CENTRE FOR
INVASIVE SPECIES SOLUTIONS

BEST PRACTICE MANAGEMENT FOR THE CONTROL OF parkinsonia (*Parkinsonia aculeata*)

ADDENDUM TO THE WEEDS OF NATIONAL SIGNIFICANCE
NATIONAL CASE STUDIES MANUAL FOR PARKONSONIA

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- Kerinne Harvey

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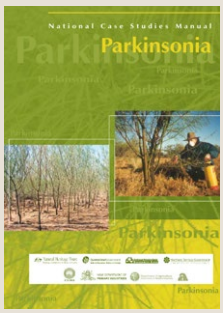
Cover images

Front — *Parkinsonia aculeata*. Image by J Hosking, NSW Department of Primary Industries.

Back — Implanting a bioherbicide capsule into the lower stem of parkinsonia using a mechanical applicator. Image by Wild Matters.

How to use this addendum



The national case studies manual for parkinsonia **(PDF, 2.6 MB) was published in 2004 and provides information on the weed and best practice management options. The manual has since been reviewed to ensure currency of best practice management advice and information. Any updates to the information contained within the manual are included in this addendum and should be taken as the most current source of information.**

Note: the addendum is not a standalone document and should be read in conjunction with the 2004 manual.

The addendum focuses on updates to control options, including mechanical, chemical and biological control methods. It also includes updates on available herbicides and where to go to find additional information on parkinsonia and its management.

When new or additional information is provided in the addendum, page numbers reference the related text in the original manual.

Section 3: Parkinsonia control

Control methods

Herbicide control

Aerial application

Page 19 – Aerial application of herbicides is suitable for seedlings 1–2 m high, or 12–24 months old. Avoid spraying if plants are stressed or bearing pods. Use a specified wetting agent and wet the foliage thoroughly.

Foliar (overall) spraying

Page 19 – Avoid spraying in dry conditions, or if plants are stressed or bearing pods.

Basal bark spraying

Page 20 – Basal bark application is recommended for plants less than 2 m tall, or of up to 5 cm in basal diameter. For smaller plants, thoroughly spray herbicide into all crevices around the base of the plant to 30 cm above ground level. For large trees, spray up to a height of 100 cm above ground level. Apply treatment when plant is actively growing. The optimum time for application is autumn.

Stem injection

Stem injection of both bioherbicide and herbicide capsules can be used to control parkinsonia infestations.

Di-Bak™ Parkinsonia is a biological herbicide produced in capsule form, containing a combination of naturally occurring fungal pathogens that kill parkinsonia plants by inducing dieback disease (Bioherbicides 2023).

Di-Bak™ AM is a herbicide produced in capsule form, containing a combination of aminopyralid and metsulfuron-methyl.

Capsules can be inserted into the tree using a specially designed handheld applicator. The applicator, used in conjunction with a hand held drill, first drills a hole into the tree stem and then inserts the capsule. The capsule is sealed in place with a plug.

Alternatively, drill a 25-mm-deep hole in the tree stem using an 8 mm-diameter drill bit, approximately 10–30 cm above ground level. Insert one capsule and seal with a plug immediately.

Over time, the capsule dissolves, releasing the bioherbicide or herbicide into the plant. See Figure 1 for images of this method and process. This process can be performed at any time of year and is a cost-effective method suitable for low-to-high-density populations.

A long-term study in the NT tracked the results of large-scale dieback inoculation using Di-Bak™ Parkinsonia in a rangeland parkinsonia infestation. The treatment resulted in successful infection, colonisation and movement of dieback through the infestation, resulting in plant mortality (81% overall) and apparent suppression of recolonisation from the (soil) seed bank (Galea 2021). Dieback was found to have moved over 290 m over approximately four years.

This method is discussed further in Galea (2021). See the section on native organisms for more information on parkinsonia dieback.

Figure 1. (a) Implanting a bioherbicide capsule into the lower stem of parkinsonia using a mechanical applicator; (b) Loading the magazine with bioherbicide capsules and sealing plugs; (c) Treated stem with sealing plug partially protruding from treatment hole; (d) Parkinsonia stem six months after treatment, showing a visible stem lesion in proximity to the treatment site. Source: Galea (2021).

