees of evolutionary relationship.

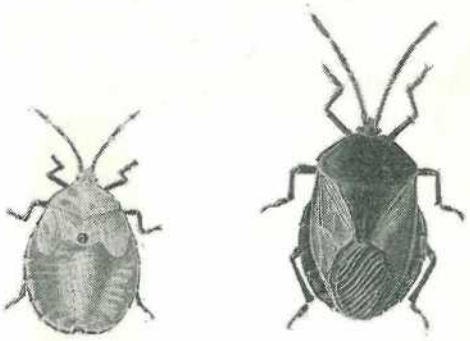
For many years, the study of insects has been synonymous with dry terms and terrifying scientific names. The necessity for such names is generally not well understood. When an insect has been adequately described, it is given a scientific name which is usually in Latin, Greek, or the latinized form of some modern language.

Latin is an almost universal language whose form has been static for many years. Scientific names are therefore the same in all countries and all languages.

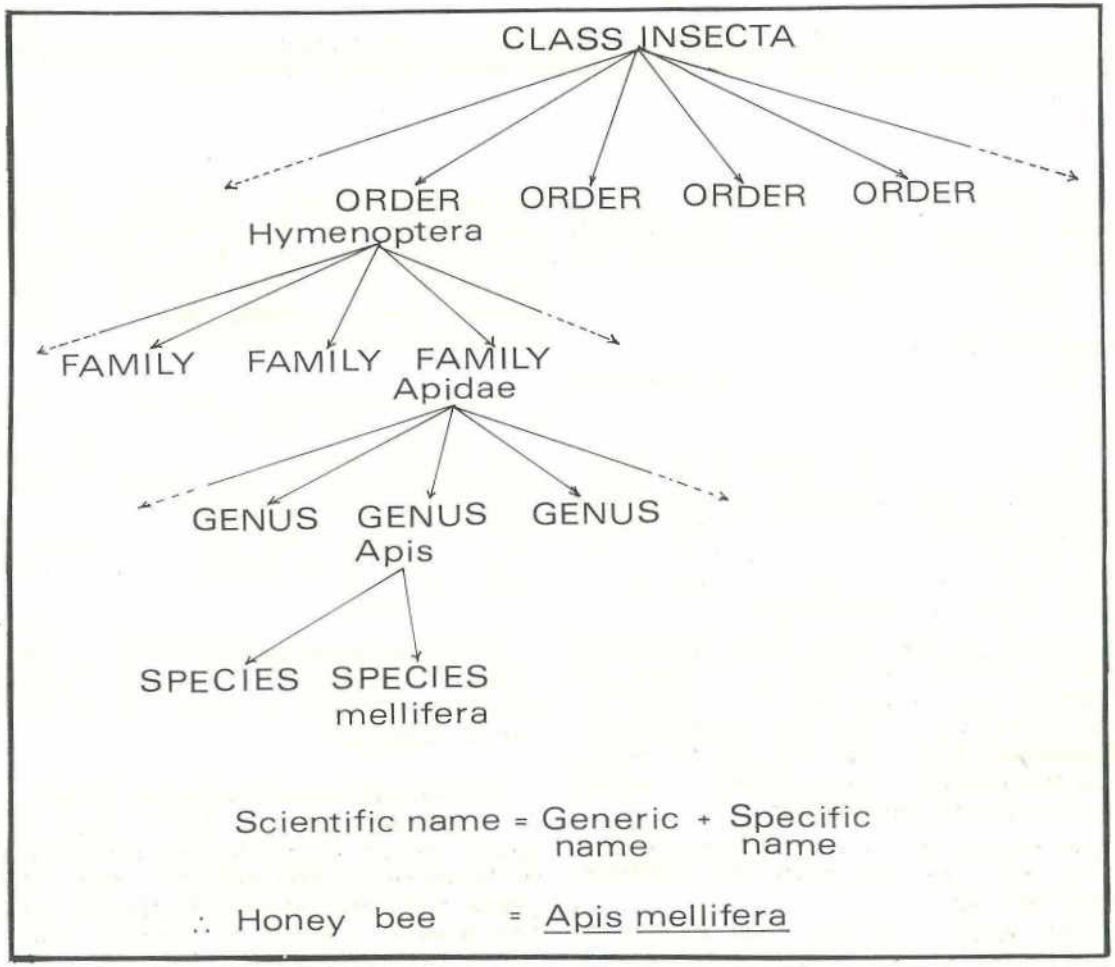
The scientific name of an insect consists of the combination of two Latin words: the generic and the specific names. For example the honey bee is *Apis mellifera. Apis* is the generic name and *mellifera* the specific name. This practice is known as binomial nomenclature and was founded by Carolus Linnaeus in 1758.

Insect classification therefore serves two purposes. It provides a method of giving convenient and universally acceptable names to all species. In addition, it shows how these species are related to one another.

An insect identification is clearly multifunctional. Essentially, it provides a universally recognized scientific name which is the key to all published information on the life history and ecology of that insect and to other data important in the development of a control programme. At this point, a control measure based on sound information can be formulated and applied.



Bronze orange bug: incomplete metamorphosis. Left, nymph; right, adult (both approximately natural size), (Figure 4).



Classification of the honey bee (figure 5).

The Buffalo Fly In Qld.

A back-rubber used for buffalo fly control is demonstrated at a field day in Central Queensland. In the lower picture, some graziers have moved in for a closer look.

BUFFALO fly has spread across the top of Australia, from Port Hedland to Bundaberg since it gained entry into this country at Port Essington in 1838.

It is suspected that this pest gained entry on buffaloes brought from Timor to Melville Island.

In Queensland, the buffalo fly is now firmly entrenched along the coast from Bororen to Cape York, and westward to the Great Dividing Range.

The buffalo fly (*Haematobia exigua*) is one of the smallest blood-sucking flies. It is about 4 mm long and is grey in colour. The proboscis, which the fly uses to puncture the skin and suck the blood, is about 1 mm long.

An attack on cattle by a large number of buffalo flies produces severe irritation and results in cattle shaking their heads, flicking their tails continuously and walking through bushes to dislodge the insects.

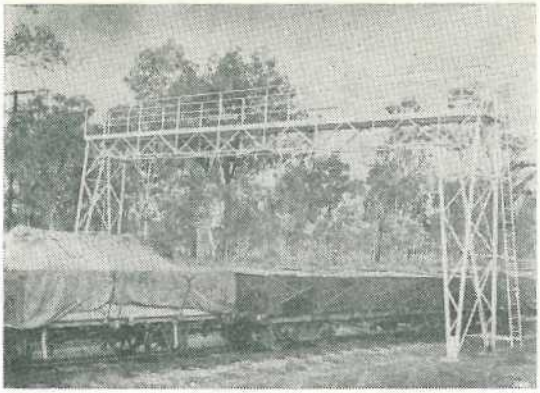
The effect of buffalo flies on cattle is to slow down the rate of fattening and also to sharply reduce milk production.

Brahman cattle (*Bos indicus*) may carry heavy infestations, but they do not appear to be as worried as British breeds. In general, they show fewer sores than British cattle, and may be unmarked even when the fly is abundant.

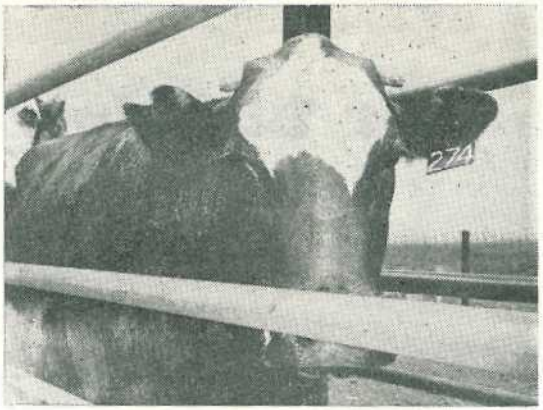
Bulls of all breeds appear to be more susceptible than females. Observations indicate that buffalo flies are more attracted to animals with darker coloured coats.

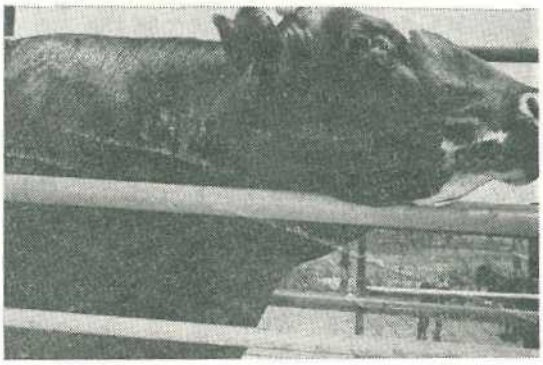
Both sexes are blood-suckers, and the bite is painful. The flies are found in greatest numbers on the shoulders, withers and the flanks, but the neck, ribs and back are also favoured sites, as are the eyes and the horns. In rainy or windy weather, they seek sheltered parts, and may burrow into the hair. When disturbed, they rise in a short, quick, vertical flight and rapidly settle again. They do not hover or dart about.

by B. EASTAWAY, Inspector of Stock.



The buffalo fly rail spray unit at Bororen. It is used for spraying all cattle moving south by rail.





Two views of sores caused by buffalo fly worry. Note the loss of hair along the neck and around the eyes.

Life Cycle

Buffalo flies must feed on blood before their eggs will mature.

The creamy-white eggs are laid in fresh dung of cattle or buffaloes and hatch in about 24 hours at a temperature of 24 to 26°C. Lower temperatures and rapid drying out will kill the eggs.

The larvae will then feed on the dung, mature in 4 days at a temperature of 27 to 29°, or up to 4 weeks if the temperature is lower. Development will cease if moisture falls below 50%.

Larvae then pupate in the soil, depending on weather conditions, and emerge at between 4 days and 3 weeks.

Adults may live for up to 7 weeks, but the normal life cycle under favourable conditions takes from 7 to 11 days to complete.

Spread in Queensland

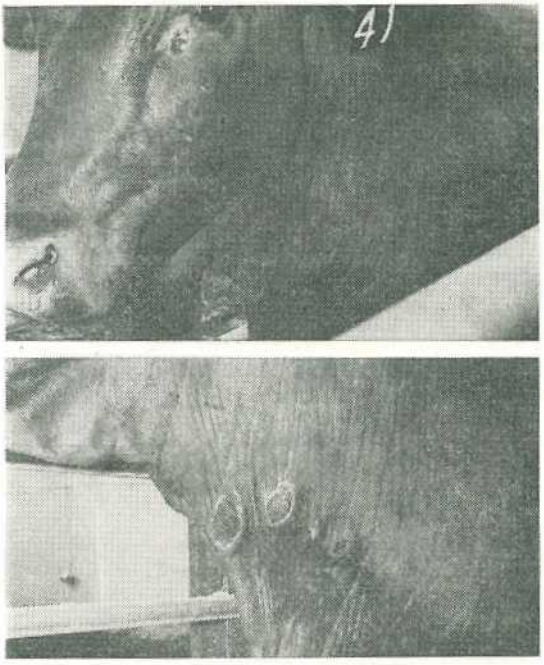
In 1928, the buffalo fly appeared on travelling mobs of cattle and grazing stock in the north-west corner of Queensland.

In 1932, it spread almost to Normanton, and then in 1940 appeared on the western shores of Cape York Peninsula.

Early in 1943, the buffalo fly reached the Great Dividing Range, near the Atherton Tableland, and soon spread to the coast north and south of Cairns, and extended to the Townsville and Ayr districts.

In 1946, the buffalo fly was reported in Bundaberg, Proston, Wandoan and Injune districts, with isolated cases reported from Roma, Miles, Chinchilla and Dalby.

Since the initial southward spread in 1946, the parasite has receded farther north and is now firmly established on the east coast from Bororen to Cape York and west to the Great



This bullock also has sores around the eyes and on the neck as the result of buffalo fly worry. The lower of this pair of pictures is close-up of the neck sores.

Dividing Range. It is also normally present in the Gulf district, extending in good seasons as far south as the Hughenden–Mt. Isa rail line and occasionally crossing it.

Mild winters with suitable rain allow the fly to over-winter in areas not normally regarded as its habitat and subsequently to make incursions into areas not normally infested by it. On the other hand, the onset of cold snaps in the autumn and early winter free marginally infested areas of buffalo fly. For instance, in suitable seasons, buffalo fly may extend west of the Dividing Range in Central Queensland to infest areas such as Jericho, Muttaburra, Longreach and Blackall.

Normally buffalo fly infestations do not extend farther south than the Theodore–Rolleston areas, but they do on occasions move southwards towards the Wandoan, Injune and Upper Warrego areas.

Control of Further Spread

All stock moving south of the buffalo fly infested areas are treated with sprayings of methoxychlor or suitable organic phosphate insecticide. The use of DDT for the control of buffalo fly was banned from 1 January 1973.

A permanent treatment plant has been established at Bororen, between Bundaberg and Gladstone, to treat stock moving south by rail. A mobile spray also has been installed for treating stock on road transport, or on the hoof.

Stock travelling from infested areas in other parts of the State are treated by Department of Primary Industries staff when deemed necessary.

Control of Buffalo Fly in Stock

CHEMICAL SPRAYING. Spraying of stock after dipping is mainly used at present. The usual treatment is 1% methoxychlor used at the rate of 550 ml per head, not more than once every 3 weeks. This rate must be adhered to, otherwise residue problems will occur.

D.D.T. may no longer be used for buffalo fly control.

CHEMICALLY-IMPREGNATED BACK-RUBBERS. These are made by binding together several strands of barbed wire into a rope about 4·5 to 6 m long.

Hessian strips or bags are wound around this to a thickness of 10 to 15 cm in diameter. The first layer of hessian must be wound tightly.

Swivels are attached to each end of the rubber and tied to trees or posts at the appropriate distance at about 130 cm high, so the middle of the back-rubber is about 60 cm off the ground.

The rubber is charged with a mixture of ethion and sump oil at a dilution of 1 in 60. To obtain this concentration, add 378 ml to 22·7 litres of oil and mix thoroughly. For the initial charging, pour the mixture along the rubber, rolling it as you wet each dry section. The initial charging requires 9 to 11 litres. Recharge the rubber in 1 week's time with about 2 litres and following this recharge

when required, which may be every 2 to 4 weeks using from 560 ml to 2 litres of well-stirred mixture.

BIOLOGICAL CONTROL. Species of dung beetles are being imported from Africa to provide a method of biological control of the buffalo fly.

Dung beetle eggs are passed through an elaborate quarantine procedure after importation. The adult beetles are then released at selected sites.

These beetles bury into the fresh dung pads, thus burying the fly eggs or larvae with the dung.

Between 50 and 100 pairs of dung beetles will bury a dung pad within 24 to 30 hours.

Histerid beetles, predators of fly larvae, have also been introduced. These beetles have large curved jaws with which they hold the fly larvae and suck them dry. These beetles do not interfere with the developing dung beetle.

The only known predators of the dung beetle are cane toads and ibises.

The liberation of dung beetle species is still in the early stages and more time will have to elapse before their usefulness as a means of biological control can be evaluated.

The Pancake Story . . .

Continued from page 256

Savoury Pancake Timbale

The Pancakes

1 cup plain flour, sifted

1 egg

1¼ cups milk

Pinch of nutmeg

Pepper and salt to taste

Make pancake batter in normal way. Stand 30 minutes. In hot, butter-brushed, 6 in. pan, pour in enough batter to cover pan base thinly, tilting pan to spread batter quickly. Cook on both sides till lightly browned. Makes eight to 10 pancakes.

The Meat Filling

1 oz. butter

1 large onion, chopped

3 garlic cloves, chopped finely

12 oz. lamb's fry, diced

¼ cup each tomato paste and water

1 tablespoon flour

¼ teaspoon oregano

Salt and pepper

Melt butter, saute onion and garlic till soft. Add liver. Saute 5 to 10 minutes. Stir in flour. Stir in tomato paste, water and seasonings. Cover, simmer 5 minutes.

The Cheese Sauce

1 oz. butter

¼ cup flour

1¼ cups milk

¼ teaspoon nutmeg

3 oz. (¾ cup) grated Australian matured Cheddar cheese

Salt and pepper to taste

Melt butter. Blend in flour. Cook 1 minute. Add milk. Stir till boiling. Add nutmeg, salt and pepper to taste. Simmer 2 minutes. Away from heat stir in cheese till melted.

TO ASSEMBLE. In a deep, round, ovenproof casserole, place a pancake on the base. Alternate with meat sauce, a pancake and cheese sauce. Repeat layers finishing with cheese sauce. Sprinkle over extra grated Australian matured Cheddar cheese. Bake in hot oven (400°F) for 20 minutes or till pancakes are heated through. Serves six.

