

Serrated tussock

Nassella trichotoma

Serrated tussock is the worst perennial grass weed in Australia. A 'Weed of National Significance', serrated tussock can reduce pasture production by up to 95%.

It is extremely competitive and infests around 1.1 million ha across the eastern states, costing livestock and crop producers over \$40 million each year. The impact on individual properties can be extreme.

Serrated tussock is difficult to remove once established so early action, particularly in winter and early spring, is critical to remove plants and prevent seed set. As it establishes readily on bare ground and is spread easily by wind, aim for healthy, vigorous pastures with good groundcover and undertake diligent, on-going monitoring and a coordinated control effort across properties.



Deliberation

Stocktake

Early detection is critical – be able to identify it, monitor at least twice a year.

Map infestations on your farm.

Identify sources of infestation.

Plan strategies

Prevention – aim for zero tolerance, don't let it establish.

Eradication – prevent seed set, remove existing plants, monitor & control new outbreaks.

Management and containment to control the weed until eradication is feasible. Prevent seed set, suppress, reduce vigour, remove plants, minimise economic impact.

Coordinate with neighbours for a regional approach.

Diversity

Use several tools

Weaken, kill and prevent seed set.

Competitive pastures in autumn/winter/spring.

Herbicides in winter and early spring before seed set.

Crop rotations for 2-3 years (on arable land) using cultivation and herbicides to bury and exhaust seed reserves. Follow with competitive pastures.

Diligence

Persist

Do it right, on time, every year.

Continue monitoring:

- For new plants – particularly after autumn/winter rain.
- The competitiveness of pastures.
- The effectiveness of each control measure.

Follow up:

- Repeat or use other tools where controls were poor.
- Adapt grazing or pasture management to increase pasture competitiveness.
- Adjust your overall strategy as needed.

Prevent

Stop seed set.

Quarantine – clean equipment and vehicles, isolate stock and equipment from infested areas, herbicide along perimeters, monitor potential entry points. Be vigilant.

Destroy new outbreaks – spot spray or chip/ho.

Neighbours – work with neighbours.

HELPING PRODUCERS MANAGE WEEDS IN GRAZING SYSTEMS

3D weed management

To cost effectively manage serrated tussock use the '3Ds' of weed management:

What will it do?

Serrated tussock competes so aggressively for moisture, sunlight and nutrients that pasture production can be reduced all year round, particularly in drought.

Serrated tussock has no grazing value as it is unpalatable to livestock and has a high fibre and low protein content.

Dense infestations (more than 8,000 plants/ha) can more than halve the carrying capacity, whilst higher densities can completely suppress pastures making them essentially of no value for grazing.

Serrated tussock readily invades disturbed and degraded pastures. Its windborne seed can spread over large distances very rapidly.

Erosion risk may be increased by the loss of ground cover. Biodiversity is reduced by dominance of serrated tussock.



Deliberation

Stocktake

The first step is to gain a clear picture of serrated tussock on your farm. As it can spread so easily, regular monitoring is important even if you don't think you have serrated tussock.

Where is it and how dense?

- Inspect each paddock twice a year, every year for serrated tussock, especially in autumn and winter before it flowers. It is easiest to identify in winter as it remains largely ungrazed and is not hidden by other pasture growth.
- Identify weed hot spots (eg, laneways, sheds, holding yards, along fencelines, dams, stock camps and hilltops on the opposite side to prevailing winds).
- Plot infestations on a farm map, including the weed density. For example:

Density	Plants / ha*	Groundcover
Light	160 (1 per 60 m ²)	0.1%
Moderate	160-5000 (<1 per 2 m ²)	Up to 2.5%
Dense	> 5000 (> 0.5 m ²)	> 2.5%

* Average across a paddock – may be as large patches

Is it spreading and how?

Cross-check current infestations with old maps or your memory to determine:

- Are there any new outbreaks?
- Are existing infestations spreading?
- A useful tool for assessing pastures is MLA's Pasture Health Kit

Where is it coming from?

Identify the potential sources of infestation and likely entry points, such as wind, machinery and vehicles, livestock, seed, hay, nearby land and water movement.