Herbicide labels and legislation

The Australian Pesticides and Veterinary Medicines Authority (APVMA) regulates the availability of all pesticides, which includes herbicides. Herbicides are registered with the APVMA for specific applications, as stated on the label. State governments regulate the use of pesticides after sale. A herbicide label is a legal document that defines where, when and how a herbicide can be used on which weed species and at what rate.

Note: not all registered herbicides are commercially available. Often, companies improve herbicide formulations and only market the new formulation. For example, many herbicides are being marketed in higher concentrations. This reduces transport, storage and container-disposal costs.

In addition to herbicides being registered and described 'on-label' for specific weeds and situations, herbicides can sometimes be used through permits or 'off-label' use. These situations are described below.

Minor use and emergency use permits

Page 23 – APVMA may issue minor use and emergency use permits for herbicide applications that are not otherwise registered for that particular use. Minor use permits are sometimes referred to as 'off-label' permits. Minor use and emergency permits are valid ('in force') for a limited time. See the APVMA website to find current permits.

Some states also have permits for the control of 'declared' weeds and may not specifically list the weed species to be controlled. These permits will often list a range of herbicides that can be used for the control of declared or environmental weeds. To find these permits for your state:

- go to the APVMA permits database search
- enter 'declared weeds' or 'environmental weeds' in the SEARCH box
- click the search term 'Pest/purpose'
- click 'Search'.

It is also recommended that if you are unsure which herbicides can legally be used on a particular weed in your state, contact the relevant biosecurity section of your state department of agriculture. When using herbicides in aquatic situations, only use those that are registered or permitted for use in and around aquatic areas.

Any minor use permits relevant to parkinsonia at time of publication are listed in Table 6.

Off-label use

Off-label use is the use of a registered chemical to address a specific issue that is not covered by the APVMA-approved label. Off-label use is to:

- control a different weed (or pest)
- apply at a different rate (only lower)
- apply in a different manner (not allowed in ACT, NSW and Tasmania).

Off-label use is permitted in all states and territories; however, conditions vary in each jurisdiction (Table 1).

Table 1. Where to find specific rules relating to herbicide use, including off-label use, in each state and territory

STATE/ TERRITORY	WEBSITE AND FURTHER INFORMATION
ACT	Agvet chemical use https://www.accesscanberra.act.gov.au/s/article/pest-and-weed-control-tab-Agvet-chemical-use
NSW	Pesticides https://www.epa.nsw.gov.au/your-environment/pesticides/pesticides-nsw-overview
	Weed control and identification https://www.dpi.nsw.gov.au/biosecurity/weeds/weed-control
NT	Chemical use https://nt.gov.au/industry/agriculture/farm-management/using-chemicals-responsibly
Qld	Chemical use https://www.business.qld.gov.au/industries/farms-fishing-forestry/fisheries/aquaculture/chemicals/registered
SA	Rural chemicals https://pir.sa.gov.au/biosecurity/rural_chemicals
	Weed control handbook https://www.pir.sa.gov.au/__data/assets/pdf_file/0020/232382/WEB_8867_PIRSA_Weed_Control_Handbook_2018.pdf (PDF, 4.2 MB)
Tas	Agricultural and veterinary chemicals https://nre.tas.gov.au/agriculture/agvet-chemicals
	Weeds https://nre.tas.gov.au/invasive-species/weeds
Vic	Off-label chemical use https://agriculture.vic.gov.au/farm-management/chemicals/offlabel-chemical-use
WA	Using pesticides safely https://ww2.health.wa.gov.au/Articles/U_Z/Using-pesticides-safely

Safety and training

Personal protective equipment (such as protective clothing, eye or face shields, and respiratory protection) must be used in accordance with the recommendations stated on the herbicide label or permit. Chemical-use training is required for people using herbicides as part of their job or business. Training is recommended for community groups and may be required if working on public land. Training courses are run by ChemCert, AusChem and TAFE in each state. Other training courses may be available through state agencies (e.g. AgTrain in Victoria, SMARTtrain in NSW), local councils or non-government organisations.

By law, you must read the label (or have it read to you) before using any herbicide product. Always follow the label or permit.