Maydis Leaf Blight in Maize

MAYDIS leaf blight *(Drechslera maydis)* recorded only recently in Queensland, was first observed during the 1971–72 season.

The disease, however, had previously devastated the maize crop in the United States during 1970. In Australia, it was first found on the Atherton Tableland, but subsequently was identified from all the major maize producing areas of Queensland. It has been reported also from the Northern Territory and New South Wales.

The severity of the disease depends on the relative susceptibility of maize hybrids to the race or races of the fungus present in an area.

Symptoms

All above-ground parts of the plant may be affected. Leaf spots are more or less spindle-shaped and pale-brown with a darker border, sometimes surrounded by a pale yellow halo.

Spots are small, mostly 10 mm long by 2 to 5 mm wide, but may reach up to 40 mm in length under favourable conditions. Infections of this type generally result in premature death of the leaves.

On the leaf sheaths and ear husks, small, round, pale-brown spots may occur. In some hybrids, a dark rot of the ear may develop, usually beginning at the tip.

Maydis leaf blight has often been confused with leaf blight caused by a related fungus, *Drechslera turcica*, which has been widespread in Queensland for many years, In this case, leaf spots are grey to brown and quite large, often measuring up to 150 mm long by 20 to 30 mm wide.

Spread

The maydis leaf blight fungus is spread by means of spores which may be carried by winds over considerable distances. Spread and subsequent disease development are favoured by warm, showery weather.

The fungus may persist from season to season on infested crop trash and volunteer plants. In addition, several common grass weeds including toesinte, summer grass, crow's foot and awnless barnyard grass are known as hosts.

The fungus may also be seed-borne in some hybrids.

Control

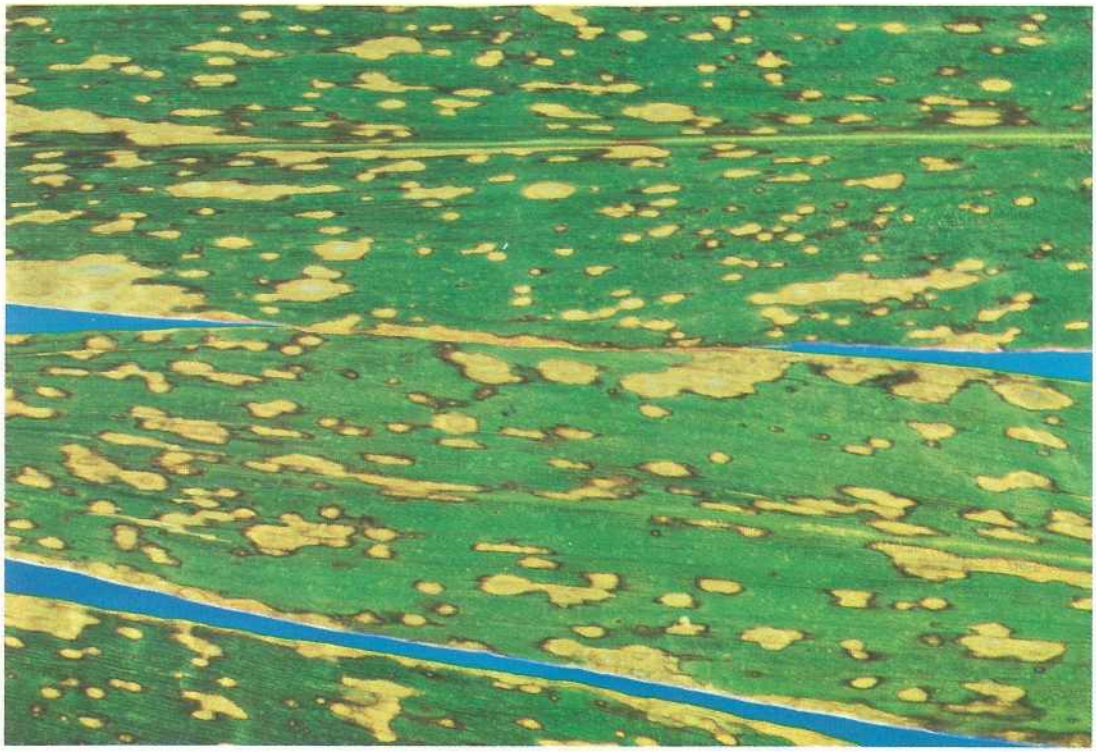
The disease may be prevented by ensuring that susceptible hybrids are avoided. Details of hybrids recommended for each maize growing area are published annually by the Department of Primary Industries before the beginning of the season.

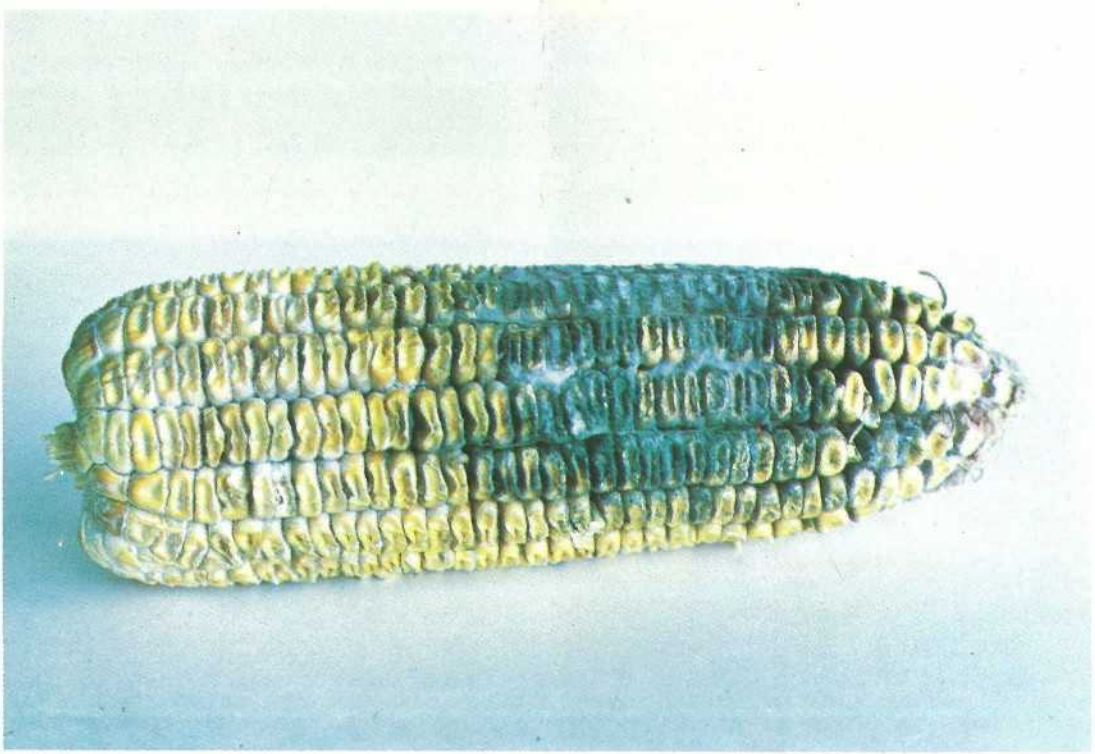
Prompt destruction of crop trash and volunteer plants will assist in disease control.

— Plant Pathology Branch

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

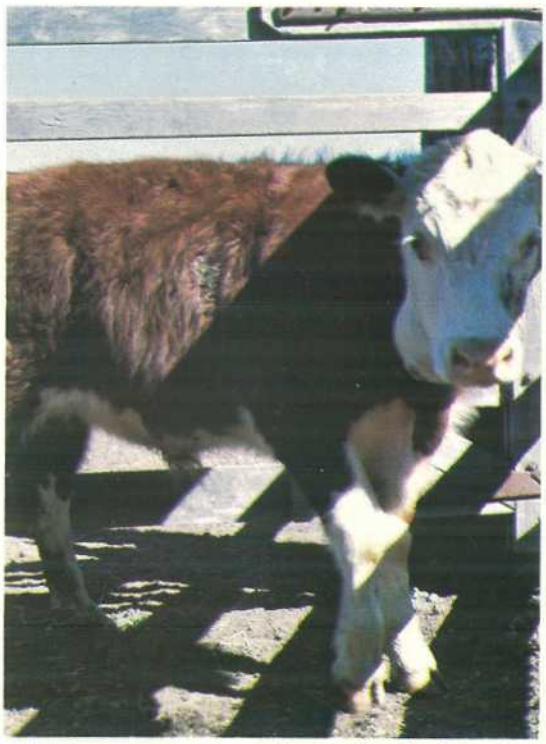
Diseases of Maize - 1





Maydis leaf blight. Upper: leaf spots. Lower: ear rot.

Two Lumpy Jaw Diseases of Cattle



Abscesses caused by actinobacillosis, like this one, affect soft tissues and are movable.

A burst actinobacillosis swelling. Just below the ear is a common site for these lesions which contain yellow, creamy pus.

Actinomycosis on the lower jaw of a bullock. Actinomycosis and actinobacillosis are easily confused because they occur in similar areas of the head. Actinomycosis abscesses are in bony tissue and are immovable; actinobacillosis abscesses are in soft tissues and movable.

Two Lumpy Jaw Diseases of Cattle

ACTINOMYCOSIS, usually called lumpy jaw, and actinobaccillosis are two common and similar diseases that attack the tissues of the head of cattle. Both are accompanied by a granular, gritty type of pus.

However, while actinomycosis causes the bones of the head and face to swell, actinobacillosis affects the soft tissues of the head. Actinomycosis is difficult to treat successfully, but actinobacillosis usually responds to treatment.

Different bacteria are responsible for the diseases.

Spread

The actinomycosis organism is thought to enter through the teeth sockets or a mouth ulcer. The disease often occurs in young cattle after they shed their temporary teeth. It is possible for an outbreak to flare up and persist at a high level of infection for up to 12 months.

Actinobacillosis gains entry through the lining of the mouth and throat, often through punctures made by grass seeds. Besides the mouth and throat, it can also cause lung abscesses. When the tongue is infected, the condition is often called 'wooden tongue'.

Symptoms

Actinomycosis of the bone first appears as a small, immovable swelling on the lower or upper jaw. On the upper jaw, it is usually located under the eye. The rate at which the growth enlarges varies greatly, but what identifies it is its immobility. As the swelling enlarges, the bone becomes spongy and the cavities fill with pus. The skin over the swelling usually breaks and a thick, white or creamy, granular pus discharges. Often the wound will heal temporarily and then break out again.

Swellings caused by actinobacillosis are movable and are generally situated under the lower jaw in the region immediately below the ear. When pressed or opened surgically, the swelling discharges a yellow, creamy pus. When the tongue is infected, it becomes swollen and hardened because fibrous tissue is laid down. This hardening has led to the common name 'wooden tongue'. Mastication is difficult and saliva may drool from the mouth.

Treatment

If treatment is planned, it is best to seek veterinary assistance. The veterinarian is able to decide whether surgical drainage and/or treatment with drugs is warranted. In cattle infected with actinomycosis, the lump invariably bursts, spreading the disease organisms over pastures, feeding boxes and troughs. For this reason, it is best to cull 'lumpies' immediately they are recognised.

Moving Infected Stock

Because actinomycosis and actinobacillosis are notifiable diseases under the Stock Acts 1915–65, affected cattle with discharging lesions are not permitted to travel. However, if, in the opinion of a Stock Inspector, the lesion is not discharging or likely to discharge, he may issue a special permit to move the affected animal direct to an abattoir to be killed on the owner's account.

Therefore, owners should cull animals with actinomycosis while the lesions are small and not likely to discharge. Such early culling reduces the incidence of the disease on the property and is an effective means of disease control.

— S.G. KNOTT, Veterinary Services Branch

Pink Wax Scale and Its Control

by D. SMITH, Entomologist.

PINK WAX scale is an important pest in most citrus growing areas of Queensland.

Responsible for extensive development of sooty mould, its control is necessary to ensure clean fruit as well as healthy trees.

Close attention to choice of spray materials and timing and thoroughness of application, are necessary for efficient control.

Distribution and Importance

Some 40 years ago, pink wax scale, together with red scale, was regarded as a dominant pest throughout the citrus areas of Queensland and predominant in the more coastal districts.

Today, though of most importance in the Howard citrus area near Maryborough, it often requires specific control measures in other coastal areas from Kuranda in the north to the Lockyer Valley in the south.

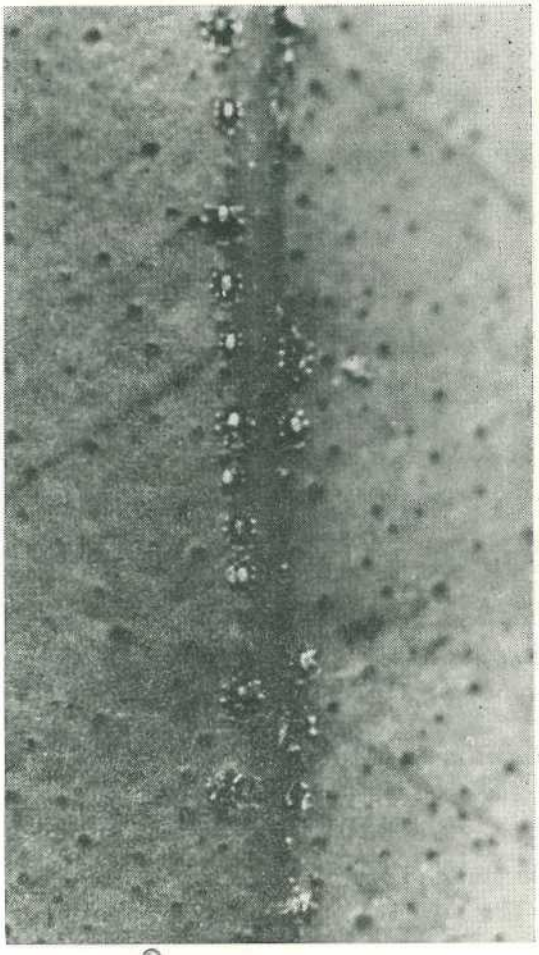
In inland areas, it is more troublesome on mandarins, as in the Central Burnett district, although relatively scarce at Charters Towers.

The scales congregate thickly along the midribs of leaves and on young twigs. Copious production of honey dew results in a heavy deposit of black fungus known as sooty mould over leaves and fruit. As well as fruit being disfigured by the mould, vigour deteriorates in heavily-infested trees.

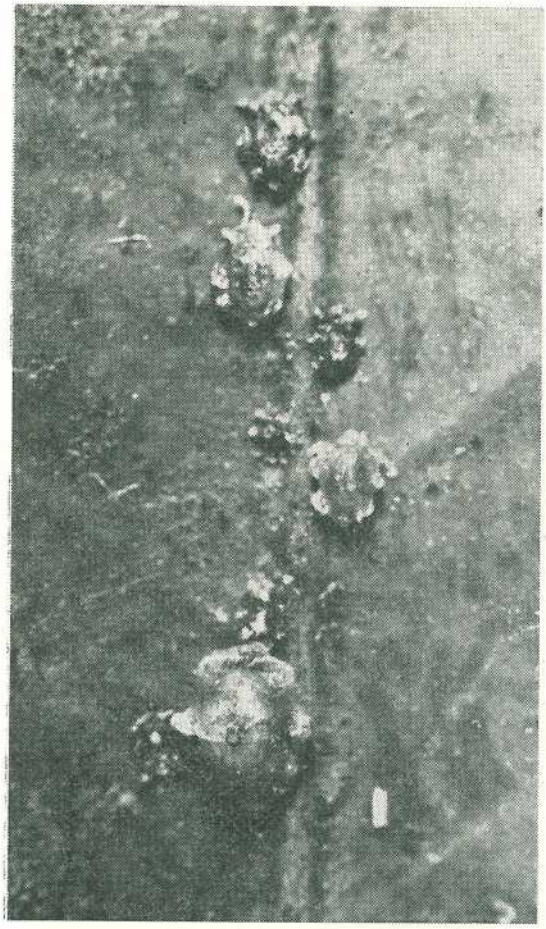
Host Plants and Origin

The pink wax scale may have been introduced into Australia from Ceylon.

