

The mesquite control toolbox



Section 3

Section 3

The mesquite control toolbox

Mesquite

Integrating control options

As mesquite species respond differently to control methods, the most effective method or combination of methods will vary depending on the size, density and species of mesquite present. For this reason, correct species identification should be made before any control work is started.

Rarely will one control option fix the problem. Usually a combination of methods (e.g. mechanical, chemical, biological and management) will be most effective. Assessment of the best option should be carried out on a paddock-by-paddock basis, and a plan made for each individual situation.

In general, the shrub form of mesquite is more difficult to control than the tree form. This should be taken into account when deciding on control methods.

The following should be considered:

- size, density and species of the infestation
- short-term and long-term objectives of the project
- accessibility of the infestation and the type of land infested—for example, flat open plains, along major watercourses and flood plains

- availability of resources—for example, spray equipment, tractor, dozer, labour
- management options
- easiest and most cost-effective methods
- complementary control options—for example, chain pulling, followed by burning, followed by application of herbicide
- type and amount of native woody vegetation present. This will have implications on what options can be used without the need for a tree-clearing permit.

When working out the control program, keep in mind that:

- widespread use of chemical and mechanical control can be expensive in rangeland situations
- seed banks can be large and long term, so follow-up control is extremely important
- mechanical control can provide the opportunity to re-sow with suitable pasture species, which will provide competition for new mesquite seedlings as they emerge.

As mesquite has different survival characteristics (see section 1), control, therefore, requires a long-term program.

Control options

In this manual, control methods have been separated into two categories—those suitable for:

- tree-form mesquite —mostly single-stemmed (*P. pallida*).
- shrub-form mesquite —mostly multi-stemmed and includes all hybrid varieties, *P. velutina*, *P. juliflora* and *P. glandulosa* complexes.

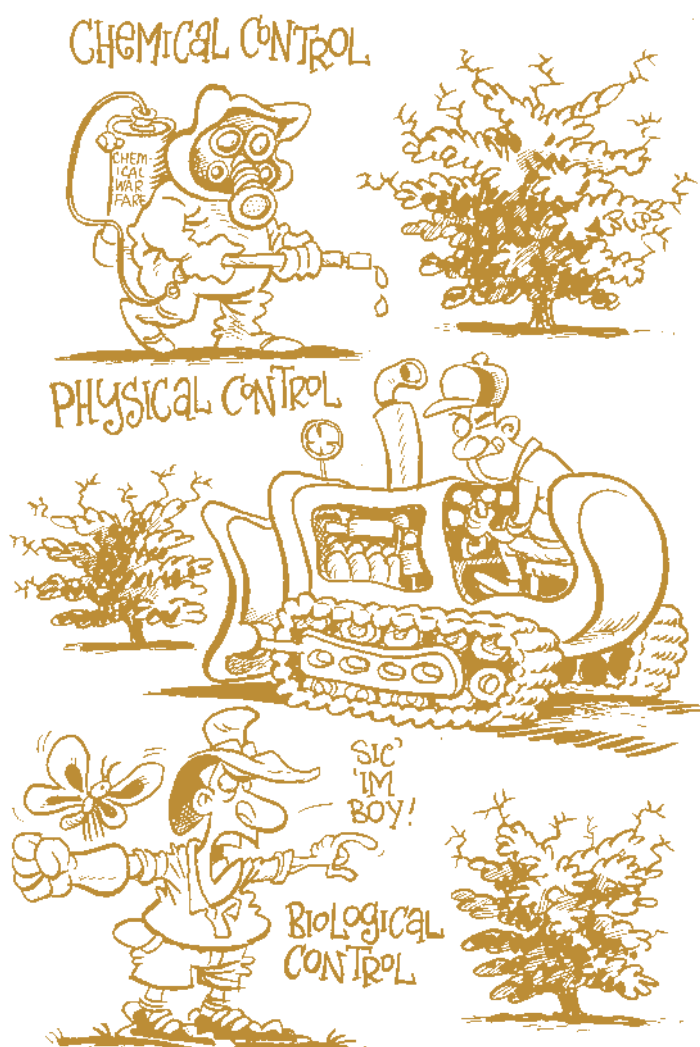


Table 3: Tree form—mostly single-stemmed (*P. pallida*)

Control option	Situation				
	Scattered	Low density	Medium density	High density	Regrowth/seedlings < 1.5 m
Physical control					
Blade ploughing ¹		✓	✓		
Chain pulling ²			✓	✓✓✓	
Dozer pushing	✓	✓	✓✓	✓✓	
Stick raking		✓	✓✓	✓✓	
Fire		✓✓	✓✓✓	✓	✓✓
Chemical control					
Basal bark spraying	✓✓✓	✓✓✓	✓✓	✓	✓✓
Cut stump technique	✓✓	✓✓	✓		
Foliar spraying					✓✓✓

Key

Suitability of control option: ✓ = low ✓✓ = moderate ✓✓✓ = very good

¹ Front-mounted blade ploughs are the recommended option for use on tree-form mesquite. Blade ploughing is effective for the removal of small trees; however, it is not recommended for large mature trees and may damage machinery.