Planning

Serrated tussock is spread easily, over long distances by the wind, so a "whole of district" approach to weed control is vital. Careful planning needs to focus on the region, each farm and each paddock.

Community groups can work together with bodies such as Catchment Management Authorities and Local Councils which may attract funding to help manage serrated tussock. A community approach is by far the best way to achieve good control.

Set goals

Determine what the region and each farmer wants to achieve and make sure it is realistic, economical and practical. Be sure to consider the potential longer term impacts. Although a few plants may not be a concern now, if not treated, in a year, they can become a real problem.

Develop strategies

Develop a strategy for the region, for your whole farm and for each paddock. For serrated tussock, prevention and eradication need to be the ultimate goals.

Infestation	Strategy
Clean paddocks	Prevention – stop it entering or establishing.
Scattered plants or small areas	Eradication – remove it.
Moderate-dense infestation	Contain – prevent seed set, reduce vigour and extent, and improve the competitiveness of crops and pastures.
Dense with sources of re-infestation	Manage – contain in defined areas until eradication is feasible, and minimise impact.

There will almost always be a need to prioritise on which farms and paddocks to spend your time and budget:

Priority	Strategies
1	Prevention – keep clean farms and paddocks clean – zero tolerance of serrated tussock.
2	Containment – prevent seeding in areas joining neighbouring farms.
3	Contain dense infestations and prevent seeding while eradicating small, isolated infestations.
4	Eradication from all farms and paddocks.



Identify

Being able to identify this weed will enable quick detection and eradication.
Serrated tussock:

- Is a tussocky perennial grass up to 45cm tall and measuring up to 25cm around the base.
- Leaves are tightly rolled, narrow, stiff and upright with small serrations.
- Is light green with brownish leaf tips on older plants. In some regions it bleaches to a golden yellow when frosted (late autumn and winter).
- Seed heads, when developing, are purplish/mauve, tending to droop then turn golden brown when mature.
- Leaf stems are a white hairless flap about 1mm long, standing vertically.
- Is difficult to identify as a seedling.

Some other native grasses that it can be confused with can be distinguished by:

- Spear and corkscrew grass (*Austrostipa* spp) have purple leaf bases with hairs near the base.
- Wallaby grass (*Austrodanthonia* spp) has hairs on the leaf.
- *Poa* species have a folded leaf with no stem.

Contact an agronomist, weeds advisor or refer to other publications for help with identification.



Case Study

At Mudgee NSW, Allan and Leanne Heath have kept serrated tussock under control for over 10 years.

Key to their strategy is regular monitoring, starting before they had detected serrated tussock, with particular attention to likely entry points. Any new infestations are promptly spot sprayed and they manage for competitive perennial pastures. For an annual outlay of \$200 in herbicide and 250 hours of time they have avoided a loss of carrying capacity worth around \$50,000 each year. Allan and Leanne believe a coordinated regional approach is now essential to keep on top of serrated tussock.

➔ To read more about how other farmers have managed Serrated tussock, see the '3D Weed Management: Serrated tussock Case Studies' from MLA & AWI.

A staged, long term strategy is usually needed for dense infestations. For example, start with management to contain the plant by preventing seed set and then later move to eradicating the weed.

A long term, on-going commitment to monitoring and treating serrated tussock is essential for any farm, including those without serrated tussock as it can readily appear or re-establish.

Actions

Develop an annual operational plan that clearly identifies the timing of critical must do actions and tools for your strategy.

The critical must do actions for any strategy are:

- ➔ Minimise seed entry – good quarantine.
- ➔ Prevent seed set – timely control.
- ➔ Quickly kill plants and root reserves in early spring (spot spray/chip), always before seed set, repeated over several seasons.
- ➔ Ensure competitive winter/spring pastures with at least 1500 kg/ha dry matter and 60% or more perennial grass content.
- ➔ Minimise bare ground (less than 5% in vulnerable areas).
- ➔ Routinely monitor, at least twice each year, (particularly in autumn and winter) paying particular attention to areas where it can enter each paddock, outbreak or regrow.