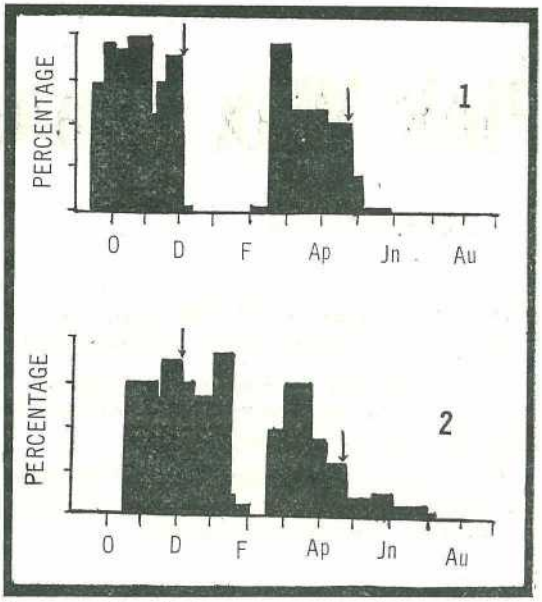
Its range of host plants is very wide. Commonly occurring hosts beside citrus varieties are the umbrella tree, custard apple, avocado, mango, various species of Ficus and Eugenia, and native daphne. All varieties of citrus are hosts; mandarins, particularly the Emperor variety are most favoured. Lemon and grapefruit varieties are least likely to be infested.



Young pink wax stages (first and second instar) on a leaf. The scales are at a suitable stage to spray.



Adult and third instar scales on a leaf.



Histogram 1. Laying stages of pink wax scale. Spraying times (early summer and midautumn) are indicated by arrows.

Histogram 2. Scales up to 1 month old (first and early second instars). Spraying times arrowed.

Life History and Habits

The adult female scale can lay from 600 to 700 eggs. The brick red coloured oval eggs 0·4 mm in length are deposited in a cavity beneath the body of the scale.

The first instar nymphs, or crawlers, emerge from beneath the parent scale and spread out over the tree. These settle after a few days on the twigs and leaves predominantly along the midrib on both sides of the leaves.

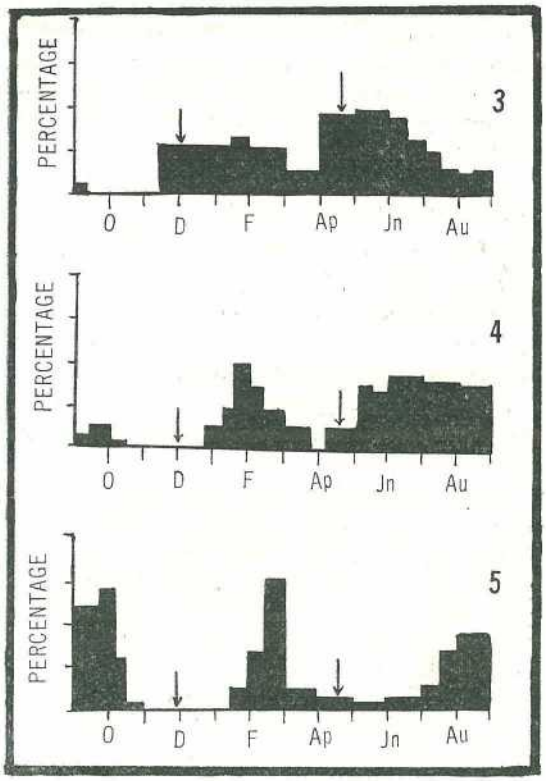
It is in the crawler stage that the scale is distributed from infested plants to other hosts by the wind.

The crawler is pink coloured, 0·4 mm long with short six-segmented antennae, and two dark eye-spots. It has three pairs of well-developed legs, paired long anal filaments and paired spiracles on each of the thoracic segments.

The young scale feeds by sucking through long tubular mouth parts inserted into the plant tissue. A dorsal pad and two peripheral rays of pink wax soon appear. Three weeks after the young insect has settled down, the anal filaments are discarded and it moults to the second instar nymph. At this point the scale is about 0·7 mm long with three paired peripheral pink rays of wax and a dorsal pad all tipped with powdery white wax. Four waxy processes develop anteriorly and two posteriorly.

As the scale further develops, the peripheral rays and the dorsal pad of wax merge, all tending to cover the body. Six to 8 weeks after settling down when the scale is about 1 mm long, it moults again to the third instar nymph.

A final moult to the adult stage occurs 10 to 12 weeks after the settling down. The adult increases to a size of 1·5 mm to 3·5 mm.



Histogram 3. Scale up to 2 months old (late second and early third instars). Spraying times arrowed.

Histogram 4. Scales up to 3½ months old (late third instar and early adult stage). Spraying times arrowed.

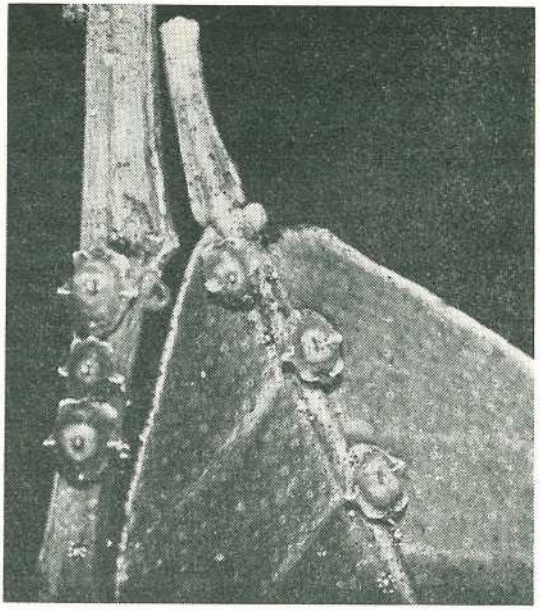
Histogram 5. Scales over 4 months old (mature adults). Spraying times arrowed.

The pink wax forms a firm globular covering over the soft body of the scale. Maturity in the adult is reached in 4 months after settling in summer, in 6 months over the winter.

The total period required for complete development varies from 5 months in the warmer weather to 7 months over the winter. All of the scale insects on the tree are females. In Queensland, development is parthenogenetic because males have never been recorded.

Seasonal History

Seasonal history studies have shown that two generations of pink wax occur each year in Queensland.



Adult scales on a leaf and a twig.

There is some overlapping of generations but not nearly to the extent found in the related white wax scale.

The accompanying histograms give comparisons of the prevalence of each of the three nymphal instars and the adult scale and of the percentages of adult scales in the laying stage.

Egg laying begins in the spring (mid September) and is complete by late November, a period of about 2 months. The spring generation crawlers first appear in mid October and continue to emerge until early December.

Individuals maturing from this generation begin laying in early autumn (mid February) and this is complete by early May. Crawlers are evident early in March and continue to emerge until June. This generation passes the winter in the adult stage.

The age of the scales on the trees is important for the successful control of an infestation. Recommended insecticides readily give effective control of scales up to 2 months old, that is, to the stage when the oldest scales are not beyond the early third instar, as shown in histograms 2 and 3.

A considerable number of young adult scales 10 to 12 weeks old may still be controlled, but scales older than 12 weeks are difficult to kill by sprays. The occurrence of scales of this older group, that is, later third instar, young adults and near mature adults are indicated respectively in histograms 3, 4 and 5.

Weather and Natural Enemies

A fair proportion of the crawlers and early instar scales die naturally before reaching maturity. An important cause of this is adverse weather, particularly very hot dry summer conditions in the period from November to December. This can result in a high death rate among the young stages. Cold has less effect because very few first or second instar scales are present after the beginning of winter.

The pink wax prefers young growth and an infestation usually declines when the tree becomes unthrifty. Young stages also have difficulty in finding suitable sites to settle on leaves already coated with sooty mould.

In the more northern wet citrus areas, Byfield, Kennedy and Kuranda, attack on the scales by entomogenous fungi is a significant factor in keeping infestations to low levels.

Complete control of pink wax infestations by fungus infection is not unusual. Good control, however, appears to be achieved only late in the season and by this time considerable sooty mould may have been deposited on the fruit.

Some predation of young scales by ladybirds and lacewing larvae can occur and several small wasps parasitize adult scales.

Control

A pink wax scale infestation can be controlled with a single spray application provided timing and thoroughness of the application are correct and an effective spray material is used.

If sprays are to be kept at a minimum, the widespread nature of the hatching makes the timing important. Control measures applied too early kill young stages but leave some mature scales which continue to lay. Measures applied late give a less satisfactory kill of the more advanced scales leaving some of them to breed up in the autumn.

The single spray application is made in late November to early December and is usually necessary in most years. If, as may often be so, white wax scale is also a problem, the same spray in early December can be used for both of these pests.

Spray materials effective against pink wax scales 2 months old are:—

Soda ash, 7½ lb. per 100 gal. plus 1 in 100 oil
Sodium metasylicate, 15 lb. per 100 gal. plus 1 in 100 oil
Carbaryl, 0·07%, plus 1 in 100 oil
Promecarb, 0·05%, plus 1 in 100 oil

The omission of oil from these sprays will considerably lessen their effect.

A second application is recommended for white wax scale and this should be in late January.

When control of pink wax has not been effected during early summer, a single spray of one of the above materials in mid April can be applied effectively. (The timing of an early summer or a midautumn application is indicated by arrows in the histogram).

If, as in some orchards, additional consideration must be given to control of red scale and circular black scale, the oil sprays used for these will kill young pink wax scales.

Where methidathion 0·05% is substituted for oil sprays to control red scale and circular black scale on mandarin varieties, control is also given of pink wax scale and white wax scale.

Sprays should be applied with a pressure of at least 200 lb. per sq. in. to wet the branches and leaves thoroughly.

The alkaline materials, soda ash and sodium metasylicate, should **not** be applied when temperatures are excessive or trees stressed from lack of soil moisture. If irrigation is available, its use a few days before spraying will help make trees more tolerant of the sprays.

Scientific names of the insects mentioned are:—

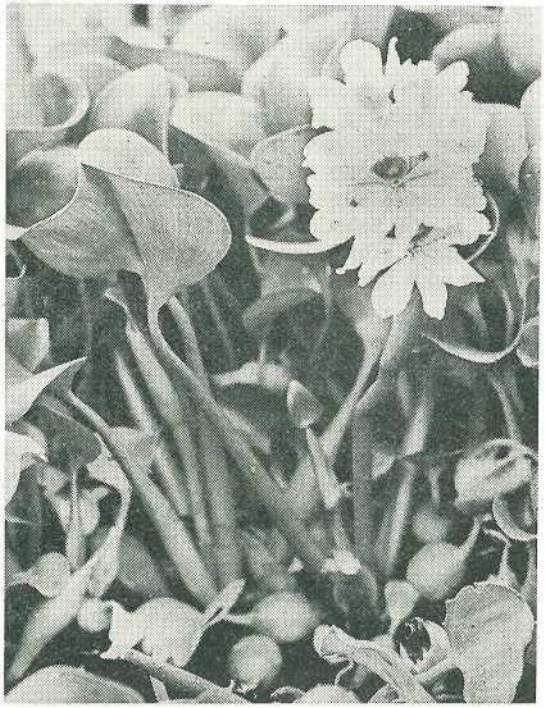
Pink wax scale	*Ceroplastes rubens* Mask.
White wax scale	*Gascardia destructor* (Newst.)
Red scale	*Aonidiella aurantii* (Mask.)
Circular black scale	*Chrysomphalus ficus* Ashm.
Ladybirds	*Rhizobius ventralis* (Er.) *Scymus* spp.
Lacewings	*Chrysopa signata* Butl.
Parasitic Wasps	*Aspidiotiphagus australiensis* Gir. *Metaphycus varia* Gir.

Water Hyacinth Control

WE see a fair amount of water hyacinth when the monsoon rains wash its floating rafts downstream. Midsummer to autumn is its flowering time when even small patches stand out with their spikes of pale lilac flowers with a small blotch of yellow.

The beauty of its flowers induced gardeners to take it from its native South America and bring it into cultivation. This, added to the plant's natural ability to grow and spread rapidly, has promoted it to near the top of the list of serious aquatic weeds throughout the warm countries of the world.

by H. E. KLEINSCHMIDT, Botanist.



Water hyacinth is one of the most serious aquatic weeds in warm countries. In Queensland, it is a problem only in some local situations in some seasons.

Except in local situations, in some seasons, it has not been a major problem in Queensland. However, where it grows thickly, it can be a hindrance to navigation and it can make stock access to water difficult. In irrigation areas it is a definite hazard. It can impede water flow and cause blockages.

Water hyacinth was brought to Australia in the early 1890s. By 1900 it had spread to about the extent of its present range in Queensland, mainly along the coast east of the Dividing Range.

The plants consist of clumps of thick, deep green leaves, joined by short horizontal stems. Young leaves have a smooth, rounded somewhat spoon-shaped blade about 6·5 cm (2½ in.) across. Below the leaf-blade, the leaf-stalk is swollen into a spindle-shaped, air-filled bladder.

As the plants age, the spindle-shaped leaf-stalks elongate. In deep water, where the plant grows best, they can grow up to 1 metre (3 ft.) long but on plants rooted in the mud of shallow water, the leaf-stalks are fat and round. Also, with age the short horizontal stems become brittle and break up easily. After flowering, the spikes turn down and the seeds apparently ripen under water.

Water hyacinth does not live long in brackish water. It is very susceptible to frost.

In dry seasons cattle eat it. Although its chemical composition shows it to be quite nutritious, it contains about 90% water and the large bulk of material seriously limits the amount an animal can eat. Attempts have been made in various countries of the world to utilize it as a fodder or as a fertilizer, but these have not been successful on any large scale because of the difficulty in handling the large mass of plant involved.

Control

Two main methods of control are effective. If it is possible to drag the plants out onto the bank they will die with exposure to hot sun and cause no further trouble in the water. But in most situations this method of treatment is not practicable and it is more economical and convenient to spray the floating plants with herbicides.

The most effective chemicals are 2,4-D, amitrole, diquat and paraquat. Choice of chemical will depend on whether there are susceptible crops growing in the vicinity and whether the water is used for irrigation.

The cheapest and most effective chemical is 2,4-D amine used at high rates. Mixed with water to give a concentration of 0·2% (1 part of 50% 2,4-D to 250 parts of water) and applied as a drenching spray using 350 to 550 litres per ha (200 to 300 gal. per acre) it gives the best results. Traces of 2,4-D remain in the water for about 4 weeks after spraying so that, although the water is safe for stock immediately after spraying, it is not safe for irrigating susceptible crops such as bananas, beans, tomatoes, cotton or lucerne.

Amitrole is used at 600 ml (1 pint) of the commercial product (Weedazol TL Plus) to 200 litres (44 gal.) of water. Again it should be applied at high volume, about 350 litres per ha (200 gal. per acre). As with 2,4-D, traces of the chemical remain in the water for about 4 weeks after spraying. The water is safe for stock immediately after spraying but is not entirely safe to use for irrigation.

Diquat and paraquat are used at 440 to 880 ml of commercial product (Reglone* and Gramoxone* respectively) plus 440 ml of a non-ionic wetting agent such as Agral 60* in about 350 litres of water per ha (2 to 4 pints of product plus 2 pints of wetting agent in 200 gal. of water per acre).

Both diquat and paraquat remain active in clear water for about 10 days after spraying but are immediately inactivated by contact with mud or muddy water. The water is safe for stock immediately after spraying and also for furrow irrigation, but not for spray irrigation unless the water is muddy.

If only water hyacinth is present, diquat is more effective, but this chemical is less effective than paraquat on some other floating plants such as salvinia. In situations where both weeds are present, paraquat is the best chemical to use.

In using 2,4-D, amitrole, diquat or paraquat, it is most important to direct the spray on to the plants and not allow it to float through the air. This increases effectiveness and reduces the risk of drift damage to susceptible crops that may be growing nearby.

When spraying, it is easy to miss a plant or two. These and seeds already present in the mud are a potential source of reinfestation.

Follow-up treatments are essential to maintain a body of water free of water hyacinth.

*Registered trade name.

Leptospirosis in the West, too

by J. SHIELD, Veterinary Officer.

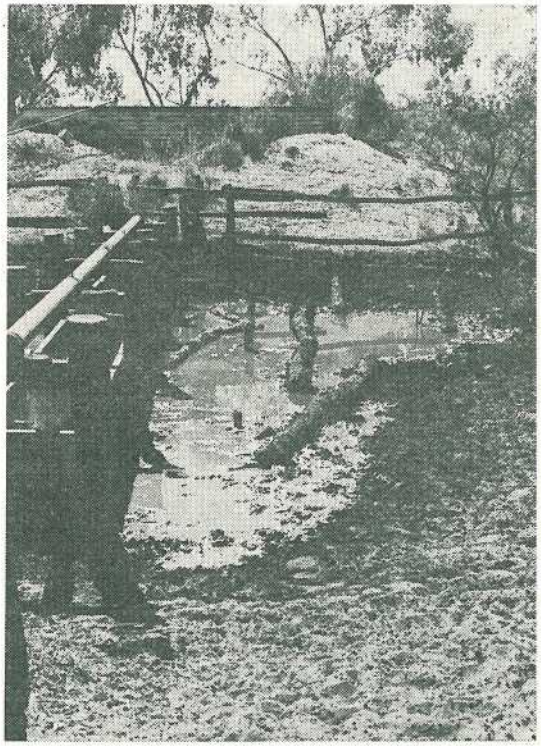
LEPTOSPIROSIS has now become one of the better known diseases of cattle.