Chemical user certification

Commercial weed-control operators need to be licenced in most states (Table 2). It should also be noted that there is now shared responsibility between landholders and their contractors for any breaches of laws and regulations (such as herbicide drift).

Table 2. Chemical-user certification by state and territory

STATE/ TERRITORY	WEBSITE
ACT	www.accesscanberra.act.gov.au/s/article/pest-and-weed-control-tab-Agvet-chemical-use
NSW	www.epa.nsw.gov.au/your-environment/pesticides/licences-and-advice-for-occupational-pesticide-users
NT	nt.gov.au/industry/agriculture/farm-management/using-chemicals-responsibly/spray-applicator-licences
Qld	www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/land-management/chemical-controls/commercial-operators
SA	www.sa.gov.au/topics/business-and-trade/licensing/building-and-trades/pest-control-licence
Tas	nre.tas.gov.au/agriculture/agvet-chemicals/licences-and-certificates/ground-spraying-and-pest-management-licences
Vic	agriculture.vic.gov.au/farm-management/chemicals/licences-and-permits/commercial-operator-licence-for-contractors
WA	https://www.health.wa.gov.au/articles/n_r/pest-industry-licensing-and-registration

Effective use of herbicides

Successful herbicide control is dependent on the right herbicide for the target species, growth stage of the target species, weather conditions during and after spraying, how thoroughly the herbicide is applied, and the herbicide mix and application rate.

For spraying, wind speeds should be low (< 15 km/h) with no rain expected in the following six hours.

Do not apply herbicide to plants that are under any sort of stress, as herbicide will not be absorbed and translocated effectively, resulting in a reduced level of control. Plants may be stressed due to:

- dry soil
- low humidity
- air temperatures above 30 °C
- frost.

Effectiveness of herbicides can be maximised further by:

- mixing dye with the herbicide to help minimise missed areas and prevent overspraying (double spraying)
- using an adjuvant – an additive that improves herbicide uptake (always read the adjuvant's product labels to ensure that they are compatible with the particular herbicide and there are no restrictions on their use; e.g. most adjuvants should not be used near waterways)
- ensuring spray equipment is correctly calibrated and maintained, including being thoroughly cleaned between uses.

Spraying in sensitive areas

Herbicide users have a legal obligation to avoid spray drift damage and to ensure that the chemicals applied stay within the target area. Target-weed infestations are often located in areas of native vegetation, so great care should be taken to avoid spraying surrounding foliage and soil. Do not use high pump/sprayer pressures that create small droplets which float in the air. Adjust the nozzle settings to produce coarser droplet sizes.

Using herbicides near water

Never spray herbicides over bodies of water or plants standing in water. Some herbicides are formulated to be a lower risk when used near water (e.g. Roundup® Biactive). NEVER add unregistered adjuvants to herbicides that will be used near water. Some states have publications explaining the safe use of herbicides near water (Table 3).

Table 3. Safe use of herbicides near water by state and territory

STATE/ TERRITORY	WEBSITE
South-eastern Australia	archive.dpi.nsw.gov.au/__data/assets/pdf_file/0011/319448/riparian-habitat-management-guide.pdf (PDF, 1.1 MB)
Qld	https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/sustainable/chemical/ground-distribution-herbicide/laws
SA	https://www.epa.sa.gov.au/files/477387_pesticide_water.pdf (PDF, 1.7 MB)
Tas	https://nre.tas.gov.au/Documents/herbicide_guidelinesFINAL2012.pdf (PDF, 689 kB)
WA	https://www.water.wa.gov.au/__data/assets/pdf_file/0016/3355/12149.pdf (PDF, 113 kB)

Regulations and permits for works in riparian zones

Areas on or near the bank of a river or other body of water (riparian zones) are sensitive habitats, and in some states a licence is required to conduct weed-control works (Table 4).

Table 4. Authorities who can advise about regulations and permits for works in riparian zones

STATE/ TERRITORY	DEPARTMENT	WEBSITE
NSW	NSW Department of Planning and Environment — Water	https://water.dpie.nsw.gov.au
SA	Landscape SA, including 8 regional boards	https://www.landscape.sa.gov.au
Vic	Catchment management authorities	https://viccatchments.com.au/about-us/our-cma-regions
	Department of Energy, Environment and Climate Action — Forests and Reserves	Riparian management licences – www.forestsandreserves.vic.gov.au/__data/assets/pdf_file/0016/31426/Riparian-management-licences.pdf (PDF, 160 kB)

Herbicides for use on parkinsonia

Page 22 – The herbicides registered for the control of parkinsonia are listed in Table 5. There are also minor use permits available (Table 6).