Suitable plans include a combination of tools such as:

- ➔ Non arable areas: revegetate with native trees, and spot spray while trees are establishing.
- ➔ Arable areas: herbicide control in cropping rotations and fallows, followed by competitive perennial pastures.

Example – Serrated tussock plan across arable and non arable areas of a farm

Stocktake

- ➔ Serrated tussock heavily infested across 5 paddocks.

Source

- ➔ Blew in from neighbouring farm 3 years ago.

Strategy

- ➔ Eradicate serrated tussock from the farm.

Actions

- ➔ Work with the neighbours and weeds advisors to develop a regional control plan and seek funding assistance.
- ➔ Quarantine and remove stock from infested paddocks.
- ➔ On the infested, arable paddocks use a 5 year rotation of winter crops, sprayed in-crop and summer fallow. Undersow the final crop with a perennial pasture. Rotational graze, so that autumn/winter vigour and density is high – at least 1,500 kg/ha dry matter. Spot spray any plants in the pasture phase.

- On the infested, hilly country, exclude stock and revegetate this area to native trees to achieve a closed canopy. Spot or broadacre spray herbicide to control serrated tussock while trees are establishing.
- Fencelines and other paddocks – monitor and spot spray every April and July.

Diversity

Effective control needs a combination of tools acting on serrated tussock over its lifecycle. Select a set of tools that will ensure that seed entry is prevented, seed set is stopped and vigour and extent are reduced.

The most effective strategies are a carefully timed combination of tools:

- Minimise new plants by encouraging competitive, winter/spring growing perennial pastures with good groundcover.
- Remove existing adult plants and prevent seed set by spot spraying and chipping.
- On arable areas use herbicides and cultivation in crop rotations.
- Monitor paddocks twice a year, every year.
- Careful quarantine to limit entry.

Prevent seed entry

Minimise the risk of seed entry and establishment by paying constant attention to likely sources of infestation such as:

Wind movement	Serrated tussock seed commonly spreads by wind, over large distances. Carefully monitor all exposed and elevated areas after windy conditions.
Farm machinery & vehicles	Machinery spreads seeds – clean down and/or quarantine to designated areas that can be monitored. Pay particular attention to machinery or vehicles from infested farms or regions.
Livestock movements	Seeds take up to 7-10 days to pass through livestock and can still be viable. Restrict livestock from unknown or infested land for 10 days to specific areas that can be easily monitored and controlled. Monitor stock camps, dams and laneways.
Seed & hay harvested from infested areas	Carefully monitor all new sowings of pastures and crops into the next season. Take care when purchasing hay, feed it in a defined area and monitor this area carefully.
Nearby land	Regular surveillance of farm boundaries.
Water movement	Carefully monitor along creeks, waterways and overland flow areas.

Understanding serrated tussock

Serrated tussock is a perennial grass weed well adapted to the cooler parts of southern and south eastern Australia.

Growth: The serrated tussock plant is very slow growing with poor seedling vigour which is vulnerable to competition in its establishment period.

Spread: Individual plants have the capacity to produce large quantities of seed, up to 100,000 per year. Flowering and seed production occurs from late spring to mid summer, most commonly from mid November until mid January.

Plants older than 1 or 2 years may set viable seed and seeds are well adapted for wind dispersal. The whole seed head detaches from the plant and is readily blown away.

Seeds can germinate and establish throughout the year, but predominantly during autumn and early winter. Seed longevity in the soil is in the order of years with seed germination being restricted below 2cm.

Weakest point: Most seedlings die during the first summer after they germinate with establishment favoured by increasing bare ground. The seedling is the weak point in the life cycle of serrated tussock which can be targeted in any integrated control program.

Pasture management

Healthy pastures that can compete strongly for moisture, light and nutrients are part of any good control plan and also improve productivity. Pasture competition is effective against serrated tussock in its first year of establishment. Maintaining strong, competitive pastures provides some protection against establishment of this weed.

To be competitive against serrated tussock, pastures need to be active and sufficiently dense and vigorous during autumn and winter when serrated tussock seedlings emerge. To achieve this:

- Choose strong, winter growing, perennial grasses that occupy space and provide groundcover and competition. Aim to have perennial grasses making up at least 60% of the pasture.
- Add legumes and annual grasses that germinate at the same time as serrated tussock, providing extra competition.
- Look after the pasture by maintaining good soil fertility and monitoring and controlling pests.