It is well recognized as a cause of abortion in cows, and of an acute 'red-water' condition in calves which can die quite suddenly with signs of fever and jaundice.

Leptospirosis is caused by a variety of organisms called leptospira. These organisms, shed in the urine of affected animals, require moist shaded conditions to survive. For this reason leptospirosis is usually associated with muddy and poorly drained yards and swampy areas. As these conditions are more normally found in coastal areas, we tend to think that leptospirosis is not a problem in the arid western areas.

Recent research in western Queensland, however, has necessitated some re-thinking on leptospirosis. Infertility investigations and random blood sampling of herds in western areas have shown some high levels of exposure to leptospirosis.

In some herds, up to 50% of cows have reacted to the test for *Leptospira pomona,* the most dangerous of the organisms. An incidence of *Leptospira hardjo* greater than 90% has been found. *L. hardjo* is a proven problem overseas but, although in Australia, its disease significance is as yet uncertain.



Muddy and poorly drained areas like the approach to this drinking trough provide ideal conditions for leptospirosis organisms to survive.

Why so much?

Leptospirosis is a fluctuating disease, reaching its highest incidence in the good seasons like those the west has recently enjoyed. The last two seasons have brought good rains, resulting in moist conditions and abundant feed. This will have allowed the leptospira organisms to survive in the environment and re-infect other animals.

Wild pigs

The greatly increased population of wild pigs has added to the problem. Pigs are affected in much the same way as cattle and recovered animals spread the infection through their urine. The problem is increased by the pigs' habit of wallowing and urinating in waters that may be used by cattle.

Most of western Queensland now has large numbers of wild pigs, which are already causing concern by killing lambs and fouling water supplies.

In a recent investigation in the Barcaldine district, a cow was found to have aborted as a result of leptospirosis. This cow and other cattle had been watering at a dirty soak shared by many wild pigs.

Some of the pigs were shot and autopsied to look for evidence of leptospirosis in them. Of eight pigs shot, five showed the small haemorrhages and white spots on the kidneys that are characteristic of leptospirosis. All of the pig blood samples were strongly positive for *L.pomona*. It appears that pig-transmitted leptospirosis can be a source of infection for cattle.

How big is the problem?

The question now arises: how big a problem is leptospirosis in western Queensland?

Even where large numbers of cows show positive blood tests to leptospirosis, the disease may not be a visibly obvious problem. This is because the positive blood test will persist for years after the cow first becomes infected.

The problem may therefore consist of just occasional abortions in cows that have no immunity. These abortions frequently go unnoticed. After all, a 5 to 8 month old foetus is only the size of a dog and is seldom found in long grass. Unless the manager keeps good records and practices regular pregnancy diagnosis, he may never know that abortions are occurring.

In the west, the classical calf red-water form of leptospirosis is less frequently seen than the abortion form of the disease.

Control

Where blood tests show an incidence of leptospirosis, it is wise policy to vaccinate. Cattle can be vaccinated against the main species of leptospira for less than 35c a dose. The value of just one calf saved will buy many doses of vaccine.

Department of Primary Industries Veterinary Services Branch staff can help you decide whether leptospirosis is costing you money, and can outline a vaccination programme to meet your needs.

Vaccination

Vaccination programmes must be planned to meet the individual property situation.

Leptospirosis vaccine promotes a high degree of immunity for 6 months. However, a degree of immunity beyond this does persist and affords some protection for about 18 months.

Whether to vaccinate or not is a matter for the individual stock owner to decide. If leptospirosis is a constant problem, it is economical to adopt a programme of vaccination.

A recommended vaccination programme is as follows—

Cows and heifers should receive a dose of vaccine around the time of mating and a second dose about 1 month before calving. Subsequent vaccination programmes will depend on whether previous outbreaks have been associated with abortions and/or calf losses.

Vaccination at the time of or soon after mating should give protection during pregnancy. On the other hand, a single dose given about 1 month before calving should protect the calf through antibodies in the colostrum and also give a measure of protection to the cow. Normally, it is desirable to vaccinate at mating and again a month before calving.

In calves, the immunity passed from the cow in the colostrum is sufficient to give protection to 4 to 6 weeks of age. To be certain of maintaining immunity, calves shoud be vaccinated at 4 to 6 weeks. When calves are vaccinated at less than 3 months of age, they should be revaccinated when they reach 3 months.

Previously unvaccinated cattle and susceptible cattle being introduced into an infected herd should be vaccinated twice with an interval of approximately 4 weeks between vaccinations. Ideally, this vaccination would be done before introduction.

Brigalow to Pasture in the North—1

by P. V. BACK, Botany Branch.

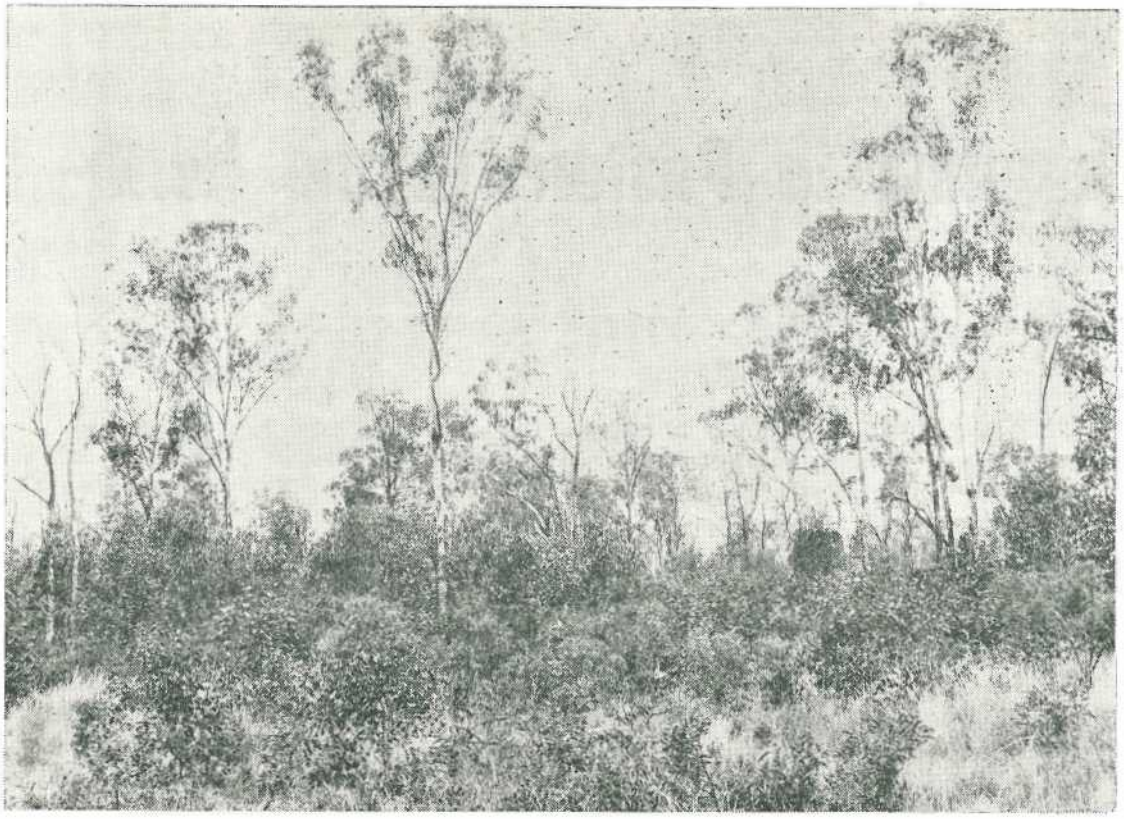
PEOPLE have been developing brigalow scrub for many years. In the last 10 years or so the amount of scrub cleared has increased enormously and this development has not always been successful.

Many graziers and settlers have found themselves in trouble with poor pasture establishment and dense, woody regrowth. Much has been learnt from the mistakes and successes of these pioneers.

Added to this experience are the results of an intensive research programme on the Brigalow Research Station at Theodore. The aim of this paper is to give detailed recommendations for developing brigalow scrub country in northern areas.

Every piece of scrub and every property has characteristics peculiar to itself. For this reason, the recommendations given are intended as guidelines and not hard and fast rules and, when adapted to the individual situation, should give good results.

A typical small northern brigalow scrub. Note the grass cover under the trees.



Burnt out brigalow-Dawson gum scrub. Regrowth is always a problem in these areas.

INITIAL DEVELOPMENT

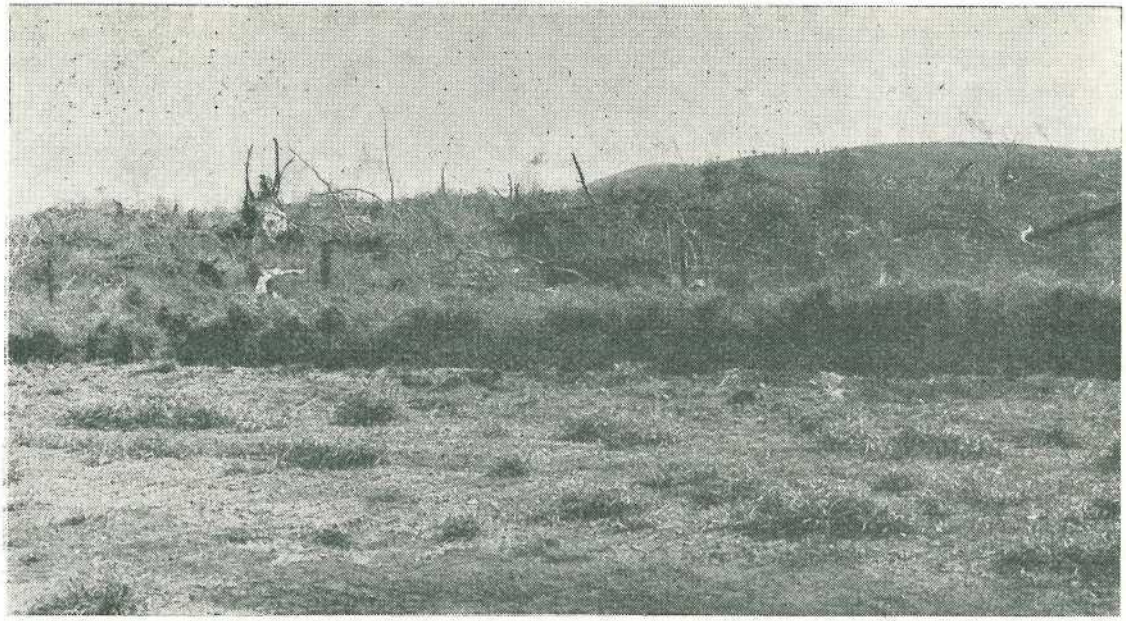
Planning

Before any piece of scrub is touched, a development plan should be worked out Factors to be considered are:—

1. THE SIZE OF THE AREA TO BE PULLED. This depends largely on the capacity of the property to handle the newly-pulled area. Factors such as finance for seeding, fencing, watering and regrowth control and the number of cattle available to utilize the area must be taken into account.

2. THE REGROWTH POTENTIAL OF THE SCRUB. Regrowth control is something that should always be budgeted for when developing brigalow scrub. Scrubs which contain eucalypts (Dawson gum and coolibah) or sandalwood can present bad regrowth problems apart from brigalow suckers. Scrubs that are burnt out always present serious regrowth problems and control of this regrowth is necessary for good development.

3. LONG-TERM USE OF THE LAND. If it is intended to cultivate the area straight away, then pasture sowing and regrowth control will not be necessary. Where cultivation is intended a few years later, then the selection of the pasture species is important. For example, buffel grasses should be left out as they are difficult to remove by cultivation.



Pulled scrub before burning.

Pulling

The next step is to pull the scrub. Here again planning is essential. Factors to be taken into account are:—

1. WHEN TO PULL THE SCRUB. Pulling operations are best undertaken when the soil is moist. This is because the scrub pulls better, trees come out by the roots with fewer butts remaining to grow again. Fewer root suckers also result.

2. HOW TO PULL THE SCRUB. Pulling with the most powerful machines available is recommended. This allows all the trees to be pulled easily and cleanly. Smaller tractors have to push the larger trees individually and this adds to the cost. All the timber should be pulled except for shade clumps and along creeks. Do not leave single trees standing in the paddock as these are usually killed in the fire and present a problem for subsequent aerial spraying.

3. LEAVE SHADE AREAS. Some trees should be left to provide shelter for cattle during periods of stress (heat or cold). They should consist of shade clumps or strips wide enough to withstand fires.

A firebreak pushed around these areas at the time of pulling is a good investment. Shade areas should be at least 10% of the total area pulled, and should be in clumps no smaller than 10 acres each. This may appear excessive but the clumps will be whittled down by fire and spray drift over the years.

It is best to leave these shade areas on ridges and in other places where the scrub is fairly open. It is no good leaving areas of dense scrub as these pose a serious mustering problem. The best clumps are probably pure brigalow or pure belah as they are usually open at ground level. However, this shade is easily destroyed by fire, so a clump of eucalypts may be safer.

It is a lot easier, cheaper, and quicker to leave and protect native shade areas than to try to plant trees at a later date.

4. CAREFULLY DEFINE THE BOUNDARIES OF THE PULL. Do not pull creek banks, steep jump-ups or broken country. These areas are very susceptible to erosion and must be protected. A strip at least 100 m wide should be left along creek banks. These strips also act as firebreaks, windbreaks, and shelter areas for cattle.

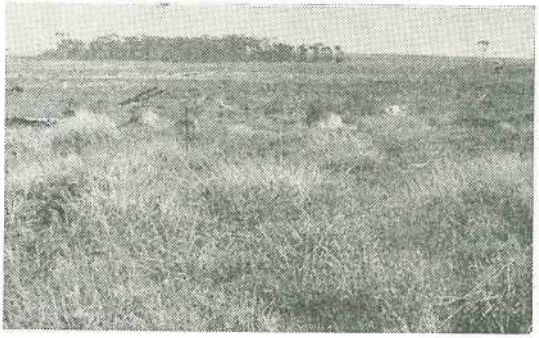
A good scrub burn. Note the white ash.

Burning

1. THE AIM OF THE SCRUB BURN. The aim of the scrub burn should be to remove as much timber trash and native grass from the pulled area as possible. This gives a good, clean seed-bed which ensures good pasture establishment. A very hot fire may also kill out native grass in the area, reducing sown pasture competition.

2. TIMING THE BURN. Timing is most important. The delay between pulling and burning depends mainly on the type of scrub.

A heavy clean brigalow scrub can be burnt as soon as 10 months after pulling. It can also be left on the ground for 2 to 3 years and still achieve a good burn with a minimum of regrowth. If burnt earlier than 10 months, sucker problems could be accentuated.



A good-sized shade clump.

Mixed scrubs in which there is already present regrowth of various species (for example, sandalwood, Dawson gum and coolibah) present a different picture. When this class of scrub is pulled, many of the smaller plants spring back and these do not die. It is therefore necessary to try to burn these scrubs while the leaves are still on the pulled timber, usually within 4 to 10 months after pulling. If left longer, the scrub greens up too much to get a clean burn.

Softwood scrub country is like the mixed species type mentioned above in that this class of scrub should be burnt when the leaves dry off but before they fall.

3. SELECTING THE DAY. The actual day to light up has then to be decided. The best burning weather is usually from the beginning of October until the end of December and usually early in the season, although in the north-western brigalow areas early burning may be unsafe for pasture establishment if delayed sowing is not practised (see seeding section). To calculate the ideal burning day consult the Brigalow Burning Guide.

4. LIGHTING UP. This can be done in numerous ways. The fire is usually most effective when it can be lit up from all sides, or at least three sides. Light the down-wind sides first and the up-wind sides last. This is easily done when a clean firebreak is dozed all the way around the scrub to be burnt, so that a vehicle can be safely driven around it.

Aerial firelighting is also practised and has proved satisfactory when used with ground lighting.

After the fire has died down, it is always a good policy to inspect the whole area and re-light any patches missed. This re-lighting may take a couple of days but it is well worth while if an even stand of high quality sown pasture is to be obtained.

Seeding

1. TIMING THE SOWING. Seeding is best carried out as soon as possible after the fire. By seeding at this stage, best use is made of the ash seedbed and the disturbed ground associated with pulling and burning. This gives the introduced pasture plants a fair chance of competing with any weeds and native grasses that come up.

