

# How do I ...

## use serradella in permanent perennial grass-based pastures in the high rainfall zone to increase livestock profitability?

- The issue:** Sub-clover is the most widely used annual legume on acid soils across the high rainfall zone of southern Australia. A range of annual legume species have been developed to diversify the pasture base. Among them is serradella, which is rapidly finding a wider role in driving productivity in animal production systems.
- The impact:** Diversification of pasture legume species commonly reduces production risks, increases productivity, helps to ensure high rates of nitrogen fixation and provides production resilience.
- The opportunity:** Alternative legumes, like serradella, can be more productive in low-phosphorus soils (compared with sub-clover), reducing inputs of phosphorus fertiliser while potentially improving productivity and environmental outcomes. Serradella comes with additional benefits as it is deep-rooted, offers lower bloat risk, is acid soil tolerant, has high levels of hard seed in most cultivars and is resilient to dry conditions. It also has other important features, such as improved tolerance to some pests and low disease risk.

Serradella, as an autumn-winter-spring growing annual legume, has many attributes often superior to other legume species like sub-clover.

Serradella is also a beneficial addition to existing pasture mixes, including native grasses and tropical and temperate perennial grasses. It can be grown in environments from low to high rainfall and from cooler, higher altitude areas to lower altitude, warmer ones.

This fact sheet focuses on growing serradella in the high rainfall zones (higher than 600mm) in southern Australia. In low and medium rainfall zones, serradella can be grown as part of a cropping system utilising cultivars specifically bred for these systems. Cultivars bred for use in cropping systems are not necessarily adaptable to the HRZ.



Ewes grazing French serradella pasture. Serradella produces abundant high quality forage when grown in soils and environments to which it is suited.

## Is serradella suitable for my farm?

In the right environment, serradella offers long-term persistence, high productivity and feed quality, improved phosphorus (P) efficiency compared to many other pasture legumes, reduced bloat risk in both sheep and cattle, tolerance to soil acidity and high levels of exchangeable aluminum, lower susceptibility to disease and pest risk and is quick to return to productivity following dry spells in the growing season.

However, serradella does not suit all situations. Like all species, it is important to match serradella, and the serradella cultivar you choose, to a suitable growing environment. It is not tolerant of waterlogging. Serradella is suited to well-drained sandy to loam-textured soils with a pH that is acidic to neutral and is also tolerant of moderate to high aluminium (Al) levels. Manganese toxicity is not uncommon in central and southern NSW but is uncommon in WA. Serradella is not well suited to clay or alkaline soils.

The two main species adapted for Australian use are yellow (*Ornithopus compressus*) and French (aka pink) serradella (*Ornithopus sativus*).

Within each species, a range of cultivars are available to suit different environments. These include early maturing cultivars for drier areas and later flowering ones for milder, higher rainfall areas. Both species have

cultivars with high levels of hard seed, important for long-term persistence.

Some of the yellow serradella cultivars developed for use in cropping systems (e.g. Santorini) have a delayed germination pattern (two to four weeks after opening season rainfall depending on soil/rainfall patterns). In a rotational system, where they are usually grown as a monoculture, it allows application of a knockdown herbicide to control weeds which germinate quickly following opening rains. However, this characteristic is not advantageous when grown with perennial grasses and other legumes as its delayed emergence may see it outcompeted for space, light and moisture.

Research findings suggest serradella could be successfully grown in a broader range of locations, including higher rainfall tableland environments (often semi or non-arable), as well as be more extensively grown in areas where producers already include it in their pasture mix.

Choosing the right cultivar for a given use and environment, and employing good management practices during establishment and grazing, are critical to serradella success.



### TOP TIP War on weeds

The importance of weed control – both pre and post-emergent – cannot be emphasised enough for successful establishment of serradella, and all pastures in general. A minimum of two and preferably three years of absolute weed control need to be undertaken prior to sowing any new pasture.

Ensuring adequate seeding rates is important for increasing the competitive advantage of pastures. It is far better to sow smaller areas at higher rates, than to attempt to sow a large area at a lower rate.

When you have successful control of weeds, along with good soil fertility and matching of the right cultivar to the soil and climate conditions, the chances of growing a highly productive pasture increase significantly.

Managing weeds in pastures can be challenging due to:

- reduced herbicide options for weed control in particular situations
- narrow window for application of some herbicides
- the need for specific temperature and/or moisture requirements for application of some herbicides.

Most herbicides are effective when applied to weeds at the seedling stage, but you must ensure the pasture species are at a stage of growth which can tolerate the application.