Determine the species composition and density of your pastures to gain an indication of its capacity to compete. In areas that are infested or vulnerable to infestation, aim to maintain at least 95% groundcover.

In other areas, maintain at least 80% groundcover. Aim to have perennial species making up at least 60% of the total groundcover. Assess groundcover using simple tools such as quadrats and the end point technique. At the same time, maintain herbage mass above 1,500kg/ha dry matter especially during late summer and autumn to help compete with serrated tussock seedling germinations.

Grazing management

Manage grazing so that the pasture plant densities (especially of perennial grasses) and competitiveness will be high in winter and spring. Particular care is needed to restore the density and competitiveness of pastures degraded by drought or overgrazing.

Aim to ensure that perennial pastures are able to rebuild root reserves and set seed to improve persistence, density, vigour and productivity.

Keep autumn and winter herbage (perennials, annual grasses, legumes) between 1,500-3,500 kg/ha dry matter. It is important to protect groundcover levels and not to overgraze the perennial species.

Use strategic rotational grazing. Even converting from set stocking to a three paddock rotation is helpful. On most perennial pasture types:

- Allow good recovery periods after grazing (30-50 days).
- Allow pastures to flower in the spring.
- Use relatively short grazing periods (2-30 days) during active growing phases.

Where this is not possible due to drought conditions, seek advice as to the best options and be particularly vigilant in monitoring for and treating serrated tussock.

Herbicides

Herbicides are critical strategic tools for serrated tussock.

Early spring is critical, when serrated tussock is flowering and before it sets seed. The plants will still be readily visible amongst other pastures, and herbicide will be effective as the weeds become more active and able to take up the herbicide.

Herbicides are most effective where pastures are strong enough to compete with the weakened weeds.

Match control strategies to the biology of the plant

Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec
Growth								Growth			
		New seedlings									
Flowering & seeding										Flowering & seeding	
			Monitor								
							Herbicide				
Chip or hoe isolated plants, before flowering & seeding											
Maintain 1500kg/ha dry matter & 80% or more groundcover			Competitive perennial pastures with 1500-3500 kg/ha dry matter & 80% or more groundcover						Maintain 1500kg/ha dry matter & 80% or more groundcover		
Strategic rotational grazing											
Slash/mow										Slash/mow	
		Winter forage crop with summer herbicide fallow for at least 3 years then sow perennial pasture									
Diligence and quarantine to prevent seed entry											

Herbicide options include flupropanate and glyphosate:

- Flupropanate is a slow acting residual herbicide that is mostly absorbed through the roots. This selective herbicide is useful in non-grass crops like legumes and in tolerant pastures like phalaris, kangaroo grass and redgrass. Avoid aerial spraying of native pastures with flupropanate.
- Glyphosate is leaf-absorbed and non-selective, therefore is used only for spot spraying under favourable growing conditions or where killing surrounding plants isn't a concern (such as fallows or high infestation areas).
- If applying herbicide later than September, it is recommended to use glyphosate or add glyphosate to the flupropanate to prevent seeding.

Spot spraying in spring is important in most programs to kill invading infestations, reduce the perimeter of the main weed problem, remove straggling weeds after other control measures and to treat non arable areas and pockets of infestation such as lane ways, fence lines, gullies or rocky outcrops.

Spot spraying needs to be carefully targeted to apply a squirt of herbicide to each serrated tussock plant. Spraying the surrounding pasture area needs to be avoided as serrated tussock will invade and dominate the bare ground.

Broadacre spraying in winter and spring is effective against serrated tussock during crop cycles:

- Winter crops – choose legume crops and pastures like lucerne or clover that allow in-crop use of grass selective herbicides such as flupropanate.
- Summer cropping – spray during fallows.

Rope wick wipers selectively apply herbicide to serrated tussock when surrounding pasture is eaten down, and are useful on small areas.

Cropping rotations

Cultivation, and herbicides used in crop rotations can help to prevent seeding, deplete the weed seed bank and allow a competitive perennial pasture to be established at the end of the crop phase.

