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Management of serrated tussock in farming areas

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Summary

Serrated tussock control does not stop with killing mature plants. It is the first step in an integrated program of control. The focus has shifted to providing farmers with methods to kill the millions of seedlings that germinate, mainly through promoting pasture competition and the strategic use of herbicides.

Introduction

Research to develop new control strategies that will make it easier and cheaper for farmers to prevent serrated tussock from heavily impacting on their lives is being carried out in the Geelong and Bacchus Marsh regions. Research is focusing on killing serrated tussock, replacing it with competitive and valuable plant species and developing management systems to keep re-infestation to a minimum. This work commenced in 1997 using existing knowledge from New South Wales (NSW) and New Zealand.

Killing serrated tussock

Biological control may have a place in the future for controlling serrated tussock but until then herbicides will remain the method of choice.

Using Frenock

Frenock is a selective herbicide that will kill serrated tussock, but its cost and damage to non-target species when blanket spraying causes concern amongst landholders. As Frenock is our biggest weapon against serrated tussock it is important to understanding what it kills, how it works and how it can best be used.

Subclover, annual grasses and some native grasses including spear, wallaby and weeping grass are susceptible to Frenock when applied in summer at a rate of 2 L ha^{-1}. However, it will not kill improved pasture species such as, phalaris, cocksfoot, tall wheat grass or lucerne or the native grasses, silver tussock, kangaroo grass and red leg grass (Campbell *et al.* 1979, Campbell and Van de Ven 1996). This herbicide is best applied in summer after subclovers and annual grasses have set seed and when improved grasses are dormant. Application at this time will not stop serrated tussock from seeding as it is slow acting. To stop seed set, Frenock must be applied prior to August (Campbell *et al.* 1979).

Some farmers add glyphosate to Frenock to get a faster kill although this use is not registered. It was observed that Frenock's activity was adversely affected by glyphosate when its rate was reduced below 2 L ha^{-1} (M.H. Campbell personal communication). Diquat is registered to be applied with Frenock to achieve a quicker kill and in effect mark the sprayed plants (ICI 1990).

How long Frenock will continue to kill serrated tussock seedlings after spraying depends on the amount of organic matter in the soil, including serrated tussock leaves, which adsorb it and the amount of heavy rainfall which washes Frenock from the root zone of germinating seedlings. Under normal conditions, residual activity may last about a year. However, if serrated tussock is burnt and leaves removed, then the residual activity of Frenock will be reduced. Generally, blanket spraying of Frenock with no follow up means serrated tussock will return and seed in four to five years. Frenock is also adsorbed by seeds but will not kill them unless they germinate before the herbicide wears off.

Research is focusing on finding the minimum rates and application times of Frenock required to kill serrated tussock and its affects on non-target species on the main soil types in the Geelong area. Frenock has been successfully applied using rotowiping in NSW, this will be further tested in Victoria (Campbell 1997a).

Killing seedlings with Frenock

After mature plants are killed, millions of seedlings germinate. Most die through competition with each other and other pasture species although some will survive. However, rather than wait five years for tussock to take over before ripping the paddock, seedlings could be removed in the first two years using low rates of Frenock. Campbell (1997b) found that Frenock applied in spring at 0.5 L ha^{-1} and 0.75 L ha^{-1} to an 18 month old improved pasture selectively killed 95% and 100% of seedlings respectively. Further work is being carried out in NSW and Victoria at Toolern Vale where Frenock has been applied from 0.1–1.0 L ha^{-1} over varying sized serrated tussock plants.

Using glyphosate as a knockdown prior to pasture establishment

The disadvantage of using Frenock in a pasture renovation program is the extra cost of applying glyphosate to kill other weeds prior to establishment. A program is being developed to overcome this. It includes burning serrated tussock in late winter and then spraying green regrowth in the following autumn / winter with

glyphosate. Burning provides a number of advantages, it removes all the dead material allowing good coverage of glyphosate and therefore a good kill, it stops seeding and it bares the ground allowing seedlings to germinate. These are later killed using low rates of Frenock applied in the following spring. In effect burning, reduces the seedbank.

Replacing serrated tussock

Killing serrated tussock is expensive without having to spend extra money on pasture or tree establishment. Therefore selective removal of serrated tussock from an already improved or strong pasture is important. However, if there is nothing but serrated tussock or the pasture is poor then blanket spraying alone will be a waste of money. Serrated tussock has weak seedling vigour. Improved pasture species, like phalaris and cocksfoot grow six to nine times faster after germination (Campbell and Barkus 1965) and compete well with serrated tussock seedlings.

