CENTRE FOR
INVASIVE SPECIES SOLUTIONS

BEST PRACTICE MANAGEMENT FOR THE CONTROL OF silverleaf nightshade (*Solanum elaeagnifolium*)

ADDENDUM TO THE WEEDS OF NATIONAL SIGNIFICANCE SILVERLEAF NIGHTSHADE BEST PRACTICE MANAGEMENT MANUAL

WEEDS.ORG.AU

weeds.org.au

Citation: Wild Matters (2023). *Best practice management for the control of silverleaf nightshade (Solanum elaeagnifolium); Addendum to the weeds of national significance silverleaf nightshade best practice management manual.* A Weeds Australia publication, report to Centre for Invasive Species Solutions.

Print ISBN: 978-1-922971-51-7
Web ISBN: 978-1-922971-50-0

Published by: Centre for Invasive Species Solutions

The Centre for Invasive Species Solutions gratefully acknowledges the funding support for this publication through the Australian Government Department of Agriculture, Fisheries and Forestry.

The Centre also acknowledges Wild Matters as the primary author and thanks those who made technical contributions and reviewed the publication, including:

- John Heap, former Silverleaf Nightshade National Coordinator and researcher
- Hanwen Wu, Principal Research Scientist, Weeds NSW Department of Primary Industries
- Andrew Storrie, Agronomo Consulting
- Royce Holtkamp, Ecological Horizons, Chair NSW Biocontrol Taskforce
- Kerinne Harvey

This publication was funded by

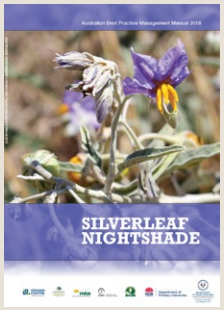
Australian Government
Department of Agriculture, Fisheries and Forestry

Cover images

Front — Silverleaf nightshade. Image by NSW Department of Primary Industries.

Back — Silverleaf nightshade. Image by NSW Department of Primary Industries.

How to use this addendum



The silverleaf nightshade best practice management manual **(PDF, 12.4 MB) was published in 2018 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 2018 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 boneseed 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: Integrated weed management for silverleaf nightshade

Surveillance

Page 30 – Wet conditions over many parts of the Australian wheatbelt during spring and summer in the early 2020s produced favourable conditions for silverleaf nightshade germination and establishment. New infestations may not be immediately obvious, so especially careful surveillance for newly established patches for three to five years following these wet conditions would be prudent. Research suggests that seed germination can occur anywhere between 11 and 36 °C, if the daytime maximum temperature is more than 6 °C above the night-time minimum.

Herbicides

Page 39

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

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.

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

Page 42 – 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

Page 41 – 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

Page 40 – 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 silverleaf nightshade

Pages 39–42 – A range of herbicides are registered for the control of silverleaf nightshade (Table 5). They should be used as part of a management plan involving enterprise rotations, strategic grazing and repeat herbicide applications.

Table 5. Herbicides permitted for use on silverleaf nightshade under registration

SITUATION	ACTIVE INGREDIENT	COMMERCIAL PRODUCT EXAMPLES[1]	RATE	STATE OR TERRITORY[2]	COMMENTS
Agricultural non-crop areas, commercial and industrial areas, forests, pastures, rights of way	glyphosate [3] (360 g/L)	Weedmaster® Duo	2 L/100 L water high-volume handgun	All	Use ONLY under good soil-moisture conditions. Apply to actively growing plants at the late-flowering-to-berry stage. Repeat spraying will be necessary to restrict regrowth and seedling re-establishment.
			300 mL/15 L water knapsack		
	fluroxypyr [3] (333 g/L)	Starane® Advanced	300 mL/100 L water high-volume handgun	All	From onset of flowering to early-berry set (usually spring to mid-summer) To ensure maximum effect, delay application until the majority of shoots have emerged. Follow-up treatment of regrowth is critical for best control.
	picloram[4] + 2,4-D (75 + 300 g/L)	Tordon® 75D	650 mL/100 L water	NSW, Vic, SA only	High-volume handgun Extend treated areas beyond the last plant for 1 m. See label.
			15 L/ha		Boom Apply at early flowering before berry set.
	picloram[4] (240 g/L)	Adama Picoflex®	205 mL + 310 mL 2,4-D amine (625 g/L)/100 L water	NSW, ACT, Vic, SA only	Spring and summer treatment only. Add non-ionic surfactant as per label.
			4.7 L + 7.2 L 2,4-D amine (625 g/L)/ha		Boom
	aminopyralid + picloram[4] + 2,4-D (7.5 + 75 + 300 g/L)	FallowBoss® Tordon herbicide	15 L/ha	NSW, Vic and SA only	Boom application See label.
Established grass pastures	fluroxypyr[3] (333 g/L)	Starane® Advanced	450 – 600 mL or 225 mL + 1.2 – 1.6 L 2,4-D amine (625 g/L)	All	From onset of flowering to early berry set (spring to mid-summer) Add Uptake® Spraying Oil at 1 L/ha. To ensure maximum effect, delay application until the majority of shoots have emerged. Follow-up treatment of regrowth is critical for best control.
	2,4-D3 ester (680 g/L)	Estericide® 680	3.3 L/ha	Vic only	Spray at flowering. Controls top growth only.