To be effective against serrated tussock crop rotations need to:

- Use cultivation and/or herbicides to control seedlings and prevent seed set.
- Be for at least three years.
- Be followed by planting a strong, competitive perennial pasture.

Mechanical control

Cultivation as part of a cropping program can reduce seed reserves by killing seedlings prior to crop sowing, during the fallow, and by burying the seed and exhausting the seed reserves. Seed will not germinate below 1.8 cm.

Mowing and slashing will not kill serrated tussock but is useful in preventing seed production as an interim measure.

Chipping (hoeing) or hand weeding may be feasible for a few, sparse new serrated tussock invasions. The plants are well anchored in the soil and difficult to pull out. It is important to remove all the root system so that the plant can't recover.

Choose a diversity of carefully timed tools for the must do actions

Tools	Prevent new seed entry	Prevent seed set	Kill existing plants	Reduce vigour	Minimise impact
Grazing	Hold stock in clean areas 10 days before moving from infested to clean paddocks.			Keep herbage above 1500kg/ha dry matter, including during summer and autumn.	
Pastures				Ensure pastures are strong and competitive in autumn-winter. Maintain 95% groundcover	
Herbicides	Treat any new entrants and seed sources.	Apply before flowering early spring.	Spot or broadacre spray depending on level of infestation – early spring.		
Cropping	Clean equipment before use.		Crop for at least 3 seasons with cultivation and / or herbicides.		Plant profitable crops.
Mechanical		Slash before flowering in early spring.	Cultivation prior to cropping.	Chip individual plants.	
Quarantine	Minimise risk of entry & watch all possible entry sites.				

Revegetation or farm forestry

Densely infested, non arable areas can be very difficult to control. One approach is to fence these areas, totally exclude stock and plant native trees to achieve a closed canopy which shades out serrated tussock.

Biological control

No biological control agents are available for serrated tussock. This is largely due to the close botanical association between serrated tussock and other grasses.

Diligence

Serrated tussock is likely to be an ongoing challenge for many properties. The key is to be diligent to achieve critical outcomes:

- Persist with control to keep on top of it.
- Prevent seed set.
- Prevent it from entering and establishing.

Monitor infested areas constantly, particularly in winter, spring and after control measures. Review and record areas of infestation by updating farm maps and/or counting weed density in quadrats to determine:

- Is the weed density reducing?
- Is it contained to existing areas?
- Are infested areas reducing in size?
- How effective was each control activity?
- Is eradication being achieved?
- Are winter pastures healthy and competitive?

Timing must be right – be sure control measures are effective before seed sets in summer. Plan carefully so serrated tussock control activities fit with other workloads.

Put into your farm diary the critical actions for your strategy:

- Winter and spring – monitor to detect outbreaks and assess control measures.
- Early spring – herbicide, chipping.
- Autumn/winter – ensure pastures are competitive.
- Summer/autumn – ensure that infested paddocks aren't grazed below 1500 kg/ha dry matter.

Follow up – if control measures haven't worked, repeat or use another tool before seed sets.

Integrate your weed management plan with your overall farm management strategy to ensure that it can be achieved.

Review and modify the plan based on progress, successes and failures. Adapt to seasonal conditions if needed to ensure pasture is competitive and to act on unusual outbreaks.

Further information



For more information on Serrated tussock or pasture management, contact your local agricultural office or agronomist. You may also find useful information from:

Australian Wool Innovation

www.wool.com.au

Ph: 1800 070 099

Meat & Livestock Australia

www.mla.com.au

Ph: 1800 675 717 – option 3

3D Weed Management: Serrated tussock Case Studies available from AWI and MLA

The Serrated Tussock Manager's Factpack

Available from NSW DPI at:

www.agric.nsw.gov.au/reader/weeds

National Taskforce on Serrated Tussock

Serrated Tussock National Best Practice Management Manual is available at www.weeds.org.au/WoNS/serratedtussock.

WEEDeck – for identification

www.weeds.org.au/weeddeck

CRC for Australian Weed Management

Weed management guide: serrated tussock

www.weeds.crc.org.au/weed_management

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