

Recognising, managing and preventing herbicide resistance in serrated tussock

Invasive Species Unit

Introduction

Serrated tussock (*Nassella trichotoma*) is a Weed of National Significance causing major agricultural and environmental impacts in Australia (see the *Publications available* section for information about serrated tussock as a noxious weed). Herbicides registered for control of serrated tussock in pastures are flupropanate, glyphosate and 2, 2-DPA. Flupropanate is widely regarded as the most selective and effective herbicide for serrated tussock control, however serrated tussock has become resistant to flupropanate in some areas.

Flupropanate is a soil-active herbicide that can prevent serrated tussock from germinating for 1 to 2 years in some situations. The residual effect is diminished by rainfall. One application can control germinating serrated tussock seedlings with effectiveness varying with soil type and rainfall. Dry conditions and heavy soils may result in two years' control of serrated tussock seedlings.

Flupropanate-resistant serrated tussock was first identified on a Victorian property in 2002 and has since been confirmed in several locations from Armidale to Goulburn in New South Wales and Diggers Rest and the Rowsley Valley in Victoria.

This Primefact provides information to help land managers identify and manage flupropanate-resistant serrated tussock. It also provides important information on how to prevent herbicide resistance.

What is herbicide resistance?

Herbicide resistance is the ability of a plant to survive and reproduce following exposure to a dose of herbicide that would normally be lethal. In a plant, resistance usually occurs through natural selection resulting from random and infrequent genetic

mutations. Susceptible plants are killed while herbicide-resistant plants survive to reproduce. If the herbicide treatment is repeated the resistant plants can successfully reproduce and become dominant in the population. The appearance of herbicide resistance in a plant population is an example of rapid weed evolution and typically develops when a weed species has been exposed to 10-14 years' of continued application of a particular herbicide group or type. Large weed populations increase the likelihood of resistance developing.

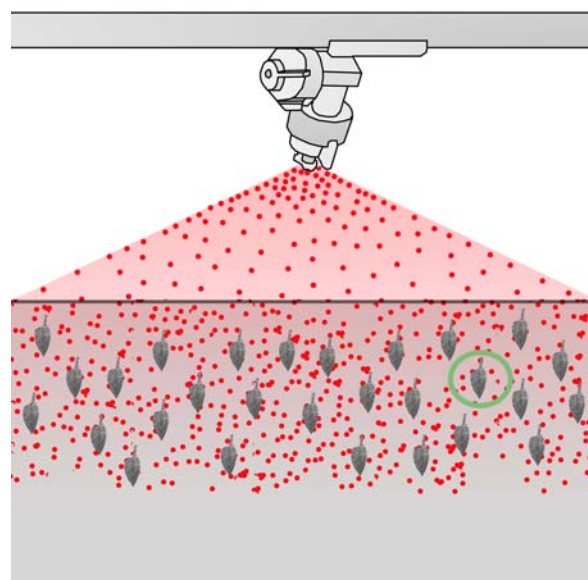


Figure 1. Millions of serrated tussock seeds can exist in the seed bank. There may be 1 seed with a genetic mutation that enables it to germinate even though it has been treated with flupropanate. The seed from this plant will also be resistant to flupropanate. ○ = seed with genetic mutation that survives treatment with flupropanate.