Pasture species to compete with serrated tussock

Serrated tussock can be replaced with species suited to the same environmental conditions, (low fertility, light textured soils and low rainfall) or the environmental conditions can be altered to suit improved pasture species (i.e. raise and maintain fertility). Our aim is to find a grass that grows more vigorously and is palatable to stock and grows in the same conditions as serrated tussock. In trials in the Rowsley Valley and at Exford we tried both approaches. The species adapted to low fertility, e.g. Wallaby grass, redleg grass and consol lovegrass failed to establish but the improved pasture species did well (Miller and Boyle 1997).

Establishment is very important, as the pasture must to be thick enough to compete with serrated tussock seedlings. In non-arable areas, we need grasses and clovers that establish by broadcasting. Species that did best in the broadcasting trials included cocksfoot and Bolta balansa clover. According to Campbell (personal communication), phalaris is the best species to out-compete serrated tussock because it is a large plant and the most drought tolerant of the grasses. Cocksfoot can hold an infestation but not reduce it and ryegrass does not compete with it at all. Grasses provide the best competition but clovers are valuable in the first three years after sowing by providing intense competition for light (Campbell 1997b) until grasses thicken up.

The species most suited to replacing serrated tussock in areas of low soil fertility is cocksfoot. It likes the same light textured soils and rainfall, requires lower soil fertility than other pasture grasses, establishes best from aerial seeding, produces growth in summer, is drought tolerant and establishes from self seeding. Currie cocksfoot is the most drought tolerant variety and seems to do the best in the marginal rainfall country around Werribee.

Trees

What frustrates most farmers is that despite cleaning up their own properties, they are continually reinfested with other landholder's seeds. Whilst they can do little about district neighbours they can make their property 'tussock proof' using a barrier of trees. The majority of seedheads tumble along the ground, become caught up in fencelines and then drop their seeds.

Some non-arable land is not suited to pasture establishment because of low soil fertility and rainfall. Here trees are the only answer and must be used to provide competition against serrated tussock and catch seedheads. The barriers to adoption of trees are their ease of establishment, cost and the time taken to stop serrated tussock seeding. Pine trees, commercially grown in serrated tussock areas in NSW, have successfully killed it after 10 years but took six years to stop seeding (Campbell 1982).

In the Rowsley Valley, work has started to find the easiest, cheapest and most effective way of establishing different tree species. One of the methods being investigated, broadcasting seed into burnt serrated tussock, has shown success in NSW (Campbell and Nicol 1996). This method could potentially be used to cheaply reforest large areas of marginal land. Frenock does not affect established trees (M.H. Campbell personal communication) or their germination. Young trees could be oversprayed with Frenock to kill serrated tussock seedlings.

Cultivation and cropping

On arable land the preferred method of control is to crop for two years before sowing an improved pasture. This reduces the seedbank by burying the seed (seedlings can not emerge if seed is buried below 18 mm (Campbell 1982)), baring the soil to encourage seedlings to emerge and then killing them by further cultivation or spraying. Subsequent cultivations must be shallower than the first so that buried seed is not brought to the surface.

Aerial spraying and sowing techniques

Serrated tussock is found mainly on non-arable land where improved pastures are difficult to establish. Aerial pasture sowing techniques use a plane or helicopter to spray weeds and then broadcast seed and fertilizer onto the soil surface. These techniques are useful in hill country with greater than 600 mm annual rainfall but become risky in lower rainfall areas. On flat rocky basalt soils, where no rain is lost through runoff, aerial pasture establishment could be successful where rainfall is low (500 mm). Paying particular attention to weed control and time of sowing reduces risk. In low rainfall areas, the optimum sowing time is from late May to mid June but only after a good germination of weeds from an early autumn break. However, in steep, low fertility soils, aerial pasture establishment is too risky to use.

Management to keep serrated tussock out

Killing serrated tussock is only the first step of a long term control program. The whole crux of serrated tussock control lies in management methods to keep it from reinvading. Grazing or competition will not kill established plants, however, seedlings are not vigorous and can be killed by competition. They are also palatable so can be eaten out.

Grazing management

The main factor controlling the ability of serrated tussock to establish is the amount of existing vegetative cover. On bare soil, 4000 seedlings m^{-2} have been counted (Campbell and Gilmour 1979). For serrated tussock seedlings to germinate they need available moisture and soil temperatures above 5°C which generally coincides with autumn and spring (Taylor 1987). Pasture cover in spring is usually more than ample to out-compete seedlings, but in autumn seedlings establish from lack of competition. Pasture cover must be maintained at this time and a strategic spell may be all that is needed. Once there is sufficient rainfall to encourage the growth of improved grasses and annuals then grazing could be commenced. These ideas will be tested in the Rowsley Valley.