Table 5. Herbicides permitted for use on parkinsonia under registration as at September 2023

APPLICATION METHOD	ACTIVE CHEMICAL CONSTITUENTS	COMMERCIAL PRODUCT EXAMPLES[1]	STATE OR TERRITORY[2]	RATE	OPTIMUM STAGE AND TIME	COMMENTS
Aerial (helicopter only)	triclopyr + picloram (100 + 300 g/L)	Nufarm Conqueror®	Qld and NT only	3 L/ha	Seedlings 1–2 m tall or 12–24 months old Avoid dry conditions, stressed plants or pod-bearing plants. Thoroughly wet foliage.	Flood plains only Apply oil-based adjuvant at label rate.
Foliar (overall spray)			Qld, NT and WA only	350 mL/100 L water	Plants to 2 m tall Avoid dry conditions, stressed plants or pod-bearing plants. Thoroughly wet foliage.	High-volume handgun Wet plant thoroughly. Use oil-based wetting agent at label rate.
Aerial (helicopter only)	aminopyralid + picloram + triclopyr (8 + 100 + 300 g/L)	Grazon® Xtra	Qld and NT only	3 L/ha	Seedlings 1–2 m tall or 12–24 months old Avoid dry conditions, stressed plants or pod-bearing plants. Thoroughly wet foliage.	Flood plains only Apply oil-based adjuvant at label rate.
Foliar (overall spray)			All	350 mL/100 L water	Plants to 2 m tall Avoid dry conditions, stressed plants or pod-bearing plants. Thoroughly wet foliage.	High-volume handgun Use Uptake® spray oil.
Basal bark	triclopyr + picloram (240 + 120 g/L)	Access®	All	1 L/60 L diesel or Biosafe®	Seedlings less than 2 m tall, or up to 5 cm diameter and actively growing	Do not treat wet stems.
Cut stump			All		Throughout year	Cut close to ground level and treat *immediately*.
Stem injection	*Lasiodiplodia pseudotheobromae* NT039, *Macrophomina phaseolina* NT094, *Neoscytalidium novaehollandiae* QLD003	Adama Di-bak® Parkinsonia bioherbicide	All	1–2 capsules per tree	Any time Insert 1 capsule per drilled hole.	Grazing lands and non-crop areas Causes fungal dieback of parkinsonia
	aminopyralid + metsulfuron-methyl (93.7 g/kg + 75g/kg)	Di-Bak AM	All	1 capsule every 10 cm of circumference	When actively growing	Situation: Forestry, Pasture, Commercial & Industrial areas, Rights of Way, Around Agricultural Buildings & Public Service areas. Use the InJecta applicator to drill a hole and deliver Di-bak AM capsule in the sapwood layer beneath the bark. Space capsule insertions at 10 cm, centres around tree circumference below any branching, otherwise remove or treat all branches below the capsule insertion. On multiple trunk trees ensure each trunk is treated. ALL TREES: Apply the capsules to each tree at waist height or below.

APPLICATION METHOD	ACTIVE CHEMICAL CONSTITUENTS	COMMERCIAL PRODUCT EXAMPLES[1]	STATE OR TERRITORY[2]	RATE	OPTIMUM STAGE AND TIME	COMMENTS
Soil: ground and aerial application	tebuthiuron[3] (200 g/kg)	Graslan®	Qld and NT only	10–15 kg/ha	Throughout year Best applied to dry soil before rain Needs moisture to activate herbicide	Grazing land Normally applicable to areas larger than 100 ha
Soil: hand application			Qld, WA and NT only	1–1.5 g/m2		Hand application Estimate the area within 30 cm beyond the drip zone of each target weed or group of weeds and calculate the amount to cover area to be treated. Distribute the required dose uniformly within this area.
Soil: spot spray – individual trees	hexazinone (250 g/L)	Bobcat® SL	Qld, NSW, ACT and WA	4 mL/spot, 1 spot for each bush or tree	Bushes or trees up to 5 m tall	Use individual spot treatment when plants greater than 2 m apart. Best when trees in active growth, and either soil is moist or rainfall will follow.
Soil: spot spray – grid pattern		Bobcat® SL	Qld, NSW, ACT and WA only	1 mL/spot	Up to 1 m tall	Use grid pattern if plants 2 m or less apart.
		Velpar® L	Qld, NSW and WA only	4 mL/spot	1–5 m tall	

Notes to this table can be found at the bottom of Table 6.