² Chain pulling is effective only if followed by burning.

Density levels

scattered: one or two isolated plants or clumps of plants

low: 1–50 plants per ha

medium: 50–500 plants per ha

high: >500 plants per ha

Table 4: Shrub form—mostly multi-stemmed (*P. velutina*, *P. glandulosa*, *P. juliflora* and hybrids)

Control option	Situation				
	Scattered	Low density	Medium density	High density	Regrowth/seedlings<1.5 m
Physical control					
Blade ploughing		✓	✓✓	✓✓	✓
Chain pulling					
Dozer pushing					
Stick raking ³		✓	✓✓	✓✓	✓✓✓
Fire			*	*	✓
Chemical control					
Basal bark spraying	✓✓✓	✓✓✓	✓✓	✓	✓✓
Cut stump technique	✓✓	✓✓			
Foliar spraying					✓✓✓

Key

Suitability of control option: ✓= low ✓✓= moderate ✓✓✓ = very good

³ Stick raking with a cutter bar is the recommended method to use on shrub-form mesquite.

*Only extremely hot fires that spread throughout the canopy are effective in these situations.

Refer to (p.50) for further information.

Density levels

scattered: one or two isolated plants or clumps of plants

low: 1–500 plants per ha

medium: 500–5000 plants per ha

high: >5000 plants per ha

Physical control options

Blade ploughing

Recommendations

Tree form

- The use of a front-mounted blade-plough attachment is recommended for the treatment of low-density to medium-density infestations. Ideally, plants should be young so that the blade can push through the stems easily. Older, more mature plants are difficult to treat in this way and can damage machinery. Rear-mounted blade ploughs are not recommended.

Shrub form

- The front-mounted Ellrott blade plough is considered a suitable option for control of medium-density to high-density infestations. The rear-mounted Homan plough is also suitable but is not as effective as the front-mounted model. Both of these options can be very expensive.

Description

Grubber attachments are mounted on either the front or rear of dozers or tractors. Front-mounted attachments can be easier to manoeuvre and can penetrate an infestation more quickly, bringing the costs down (depending on whether the dozer is hired or owned).



▲ Front-mounted blade plough (Ellrott design).

A 4 x 4 tractor of at least 80 hp for smaller infestations, and dozer of minimum size D6 are recommended for blade ploughing medium to high density mesquite. Blades are pushed or pulled under the trees and stems are cut off below ground level. Success depends on cutting the root system below the bud zone (20–30 cm) to reduce the likelihood of re-shooting. Multi-stemmed plants may grow back if they snap off at ground level.



▲ Rear-mounted blade plough (Homan design).



▲ Front-mounted blade plough

Care should be taken to avoid native trees and shrubs when blade ploughing, unless a permit has been granted. Check state or territory native tree-clearing guidelines.

Timing

In southern states, the recommended time for blade ploughing is during spring, before seed set. In northern Australia, this method is likely to be most effective in late autumn and winter when root reserves are low and are not being replenished (Parsons & Cuthbertson 2001).

Advantages

- Provides the opportunity to re-sow with suitable pasture species.
- Results in immediate kill of up to 95% of treated plants
- Is less labour intensive than chemical treatment.
- Loosens soil surface and allows for increased water retention.

Disadvantages

- Can place large strain on equipment, especially if used on large trees and in areas with hard-setting soil.
- May result in re-shooting if trunks snap off at ground level (i.e. are not cut below the bud zone).
- Is not as effective on shrub forms.
- Though disturbed soil will promote seedling emergence, this will help reduce the soil seed load.

Cost

Cost will vary depending on the size of the dozer used, owned versus hired dozers, density of trees, operator experience, transport requirements and the type of implement used.

Chain pulling Recommendations

Tree form

- Best for the control of high-density infestations. Chain pulling is effective only if used in combination with fire, and followed up with herbicide treatment.

