Trees in the landscape

Technical Report 192

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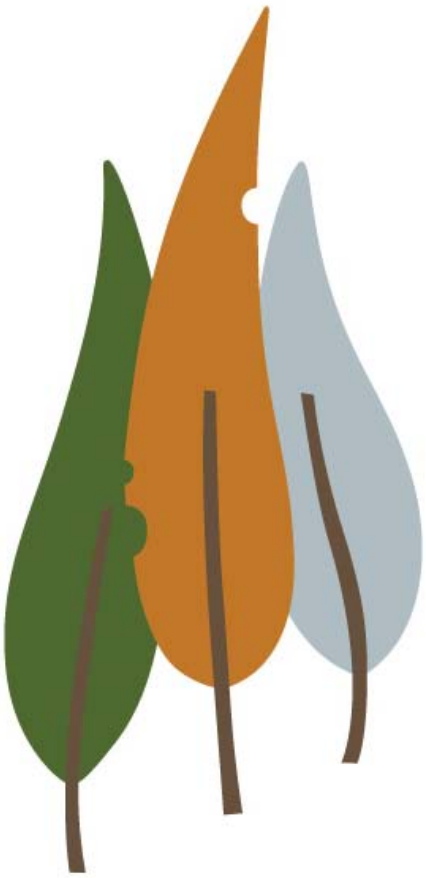
CRC for Forestry
Researching sustainable forest landscapes



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"Eucmix": An evaluation of the feasibility of using a selective residual herbicide to control weeds in direct-seeding revegetation trials

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Summary

Weed control is a major factor influencing the success of revegetation projects in the rural landscape. Eucmix® herbicide is widely used as an effective form of weed control in plantations of *Eucalyptus globulus*, *E. nitens* and *E. regnans*, however little is known regarding its effectiveness in controlling weeds in landscapes being revegetated with native species. This report presents the results of a glasshouse trial investigating the effect of Eucmix® on the growth and health of several species commonly used to revegetate rural landscapes. Results showed that Eucmix® was successful in killing off all weeds within one month of application and had no adverse effects on the growth or health of the species tested. These findings confirm the results of earlier studies documented in CRC for Forestry Technical Report 150.

Acknowledgments

Thankyou to Macspred Australia for donating the herbicide used in this experiment.

Introduction

Need for weed control

Competitive weeds pose challenges for revegetation projects based on native tree and understorey species across Tasmania. As Davidson and Close (2001) noted, "weed control is one of the major factors determining the success or otherwise of revegetation projects in the rural landscape".

Revegetation often occurs in "improved" pasture environments where a variety of grasses are sown that are selected for drought tolerance and their success in competition with other species. In areas subjected to such agricultural practices for many decades, a significant seedbank accumulates in the soil, which enables recolonisation after an initial application of 'knockdown' herbicide. The presence of annual and broad-leaf weeds also poses problems, as they compete for resources (such as water, nutrients and light) necessary for the successful establishment of trees.

Limitations of conventional weed control approaches

While knockdown and translocatable herbicides (such as those containing glyphosate) can be effective in combating weeds, they must be applied with care as they are non-discriminatory and any spray drift from the target weeds onto non-target plants can result in growth set-back or death. Applying knockdown herbicide is also time-consuming and therefore costly in terms of labour. However, without weed control, desirable plants often become indistinguishable from the weeds surrounding them. Consequently, the usual growth of desirable plants is suppressed and they eventually die.

Conventional knockdown spray-application weed control is virtually impossible where planting spacing is very close, such as in revegetation projects where direct seeding is often used rather than the planting of seedlings.

Evidence of the effectiveness of Eucmix®

Eucmix® GR granular herbicide (Macspred Australia, Delacombe, Victoria) has an initial knockdown as well as a residual effect and is already widely and effectively used in commercial eucalypt plantations for the control of certain annual and perennial weeds. The formulations of Eucmix® available are prescribed for use in plantations of *Eucalyptus globulus*, *E. nitens*, and *E. regnans*.

A body of evidence is slowly mounting that Eucmix® GR can be used as a selective herbicide to control weeds around a range of non-commercial eucalypts and other species. A trial was conducted in South Australia on direct-seeded native perennial vegetation in which Eucmix® at the rate of 20 kg/ha had no negative effects on the survival of seedlings of the species tested at any site. Stokes and Bookman (2000) stated that "Eucmix® application appeared visually to be far more effective in eliminating weeds than the conventional glyphosate overspray".

Encouraged by these results and the potential to use Eucmix® GR as a means of controlling weeds among some mixed-species revegetation trials, Eucmix® GR was applied to five eucalypt species and two non-eucalypt tree species in a glasshouse pot trial (Churchill 2004). Eucmix® was applied at half the prescribed rate due to the confined nature of the pots. Churchill (2004) found that "Eucmix® GR applied at half the prescribed rate had no effect on any of the tree species tested, except *Eucalyptus pulchella* which displayed extensive tip necrosis. As a precaution, it was recommended that other species in the subgenus Monocalyptus, except *Eucalyptus pauciflora* which was unaffected in the trial, not be treated with Eucmix® prior to further testing."

Despite the noted adverse effect on *Eucalyptus pulchella*, Eucmix® GR has been applied in revegetation trials aged 18 months, and to trees older than three years within the subgenus Monocalyptus, with no negative effects (Churchill, unpublished results).