Table 6. Herbicides permitted for use on parkinsonia under minor use permits as at September 2023

APPLICATION METHOD	ACTIVE CHEMICAL CONSTITUENTS	COMMERCIAL PRODUCT EXAMPLES[1]	RATE	COMMENTS
PER13333 – Control of environmental weeds in various situations. Expires 31 March 2025 WA only				
Basal bark/cut stump	triclopyr + picloram (240 + 120 g/L)	Access®	1 L/60 L diesel	Paint stump immediately after cutting. Or paint or spray basal bark.
PER92454 – Control of various weed sin railway tracks and corridors. Expires 31 January 2025 SA and WA only				
Soil application	Tebuthiuron[3] (200 g/kg)	Apparent tebuthiuron 200	10–15 kg product / hectare	Situation: Railway tracks and corridors

1 Commercial products listed here are examples only, and many other products containing these active ingredients are registered for use on parkinsonia. Search at https://apvma.gov.au/node/10831

2 Products may be registered for use on parkinsonia in all states and territories (shown as 'All') or only in the specific states and territories listed.

3 Products containing different concentrations of the active ingredients are registered for this use. For example, registered products containing the active ingredient tebuthiuron are available with 200, 400, 600 and 750 g/kg concentrations. Check the label for application rates.

Note: not all currently registered herbicides are commercially available. Check the company website for a current label.

Note: herbicides are not to be used for any purpose or in any manner contrary to the label unless authorised under appropriate legislation. By law, you must read the label (or have it read to you) before using any herbicide product. The same applies for minor use permits. Always follow the label and permit directions.

Use of soil-applied herbicides must be in accordance with state and/or local native vegetation legislation.

– Do not use soil-applied herbicides within a distance of 2–3 times the mature height of wanted trees.

– Do not apply tebuthiuron within 100 m of a recognised watercourse, or on land with a slope greater than 20% (11 degrees).

Mechanical control

Page 24 – For small plants and recent outbreaks that have not released seeds, hand-pulling or grubbing with a mattock can be effective.

Page 24 – Establishing pasture or native vegetation following mechanical control can reduce or prevent re-sprouting and seedling establishment of parkinsonia.

Fire

Page 25 – Fire has been observed to destroy seedlings if sufficient fuel load is present. This can be an effective follow-up control method after primary control techniques (such as herbicide application).

Native organisms

Page 27

Parkinsonia dieback – disease monitoring in northern Australia (Diplock and Galea 2022)

Parkinsonia dieback is a disease that can kill juvenile and mature parkinsonia plants. (The term 'dieback' is applied when the cause of plant health decline is unknown.) These naturally occurring fungal pathogens have been observed impacting individual plants and larger parkinsonia infestations across northern Australia.

Dieback symptoms start on the tips of branches, causing the plants' 'leaves' (modified leaf stalks) and leaflets to dry up. Dark and dead stem tissue progressively becomes visible down the length of the plant, leading to its eventual death.

A seven-year study looked at the time frames associated with adult parkinsonia plant death from dieback, as well as impacts on seedling recruitment. The disease was observed to move through the study site at an average of 7.7 m per year. Plants infected with dieback did not recover. Seedling recruitment also appeared lower than expected in dieback-affected areas, compared with sites with healthy parkinsonia populations. When germination was observed, all seedlings subsequently died.

Modelling of the study's field data suggests that over 75% of a parkinsonia population will be dead within five years once dieback has established at the site. The study also suggested that plants can become infected through direct contact with infected plants or via spores spread via soil-water movement from infected plants nearby.

The study noted that dieback did not occur naturally at other properties in the same region and that active management, including inoculation with dieback, would be necessary.