Shrub form

- Not recommended—considered ineffective because of the robust nature of these species and the potential for regrowth at the root system.

Description

Two dozers are used to pull the chain through dense infestations, first in one direction and then in the other to remove the trees from the ground. At a minimum, the dozer should be a D8. The chain should be heavy enough so that it is not pulled up over the plants. A triple chain with swivels has been effective in killing a higher proportion of smaller plants.

When used alone, chain pulling, will give moderate kill rates. The main objective of this method is to push woody trees to the ground to provide fuel for burning. After chain pulling, grazing should also be kept to a minimum to allow grass fuel to

accumulate. This will ensure that the fire will travel between clumps of woody material. With sufficient fuel, any plants that survive the chain pulling will be burnt.

Care should be taken to avoid native trees and shrubs when chain pulling, unless a permit has been granted. Check state or territory native tree-clearing guidelines.

Timing

Optimum time to pull is from July to October during the dry season, and before the first rains in areas with summer rainfall. Tree-form mesquite is uncommon in areas that do not have a summer rainfall.



▲ Three-twine chain.

Advantages

- Usually used as part of an integrated program incorporating fire. Pulling alone will give only a 20–30% kill rate; while pulling followed by burning may result in up to 95% kill rates.
- Provides the opportunity to re-sow with suitable pasture species.
- Results in improved access and easier mustering.

Disadvantages

- Results in a low kill rate if not combined with other options.
- Requires a high level of follow-up control.
- Disturbed soil promotes seedling emergence; however, this will help to reduce the soil seed load.
- Can be expensive on a large scale.



▲ Chain pulling in action.

Cost

Cost will vary depending on the size of the dozer used, owned versus hired dozers, density of trees, operator experience and transport requirements.



▲ Two dozers are required to pull the chain.

Dozer pushing Recommendations

Tree form

- Most suited to medium and high densities of mesquite; however, is still effective for low and scattered densities. Cost is the most limiting factor for this type of control.

Shrub form

- Not recommended for this type of mesquite because of its robust nature and potential for regrowth at the root system.

Description

A blade is used to push individual trees at, or slightly below, ground level. This can be achieved by using

at least an 80 hp 4 x 4 tractor with attached implement (in low-density situations) or with a dozer with blade attachment. The size of the machinery will depend on the size and density of the infestation.

Care should be taken to avoid native trees and shrubs when bulldozing, unless a permit has been granted. Check state or territory native tree-clearing guidelines.

Timing

Optimum time for pushing is from July to October during the dry season, and before the first rains in areas with summer rainfall. Tree-form mesquite is uncommon in areas that do not have a summer rainfall.



▲ Dozer pushing.



▲ Results of dozer pushing.

Advantages

- Results in immediate kill.
- Achieves a moderate to high kill rate.
- Improves access and ease of mustering.
- Is less labour intensive than chemical control.
- Provides the opportunity to re-sow with suitable pasture species.
- Tree form does not tend to germinate as well as shrub form after soil disturbance.

Disadvantages

- May result in re-shooting if trunks snap off at ground level.
- Requires a high level of follow-up control.
- Though disturbed soil will promote seedling emergence, this will help to reduce the soil seed load.

Cost

Cost will vary depending on the size of the dozer used, owned versus hired dozers, density of trees, operator experience and transport requirements.

Stick raking

Recommendations

Tree form

- Most effective for medium-density to high-density infestations.

Shrub form

- Suitable for the removal of dead mesquite and dense regrowth of hybrids.

Description

A stick rake, with cutter bars to cut the stems below ground level, is attached to the bottom of the dozer tines. The minimum size of dozer required is D7. After cutting, the mesquite is pushed into windrows for burning.

Stick raking *P. velutina* regrowth using a D6 dozer without a cutter bar has been effective, achieving up to 50% kill rate.

Care should be taken to avoid native trees and shrubs when stick raking, unless a permit has been granted. Check state or territory native tree-clearing guidelines.

Timing

Optimum time is from July to October during the dry season and before the first rains, in areas with summer rainfall. In areas of winter rainfall, the ideal time is during spring before seed set.



▲ Stick rake with cutter bar.

Advantages

- Results in excellent kill rates if properly applied.
- Provides the opportunity to re-sow with suitable pasture species when the fallen material is pushed into windrows.
- Is effective in strategic areas such as mustering lines, fence lines and watercourses.
- Results in improved access to previously impenetrable, thorny thickets.