Delaying the seeding can be dangerous if the burn is not a very clean one. This is because native species can take over very quickly, thus making conditions unfavourable for good sown species establishment. However, when the scrub is burnt early (October), seeding can be delayed until late November-December to avoid any false germination with early storms, provided the burn is clean and there is no residue of native grasses and herbage.

2. METHOD OF SEEDING. Most scrub burns are seeded using an aeroplane. This is usually satisfactory on large areas but in smaller areas, where a more even stand is required seeding with a tractor or from horseback is often used with good results. Walking a mob of cattle around the burn after seeding helps improve the strike, but is not practical in most cases.

3. SEED QUALITY. As the aim of scrub development is to establish a highly productive pasture, the quality of seed used is of paramount importance. It is essential, when buying seed, to accept only top quality seed. Only properly tested seed should be purchased, and its quality can be gauged by the seed analysis report on each particular batch of seed.

Home-grown seed can be used but, unless it has been tested for germination and purity, it should be used at a much higher seeding rate. Beware of untested seed that may contain noxious or prohibited weed seeds.

Pasture seed testing is carried out by the Department of Primary Industries and is free for seed that is not for resale.

4. SEEDING RATE. The seeding rate to be used needs careful consideration. The minimum seeding rate should be 2·25 kg total (mixture) of good quality seed per hectare. Higher rates should be used with poor quality seed. Higher seeding rates can also be used to achieve a quicker, purer stand of sown pasture. After all, this is the primary aim of brigalow scrub development.

Local Agriculture Advisers can give more specific information on pasture mixtures and seeding rates.

5. COMPOSITION OF SEED MIXTURE. The problem of what species should be used then arises. Three main permanent species are used in brigalow scrub development. They are: green panic, the buffel grasses, and Rhodes grass. Of these three, the most adaptable are the buffel grasses. Usually, however, a mixture of two or more of these grasses is used and this depends on the preferences of the owner, soil types and seed prices.

Other grasses such as *Sorghum almum* can be used in the establishment phase.

6. GRAZING. Improved pasture grasses sown into ash seedbeds should not be grazed until they have seeded. This is to enable them to establish and spread and to allow the plants to become strong enough to resist being pulled out when grazed.

When fast-growing species such as *Sorghum almum* are included in the pasture mixture, the pasture should be grazed fairly heavily during the first winter. This is to utilize the high initial production that this species is capable of. Spelling when the annual grass has been grazed down is a good policy as this allows the permanent species to recover and thicken up.

[TO BE CONCLUDED]

Irrigation Measures In Metrics

METRICATION has meant some changes in the units used by irrigators for measuring water volume.

Under the imperial system of units, calculations are fairly simple. For example, an acre-foot of water is the volume of water standing on an acre to a depth of 1 foot. To calculate the water needed to irrigate an area of, say 6 ac. to a depth of 3 in., you simply take six times three to give 18 ac. in. or 1½ ac. ft.

In the metric system, the new unit of large volumes of water is 1 000 cubic metres, which is the same as 1 million litres or 1 megalitre (Ml). This unit is slightly smaller than 1 ac. ft. To convert a number of ac. ft. to megalitres, multiply the number of ac. ft. by 1.23.

Once a farmer is thinking in units of 1 000 cubic metres and hectares, the calculation of depth of water applied is fairly simple. For example, one unit of 1 000 m^3 applied to 1 hectare, which is 10 000 m^2, represents a depth of 0·1 of a metre or 100 mm, or about 4 in. in the imperial system.

To find out the amount of water needed to put, say 70 mm (about 2½ in.) on 12 hectare (about 30 ac.), divide the 70 by 100 to get 0·7, and multiply this by 12 hectares to get 8·4 megalitres.

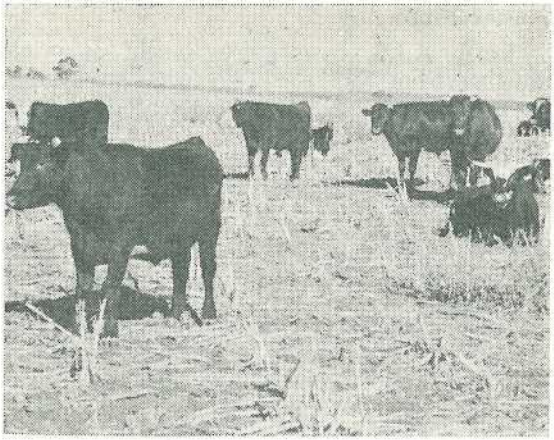
The units of water flow will, of course, be litres a minute for small flows where gallons a minute were used previously. The formula for calculating a spray irrigation application in metric is simple compared with the method used with the imperial system. In the metric system, the number of litres a minute is multiplied by 60 and divided by the number of square metres covered. Using the imperial system, the calculation is the number of gallons a minute multiplied by 115·6 and divided by the area in square feet. The area covered is the sprinkler spacing multiplied by line shift distance.

As with all other metrication, the change will be gradual. Already some water equipment catalogues show meters head and litres a minute on the pump performance charts as well as the imperial units. The Irrigation and Water Supply Commission will be changing the units from an acre foot basis to a 1 000 m^3 basis during 1974.

In converting to the metric system, the main initial practical step is to work out the area of your irrigation paddocks in hectares. The units of depth of water application (mm), volume (1 000 m^3) and flow (litres a minute or m^3 a minute) will then all tie in readily.

—A. S. GREASLEY, Senior Agronomist.

From Wool to Beef through Dairy Calves



Two-year-old dairy and dairy-cross steers raised by Mr. Malcolm Stuart, of 'Clunie', Glenmorgan. The steers shown grazing on sorghum stubble were raised by multiple suckling on cull dairy cows.

DURING the wool slump, many graziers in the wheat-sheep-beef area of Southern Queensland reduced their sheep flocks and increased their beef herds.

Most would have preferred to have bought cows and calves and to have started with a producing herd but, because of financial limitations, this was not always possible.

Some graziers in the Tara area whose major source of income in the past had been wool changed their enterprise by buying dairy calves and dairy crossbred calves from the Dalby saleyards. Two such graziers were Mr. Malcolm Stuart and Mr. Graham Shannon. Each adopted a different method of rearing his calves but both had the same end in view: to produce beef off their properties quickly and economically.

by A. J. BOORMAN, Beef Cattle Husbandry Branch.

Mr. Stuart bought 122 calves in the 12 months from August 1968. All were reared on foster mothers and only two died. The highest price paid for an individual calf was $30.60 for a crossbred Hereford which was estimated to be 8 weeks of age. The lowest price was $7 for a crossbred Hereford of approximately 1 week old. The average price for all calves purchased was $19.04.

Calves reared in a calfateria by Tara district grazier Mr. Graham Shannon were given access to a calf starter meal while they were still on liquid feeding.

Foster Mothering

Forty A.I.S. cows were bought at prices ranging from $95 to $122, with an average of $110 per head. Each cow reared an average of four calves.

As each cow calved, she was tagged with a plastic numbered ear tag, her calf was placed in the sheep yards and the cow was allowed to suckle it only twice a day. When a number of cows had calved, a batch of calves would be bought at Dalby, 135 miles away. This was usually at fortnightly intervals but on occasions consecutive trips were up to 1 month apart.

When the calves were brought home, they were allotted to a cow and tagged with an ear tag carrying the same number as the foster mother. The cow's own calf was similarly tagged. This was done to ensure that each cow suckled the same calves on each occasion. All calves were held in the sheep yards. Each calf received a daily supplement of 1 kg of wheat from about 8 weeks of age until they were weaned.

The wheat was taken from the chick wheat box during harvest and received no further treatment. No other supplement was offered to the calves. However, a supply of fresh water was available to them at all times.

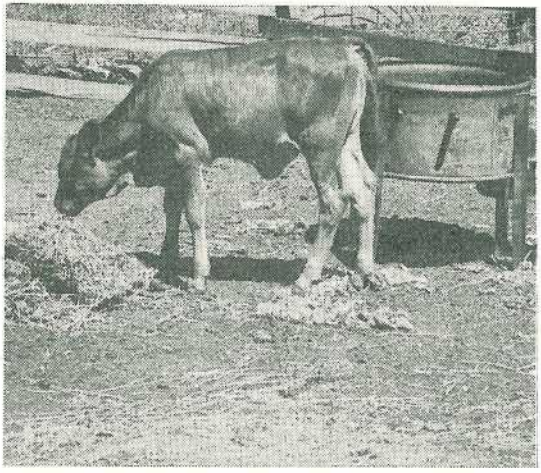
The first draft of calves was weaned and turned out to graze on pasture when they were considered big enough. This was between 4 and 5 months of age.

When each cow was weaned of her first calves, a new calf was put on her. This caused a great deal of trouble with some cows as each cow had been allowed to suckle her own calf. Mr. Stuart feels that this problem could be overcome by building a small set of yards side by side off a lane with a simple bush bail in each yard. The gate for each yard should open into the lane to block off the calves or a cow as appropriate and turn them into the yard. The cow could then be held in the bail and any number of calves put in with her. With such a system each cow would probably feed a different set of calves at each feeding and weaning would not be a problem.

Mr. Stuart followed the same method of rearing with the second batch of calves and weaned them at about 5 months.

Getting the cows back in calf was not as big a problem as had been expected and approximately 75% of the cows had a calf again within 12 months. This result was achieved in a year of below average rainfall and pasture growth.

Other problems encountered were scouring in the calves and mastitis in the cows. Scouring occurred frequently but generally did not require treatment. When treatment was necessary antibiotics were used.



When grazing was not available, Mr. Shannon gave his calves good quality hay.

As cull dairy cows are likely to be susceptible to mastitis, a careful watch was kept and cases were treated as they appeared. No complications were encountered with any of the cases.

Artificial Rearing

Mr. Shannon reared his calves in a calfateria on whole replacer and concentrates, giving them two feeds a day until 5 weeks of age, and then one feed a day. He weaned them at 8 weeks.

Mr. Shannon fed 17 calves at a time from this calfateria with 18 teats. It was made from an oil drum cut in half lengthways.

Mr. Shannon used the following feeding schedule:

Week	Milk Replacer Powder per Day	Water to Mix With Powder	Feeds per Day
	grams	litres	
1	340	4·5	2
2–4	450	4·5	2
5–7	450	4·5	1
8	340	4·5	1

Over the fourth week, one feed was gradually reduced and the other increased so that, by the start of the fifth week, the calves were receiving only one feed of milk a day. This allowed a considerable saving in time.

A concentrate starter ration, made up as follows, was introduced at 2 weeks:—

STARTER RATION

30 kg crushed grain (preferably mixed grains)
4 kg cotton-seed meal (peanut meal)
7 kg milk replacer powder
450 g ground limestone

The calves ate a little of this to begin with but, when they were changed over to one feed of milk a day at 5 weeks their intake rapidly increased until at 8 weeks they were eating approximately 1·5 kg a day.

At weaning, they were introduced to a concentrate grower ration made up as follows:

GROWER RATION

45 kg crushed grain
4·5 kg meat meal
220 g ground limestone

The calves ate up to 2 kg of grower ration a day. From a very young age, the calves were given access to pasture, crop, crop stubble or, if none of these was available, good quality hay.

Mr. Shannon believes that, to keep disease to a minimum, it is necessary to have the calves concentrated as little as possible and, for this reason, he allowed them to run in paddocks adjacent to the feeding facilities. The feeding site was also changed from time to time.

When the calves were brought home, they were given the first two feeds locked in a small set of calf bails so that each calf fed from its own container of milk. No attempt was made to hurry the calves at this stage and they were handled gently so that they gained confidence in the system very quickly. During the next 2 days, the calves were still fed individually in the bails but they were not locked in. Subsequently, all calves were fed together from a bulk container.

In 1970, Mr. Shannon paid an average price of $29 per head for the 10 calves he reared that year but in 1971 he paid an average of only $18 per head.

Each calf was vaccinated against leptospirosis immediately it was landed on the property and, at 1 month, they were treated for lice control. At 6 weeks, the calves

were vaccinated against blackleg, treated for lice again and drenched with an injectable broad spectrum worm drench.

Selecting the Calves

Both Mr. Shannon and Mr. Stuart considered that time spent examining calves before the sale was time well spent. Consequently, they both arrived in time to inspect every calf and decide which ones they would bid on. They also considered it was essential either to buy calves personally or to have the person responsible for them after they arrived on the property do the buying.

In selecting calves they considered the following points important. The calf should be bright, alert and strong, and have a dry navel cord. The calf should not be scouring or appear to have been scouring, lethargic in appearance, or show evidence of bad treatment or of being hurt during transport (such as patches of skin missing.)

When fattening is the prime object, the breed and sex of calves appears to be of little consequence, although Friesian steers are difficult to finish off on crop and pasture under $2\frac{1}{2}$ years and, of course, Jersey and Jersey-cross animals often meet buyer resistance.

However, even when the primary objective of a scheme such as this is to build up a breeding herd quickly, it is advisable to buy some steers in each draft of calves. This will give a quicker return to capital and consequently will reduce interest charges.

Whether all male calves are chosen or a combination of males and females are chosen and whether the calves are sold as vealers. stores, yearlings, or 2-year-old fats will depend on the requirements and capabilities of the individual. However, provided reasonably long term finance is available, the sale of turnover cattle as 2-year-old fats appears to be the best of the available alternatives in the area. Where it is possible to provide a continuous supply of high quality feed, the sale of finished yearlings is worth considering.

Economics

Mr. Stuart sold the first of his steers in May 1970 when 12 head averaged $135. Immediately after that drought conditions made sale of any more steers as fats impossible and, for 3 months from June to September, the remaining 108 steers were fed scrub and urea-molasses. Although poor at the end of the drought, the steers came away well when rain fell and another 12 were sold as fats in January 1971 at an average price of $135.50 a head. A further 55 head were sold by November 1971. The average price received for all cattle sold to that time was $137.37 per head.

It can be assumed that Mr. Shannon's cattle would have sold at similar prices at similar ages. Therefore, to determine the economics of the different operations the costs of getting a calf to 5 months of age under either system are set out. Costs are as at January 1972.

MR. STUART'S CALVES	$ c
Purchase price 120 calves (per calf)	19.04
Supplements (grain) for calf[1]	0.70
Supplements (grain) for cow[1]	0.18
Antibiotics (scours and mastitis)	0.25
Labour[2]	7.00
Fixed costs (cow)[3]	2.40
Income forgone[4]	5.60
	$35.17

MR. SHANNON'S CALVES	$ c
Purchase price	18.00
Milk replacer powder[5]	7.64
Calf starter meal	3.43
Grower meal	3.27
Vaccinations and veterinary treatment	0.70
Calfateria equipment	0.10
Labour[2]	2.90
	$36.04

1. The grain was taken from the chick wheat box of the header and required no further treatment. It had little commercial value but was given a nominal value of 1·1c per kg. If grain had been purchased it would have cost 3·3c per kg and a further 0·4c to 1·1c per kg to crush.

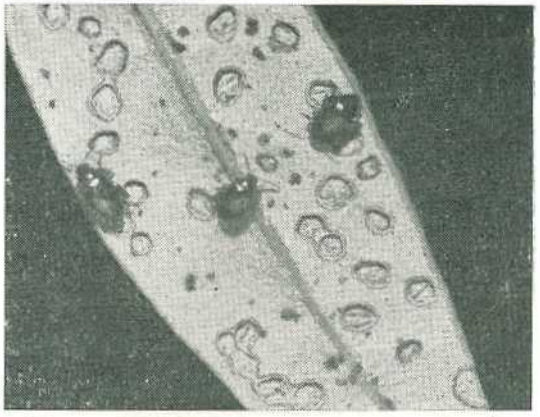
2. Labour. Calves reared on foster mothers required 50% of the time of one labour unit and calves reared on milk replacer required 20% of the time of one labour unit.

3. Fixed costs associated with the cow include rates and rents, and depreciation on yards and fences.

4. Income forgone is an allowance for running the cow on land which conceivably could have been used to fatten a steer.

5. By March 1972, the cost of milk replacer had gone up by 50% and further increases were expected.

Insect and Other Pests of Duboisia



Duboisia leaf showing flea beetles and their damage.

by D. SMITH, Entomologist.

OVER 2 500 acres of native Duboisia are cultivated in Queensland. The leaves are harvested for the production of medical drugs, principally hyoscine and hyoscyamine.

