# Control of serrated tussock by applying flupropanate at 3- or 10-year intervals.

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In September 1995, seven rates (0 to 1.5 L/ha) of flupropanate (75% a. i.) were applied to an 18-month-old introduced pasture near Berridale, NSW. The pasture was infested with serrated tussock seedlings (67 000/ha) from 2-10 cm high, with 20-80 leaves and 0.7-1.5 years old respectively. Control of tussock was recorded until 2000. Plots were in 3 randomised blocks and were part of a 50ha paddock that was grazed heavily during the 5 years after spraying.

Possible control methods for re-infestation of serrated tussock on herbicide treatments that gave 100% kills (0.75 to 1.50 L/ha) were compared with the nil herbicide treatment. The four control methods considered were boom spraying, fixed wing aircraft, helicopter and spot-spraying of flupropanate applied at 3 and 10-year intervals; the former to prevent seed production from re-infesting plants (important where the treated area was not showered with seedhead from outside); the latter to prevent tussock from substantially reducing pasture production (appropriate where the treated area was subject to annual receipt of seedheads from outside). The rate of flupropanate necessary to kill seedlings at 3-year intervals and mature tussocks at 10-year intervals was, respectively, 0.75 and 1.5 L/ha. A linear programming model (Jones and Vere 1998) was used to evaluate each control treatment in terms of net present value (NPV) and benefit-cost ratio (BCR) using a 7.5% discount rate over 20 years. Any treatment with a NPV >0 and a BCR >1 is economic and the treatment with the largest values is the preferred option.

## Results

Flupropanate applied in 1995 killed all tussock seedlings present at rates of 0.75 L/ha and above. Re-infestation of serrated tussock on the nil herbicide treatment from 1995 to 2000 occurred much faster than on the successful spray treatments (Table 1). The benefit-cost analysis demonstrates the economic superiority of treatments used to control re-infestation on the successful spray treatments over the nil herbicide treatment (Table 2). The main cause of re-infestation on the nil herbicide treatment was seedlings that had established before spraying in September 1995 and grew into large tussocks by 2000. The density of these seedlings (53 500/ha) was much higher than the initial re-infestation of seedlings on the successful spray treatments (750/ha in 1998), which resulted in an increase in ground cover of serrated tussock of 1%/year (Table 1). Re-treatment after the successful spray treatments, by boom, aerial or spot spraying, could be applied at 3 or 10-year intervals after the initial spraying. The benefit-cost analysis of control treatments applied after the successful spray treatments showed that boom spraying was the most economical option at either spraying interval and spot spraying the least economical (Table 2).

**Table 1. Re-infestation of serrated tussock on the nil herbicide and successful spray treatments (0.75 to 1.50 L/ha flupropanate)**

| Treatment | Number ha$^{-1}$ | | | | | Ground cover (%) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1995 | 1996 | 1998 | 1999 | 2000 | 1995 | 1996 | 1998 | 1999 | 2000 |
| Nil herbicide | 53,500 | 51,000 | 51,000 | 42,000 | 43,000 | 5 | 18 | 36 | 54 | 49 |
| Spray | 56,500 | 0 | 750 | 1,250 | 2,250 | 7 | 0 | 1 | 1 | 2 |

**Table 2. Benefit-cost analysis of control treatments ($ ha$^{-1}$) applied at 3- and 10-year intervals to successful spray treatments, compared to the nil herbicide treatment** (evaluated by the net present value (NPV) and benefit-cost ratio (BCR) over 20-years and discounted at 7.5%)

| Control treatment | 3-year intervals | 10-year intervals |
|---|---|---|

| | NPV | NPV | BCR | NPV | BCR |
|---|---|---|---|---|---|
| **Successful sprays** | | | | | |
| Boom spray | | 830 | 4.13 | 948 | 7.45 |
| Fixed wing | | 734 | 3.03 | 886 | 5.34 |
| Helicopter | | 620 | 2.30 | 878 | 5.05 |
| Spot spray | | 453 | 1.71 | 431 | 1.71 |
| **Nil herbicide** | 141 | | | | |

**Discussion**

Re-infestation after the successful spray treatments was slow, no seedlings being found in the first 2 years after spraying due to the residual effect of flupropanate and low numbers (750 /ha /year) returning in the following 2 years. Possible treatments to control re-infestation on the treatments applied by boom or aerial spraying were more profitable than spot spraying at both the 3-year and 10-year intervals. Another disadvantage with spot spraying is the impossibility of spraying all small tussocks.

Applying a low (0.75 L/ha) or high (1.5 L/ha) rate of flupropanate at 3- or 10-year intervals will not damage the introduced pasture provided spraying is undertaken in spring or early summer. Repeating the 3-year interval treatment over long periods will not foster herbicide resistance by serrated tussock to flupropanate because the re-infesting seedlings will be coming from the same seed bank that existed before spraying began. Repeated application of a high rate of flupropanate at 10-year intervals over long periods has little chance of causing serrated tussock to develop resistance to flupropanate.

Opposition to 10-year intervals from weed control authorities, because of the seed produced between sprayings, could be overcome by formulating a property weed control plan to spray whenever the weed reached an agreed level of re-infestation. As the 10-year interval program will only be promoted where seedhead dispersal occurs, the small amount from the treated paddock will not substantially alter the overall position.

On non-arable land, re-infestation by serrated tussock after an aerial spray-sow-spray program (high rate of flupropanate to kill mature tussock-sow introduced pasture-low rate to remove seedlings 15 months after sowing) could be removed by applying 0.75 L/ha flupropanate at 3-year intervals or 1.5 L/ha at 10-year intervals. Similarly, where flupropanate has been used to kill mature serrated tussock in native grasses that tolerate high rates (red grass, kangaroo grass, poa tussock), a 3- or 10-year interval treatment could maintain the pasture relatively free of the weed by applying, respectively, a low or a high rate. In native grass pastures, susceptible flupropanate weed seedlings (wallaby and weeping grass) could not be selectively removed.

Application of low or high rates of flupropanate at 3-year or 10-year intervals as proposed above for serrated tussock could have application in the selective removal of other grass weeds susceptible to flupropanate, eg. Chilean needle grass, African lovegrass, giant Parramatta grass and giant rat's-tail grass.

**References**

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