

# An assessment of native tree susceptibility to the simulated aerial application of the herbicide flupropanate, for management of exotic unpalatable grasses.

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**Summary** Re-forestation is a management tool for long term control of exotic unpalatable grasses. Grass control is required at tree planting to maintain tree vigour and establishment. Flupropanate is a widely used herbicide for managing unpalatable grasses. The impact of a simulated aerial application of flupropanate at the recommended rate (2 L/ha) and double the recommended rate (4 L/ha) on a replicated native tree trial located in the Rowsley Valley at Glenmore was conducted between 2004 and 2006. Results show that flupropanate does impact on tree survival with approximately 1 in 40 seedlings dying at 2 L/ha and 1 in 20 dying at 4 L/ha. Flupropanate reduced height, at 14 months post application, of black wattle by 60-70%, varnish wattle by 30% and drooping sheoak by 20%. Flupropanate did not affect tree heights of grey box and yellow gum. The use of flupropanate for wide scale unpalatable grass control in the establishment of native tree re-forestation is discussed.

**Keywords** serrated tussock, *Nassella trichotoma*, flupropanate, trees.

## INTRODUCTION

Unpalatable perennial grasses such as serrated tussock (*Nassella trichotoma* (Nees) Hack. ex Arechav and Chilean needle grass (*Nassella neesiana* Trin. & Rupr.) are Weeds of National Significance (Thorp and Lynch, 2000). They cost Australia millions of dollars in lost agricultural production while they are also invading and replacing Australia's endangered native grasslands (McLaren *et al.* 1998). Despite many years of research, there are still limited control options for managing weeds such as serrated tussock in Australia (Michalk *et al.* 1999). The only registered herbicides 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 controlling serrated tussock while its residual action in the soil can prevent serrated tussock regrowing for three to five years (Campbell and Vere 1995).

Native trees are increasingly seen as a tool for long-term management of prohibited weeds such as serrated tussock, particularly on non-arable lands where management by more traditional methods can become difficult (Campbell and Vere 1995). Weed control to enhance tree establishment and growth during afforestation is an integral component of forestry operations in such management systems. In steep and/or inaccessible situations this control may best be achieved by aerial herbicide application.

A large rehabilitation program "Grow West" is aiming to reforest large areas (2,000 ha) of the Rowsley Valley escarpment (Grow West Business Plan 2003), 20 km west of Melbourne. The Rowsley Valley escarpment is heavily infested with serrated tussock and is a major source of serrated tussock seed leading to continual re-infestation of surrounding land. The dollar investment in forestation in the Rowsley Valley is massive. This project aims to assess whether flupropanate used to control serrated tussock during the afforestation process has negative effects on early growth and survival of trees. Registered for serrated tussock control, flupropanate is the only herbicide that might allow this type of integrated management with limited damage to native tree species and adjacent pasture species. However, the effects of flupropanate on native tree species in the Rowsley Valley have not been documented and such information will be an important step towards improving current management of serrated tussock. This paper reports on a trial to assess the impact of flupropanate on the survival and growth of five native tree species that are considered to be the most important rehabilitation species for this region.

## MATERIALS AND METHODS

The trial was conducted on a 0.2 ha block of undulating pasture at in the Rowsley Valley in Southern Victoria. Soil type is a fine sandy clay loam and the region receives an annual rainfall of 480 mm. Five native tree species were selected for their timber and local reforestation qualities. These were grey box (*Eucalyptus microcarpa* (Maiden)), yellow gum (*Eucalyptus leucoxylon* F. Muel.), black

Table 1. Effect of flupropanate on tree survival and damage.

Measurement	Transformed				Back Transformed			P Value	
	0 rate	2 L/ha	4 L/ha	sed	0 rate	2 L/ha	4 L/ha	Flu	Sp x Flu Interaction
<i>Survival (%)</i>									
black wattle	86	83	77	7.5	1.00	0.98	0.97	0.026	0.51
varnish wattle	90	83	82	7.5	1.00	0.98	0.98		
drooping sheoak	90	74	72	7.5	1.00	0.92	0.91		
grey box	90	80	75	7.5	1.00	0.97	0.93		
yellow gum	78	86	82	7.5	0.96	1.00	0.98		
<i>Average height of surviving trees (cm)</i>									
black wattle	34	21	18	1.5	1160	440	330	< 0.001	< 0.001
varnish wattle	30	26	26	1.5	920	620	640		
drooping sheoak	28	25	25	1.5	770	620	640		
grey box	23	23	23	1.5	530	520	520		
yellow gum	24	26	24	1.5	590	650	590		