Disadvantages

- May result in re-shooting if trunks (of trees and particularly multi-stemmed shrubs) snap off at ground level.
- Results in very high disturbance of soil, causing initial loss of perennial grasses and potential for erosion.
- Though disturbed soil promotes seedling emergence, this helps to reduce the soil seed load.



▲ Stick raked mesquite pushed into windrows.

- Requires a high level of follow-up control.
- Can be expensive if used on a large scale.

Cost

Cost will vary depending on the size of the dozer used, owned versus hired dozers, density of trees, operator experience, transport requirements and if implements are used.

▼ Mesquite being stick raked.



Fire

Recommendations

Tree form

- Best for low and medium density infestations and for seedlings. Can be used for high-density populations if there is sufficient fuel load.
- A very effective tool when used after chain pulling.

Shrub form

- Burning can be used to clean up windrows that have been stick raked.
- Beneficial only if the fire is very hot and can carry through the canopy.

Description

Fire is most beneficial for the control of tree-form mesquite. It is an under-utilised 'cheap' option that can result in good kill rates, and is currently the only method that will reduce the seed bank. Only very hot fires are effective on all other species of mesquite as they are relatively fire-tolerant. Fire is also used to burn mesquite stacked into windrows after stick raking.

Controlling mesquite successfully with fire requires effective planning. As fuel can be built up if grazing is minimised, the use of fire as a method of control should be integrated into stock management.



▲ Sufficient fuel is required for an effective fire.

Firebreaks need to be installed and appropriate permits and notification are required.

Timing

Burning is best done late in the dry season when trees are stressed, there is plenty of fuel, and the weather is hot. Intense fires can be produced under these conditions. Burn conditions are critical for obtaining a successful fire, even more so for more fire-tolerant species. Refer to 'Using fire as a management tool for the control of mesquite' on p.70.

Advantages

- Good kill rates of up to 95% for the tree form.
- Results in emergence of fewer seedlings.
- Depletes the seed bank of seeds up to 2 cm deep in the soil.
- Is relatively cheap compared with other control options.

Disadvantages

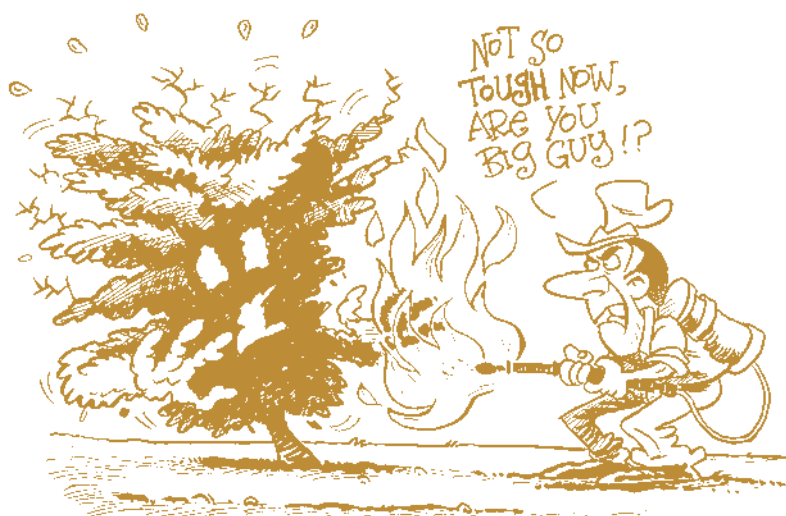
- It is difficult to generate fires that are sufficiently hot to kill shrub forms.
- A high fuel load is required for the most favourable fire conditions.
- Pasture is sacrificed for fuel load.
- Fire can be a danger to other pastures.
- Method may promote the germination of undamaged seeds in the following wet season.
- There is a risk to neighbouring property and infrastructure if the fire becomes uncontrollable.
- Ensuring safe burning practices can involve a large number of people.



▲ Effects of fire on tree-form mesquite.

Cost

Using fire is generally a much cheaper option than mechanical or chemical control. However, it is necessary to consider the labour requirements and the feed value of the pasture that will be used as fuel.



Chemical control options

Basal bark spraying

Recommendation

Both tree and shrub form

- Best for use in scattered, low-density and medium-density infestations, and also for regrowth. At high infestation levels, can become very costly and time consuming.

Application

- Ensure any debris is removed from the base of the plant to allow maximum coverage.
- Carefully spray completely around the base of the plant to about 30 cm above ground level.
- Thoroughly spray all crevices and each stem of multi-stemmed *Prosopis* species—any area missed on the stem of either form of mesquite will regrow.
- Spray up to 1 m above ground level for the control of larger trees.
- Spray plant to the point of run-off.