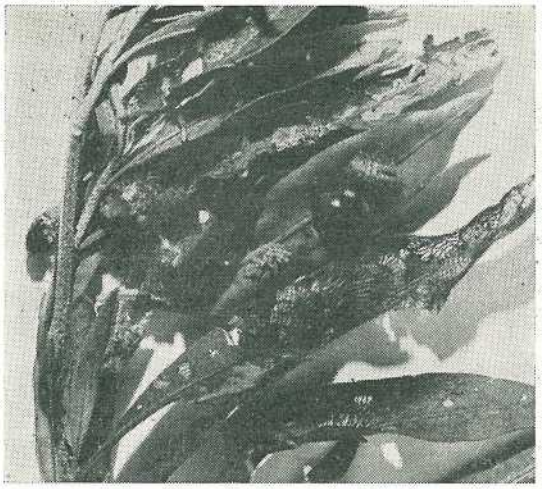
The two species of Duboisia harvested are *Duboisia leichhardtii* which is restricted to South Burnett districts, and *Duboisia myoporoides* which occurs along the east coast of Australia. At present, most of the leaf harvested is from *D. leichhardtii*.

A number of insect pests has been recorded as damaging the foliage, twigs or trunk of Duboisia. Two foliage feeders, a small flea beetle and the large leaf-eating ladybird, most often necessitate special control measures.

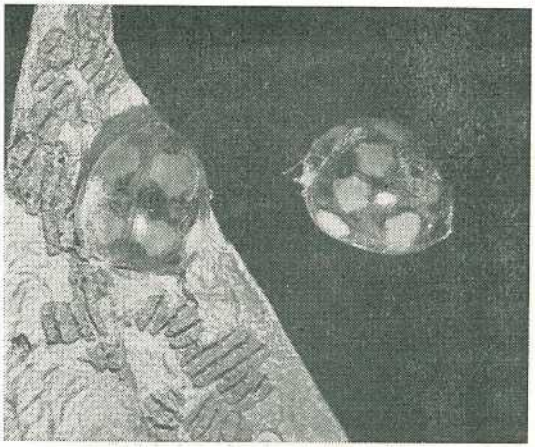
The brown olive scale, normally kept in check by parasites, can sometimes become a problem where insecticides are regularly used for the leaf-eating pests.

Efficient and minimal use of insecticides is necessary to preserve parasitic and predatory insects thus preventing a possible upsurge of fresh insect problems. Investigations are being continued to determine more of the habits of the important pests and where necessary to find effective control measures.

A Duboisia shoot showing flea beetle damage.



Duboisia leaves showing damage by the large leaf-eating ladybird. Eggs, a larva and a beetle are shown on the leaf.



Two beetles of the large leaf-eating ladybird.

D. leichhardtii suffers heavier damage by several of the pests than does *D. myoporoides*. Work will be undertaken to determine the pest susceptibility of hybrids of the two species.

MAJOR PESTS

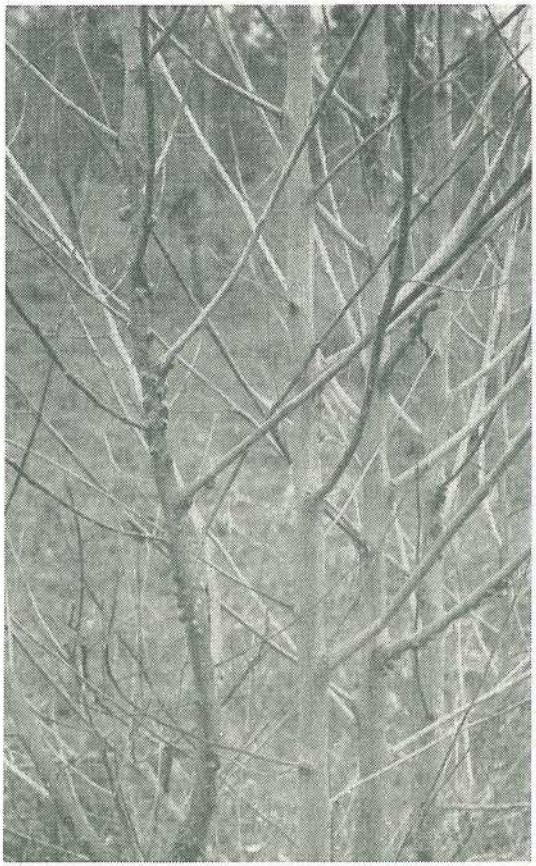
The Small Flea Beetle

The small flea beetle is the most widespread and persistant pest of Duboisia in the South Burnett region. Both species of Duboisia are attacked but incidence in coastal areas is much less common.

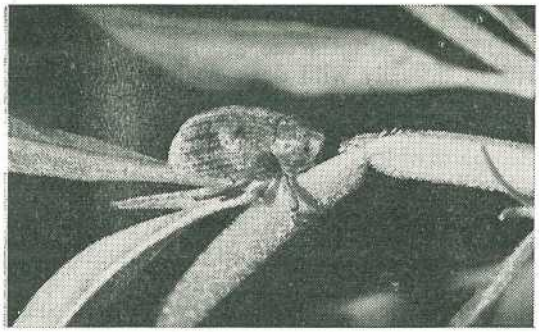
The adult is a small, deep metallic blue beetle some 2 mm in length. The femora of its hind legs are greatly expanded and the insect, when disturbed, readily jumps 2 to 3 ft. (up to about 1 m). The beetle can also fly.

A larger species of flea beetle, 3 mm long and metallic blue in colour, is a less serious pest of Duboisia. This species attacks also the thornapple commonly occurring in South Burnett districts.

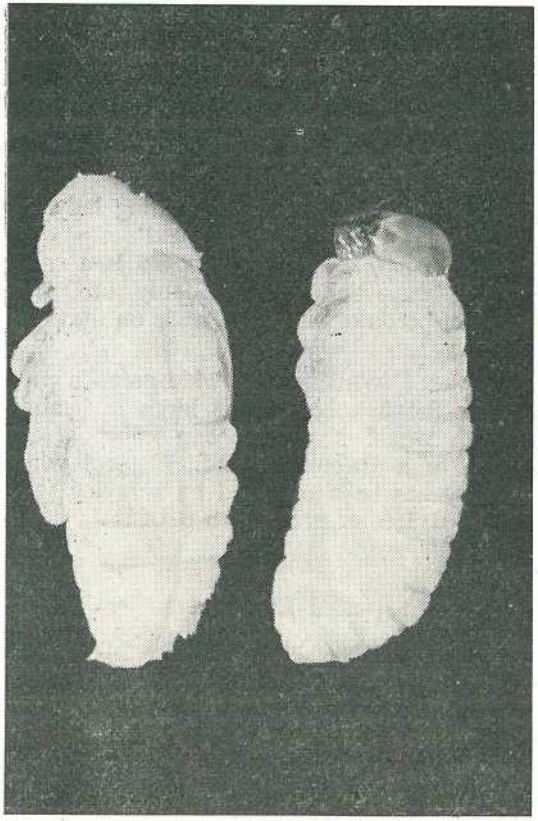
LIFE HISTORY AND HABITS. The adult lays its eggs singly or in small groups of up to a dozen on the soil surface or more commonly between soil particles at about 5 mm depth.



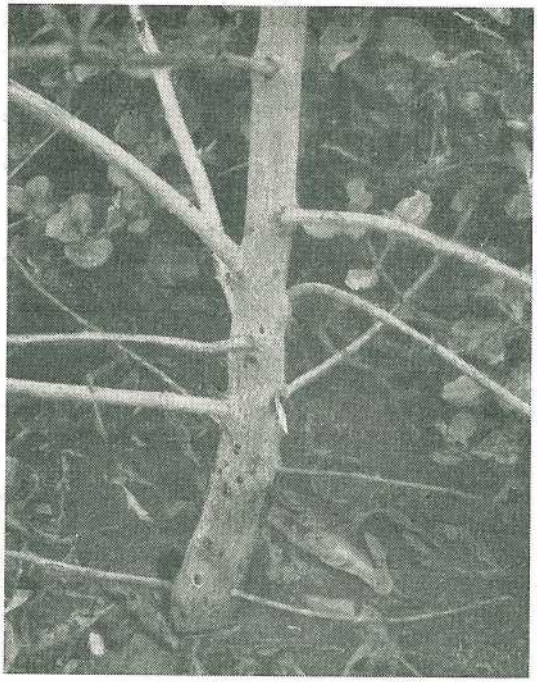
Part of a Duboisia tree defoliated by the large leaf-eating ladybirds. Pupae are shown on the stems.



An adult of the Duboisia trunk borer feeding in a shoot.



Larva and pupa of the Duboisia trunk borer.



Oviposition marks of the Duboisia trunk borer on an old tree.

The cream coloured eggs less than 0·5 mm long, on hatching, give rise to slender grey coloured larvae 1 mm long which actively crawl through the soil. Later instars are white in colour as is also the pupal stage which is in form and size similar to the adult beetle. During the summer, the life cycle from egg to adult takes about 6 weeks.

The flea beetle is least active during periods of cold, wet weather. There is some movement of beetles on to the trunk at night and up onto the foliage in the morning.

The feeding habits of the larvae have yet to be determined. Young larvae have been observed to damage the roots of young seedling Duboisia but it is not known whether Duboisia is the normal host plant. Adult flea beetles have also been bred from pots containing Duboisia formerly infested with the insect. Larvae and pupae can be found in soil samples from areas of Duboisia infested by the beetles.

DAMAGE. Flea beetle adults feed on the foliage of Duboisia, peppering the leaves with numerous holes.

Damage to the young leaves and growing points is the worst aspect of their feeding. Where the infestation is heavy, more than 20% of the leaf area of a tree may be destroyed.

On freshly harvested trees, the beetles concentrate on the remaining foliage and any new growth is then severely damaged. Up to 30 flea beetles may accumulate on one shoot.

CONTROL. Investigations are continuing on the possibility of achieving long term control of flea beetle by applying insecticidal dust to the soil just before planting, the aim being to kill the larvae in the soil.

Control of the adults can be obtained by a thorough foliage spray with DDT 0·1% or carbaryl 0·1%. Where an infestation has been heavy, a second spray may be required 6 weeks later. Up to four sprays could be required annually.

Large Leaf-eating Ladybird

The large leaf-eating ladybird, both adults and larval stages, feed on the foliage of Duboisia, eating out the leaf surface in a lace-like patten leaving only a fine transparent skin. Damaged leaves fall and the tree may be rapidly denuded of foliage.

DISTRIBUTION AND HOST PLANTS. The large leaf-eating ladybird is native to Australia. It occurs throughout Queensland, commonly on Solanaceous plant hosts such as potato, tobacco, egg fruit, tomato and cape gooseberry. It is also recorded from pumpkins. Both species of Duboisia are attacked although *D. leichhardtii* is preferred.

LIFE HISTORY. The adult ladybird is an oval shaped beetle 9 mm long. The wing covers are black with two large red spots and one yellow spot on each. The shield covering the thorax and head is yellow, with a medium dark band. The beetle can fly, but when disturbed it usually drops to the ground.

Eggs are spindle shaped, yellow in colour and readily seen by the unaided eye. They are attached mainly on the under leaf surface, lightly stuck together in bunched clusters of 20 to 60.

In the summer, eggs hatch in less than a week. The young larvae are light yellow and covered dorsally with dark fleshy spines, four on the fore part of the body and six on each of the body segments. They have the usual three pairs of legs on the thorax and posteriorly sucker-like podia.

Approximately 3 weeks are spent in the larval stages. The fourth and final larval instar, 10 mm in length, pupates forming a dark brown pupae which darkens with age. The spiny cast skin of the final larval instar is incorporated into the pupal case and can be seen surrounding the abdomen of the pupa.

The pupa is attached usually to the upper section of the trunk or to a twig. After a week, the adult emerges. The total life cycle from egg to adult occupies 5 weeks in the summer and up to 2 months in the cooler part of the year.

NATURAL ENEMIES. A considerable amount of parasitism of the large leaf-eating ladybird is caused by a small black chalcid wasp some 4 mm in length. Another parasite is a small eulophid wasp, and a commonly occurring species of predatory ladybird feeds on the eggs.

CONTROL. While not as widespread a problem as the flea beetle, the large leaf-eating ladybird, where it occurs, can inflict severe damage to a Duboisia stand. Control when necessary has been obtained by spraying with carbaryl 0·1% or promecarb 0·05%.

Twenty-eight-spotted Ladybird

A second species, the twenty-eight-spotted ladybird, also occurs on both species of Duboisia. It is less common than the larger species and control measures are usually unwarranted.

Duboisia Trunk Borer

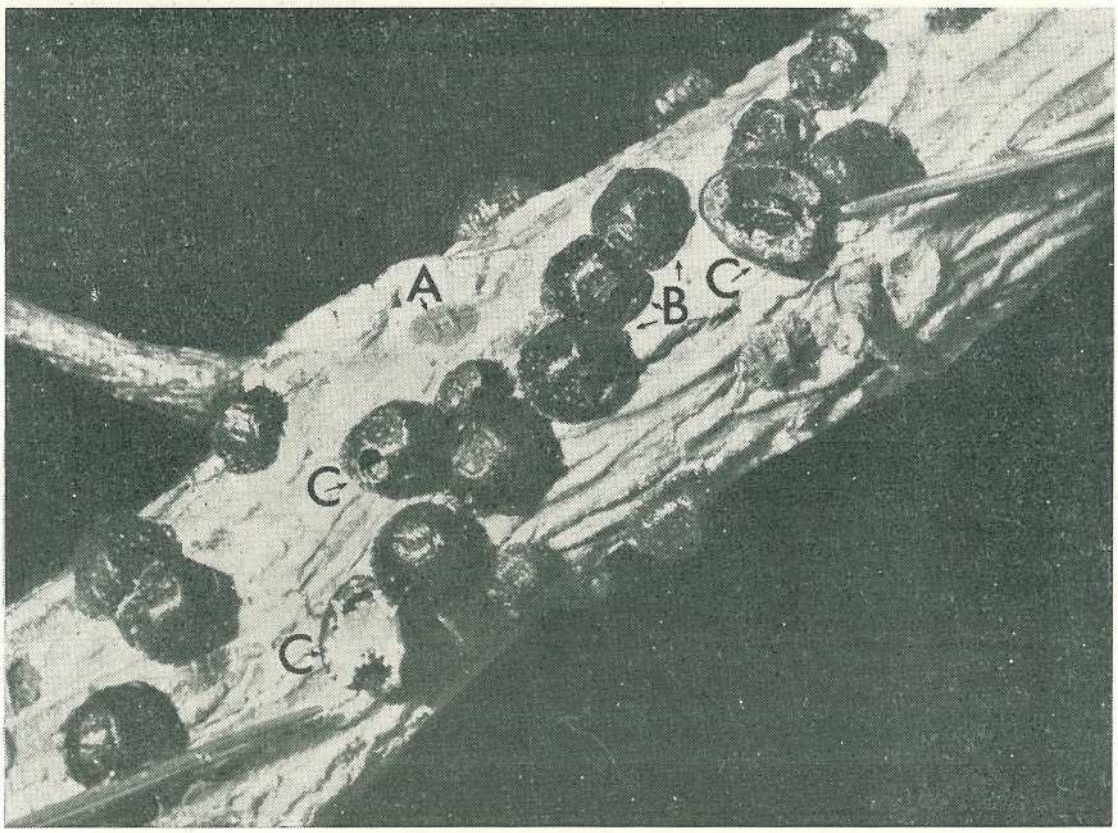
The importance of the duboisia trunk borer has not yet been fully determined. The beetle occurs throughout the South Burnet districts on *D. leichhardtii*. It has not been observed to date infesting the coastal species *D. myoporoides*.

Tunnels of the Duboisia trunk borer in the wood of a tree stem.

LIFE HISTORY. The adult is a mottled brown weevil from 6 to 10 mm in length. It is present on Duboisia mainly during the period from November to March though a few adults have been observed as early as September.

The adult feeds on the shoots inserting its proboscis into the young tissue. It lays its eggs mainly in wood freshly covered with cork. On young trees, most eggs are laid in the lower part of the trunk. In larger trees, they are laid more in the young limbs and branches.

The weevil chews out a circular hole in the cork about 3 mm in diameter as deep as the cambium and inserts the egg, finally plugging the hole with faecal material. The trunk of a young tree may be marked by scores of these



Brown olive scale on a Duboisia branch showing (A) a young insect, (B) mature insects and (C) parasitized insects.

oviposition holes. The egg is oval shaped, white in colour and about 1·5 mm long. The young larva is white except for the yellow head. It tunnels into the sap-wood leaving behind it a continuous plug of powdery frass.

During growth, the larva moults three or four times. When fully grown, it is a white, legless grub over 10 mm in length, with a yellow head capsule. After 9 months, the larva finally pupates in the spring. The pupa is also white and superficially resembles the adult beetle. Before pupating, the larva cuts a circular hole through the wood to the cork surface as an exit hole to allow the adult beetle to emerge from the tree.