Serradella tolerance to herbicides is different to that of other pasture species, such as sub-clover. Only herbicides registered for use on serradella can be legally applied to serradella. It is also essential that stock withholding periods are adhered to.



Trials underway as part of research conducted in the HRZ.

Serradella is:

- **Phosphorus efficient.** MLA-funded research by CSIRO, universities, state agriculture agencies and agricultural consultants found serradella performed at maximum or near-maximum production at lower soil phosphorus levels than those required for other legume species, such as sub-clover and medics, when grown in suitable soils.

For example, on sandy loam soil with a low phosphorus buffering index (PBI = 40–80), serradella grows at maximum productivity at around 20mg/kg (Colwell P test), whereas sub-clover required 30mg/kg or higher for maximum production. Performing well at lower phosphorus levels may mean reduced fertiliser costs and reduced risk of phosphorus leakage to the environment, such as waterways via erosion.

- **Acid tolerant.** Serradella is one of the most tolerant pasture species for acidic soils, including those where acidity is present through the profile. High levels of exchangeable aluminium (Al) are often, but not always, associated with low soil pH and can adversely affect many pasture species. For example, past research has found sub-clover production is adversely impacted where Al availability exceeds 15% of total cation exchange capacity (CEC) (Evans et al. 1988). Many serradella cultivars have excellent tolerance to moderate to high Al toxicity levels. Serradella has proven to be productive and has displayed long-term persistence in soils with a  $pH_{Ca}$  as low as 4.0 and where exchangeable Al is as high as 50% of the CEC. However, production and nitrogen-building efficiency is not optimised in these

conditions. Serradella is not tolerant of high levels of exchangeable manganese (Mn), which can also occur in some low pH soils.

- **Safe.** Serradella is regarded as low risk for bloat as it contains a moderate amount of tannins, which reduce frothing in the rumen. Low bloat risk is a major advantage in good seasonal conditions where animal losses can be high, especially for cattle, for many pasture legume species. Other animal health impacts, such as pulpy kidney, are likely to be similar to those of other pasture species.
- **Good at growing roots.** Serradella roots faster and deeper than legumes species like sub-clover. Faster root development can mean better seedling survival in a dry autumn and deeper roots mean more reliable seed set in spring, even where rainfall conditions are highly variable. Serradella has reliable seed production even in drought years where other species have died before seeding. Capacity to reliably build a seed bank is critical to long-term persistence. Part of its greater phosphorus efficiency is attributed to its extensive root system and longer, more numerous root hairs.
- **Rain responsive.** Serradella is capable of extended periods of indeterminate growth, meaning it can continue to grow and produce seed while moisture is available and can respond to late-season rainfall.
- **Persistent.** Many cultivars have high levels of hard seed which allows them to persist once reasonable soil seed reserves are established. For example,

many areas of Australia experienced three consecutive drought years (2017, 2018 and 2019) with little to no seed set occurring. Yet regeneration of serradella following drought-breaking rains (as in 2020) has commonly been excellent. In some areas, serradella stands established 40 years ago continue to be productive and persistent.

(A note of caution: in long-season permanent pasture areas new to serradella use, some of the serradella cultivars used in other areas in cropping rotation situations have not persisted well in the high rainfall zone. Research to resolve this is ongoing. Seek informed local agronomic advice when selecting cultivars.)

- **Disease resistant.** MLA-funded research found serradella has few known disease issues, whereas species like sub-clover are commonly compromised by various root rots and virus leaf diseases.
- **Bug tolerant.** Aphids are, in some environments, a common threat to many pasture legumes, especially in spring. Yellow serradella has good tolerance to various aphid species and commonly is hardly affected, whereas sub-clover can be badly compromised. French serradella is more affected by aphids than yellow, but less than sub-clover. While serradella is more tolerant of red-legged earth mite than lucerne or sub-clover, bare earth sprays should be considered when establishing new stands and emerging seedlings should be monitored for damage; if high populations develop be prepared to treat as you would for sub-clover or medics.

Seed pods of French serradella can be severely affected by *Helicoverpa* (a bollworm-breeding moth) and infestation can decimate seed production; yellow serradella is usually less vulnerable to this common seed pest. Monitor pastures for signs of infestation.

At the first sign of infestation with *Helicoverpa* budworm, seek specialist advice to implement insecticide-based control.

