Use of low rates of herbicides to control serrated tussock, African lovegrass and St. John's wort in NSW

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The best method of controlling serrated tussock (*Nassella trichotoma*), African lovegrass (*Eragrostis curvula*) and St. John's wort (*Hypericum perforatum*) is to plough or spray the weed and sow introduced pastures. However, due to the continuing fall in the farmers' terms of trade it is now unprofitable to use such methods in many areas of NSW (Vere et al. 1993). Thus, recent research has concentrated on the use of low rates of herbicides and the promotion of native or naturalised pastures to control the weeds. Recent extension has urged producers to try a number of low rates to establish the most efficient for their environment.

Serrated tussock

Killing mature tussock

Frenock® is effective at lower than the recommended rate of 2 L/ha on granite and shale soils, in dry seasons, in some environments and when applied from September to March inclusive. For example, rates from 1.25 to 1.75 L/ha are effective on the Monaro. The 2 L/ha rate was selected because it was effective at any time of the year, including winter when Frenock® is least effective and was necessary in high rainfall areas with rocky basalt soils where serrated tussock is hardest to kill. As research cannot be carried out in all environments in NSW producers should try 1.0, 1.25, 1.5, 1.75 and 2.00 L/ha to determine the minimum rate for their environment. Permits have been obtained to enable producers to try rates lower than 2 L/ha. However, results from these low rates will not be guaranteed by Cropcare Aust. P/L the company marketing Frenock®.

Applying herbicides by wiping

At Dalgety NSW large serrated tussock plants were killed without damaging the associated pasture when wiped one way in September with rates of Frenockâ : water of 1:10, 1:20 and 1:40 (Campbell and Nicol 1998). The highest rate was necessary to kill the weed near Tuena and thus producers should try all the above rates to establish the best for their environment. Roundup CT® was ineffective at 1:10, thus 1:5 to 1:2 may be necessary to kill the weed. Use of the wiper will be restricted by rocks, stumps, undulations and slope but could selectively remove large plants (only) from heavily grazed pastures in country without obstructions. Repetitive treatment could remove all plants over time by wiping as they reach wiping height (20 cm).

Herbicides other than Frenock®

Because the price of Frenock® has increased from $13/L to $35/L over the past 25 years a search for alternatives is in progress. Roundup CT® is the most promising and is effective in Victoria at 3 to 5 L/ha (Miller 1995). Lower rates than 3 L/ha are reported to kill tussock when applied in October at Bredbo NSW but 11L/ha was necessary to kill the weed at Mt. David. This indicates there could be ecotypes of serrated tussock susceptible to different rates of Roundup CT® or varied response to the herbicide in different environments. The success of Roundup CTâ in Victoria is attributed to its application to serrated tussock recovering from burning (L.G. Miller, personal communication 1998). Research is underway in NSW to ascertain the lowest rates that can be used in different environments. Roundup CT® is used for spot-spraying in Victoria but as it kills useful species it

has to be applied accurately. When spraying patches of tussock small plants often survive when protected from Roundup CT® by larger plants.

If Roundup CT® proves effective in killing serrated tussock it would simplify the spray-sow technique for replacing tussock with pasture, because only one spray would be necessary before sowing (to kill serrated tussock and other weeds after the seasonal break), instead of the two sprayings now used (one with Frenock® in spring to kill tussock and one with Roundup® in autumn to kill other weeds; Campbell 1985).

Replacing serrated tussock with introduced pastures

Details for replacing serrated tussock with introduced pastures after spraying or ploughing are given in Campbell (1985).