Timing

Best time to spray is when plants are actively growing and soil moisture is good. In southern areas where there is a dominant winter rainfall, this is during spring and summer. In tropical parts of Australia, it is from March to July.



▲ Basal bark spraying of shrub-form mesquite—all stems must be treated.

Advantages

- Results in greater than 97% kill rate if carried out correctly.
- Kills quickly.
- Is target-specific.



► Basal bark spraying of tree-form mesquite.

Disadvantages

- Is labour intensive.
- Requires that all stems of multi-stemmed shrubs are sprayed or regrowth will occur.
- Is costly if large areas and dense patches are treated.

Registered herbicides

Triclopyr 240 g/L plus picloram (ester) 120 g/L at a rate of 1 L/60 L diesel mix. For example, Access®.

As all herbicides must be applied strictly in accordance with the directions on the label, always read them carefully before use.

Cost

Cost depends on the size of the plant being treated, and the thickness of the stem.

An Access® 100 L mix will cost approximately \$182 (excl. GST) based on the following assumptions:

- chemicals—\$53 per litre
- diesel—\$0.94 per litre.



▲ Result of basal bark spraying near a watering point.

Cut stump technique

Recommendations

Tree form

- Good for low densities. Because of its growth habit, the tree form is easier to treat using the cut stump technique than the shrub form.

Shrub form

- The cut stump technique is suitable for shrub-form mesquite in scattered and low-density situations. This method of application is best when stems are less than 50 mm in diameter.
- The drooping canopy and multiple stems of this form of mesquite make it much more difficult to treat in this way.



- ▲ Stump should be cut as close to the ground as possible.



- ▲ For thinner stems, garden shears can be used.

Application

If properly used, the cut stump technique may result in higher kill rates than basal bark spraying. For the best results, this method usually requires the efforts of a two-person team—one for cutting and the other for applying the chemical. Thinner stems (< 50 mm in diameter) can be cut by a person working alone using a branch cutter. Stems of trees should be cut horizontally as close to the ground as possible and the cut surface swabbed or sprayed with herbicide mixture immediately (within 15 seconds), otherwise the tree will seal itself and the chemical will be unable to penetrate the stump.

Timing

This treatment can be used at any time of the year.

Advantages

- Results in limited regrowth.
- Requires less chemical than basal bark spraying.
- Results in good kill rates.
- Is target-specific.

Disadvantages

- Is time-consuming and extremely labour intensive.
- Will not result in good kill rates if chemical is not applied immediately after cutting.

Registered herbicides

Triclopyr 240 g/L plus picloram (ester) 120 g/L at a rate of 1 L/60 L diesel mix. For example, Access®.

As all herbicides must be applied strictly in accordance with the directions on the label, read this carefully before use.

Cost

The thicker the stem, the more chemical mix will need to be applied.

An Access® 100 L mix will cost approximately \$182 (excl. GST) based on the following assumptions:

- chemicals—\$53 per litre
- diesel—\$0.94 per litre.



▲ Apply herbicide mix immediately after stem is cut.

Foliar spraying Recommendations

Both tree and shrub form

- Best for seedlings and regrowth of previously treated areas on plants under 1.5 m in height.

Application

Best applied with a spray unit. A wetting agent must be used and plants sprayed to the point of run-off. For best results, apply to actively growing plants with a large area of foliage.

Timing

Best time to spray is when plants are actively growing and soil moisture is good. In southern areas where there is a dominant winter rainfall, this is during spring and summer. In tropical parts of Australia, this is from March to July.

Advantages

- Is less labour intensive than other chemical treatments.
- Good for follow-up control when plants are young and actively growing.

Disadvantages

- Spray equipment can be expensive to purchase.
- Regrowth can occur if spray is not applied correctly.



▲ Foliar spraying.

Registered herbicide

Triclopyr 300 g/L plus picloram (salt) 100 g/L. For example, Grazon DS[®] and Grass-Up[®]:

- rate of 350 mL/100 L water mix
- rate of 670 mL/100 L water mix for *P. velutina* in Queensland only.

A 100% concentrate non-ionic surfactant (e.g. BS 1000) must be added at a rate of 100 mL/100 L.

As all herbicides must be applied strictly in accordance with the directions on the label, read this carefully before use.

Cost

More herbicide is required per plant for foliar spraying than for basal bark spraying or cut stumping.