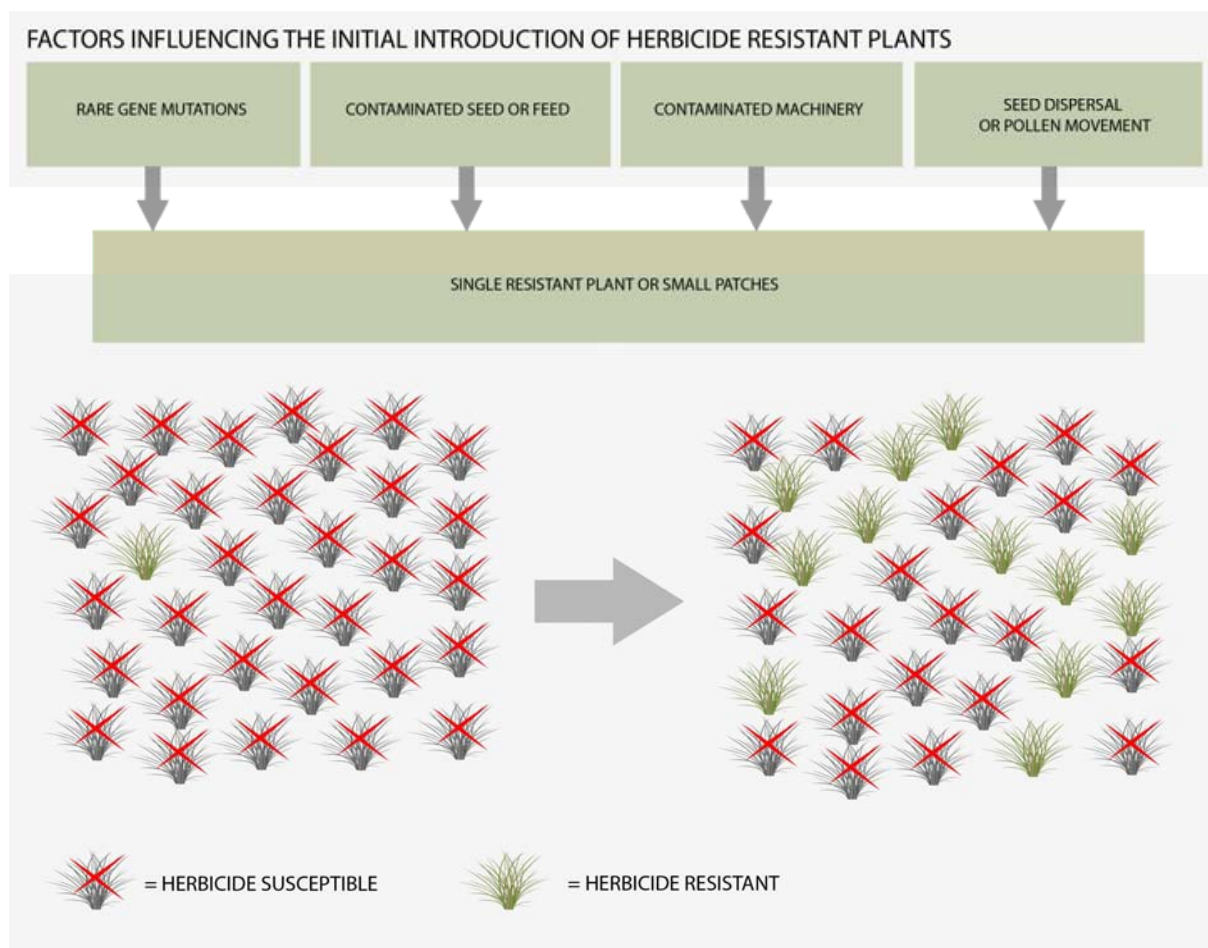


Figure 2. Herbicide-resistant plants can rapidly build up in a plant population.

Serrated tussock resistance to flupropanate

The serrated tussock seed bank may consist of millions of seeds of which many will germinate depending on environmental cues (Figure 1). The initial frequency of resistant genes in the population is likely to be extremely low. However, the likelihood of an individual resistant plant occurring is increased when seed banks are large. Once herbicide application has occurred, the resistant serrated tussock plant will survive the effects of the herbicide and continue to reproduce and spread the resistance (Figure 2). Resistant seed may enter a property in contaminated feed or seed, on machinery or through natural seed dispersal.

The implications of serrated tussock resistance to flupropanate include:

- Increased dominance of serrated tussock as a weed and reduced grazing opportunities for stock;
- Increased costs to land managers;
- More herbicide usage and increased time spent by land managers controlling serrated tussock;
- Higher levels of environmental pollution and damage as a consequence; and

- The need to actively manage pastures with serrated tussock using integrated weed management principles.

How do I know if the serrated tussock I manage has resistance?

Flupropanate is a slow-acting herbicide that requires rainfall for its activation and may take as long as 12 months in some situations to kill mature serrated tussock plants. This can be confusing for land managers who forget when treatments have been undertaken.

- Keep careful records of when and where serrated tussock has been treated and the effects.
- Watch your paddocks! Look out for live serrated tussock plants or new seedlings amongst dead serrated tussock in paddocks that have been blanket treated (boom sprayed) with flupropanate in the last 12 months.



Figure 3. Live and dead serrated tussock after flupropanate application, indicating potential resistance.



Figure 4. Serrated tussock seedlings surviving in a treated area, indicating potential resistance.

Ways to avoid herbicide resistance

Most importantly do not rely solely on herbicides to control infestations. Where herbicides are used choose immediate acting or short term residual herbicides whenever possible. Do not use long term residual herbicides such as flupropanate continuously over the same area. Avoid continual use of herbicides with the same mode of action on large populations of serrated tussock. Regularly rotate herbicides types with different modes of action, for example, Group J herbicides (flupropanate and 2,2-DPA) with Group M herbicides (glyphosate).

Integrate herbicide use with other control methods including chipping, cultivation, mulching, cropping, pasture rehabilitation, fire, grazing management, forestry/native revegetation, strategic fencing, use of shelter belts/windbreaks, slashing, and vehicle/machinery hygiene. For more information on control of serrated tussock see the *Serrated Tussock National Best Practice Management Manual* (see Publications available below).

Identify and monitor surviving weed populations and check for resistant weeds on your farm. Keep good records of treatments and weed populations. Attend chemical application and integrated weed management training courses.

Report suspected herbicide resistance to your local weeds officer.



Figure 5. Remove any live serrated tussock plants from treated areas.



Figure 6. Slash to prevent serrated tussock from seeding.

Monitor and remove (chip out) any regrowing (potentially resistant) serrated tussock plants. Aim not to let any serrated tussock plant set seed. Glyphosate can be used to treat any seedlings that emerge after larger areas have been treated with flupropanate, but treat quickly to avoid seed set.

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Publications available

Serrated Tussock – National Best Practice Management Manual. Copies are available from the Industry & Investment NSW Bookshop, Orange. Ph: 1800 028 374 and can be downloaded from www.weeds.org.au/WoNS/serratedtussock

Serrated Tussock – Identification and Control. Primefact 44, NSW DPI. Copies are available from the Industry & Investment NSW Bookshop, Orange. Ph: 1800 028 374 and can be downloaded from www.dpi.nsw.gov.au/weeds

Serrated Tussock Manager's Fact Pack, NSW DPI. Copies can be downloaded from www.dpi.nsw.gov.au/weeds

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Pasture improvement may be associated with an increase in the incidence of certain livestock health disorders. Livestock and production losses from some disorders are possible. Management may need to be modified to minimise risk. Consult your veterinarian or adviser when planning pasture improvement.

The *Native Vegetation Act 2003* restricts some pasture improvement practices where existing pasture contains native species. Inquire through your office of the Department of Natural Resources for further details.

ALWAYS READ THE LABEL

Users of agricultural or veterinary chemical products must always read the label and any permit, before using the product, and strictly comply with the directions on the label and the conditions of any permit. Users are not absolved from compliance with the directions on the label or the conditions of the permit by reason of any statement made or not made in this publication.