Replacing serrated tussock with native grass pastures

Native grasses that can tolerate high rates of Frenockâ (Redleg grass Bothriochloa macra, kangaroo grass Themeda triandra, poa tussock *Poa labillardieri*) can replace serrated tussock provided they are present before spraying. For example, the ground cover of redleg grass in a paddock facing north near Tuena NSW aerially sprayed with 1.7L/ha Frenock® in October 1995 increased from 5% before spraying to 40% in January 1998 despite heavy grazing after spraying. Had the pasture been strategically spelled and fertiliser and subterranean clover seed applied, conditions would have favoured increased competition from redleg grass and winter annuals and more redleg grass seeds in the soil for regeneration (the seedbank of redleg grass in January 1998 was 490 viable seeds/m^2). Despite grazing no tussock seedlings were present in March 1998 due to the combined effects of residual Frenock® and pasture competition. The effect of the competition can be gauged from the regeneration of, respectively, 5.0 and 2.5 tussock seedlings/$10m^2$ on areas in the paddock sprayed with Roundup CT® in September 1996 and July 1997. The Roundup CT® removed annual grasses and broad-leaved plants which allowed the tussock seedlings to establish.

Selective removal of serrated tussock from Wallaby grasses (*Danthonia* spp.) and weeping grass (*Microlaena stipoides*) was not considered possible in the early 1990s because these grasses were killed by rates of 1 L/ha Frenock® and above in the southern tablelands of NSW (Keys and Simpson 1993). More recent trials (M.H. Campbell, unpublished data) in the central tablelands show weeping grass can tolerate rates of Frenockâ from 0.25 to 1 L/ha. Thus the tolerance of this species could vary with ecotype and environment. But, as mature serrated tussock is rarely killed by 1 L/ha, selective removal will only be successful from ecotypes of weeping grass that can tolerate rates above 1L/ha. As Wallaby grass (*Danthonia eriantha*) only tolerated 0.25 to 0.5 L/ha Frenock® in the central tablelands selective removal of mature serrated tussock would not be possible. However other species of *Danthonia* may be more tolerant to Frenockâ than *D. eriantha*. Perhaps the most promising method of replacing serrated tussock with Wallaby grass and weeping grass would be to sow seeds of these grasses after residual Frenock® has been washed from the soil. However, as seed of these grasses is very expensive this method is not practical at present.

Use of Roundup® to selectively remove serrated tussock from native grasses would only be possible if mature tussock was susceptible to low rates or if the native grasses had no green leaves when sprayed.

Management of a native grass pastures for the control of serrated tussock

Under "normal" grazing pressures serrated tussock will eventually dominate a native grass pasture. But if low rates of superphosphate and subterranean clover are applied and grazing pressure used in line with carrying capacity (Crofts 1989) the native grass pasture can be productive and stable.The Crofts (1989) management system is based on set-stocked merino ewes in groups of about 500 from lambing to weaning but mob stocking for the rest of the year to control edible weeds and internal parasites. For details see Crofts (1989). If serrated tussock seedlings invade the native grass pasture managed in this way they could be selectively removed with low rates of Frenock® applied in the spring/summer after they establish (see below).

Killing tussock seedlings in introduced pastures

Research on the Monaro showed that Frenock® applied on 6 September 1995 at 0.25, 0.5 and 0.75L/ha gave, respectively, 53%, 95% and 100% kill of 8 to 18 month-old (2 to 10cm high) serrated tussock seedlings without damaging the 18 month old sown pasture (Campbell 1997a). The pasture was grazed after spraying but had it been spelled the tussock seedlings could have been killed at even lower rates due to the combined effects of Frenockâ and pasture competition. As it has been shown that germinating seedlings can be killed by 125 ml/ha of Frenockâ (Campbell and Murison 1987), spraying with very low rates in spring or summer at regular intervals of 1, 2 or 3 years, or after a massive establishment, could kill tussock seedlings and be cheaper than spot-spraying. For example, annual or biennial spraying with 125 to 250 ml/ha Frenock® in spring of paddocks that become infested each year from nearby infestations could remove tussock seedlings without damaging the pasture. Again, producers should experiment with these low rates and timings to find the minimum effective rate for their situation.

Killing tussock seedlings in native grass pastures

Tussock seedlings (2 to 10 cm high) could be selectively removed from redleg grass, kangaroo grass and poa tussock with 0.5 to 1 L/ha of Frenock® applied in spring or summer. Weeping grass could tolerate these rates in some regions of NSW but Wallaby grass may only tolerate 0.5 L/ha or lower.