DAMAGE. Although the adult weevils injure some of the young shoots, the main damage is caused by the mining of the larvae in the sap-wood.

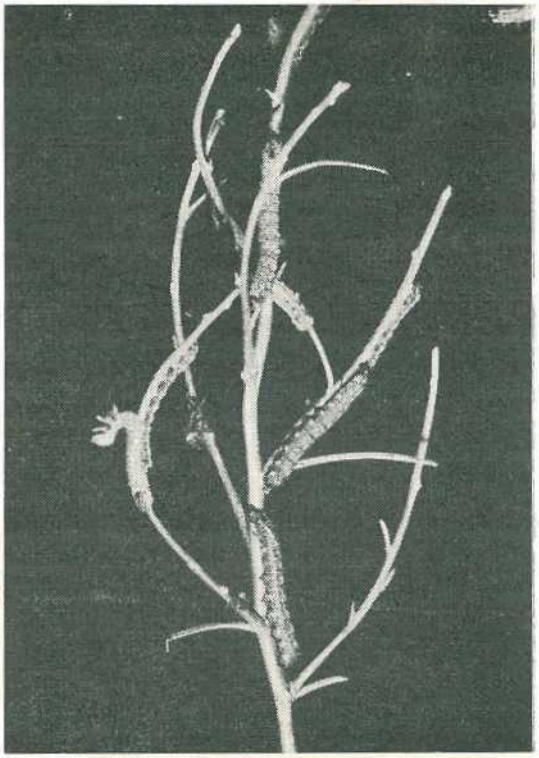
In severe attacks, the lower trunk of young trees infested in the early summer becomes a mass of tunnels and frass by the following spring. These trees are easily broken off or blown over at ground level.

An associated problem with trees damaged in this way has been a heavy root-knot nematode infestation. It appears that many of the younger trees which succumb to weevil damage have been in a weak state from nematode infestataion and unable by continued vigorous growth to curtail or overcome the weevil activity. The attacks of a few weevil larvae are not of great consequence but where large layings of weevil eggs are able to develop to maturity, the tree is severely damaged.

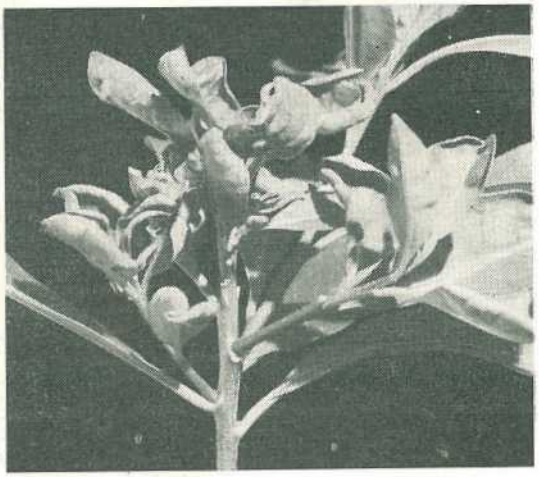
The trunks of many well established large trees are not further significantly attacked. Attacks in large mature trees are more likely in young limbs and twigs.

In many districts, the activity of the weevil is a contributing factor to the termination in productivity of Duboisia stands after 4 to 5 years.

CONTROL. The adult weevils emerge and are active during the summer, November to March. Investigations are continuing into the feasibility of protecting young plantings during this period with suitable foliage sprays. Two

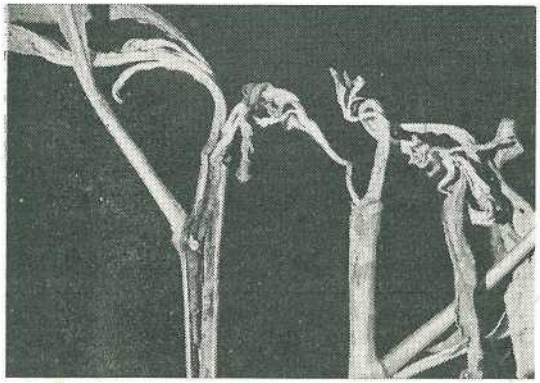


Larvae of the sandal-box hawk moth.



A Duboisia shoot showing distortion from feeding by the green leaf hopper.

A Duboisia shoot showing distortion from infestation by the broad mite.



Dead Duboisia twigs from tip borer damage, with one sectioned to show internal damage. A larva (curled) is visible in the left shoot.

or three sprays as a schedule might not necessarily completely prevent weevil infestation but would prevent heavy infestations.

After March, new plants escape significant infestation until the following summer permitting the tree to become well established before suffering an attack. Sound farming practice should be maintained to keep trees in as vigorous growing condition as possible.

D. myoporoides has not been attacked by the weevil. It is also likely that the pest will not be of much significance in *D. myoporoides-D. leichhardtii* hybrids.

Brown Olive Scale

On occasions, the twigs of Duboisia are infested with the brown olive scale. Heavily infested trees become covered in black sooty mould which is a fungus growing on the sugary secretion of the scales. Twig dieback can occur and older plantings are worst affected.

DISTRIBUTION AND PLANT HOSTS. Brown olive scale is of world-wide occurrence on a wide range of host plants. It is regarded as a major scale pest of citrus in California.

In Queensland, some common hosts besides *D. leichhardtii* and *D. myoporoides* are oleander, fig, persimmon, groundsel and poinsettia, although heavy infestations are rare.

LIFE HISTORY. The adult female brown olive scale is 3 to 5 mm in diameter, dark brown to black in colour, with two transverse and one longitudinal ridge dorsally forming a letter H.

One or possibly two generations occur annually. In the Proston area, adults have been observed to be in peak numbers on Duboisia during the autumn to winter months, with egg laying occurring through the late winter and early spring.

Most females can lay up to 500 eggs although the insect is known to lay as many as 3 000. The eggs are deposited in a mass beneath the body of the scale and are 0·6 mm long and light pink-straw coloured. Eggs hatch in 2 to 3 weeks. The young crawlers, or first instar larvae, are slightly longer, straw coloured, with paired fine filamentous antennae and anal setae, three pairs of legs, and two red eye spots.

Crawlers settle firstly on the leaves but eventually take permanent positions on the twigs. The insect moults twice before the adult stage is reached. The adult male is a small fragile insect with fine membraneous wings.

Ants are usually associated with brown olive scales feeding on their sugary secretion, tending, and facilitating their spread.

IMPORTANCE AND CONTROL. The brown olive scale is normally kept well in check in Queensland by small wasp parasites. On Duboisia, over 80% parasitism of adults by a small, dark blue wasp has been recorded during the winter months. The parasite larvae feed on the eggs and the adults emerge mainly in late winter to early spring.

Upsurges in activity by the scale insect are mostly caused by the use of insecticides applied to control other pests. The use of insecticides therefore should be curtailed as much as possible.

If spraying for the brown olive scale should become necessary, white oil 1:60 can be applied when the majority of scales are small. This is in late November.

Ants associted with scale infestations tend to interfere with normal parasitic control. Ant control can be obtained with a 0·05% dieldrin, or lindane 0·03% spray applied to the lower part of the trunk.

MINOR PESTS

Leaf Eating Caterpillars

Several species of moth larvae can infest Duboisia, especially during the summer months. Attacked trees may be heavily infested and these are rapidly defoliated. Infestation through Duboisia stands, however, tends to be sporadic with many trees escaping damage.

Sandal-box Hawk Moth

Larvae of the sandal-box hawk moth are black with three conspicuous rows of eight red spots—two lateral rows and one dorsal. The black body surface is also covered with numerous small white spots; posteriorly a black hook projects from the abdomen. Fully grown larvae measure up to 7 cm in length. The adult is a fawn coloured, stout bodied moth about 6 cm across the outspread wings.

DISTRIBUTION AND HOSTS. Larvae of the moth are recorded from southern inland Queensland feeding on *D. leichhardtii, D. myoporoides* and sandalwood. *D. leichhardtii* is favoured as food in preference to the coastal species.

DAMAGE AND CONTROL. Large numbers of larvae of the sandle-box hawk moth often occur on individual trees and all available foliage and young shoots are soon eaten.

Effective control has been obtained by spot spraying infested trees with 0·1% DDT.

Cluster Caterpillar

Fully grown cluster caterpillars are smooth, stout larvae up to 8 cm. long. They are grey coloured with longitudinal orange stripes and black triangular markings along the body. The adult moth lays its eggs in clumps covered by light brown hairs from the body. The eggs, on hatching, give rise to clusters of young larvae.

DISTRIBUTION AND HOSTS. The cluster caterpillar occurs throughout Australia on a wide range of host plants including tobacco, tomatoes, strawberries and several ornamental plants.

DAMAGE AND CONTROL. Clusters of the larvae defoliate individual Duboisia trees. Extent of the damage in a block of trees tends to be sporadic, and satisfactory control has been obtained by spot spraying with DDT 0·1%.

Other Minor Pests

Other moth pests but less troublesome, include **cutworms** and the **painted apple moth.**

Cutworms are stout bodied, grey or pinkish-grey larvae up to 5 cm long which attack young seedlings. Where damage has occurred in the nursery, a spray around the base of the plant with DDT 0·1% or trichlorphon 0·1% has given satisfactory control.

The painted apple moth is a tussock moth with larvae typically covered with tufts of setae. Trees heavily infested with larvae may be defoliated.

MISCELLANEOUS PESTS

Grasshoppers

Grasshoppers in large numbers can cause damage to young trees with loss of foliage. Three species have been involved but only occasionally, however, do they reach sufficient

numbers on Duboisia to warrant control. Control, if necessary, can be obtained with lindane 0·03% or carbaryl 0·1%. Reinfestation may occur from nearby grassy headlands.

Leafhoppers and Aphids

Flatid leafhoppers and **aphids** can cause twisting and distortion of the young growth but not of sufficient intensity in the field to warrant control. Seedlings in the nursery can be kept free of leafhoppers with DDT 0·1% or trichlorphon 0·1%. A satisfactory aphicide is nicotine sulphate, or demeton-S-methyl 0·025%.

Shield Bugs

Some shield bugs, in particular the green vegetable bug, occur on Duboisia. Young shoots are sucked but damage is not significant.

Tip Borer

A small moth larva burrows in the tips of shoots. Incidence is greatest during the late spring to early summer.

The larva is white, long and narrow, growing to 1·5 cm in length. Individual trees may have up to 50% of tips affected, but usually the percentage is very much lower and control measures are unwarranted.

Mites

Broad mite and spider mites can be troublesome on seedlings in the nursery. The broad mite, which can be seen with the aid of a hand lens, is white changing to yellow with age. It causes twisting and hardening of young growth.

Spider mites are larger, with longer legs, and bright red or greenish yellow in colour. These mites, when severe, are accompanied by webbing. The leaves become mottled and yellow, and finally are shed.

Satisfactory control of both mites is obtained with sulphur, or dicofol 0·05%.

Other Insects

A leaf galling wasp and a small twig galling moth have also been observed on *D. myoporoides*. Both insects have not yet been specifically identified.

Other incidental occurrences have involved the red-shouldered leaf beetle, the orange fruit borer, the potato moth, and the passion vine mite.

Scientific names of the insects referred to are:—

Pests

A small flea beetle	*Psylliodes parilis* Weise.
A larger flea beetle	*Psylliodes* sp. nr. *nouaecaladoniae* Baly.
Large leaf-eating ladybird	*Henosepilachna guttatopustulata* (F.)
Twenty-eight-spotted ladybird	*Henosepilachna vigintioctopunctata* (F.)
Duboisia trunk borer	Name not yet available (*Curculionidae*)
Brown olive scale	*Saissetia oleae* (Bern.)
Sandal-box hawk moth	*Coenotes eremophilae* (Lucas)
Cluster caterpillar	*Spodoptera litura* (F.)
Cutworm	*Agrotis* sp.
Painted apple moth	*Orgyia anartoides* (Walk.)
Long-headed grasshopper	*Acrida conica* (F.)
Australian plague locust	*Chortoicetes terminifera* (Walk.)
A grasshopper	*Oedaleus australis* Sauss.
A grasshopper	*Peakesia puella* Sjost.
Pink-edged leafhopper	*Colgar peracuta* Mel
Green leafhopper	*Siphanta* sp.
Green vegetable bug	*Nezara viridula* (L.)
Metallic shield bug	*Scutiphora pedicellata* (Kirby)
Green stink bug	*Plautia affinis* Dall.
A tip borer	Name not yet available
Broad mite	*Hemitarsonemus latus* (Banks)
Two-spotted mite	*Tetranychus urticae* Koch
Cotton spider mite	*Tetranychus ludeni* Zacher
Passion vine mite	*Brevipalpus phoenicis* (Geij.)
Red shouldered leaf beetle	*Monolepta australis* (Jac.)
Orange fruit borer	*Isotenes miserana* (Walk.)
Potato moth	*Phthorimaea terrella* (Walk.)
Brown looper	*Lophodes sinistraria* Guen.

Parasites and Predators

Host—*Henosepilachna guttatopustulata*	*Pediobus* sp. (Eulophidae)
	Uga collisscutellum (Gir.) (Chalcididae)
	Alesia frenata Erich. (Coccinellidae)
Host—*Saissetia oleae*	*Metaphycus lounsburyi* (How.) (Encyttidae)
	Scutellista cyanea Motch. (Pteromalidae)
	Myiocnema comperei Ashm. (Encyrtidae)

Contraction Joints in Concrete

A contraction joint is a concrete-to-concrete joint made in such a manner that the concrete is free to shrink away from the plane of the joint while all other relative movement across the joint face is prevented.

by H. WOODINGS, Field Officer (Silo Construction).

As concrete sets, hardens and dries out, it shrinks. Contraction joints are built into a concrete structure to relieve the tensile stresses which result if the shrinking concrete is restrained. If this were not done, random cracking would occur when the drying shrinkage stresses within the concrete exceeded the concrete tensile strength. The tensile strength of concrete can be improved very considerably by suitably reinforcing concrete.

Reinforcing restrains overall shrinkage movement and prevents the formation of large shrinkage cracks. It does this by subdividing the amount of shrinkage into minute cracks over the whole area. These cracks are not visible to the naked eye or harmful to the concrete. Contraction joints are necessary and should be used in all concrete structures that are not reinforced.

While it is generally possible to reinforce a floor adequately to prevent the formation of large shrinkage cracks, the reinforcing is usually stopped just short on either side of the joint, especially where only light reinforcement is used. If this is not done, the joint will allow only partial contraction and the reinforcing could be exposed to corrosion.

Large areas of concrete should be divided into approximately square bays by means of contraction joints, as these bays then provided convenient points at which to interrupt the placing of concrete. A day's work should never cease in the middle of a bay but should be taken to a contraction joint.

It is worth noting that the spacing of contraction joints will generally be dictated by the supervising engineer. It is suggested that the spacing for the contraction joints should not exceed 3 m when using gravel aggregate of less than 2 cm, and 8 m when using crushed granite.

Points to bear in mind to help overcome the shrinkage of concrete are:—

- Lean mixes with a low water content.
- Low water-cement ratios.
- High relative humidity.
- Low temperatures.
- Sound aggregates.

Contraction joints must be filled with a caulking compound which will not oxidise, harden or crack but remain flexible and weatherproof under extreme conditions of exposure. This material is available from several firms. Directions on the method of use are on the container.

Anne Cook's farm home

Cheshire Cheese

IN days of old, a lively little pub in London was appropriately named 'Ye Olde Cheshire Cheese'.

Chroniclers of the period tell us that Dr. Samuel Johnson and other luminaries used to eat and drink there.

But most of all, the chroniclers write of the famous Cheshire cheeses eaten there ceaselessly and in quantity, sometimes plain with chunks of bread, sometimes toasted, and sometimes 'stewed'—their name for Welsh rabbit.

Dr. Johnson was one of the cheese's staunchest champions. Not only did he consume huge quantities of it, but he also referred to it as 'bright as a lantern and sharp as a pick'.

Cheshire is considered to be England's oldest cheese, well known by the twelfth century. It didn't arrive in Australia until quite recently, but is now one of the country's favourites with its fine melting properties and satisfying flavour.

Described as one of the great toasting cheeses, it has a wholesome, almost aromatic flavour when melted over a piece of toast.

It is also a perfect cheese to eat with celery, radish, cucumber, in fact any vegetable that can be eaten raw, or with bread and biscuits.

The freshness of the Cheshire's flavour is a good protection against its ever becoming monotonous.

The brand of Cheshire manufactured in Victoria and available nationally is presented in 10 lb. rectangular rindless blocks, and in 6 oz. pre-packed portions.

In Queensland, the shaping of the cheese follows traditional lines and it comes in rinded cylindrical shapes of 40, 20 and 10 lb. weight. It is also available in 6 lb. plastic packed blocks.