Approximately 1.5 L of herbicide mix is required per plant to spray regrowth and seedlings under 1.5 m in height.

Biological control

Biological control is another option for use on mesquite. It involves the introduction of insects or pathogens that will feed on the plant. Such programs are long term and include:

- selecting potential biological control agents
- ensuring that they are safe for release in Australia
- mass-rearing and releasing them
- monitoring them to determine whether they are established and causing damage.

Once established, only a proportion of biological control agents typically reach sufficient numbers to have a significant impact on the target species—and it may be many years until this point is reached.

Mesquite is a particularly challenging target for biological control, in part because it is a tough plant with large root reserves. It also grows in a range of climates within Australia and biological control agents will not necessarily perform equally well everywhere.

To date, four introduced biological control agents have been released in Australia for the control of mesquite. All have been distributed throughout most parts of Queensland, Northern Territory, Western Australia and New

South Wales, with varied success. Although the impact in the Pilbara region has been dramatic, this is unlikely to be the case elsewhere in Australia, as the control agents do not reach sufficiently high densities.

Biological control should be regarded as only part of a control program. Even at their best, the available agents are unlikely to kill mesquite; however, they may improve the effectiveness of other control techniques by reducing its growth and spread rates. Therefore, consider integrating this method with other control techniques and management options.



▲ *Algarobius bottimeri*.

Bruchid seed-feeders

Two seed-feeding beetles, *Algarobius prosopis* and *Algarobius bottimeri*, have been introduced to Australia with the intention of reducing viable seed numbers and thereby the invasiveness of mesquite.

The newly hatched larvae of the beetles will destroy mesquite seeds in mature pods both in the tree and on the ground by drilling through the pod and into the seed where they feed and develop. Adults emerge after about 6–10 weeks, leaving a characteristic emergence hole.

Both species of beetle were released at many sites in Queensland and also in the Pilbara during 1996 and 1997. Both have established in Queensland and Western Australia; however, their impact is likely to be limited, as it is believed that vertebrate herbivores consume most of the pods before the beetles can damage the seeds.



▲ *Algarobius prosopis*.

New agents

Since the release of the seed-feeding beetles, two other agents, *Prosopidosylla flava*, a sap-sucking psyllid that causes dieback, and *Evippe* spp., a leaf-tying moth that defoliates plants, have been released throughout Western Australia, Queensland, the Northern Territory and New South Wales since 1998. The psyllid, which appears to prefer cooler climates, has only established in small populations in south-west Queensland and north-west New South Wales, where its numbers are too low for it to have any impact on mesquite. It is probable that ant predation is preventing this agent from being effective.

◀ Emergence hole caused by bruchid seed-feeders.

In contrast, the leaf-tying moth has become established at all release sites, but is most abundant in the hotter parts of Australia. It is causing most damage in the Pilbara region (WA) where it is causing death of 50–100% of leaves, and prolonged defoliation throughout the 150 000 ha infestation. This is already resulting in greatly reduced seed set and decreased plant growth rates. The leaf-tying moth also causes relatively heavy defoliation in the Barkly region (NT) and in northern Queensland. However, this effect is probably not yet sufficiently prolonged to have a major impact in these areas.

Where the moth is abundant and damaging, it will rapidly recolonise cleared areas of mesquite to attack regrowth. It can therefore be an excellent complement to other control techniques.



▲ *Evippe* spp.



▲ *Prosopidosylla flava* nymph.

▼ Early stages of *Evippe* leaf-tie.





▲ Results of *Evippe* leaf damage.

Redistribution of agents

Redistributing biological control agents can be a valuable way of maximising their impact. The Department of Natural Resources and Mines has already widely released all the seed feeding agents in large numbers, and CSIRO has released the psyllid and the leaf-tying moth.

Redistribution of the psyllid and the seed-feeders is probably not worthwhile. Despite massive releases, the psyllid has not been effective anywhere in Australia, and redistribution requires considerable expertise. The seed-feeders cause only limited damage and are probably already very well distributed as they are excellent dispersers.

Most benefits are likely to result by redistributing the leaf-tying moth in northern Queensland, where it may reach sufficient densities to improve results when used with other control methods. Even redistribution into relatively small mesquite populations that are being targeted for eradication can be valuable, as the moth can potentially reduce the seed set of remaining trees.

The *Evippe* spp. has the capacity to spread over 100 km within a few years; however, it may not yet have reached all mesquite infestations. Assisted redistribution could, therefore, speed up the impact by several years.

Contact local weed officers or CSIRO Entomology for further information.