Stopping seedhead production

Low rates (0.5 to 1.0 L/ha) of Roundup CT® applied when the thick flowering tillers are present in September to November, 0 to 8 weeks before the start of seedhead emergence, will reduce seedhead production of serrated tussock from 91% to 99% but will not kill the weed (Campbell et al. 1998). This treatment could be applied to reduce seed spread until more permanent control measures can be implemented.

Mixing Frenock® and Roundup CT®

If it is desired to stop seedhead production and kill serrated tussock a mixture of Frenock® and Roundupâ can be applied from September to November (Campbell et al. 1998). However, when applying the mixture at minimum rates (*eg.* 0.5 L/ha Roundupâ + 1.5 L/ha Frenock®) the seedhead reduction effect of Roundup CT® is reduced and the effects of Frenock® in killing mature tussock and restricting seedling regeneration are reduced. These effects are not critical when spot-spraying but for large scale aerial or boom spraying it would be wise to apply Roundup CT® or Frenock® alone.

Bio-control

A recent survey of serrated tussock in Argentina found two promising bio agents. As a result a three-year research program has been organised and is in the process of obtaining supporting finance.

African lovegrass

Because African lovegrass seedlings are susceptible to low rates of Frenock® (Campbell and Murison 1987) field testing for their selective removal from introduced and native pastures, similar to that carried out on serrated tussock seedlings (Campbell 1997), needs to be done. Also, the effect of Roundup CT® in stopping seedhead production needs testing. Although large plants of African lovegrass were killed when wiped one way in September with 1:10, 1:20 and 1:40 Frenock®: water (Campbell and Nicol 1998) further field testing is necessary to refine this treatment.

St. John's wort

Starane® gave 100% kill of St. John's wort when sprayed at Orange in December 1994 with 2 L/ha and oversprayed in December 1995 with 3 L/ha (Campbell and Nicol 1997). Starane® did not damage subterranean and other clovers that germinated in the following autumns whereas Grazon® killed the clovers and Roundup® killed the grasses.

Low rates of Starane® applied in November 1997 near Wellington reduced St. John's wort and promoted the redleg grass association (Table 1). Although St. John's wort has not been eliminated, control could be achieved by either applying subterranean clover and superphosphate and grazing heavily in winter to force animals to eat the wort or by applying the Crofts (1989) management strategy. The weed may gradually return, particularly in large paddocks where complete utilisation of the pasture is difficult (Campbell 1997b), but if control were achieved for up to 10 years another spraying with Staraneâ could start the control cycle again. DowElanco advises that Staraneâ should be registered for use on St. John's wort by the end of 1998.

A relatively new bio-agent, the mite *Aculus hyperici*, is available and should be established in unused nurseries on all properties with St. John's wort and growing points transferred monthly to spread the mite through the property.

Conclusion

Because the effectiveness of herbicides varies in different environments producers should ascertain the minimum rate necessary to kill the weed and promote pastures on their properties. The factor fundamental to the use of low rates of herbicides is accurate application. Often, higher rates than recommended are applied to ensure a quick kill. This is expensive and kills useful plants growing with the weed. Thus it is essential to calibrate equipment for boom and spot-spraying. The latter

Table 1: Effect of herbicides applied in November 1997 on St. John's wort and associated grasses, measured in March 1998.

Herbicide	Rate (L/ha product)	Ground cover (%)		
		St. John's wort	Redleg grass association	Wiregrass (*Aristida* sp.)
Starane® (20% a.i.)	1	11	35	23
	2	3	39	20
	3	3	39	19
Grazon® (40% a.i.)	3	5	35	24
Roundup CT® (45% a.i.)	3	33	30	18
Nil	0	51	15	27

can be done by spraying a 10 x 10 m area at your normal spot-spraying speed, measuring the amount of water used and multiplying by 100 to give rate per ha. You can then add the recommended amount of herbicide per ha and be sure of applying an accurate rate. For example, if you apply 10 L to 100 m^2 then you are spraying at 1000 L/ha, so if you wish to apply herbicide at 1.5 L/ha add 1.5 L to 1000 L of water. Calibration of boom sprays can be done in a similar way.

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