wattle (*Acacia mearnsii* De Wild.), varnish wattle (*Acacia verniciflua* A. Cunn.) and drooping sheoak (*Allocasuarina verticillata* (Lam.)). To aid survival of tree seedlings, the block was ripped and an application of glyphosate (Roundup Max at 6 L/ha) was applied one month prior to tree planting in June 2004 to eliminate competition from serrated tussock and other weeds. The planted block was fenced to prevent tree seedling damage from grazing animals.

Seedlings of the five tree species were planted in a 6 replicate randomized block design with a plot consisting of a row of 18 tree seedlings, and with the rows being 2 m apart. Within a row, 3 treatments (nil herbicide, 2 L/ha flupropanate and 4 L/ha flupropanate) were allocated to 3 groups of six adjacent tree seedlings. The groups were 3 m apart, and the trees within a group were 1.5 m apart. Thus in total there were 5 tree species x 3 treatments (0, 2 & 4 L/ha flupropanate) x 6 replicates (blocks) x 6 trees/plot = 540 trees. Herbicide treatments were applied in August 2004 using a hand held Azo-Dutch 1 m boom sprayer with spray volume 176 L/ha<sup>-1</sup> to simulate aerial application. In October 2005 (14 months after application) the percentage of trees surviving on each plot was recorded, and the average tree height (cm) of surviving trees in each plot was measured.

Angularly transformed survival to December 2005, the square root of the average height of surviving trees in a plot were analysed as a 5 tree species by 3 flupropanate factorial split plot analysis. Replicates consisted of 5 rows of 18 trees, mainplots consisted

of one row of 18 trees of the same species, and subplots consisted of 6 adjacent trees with the same rate of applied flupropanate. Since the data for survival had discrete values for many treatment combinations, P-values of angularly transformed survival were calculated using exact permutation tests appropriate for the split plot design (Payne 2006).

#### RESULTS

Results show that flupropanate did impact on tree survival with approximately 1 in 40 (2.5%) tree seedlings dying at 2 L/ha and 1 in 20 (5%) dying at 4 L/ha flupropanate compared to the control (Table 1). However, there were no tree species interactions across the treatments.

Flupropanate substantially reduced the height of black wattle (from 1160 cm to 440 cm at 2 L/ha) and varnish wattle (from 920 cm to 670 cm at 2 L/ha) compared to the control (Table 1). It also caused some reduction in height of drooping sheoak but had no impact on grey box or yellow gum.

#### DISCUSSION

On average, flupropanate resulted in a 2.5% tree mortality at the recommended rate of 2 L/ha and 5% tree mortality at 4 L/ha. There was no evidence that this effect differed between species. Flupropanate substantially reduced early growth of varnish wattle and drooping sheoak. Post emergent applications of flupropanate were specifically selective against black wattle (*Acacia mearnsii*), with a reduction in

14 month height of 60-70%. Previous studies have shown that flupropanate may be useful for control of wattle volunteers in South Africa (Schumann 1990) while hardwood species like acacia or ash are more susceptible to flupropanate than conifers (Kuo and Rin 1987). Flupropanate is known to be damaging to annual legume species such as subterranean clover (Campbell and Vere 1995) and this project shows it can also inhibit growth of perennial *Acacia* legume species such as black wattle. Though early growth of treated black wattle seedlings was substantially hampered by the flupropanate treatments, most were still surviving 14 months after treatment. This begs the question whether these trees will recover or perish. Observations from a number of council weed officers and landowners during a recent series of national serrated tussock workshops (Fullerton *et al. in press*) suggest that *Acacias* usually recover from flupropanate damage.

Flupropanate had no recognisable effects on growth of either grey box or yellow gum and this supports previous studies that *Eucalyptus* species are relatively tolerant to flupropanate (Campbell and Nicol 1998).

The primary conclusion from this trial is that it is possible to use flupropanate for the selective control of serrated tussock amongst seedling *Eucalyptus* and sheoak species but care should be taken to select the lowest possible flupropanate rate to reduce the likelihood of off target impacts if spraying over *Acacia* species.

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