—Australian Dairy Produce Board.

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Heat Exhaustion

HEAVY physical exertion and hot summer weather can lead to heat exhaustion. Most of us are naturally inclined to take it easy when the weather gets hot, but sometimes we just can't stop completely, and heat exhaustion is the result.

This is how it happens: the body has its own built-in air conditioning system. The circulation of the blood can either warm the body or cool it by facilitating the free production of sweat which, in turn, cools the body by evaporation. Consequently, the hotter the environment, the greater the tax on circulation by sweat glands.

By itself, this taxation will not cause heat exhaustion. But vigorous exercise can cause the muscles to demand more blood. The body can stand the strain for only a limited time before the brain is robbed of its share of blood, causing faintness or coma.

These simple ideas will help you to avoid the worst consequences of a heatwave:—

- Maintain a nutritious diet. Hot weather is sometimes inclined to jade the appetite, making it much more important to eat the right types of food. Stick to the high protein, low bulk foods such as fish, eggs and cheese, and serve them with a cold salad.

- Stay active, but don't overdo it. Light exercise or normal activity will help you adjust to the heat. On very hot days, get an extra hour's sleep.
- There's nothing like a cold beer on a hot afternoon. But too much alcohol will impair the body's control mechanism and make you feel hotter. Drink plenty of water.
- Wear lightweight, loose-fitting clothes. You should find this more comfortable than wearing a swim suit.
- If you can get away with it, go barefoot. Not only is it cooler, but healthier too. A straw hat with a wide brim will keep your head cool.
- A cold shower will cool you off for a few minutes, but will only make you feel warmer later on. Unless you plan to spend all day in the shower, don't bathe too often during the day and keep the water tepid rather than cold.

However, the body also has a built in warning system—fatigue. If this warning is ignored, the next sign may be a feeling of faintness, nausea, headache or restlessness. If the patient passes out in the sun but is still perspiring freely, usually the only treatment required is for him to be left in the shade, lying flat, until he recovers.

After he has completely regained consciousness, he may be given some water to drink but should remain at rest. If in doubt, or if the condition appears to be more serious, call a doctor.

—Queensand Health Education Council.

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Head Lice

MENTION of head lice makes most mothers shudder, and think of unclean living conditions and unwashed children. But head lice are so easily picked up that anyone can become infected.

Live lice or their eggs (called nits) fall or brush off on to floors, desks, chairs, or train and bus seats, and can be picked up very easily by anyone who afterwards comes in contact with the infested surface.

Each louse lays about 60 eggs which are attached to the hairs of the head. These eggs are much more readily seen than the live louse. They look like tiny white specks near the base of the hair shaft, and they take about a week to hatch.

Head lice or the eggs can be exchanged by contact at play, or they can rub off on pillows, cushions, collars of sweaters or other garments, or on hats.

One infested child at a school or kindergarten can quickly cause lice to spread to many of his or her classmates, and to anyone who comes in contact with them before the lice are detected.

It's up to parents to make frequent checks of their children for head lice, and if lice are found, to act immediately. Getting rid of the pests is not an overnight job. Whatever methods are used for destroying the lice, persistent action until all signs of them have disappeared is essential.

WHAT TO DO. Destroy live lice. Remove and destroy eggs. Kill any freshly hatched lice.

Use of soap and water, cutting very long hair, and combing with a fine-tooth comb make a good start. After this, daily combing with a fine-tooth comb dipped in hot vinegar will loosen eggs from the hair.

A chemical called gamma benzene haxachloride (sold by chemists under the name, Lorexane) will effectively kill lice. If unable to obtain this preparation, a hair dressing of equal parts of olive oil, and either kerosene or eucalyptus will reduce chances of picking up more eggs or lice during an outbreak. However, because of the fire risk, many authorities do not recommend the use of kerosene.

Outbreaks of head lice have occurred at many schools recently, and no doubt will crop up again from time to time. Although head teachers may help with advice, and will alert parents if there is an outbreak, the responsibility for dealing with the lice belongs with the parents.

All forms of body lice are classified as "Communicable Disease", under the Health Act and, where necessary, authorities can take firm action over neglected cases.

—Queensland Health Education Council.

The Pancake Story. . .

IN Holland they are 'flensjes' in Italy 'canneloni' in Sweden 'plaltar' in Israel 'blintzes' and in France the delicate, lacy 'crepe'.

Originally a simple flour-and-water batter baked on a hot hearth, the pancake is, today, one of the most versatile and imaginative of dishes.

Evaporated milk, buttermilk, skimmed milk powder and natural wholesome milk are used here in pancakes crammed with delicious savoury and dessert fillings.

Simply rolled, stacked, folded in half, in triangles or cornets, these pancakes are ready for a hot oven, a quick grilled gratineed topping or accompanying sauce.

They fill an enviable place in any menu and sound so easy to make—and they are.

The standard 8-oz. measuring cup and level spoon measurements are used in these recipes.

Apricot Nut Crepes

The Pancakes

1 cup plain flour, sifted

1 egg

1, 6-oz. can undiluted evaporated milk

2 tablespoons crushed mixed nuts

The Filling

1, 8-oz. carton low fat apricot yoghurt

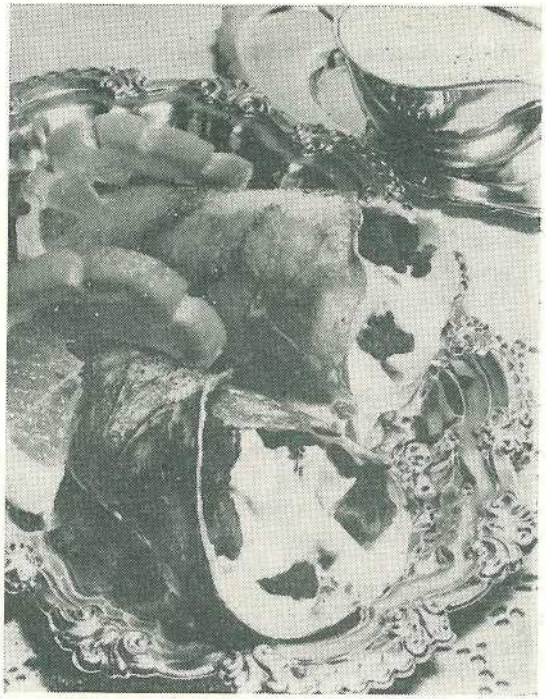
½ cup dried snipped apricots

2 oranges, thinly sliced

3 tablespoons sugar

1 tablespoon crushed mixed nuts

Mix dried apricots into yoghurt. Refrigerate till required. Dilute evaporated milk with water to make 1¼ cups. Make up pancake batter in normal manner. Stand 30 minutes.



Apricot Nut Crepes

Add nuts just before cooking. In butter-brushed, 6-in. pan make eight to 10 pancakes. On each pancake, spread 1 to 2 tablespoons apricot filling. Fold into triangles or roll into cornet shapes. Arrange in serving dish. Place orange slices on each pancake. Sprinkle with nuts and sugar. Place under hot griller to melt sugar and brown nuts lightly. Serve at once. Serves four or five.

Note.—If pancakes are prepared ahead, reheat on a covered plate over hot water.

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Bacon Pancakes

The Pancakes

½ cup plain flour, sifted

1 egg yolk

⅔ cup milk

1 bacon rasher, finely chopped

Pinch salt

The Filling

6 slices Australian mild Cheddar cheese
2 oz. butter
5 spring onions, finely chopped
½ cup flour
⅔ cup chicken stock
½ cup dry white wine
Salt and pepper
½ cup cream
1, 3½ oz. can champignons, drained and sliced finely

Make batter in normal manner. Stir in bacon. Stand 30 minutes. Stir bacon through batter each time before making six pancakes, using a 6 in. butter-brushed pan. Melt butter, saute spring onions for 1 to 2 minutes. Blend in flour. Cook 1 minute. Add stock and wine. Stir till boiling. Season with salt and pepper. Stir in cream and champignons. On each pancake place a slice of Cheddar cheese and 2 teaspoons of sauce. Fold in half and place in shallow oven-proof dish. Dot with butter. Bake in moderate oven (350°F) for 15 minutes or till heated through. Garnish with chopped parsley and extra grilled bacon rolls. Serves six.

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Brandied Apple Flapjacks

The Pancakes

1 cup plain flour, sifted
1 egg
1½ cups buttermilk

The Filling

5 oz. butter
2 lb. cooking apples, peeled, cored and sliced in 2½-in. rings
1 cup brown sugar
3-4 tablespoons lemon juice
1 teaspoon cinnamon
3-4 tablespoons brandy
2 tablespoons flaked almonds
1 cup cream, whipped

Make pancake batter in usual manner. Stand 30 minutes. In a large, heavy-based lightly-buttered pan, drop tablespoons of batter. Tilt pan slightly to spread batter. When bubbles appear, turn and brown other side. Make 24, 2½-in. pancakes in this way. In the same pan, melt half the butter. Fry apple rings till just soft turning to brown lightly. Remove, set aside. Add remaining butter, brown sugar, cinnamon, lemon and brandy. Stir till sugar melts and sauce boils. In a flat serving dish place a layer of pancakes; top with apple rings. Spoon ½ teaspoon almonds on each apple centre. Top with remaining pancakes. Pour over hot sauce. Serve with whipped cream. Serves six.

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Pancakes Stroganoff

The Pancakes

1 cup plain flour, sifted
3 tablespoons non fat milk powder
1 egg
1¼ cups water
Salt and pepper to taste

The Filling

1½ oz. butter
2 cloves garlic, finely chopped
1 large onion, diced
3 bacon rashers, chopped
1 lb. minced topside steak
1 tablespoon flour
½ teaspoon each mixed herbs and sugar
8 oz. tomatoes, peeled and chopped
2 teaspoons Worcestershire sauce
¾ cup sour cream

Sift flour and milk powder into bowl. Stir in egg and water to make a smooth batter. Stand 30 minutes. In butter-brushed 6-in. pan make 10 pancakes. Fry garlic, onion and bacon in butter till onion is softened. Stir in topside steak. Allow to brown for 5 minutes stirring occasionally. Add next four ingredients. Cover. Simmer 10 minutes. Reserve 3 tablespoons sour cream, stir remainder into pan. Spoon filling down centre of pancakes. Roll up, place in shallow serving dish. Spoon remaining sour cream over each pancake. Garnish with chopped parsley. Serves four to five.

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S. G. Reid, Government Printer, Brisbane

Brown Spot of French Beans

BROWN SPOT *(Pseudomonas syringae)*, a seed-borne bacterial disease, occurs sporadically in French bean crops in Queensland.

Under favourable conditions, however, it can cause extensive damage to cultivars that are particularly susceptible to the disease.

Brown spot is of major concern in bean crops grown for processing because pod spots do not blanch out during processing. It is important then for these crops in particular to be free of this disease.

Symptoms

On the leaves, the bacteria produce small, reddish-brown, circular spots sometimes bounded by the veins. There is often a very narrow, yellow-green halo around the margin of the spot. With time, the central lighter-brown part of the spot may tear. In severely affected plants, leaves may assume a rather ragged appearance with extensive defoliation occurring in some cultivars.

Under favourable conditions, stem spots may occur. These are tan with a reddish-brown margin and up to 10 mm across.

Pod spots begin as dark-green, circular, water-soaked areas which gradually enlarge, eventually becoming depressed and tan with a distinctive, reddish-brown margin. In cultivars that are extremely susceptible to this disease, the pods often bend at acute angles at points where spotting occurs. The brown spot bacterium often infects the leaves through rust pustules and thus rust and brown spot can often be found together in the one lesion.

Spread

The bacterium can be carried both inside and outside the seed. This is the most common way of transmitting the disease from one season to the next and of introducing it into a new area. Most seed infestation occurs as result of pod infection or contamination of the seed coat by plant debris during harvesting and subsequent handling.

Cool, showery weather favours the disease. Its spread within a crop takes place during periods of wind-driven rain and by contact with contaminated agricultural implements, insects, animals and people's clothes. Spread can be extremely rapid.

The bacteria can survive for more than a year in undecomposed trash from a diseased crop.

Control

To minimize the risk of spreading the disease in the seed, the use of approved disease-free seed is strongly recommended.

Certain hygiene measures are important. Refuse from diseased crops should be destroyed as soon as harvesting has been completed to ensure rapid and complete decomposition. Movement of machines and people between diseased and disease-free areas of crop should be avoided, especially while the crops are wet with rain or dew.

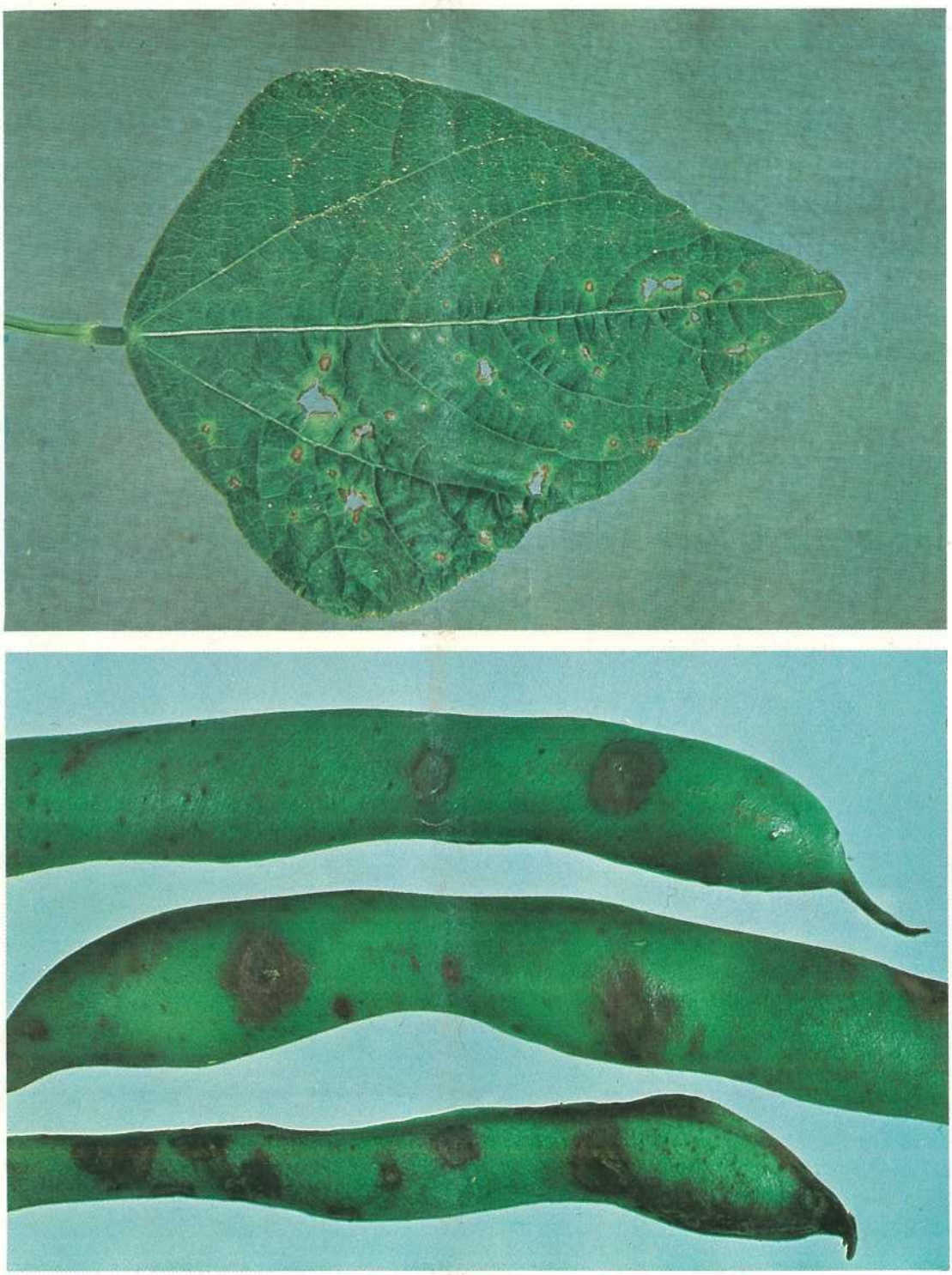
Cultivars that are particularly susceptible to brown spot should be avoided in areas where extensive damage has previously occurred.

Where isolated plants within a crop develop obvious symptoms, roguing of these plants and those in close proximity may be beneficial in preventing extensive spread of the disease. For this to be effective, regular inspections of the crop are necessary.

— Plant Pathology Branch

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

Diseases of French Beans - 5



BROWN SPOT. Upper: leaf symptoms. Lower: pod symptoms.