SITUATION	ACTIVE INGREDIENT	COMMERCIAL PRODUCT EXAMPLES[1]	RATE	STATE OR TERRITORY[2]	COMMENTS
Forestry (softwood plantations), roadsides, industrial areas, rights of way	fluroxypyr[3] (333 g/L)	Starane® Advanced	600 mL–1.8 L/ha	All	**Pre-plant spray operations in forestry or general broadleaf weed growth** Helicopter (forestry – softwood plantations only) or ground-based application only. Can be mixed with rates of glyphosate up to 2.9 kg/ha. **Post-plant spray operations** Ground-based directional spraying to the inter-row zone only in forestry
Broadacre sorghum			450 mL + 1 L Uptake®/ha		Boom spray Full flower to early berry May be slightly damaging to the crop. To minimise crop damage, apply using dropper nozzles at all crop stages.
Summer fallow			450–600 mL/h 225 mL + 1.2–1.6 L 2,4-D amine (625 g/L)/ha		Boom spray Full flower to early berry set (usually December–February) Add Uptake® Spraying Oil at the rate of 1 L/100 L spray mixture. To ensure maximum effect, delay application until the majority of shoots have emerged. Follow-up treatment will be required to control regrowth and is critical for optimal control. If wanting to prevent seed set, repeat applications may be needed in the same season, although this does not lead to better long-term control.
Fruit and nut orchards, vineyards, nursery stock, ornamentals, amenity plantings, industrial areas, rights of way	oryzalin (500 g/L)	Prolan® 500	4.5 L/ha Up to 4 months control 6.8 L/ha Up to 8 months control	All	Pre-emergent control See label.

1 Commercial products listed here are examples only, and many other products containing these active ingredients are registered for use on silverleaf nightshade. Visit www.apvma.gov.au to find registered products.

2 Products may be registered for use on silverleaf nightshade 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 fluroxypyr are available with 200, 333 and 400 g/L concentrations. Check the label for rates.

4 Picloram remains active in soil for extended periods and may leach into groundwater.

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.

Management in non-agricultural land

Page 45 – Silverleaf nightshade rarely invades healthy native vegetation. Where it does grow in native vegetation, it is likely that the area has previously been weakened and the soil disturbed by grazing sheep and cattle spreading silverleaf nightshade seed in their dung. Spread of silverleaf nightshade within degraded native vegetation appears to be slow when grazing animals are removed, minimising seed dispersal. If resources allow, non-residual herbicides suitable for woody-weed treatment in native vegetation may be an option (check label).

Biological control

Page 47 – No biological control agents have been released in Australia.

Current research

Research is ongoing to find suitable, host-specific agents.

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

Further information

Silverleaf nightshade Australian best practice management manual. Heap J and Wu H (2017). https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0004/839857/Silverleaf-nightshade-best-practice-management-manual-2018.pdf (PDF, 12.5 MB)

Weeds Australia silverleaf nightshade profile. Weeds Australia (2019). https://weeds.org.au/profiles/silver-nightshade-leaved/

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