Biological control

Page 29 – Five biological control agents have been released in Australia in two separate campaigns. Initial releases included:

- a seed-feeding bruchid, *Mimosetes ulkei* (released in 1993)
- a leaf-feeding mirid, *Rhinacloa callicrates* (released in 1989)
- a seed-feeding bruchid, *Penthobruchus germaini* (released in 1995).

Of these three agents, only *P. germaini* has become widely established; however, it is not causing population-level impacts.

CSIRO recommenced the parkinsonia biological control program in 2002, resulting in the release of:

- a leaf-feeding moth, *Eueupithecia cisplatensis* (UU1) (released in 2012)
- a leaf-feeding moth, *Eueupithecia vollonoides* (UU2) (released in 2014).

UU1 and UU2 are leaf-feeding looper caterpillars from Argentina. They defoliate the leaflets of parkinsonia, which stresses the plant and reduces flower and seed production. **Surveys have indicated establishment and spread of UU1 and UU2 at many of their release sites.** Understanding the impact of these two agents may take time, and evaluation studies are continuing.

Current research

Research into additional agents is ongoing; see more at https://research.csiro.au/parkinsonia/

Integration with other control methods

Because of the wide range of environments and land-management systems that are infested with parkinsonia, it is unlikely that individual biological control agents will be effective throughout the distribution of the weed.

Biological control is just one of the control options that can be incorporated into an integrated management approach. Such approaches include management of small, often outlying parkinsonia infestations by killing adult/reproductive plants using chemical or mechanical techniques, and the use of biological control in larger, core infestations to suppress plant health and reproduction.

Biocontrol Hub

Information sharing is vital to the success of biological control of weeds. Recording which weed species you are controlling, and the locations of agent-release sites can assist others in obtaining access to the right agents for their infestation.

The Atlas of Living Australia (ALA) is a national, online, biodiversity database that helps information sharing. The Australian Biocontrol Hub is a portal within the ALA that acts as a one-stop shop for data and information sharing on biological control of weeds.

The Biocontrol Hub can:

- facilitate recording of biological control agent-release and establishment data
- capture observations of biological control agent spread
- ensure biological control agent distribution data is readily accessible
- provide access to biological control extension material.

For further information on how to contribute to or use information on the Australian Biocontrol Hub, visit the website: https://biocollect.ala.org.au/biocontrolhub

Contacts

STATE/ TERRITORY	DEPARTMENT	PHONE	EMAIL	WEBSITE
National	Australian Pesticides and Veterinary Medicines Authority	02 6770 2300	enquiries@apvma.gov.au	www.apvma.gov.au
ACT	Parks and Conservation	13 22 81	ACTBiosecurity@act.gov.au	www.environment.act.gov.au/parks-conservation/plants-and-animals/Biosecurity/invasive-plants
NSW	Department of Primary Industries	1800 680 244	weeds@dpi.nsw.gov.au	www.dpi.nsw.gov.au/biosecurity/weeds
NT	Department of Environment, Parks and Water Security	08 8999 4567	weedinfo@nt.gov.au	www.nt.gov.au/environment/weeds
Qld	Department of Agriculture and Fisheries	13 25 23	info@daf.qld.gov.au	www.daf.qld.gov.au/business-priorities/biosecurity/invasive-plants-animals/plants-weeds
SA	Department of Primary Industries and Regions	1300 374 731	invasivespecies@sa.gov.au	www.pir.sa.gov.au/biosecurity/weeds
Tas	Department of Natural Resources and Environment	1300 368 550	biosecurity.tasmania@nre.tas.gov.au	www.nre.tas.gov.au/invasive-species/weeds
Vic	Agriculture Victoria	13 61 86	Refer to www.agriculture.vic.gov.au/about/contact-us for contact options	www.agriculture.vic.gov.au/biosecurity/weeds
WA	Department of Primary Industries and Regional Development	08 9368 3333	enquiries@agric.wa.gov.au	www.agric.wa.gov.au/pests-weeds-diseases/weeds

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CENTRE FOR INVASIVE SPECIES SOLUTIONS

Building 22, University of Canberra
University Drive South, BRUCE ACT 2617
T 02 6201 2887
E communications@invasives.com.au