- **Safe for ewes.** Unlike some old cultivars of sub-clover, serradella does not contain harmful levels of oestrogen which can and have led to sheep fertility issues.
- **Nutritious.** Serradella is considered at least equal to other pasture legumes for feed quality, including for grazing, hay, silage or carryover feed. Metabolisable energy (ME) in the vegetative stage is typically excellent at about 11.5 MJ/kg, with crude protein around 25%. Due to its capacity for extended periods of indeterminate growth, serradella can provide high quality green feed later into the growing season than traditional annual legume species.
- **Productive.** Productivity comparisons of various winter legume species vary according to environment and soil type. In some situations, such as highly acidic deep sandy and sandy loam soils, serradella is commonly far more productive than species like sub-clover. Research is showing promise for mid-season and late-season serradella varieties in non-traditional southern NSW tableland environments, where production can be equivalent to sub-clover. In environments where serradella thrives, annual dry matter production has exceeded 10t/ha.
- **Adaptable.** Serradella has a large gene pool and cultivars vary from early flowering types for low-rainfall environments, to long-season ones for higher rainfall areas.
- **An aerial seeder.** Unlike sub-clover, which in many cultivars flowers and sets seed close to the ground, often burying much of its seed, serradella is an aerial seeder. To ensure good levels of soil seed reserves, grazing needs to be carefully managed for good seed set, especially in the year of sowing of a long-term pasture.



## Getting it to grow

For serradella to be a long-term success, good seed bank establishment is essential. Underpinning this is effective weed control, particularly of broadleaf weeds common in the HRZ.

Commonly serradella is sown in higher rainfall zones and/or in permanent pastures as part of a pasture mixture designed to cover aspects such as variable soil type, pH, soil depth and paddock aspect. However, a mixture of species can limit the choices of post-emergent herbicides and make weed management during establishment more challenging. Sowing rates of each species are adjusted accordingly. When planning a pasture mix, attention needs to be given to herbicide tolerances and options. For permanent pastures, sowing needs to take place in autumn before minimum temperatures drop below 7–10°C.

When used in a mix, 4–7kg/ha of seed is needed. When sown alone 7–10kg/ha is recommended. The seed must be Group G/S inoculated to ensure the appropriate rhizobium are present to initiate nodulation. Peat-treated seed must be sown within 12 hours of treatment.

Failure to inoculate with the right strain of rhizobium when establishing serradella for the first time is likely to

### More information

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MLA's Feedbase Hub: [mла.com.au/extension-training-and-tools/feedbase-hub/](https://mla.com.au/extension-training-and-tools/feedbase-hub/)

For information on growing serradella in the low and medium rainfall zones go to:

[www.dpi.nsw.gov.au/agriculture/pastures-and-rangelands/species-varieties/serradella/part-a](https://www.dpi.nsw.gov.au/agriculture/pastures-and-rangelands/species-varieties/serradella/part-a)

[www.agric.wa.gov.au/pasture-management/french-serradella-use-and-management](https://www.agric.wa.gov.au/pasture-management/french-serradella-use-and-management)

Evans J, Hochman Z, O'Connor GE and Osborne EJ (1988). Soil acidity and Rhizobium: their effects on nodulation of subterranean clover on the slopes of southern New South Wales. *Australian Journal of Agricultural Research* 39(4) 605-918.

result in legume failure because the soil may contain no suitable rhizobium strains.

Where a legume like serradella has adequately formed nodules with effective rhizobia (Group G/S) they can build soil nitrogen by up to 20–40kg/ha for each 1t/ha of above-ground dry matter.

### Sowing rates

Conventional sowing (monoculture, dehulled, scarified seed): 7–10kg/ha

Conventional sowing in a mixture: 3–7kg/ha

Late summer sowing in pod using hardseeded cultivars: 30kg/ha (and a persistent form of inoculant must be applied).

The more rapidly you can achieve high density, the higher the productivity of the pasture and the less opportunity for weed competition.

## Choosing a cultivar

Selection of appropriate serradella cultivars involves consideration of the situation and environment. However, seed supply can be the limiting factor for some cultivars.

Avila is a cultivar which can be used in the HRZ.

Cultivar development for the HRZ region is ongoing.

Seek recommendations from informed local advisors and consider soil type, rainfall, environment, nutritional constraints and the end use.

## Summary

Serradella can be a highly successful pasture legume in the high rainfall zone. Choice of cultivar is important and, for some cultivar choices, seed can be limited.

Current research, including projects funded by MLA, indicate serradella has potential to be far more extensively grown than is currently the case. Seek recommendations from informed local advisors and consider soil type, rainfall, environment, nutritional constraints and the end use when deciding if serradella is the right plant for your specific circumstances.



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*First published in 2021*