The feed value of mature serrated tussock leaves is very low (Campbell 1990) but young plants have a higher feed value because they lack the build up of dead straw. Rotational grazing where paddocks are grazed then rested reduces selective grazing, and this may enable seedlings to be grazed without too much damage to other pasture species.

Grazing management to keep improved pastures and native pastures vigorous and dense involves strategic spelling or rotational grazing. This gives pasture species a chance to build up food reserves. A cocksfoot paddock can respond to a summer spelling, a phalaris pasture to resting in spring and native grasses to resting in late spring and summer (Campbell 1958, Campbell and Barkus 1965).

Fertility

Under high fertilizer regimes, weeds are generally more palatable and growth of improved species is increased; the combined effect results in the weed's death.

Fertility conditions do not greatly affect mature serrated tussock but may impact on seedlings. This will be investigated in the Rowsley Valley. Already soil tests taken on areas in a paddock with and without serrated tussock have shown a clear difference in the fertility levels. Deficiencies in nitrogen, phosphorous and potassium all occurred where serrated tussock grew but where nutrients were adequate it was absent.

Spraytopping

Stopping viable seed set of serrated tussock could buy time until long-term control plans can be undertaken. Spraytopping uses low rates of glyphosate (450 g L^{-1} at 500 mL ha^{-1}) plus wetter applied in spring to stop seedhead emergence and sterilize any seeds which form (Miller and Boyle 1997). The effectiveness of spraytopping is dependent upon application timing and rate. It is most effective when the stems of serrated tussock have thickened from the formation of seedheads within them, but before emergence. This occurs from mid September to early October depending on season and district.

Conclusion

To have a chance at eradicating serrated tussock or even minimizing its impact on productivity, a plan to limit seed re-invasion must be in place. Spraytopping, strategic use of Frenock and tree barriers are all necessary to achieve this. On arable land, cropping followed by establishment of improved pastures will remain the best method. On non-arable land, Frenock can be used to selectively remove the weed with minimal damage to the existing pasture. Where serrated tussock can not be selectively removed without it impacting heavily on non-target species then establishment of pasture or trees will be necessary.

After removal, seedlings will germinate. Encouraging existing pasture to compete with serrated tussock using appropriate grazing management and fertilizers will kill the majority of seedlings and spot spraying will be required to remove the remainder. However, if the pasture is weak, further opportunities may exist to selectively remove seedlings using low rates of Frenock.

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The transmission of serrated tussock (*Nassella trichotoma)* seeds through the sheep rumen and their viability after ingestion

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This study examined the possibility of animals and hay acting as dispersal agents for *Nassella trichotoma.* Nine, eighteen month old, merino wethers were separated into two groups and housed in metabolism cages. The first five sheep were fed a diet (1) of 800 g lucerne chaff and 200 g barley, the other four were fed on a diet (2) of 800 g oaten chaff and 400 g Barastock pellets. After nine days on the diet, each sheep was fed 5 g of *N. trichotoma* seeds. Faecal collections were taken at approximately the same time each day for 21 days. Samples were taken to measure dry matter, faecal extraction, and faecal germination. Most seed extracted was recovered in the first seven days for both diets. All seeds extracted were germinated at 25°C (12 h light / dark). Faecal germination samples were crushed and covered in sand and placed in the glasshouse to germinate.

There was no significant difference between the rate of passage of the two diets, however, the mean number of seeds recovered was higher for diet 1 (921 ± 169) than diet 2 (699 ± 103). Peak recovery occurred on days three and four with the peak number for any sheep being 1131 seeds on day three. Recovery of seeds from 50 g fleece samples averaged 10 seeds of *N. trichotoma* per sample for high and two seeds per sample for low *N. trichotoma* infestation properties.

Results from this study may be used in the development of management strategies for the movement of stock and fodder from *N. trichotoma* infested regions. Farmers must be made aware of the possibility of spreading seed via stock or fodder.

Guidelines on the transport of animals and hay should be considered. These guidelines would require farmers in infested regions to:

- quarantine stock either before or after sale,
- shear animals before sale,
- restrict sale of animals with muddy hooves (not examined here, but highly likely to be a cause of seed dispersal),
- restrict sale of unshorn stock in the flowering period,
- restrict hay and fodder sales from contaminated properties.

In addition, it should become a requirement for the Department of Natural Resources and Environment to notify stock agents of properties and farmers who have been served with notices regarding *N. trichotoma* infestations. The stock agents would then be required to notify potential purchasers that the stock for sale originated from a property infested with *N. trichotoma.*