Objective

The objective of this study was to determine the effect of the selective herbicide Eucmix® on twelve ground cover and shrub species in order to arrive at an efficient weed-control strategy for direct-seeding revegetation trials managed by the CRC for Forestry and CSIRO. Species in the study were monitored for stem volume (expressed as d^2h), average height growth and plant health. The species chosen for this experiment are the same as sown in revegetation trials in the southern midlands of Tasmania in August and September 2006 (Churchill, unpublished results).

Materials and method

Glasshouse trial design

The experiment was a randomised block design with three replicates. Ten individuals per species were allocated to each replicate. Five were allocated to the herbicide treatment; five were untreated controls. Levels of light, nutrients and the supply of water on the species tested were maintained consistently across species throughout the trial.

Twelve species were tested: *Acacia mearnsii*, *Acacia melanoxylon*, *Allocasuarina littoralis*, *Allocasuarina verticillata*, *Bursaria spinosa*, *Callistemon pallidus*, *Cassinia aculeata*, *Dodonaea viscosa*, *Lomandra longifolia*, *Poa labillardierei*, *Poa rodwayi*, and *Banksia marginata*. Seedlings were bought as one-year-olds grown in 50 mm x 50 mm x 120 mm "tube" pots and then transplanted to 1.7 L plastic pots containing a mixture of composted pine bark and coarse washed river sand. The seedlings were grown in a glasshouse at ambient temperature for five weeks prior to the start of the experiment.

The herbicide tested was Macspred Eucmix® GR granular herbicide with the active constituents: 44 g/kg Terbacil and 2 g/kg Sulfometuron Methyl. 1.5 g/m^2 (half the prescribed rate) of Eucmix® was applied to the soil surface of treated plants. The prescribed rate was halved because of the confined nature of pots compared to soil conditions in the field. After one month, a further application of the same amount was applied to the pots.

Two seedling flat trays of "pasture mix" grass including perennial and annual rye grass, as well as couch and fine fescue, were included with each replicate and had herbicide applied at the same rate as the pots.

Each replicate was watered from above and the drainage water (containing herbicide runoff) was contained within a metal tray. The water contaminated with herbicide was collected and disposed of through the University of Tasmania's chemical disposal facility.

Assessment

Those species with a single defined stem (leader) were initially measured for height and diameter (at base) and given a health score immediately after application of the herbicide and at two months after treatment. The multi-stemmed species were measured for height and given a health score immediately after application of the herbicide and at two months after treatment.

The health score was a six-point scale, where 0 = dead plant, 6 = very healthy.

The species able to provide a single diameter (at base) measurement included *Acacia mearnsii*, *Acacia melanoxylon*, *Allocasuarina littorallis*, *Allocasuarina verticillata*, *Banksia marginata*, *Bursaria spinosa*, *Callistemon pallidus* and *Dodonaea viscosa*. These species and their response to Eucmix® GR application are compared using increments of stem volume expressed as d^2h.

The species unable to provide a single diameter measurement included *Cassinia aculeata*, *Lomandra longifolia*, *Poa labillardierei* and *Poa rodwayi*. These species and those able to provide a single diameter measurement are compared using average height growth measurements and average health scores. Average height growth measurements are calculated by subtracting the initial growth measurement from that taken two months after the application of Eucmix®. With the advent of any dieback, negative growth results could be seen.

The statistical significance of any differences between control and treated plants was assessed using *p*-values calculated by applying t-tests to the data using EXCEL©, testing the null hypothesis that Eucmix® GR has no effect on the growth of the plants tested.

Results

Cassinea aculeata and *Poa rodwayi* suffered severe aphid infestation as well as a fungal disease related to the high humidity conditions in the glasshouse. The poor condition of these plants confounded any adverse symptoms. Consequently they were eliminated from the trial.

There were no significant differences ($p>0.05$) in growth (Figures 1, 2) or health (Figure 3) between the controls and seedlings receiving Eucmix® GR two months after treatment.

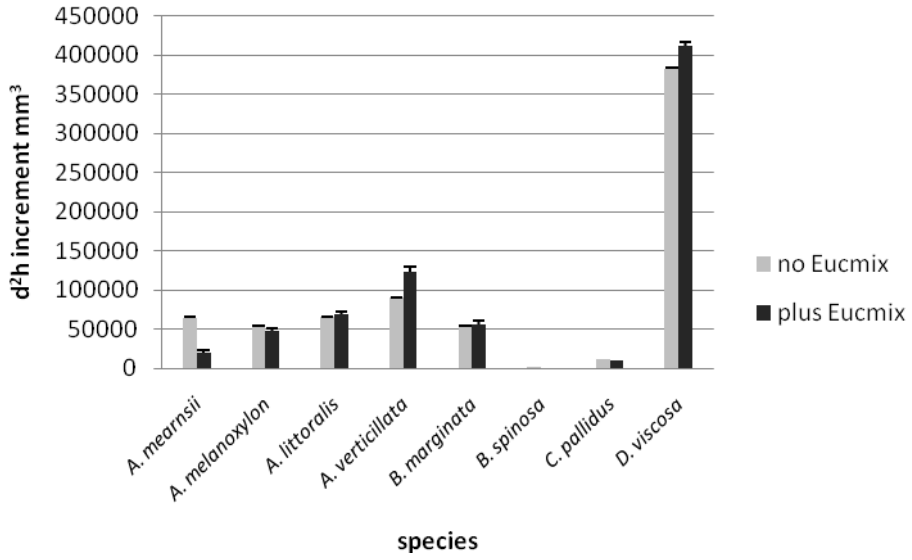

Figure 1. The effect of Eucmix® GR granular herbicide on plant growth indicated by increment of stem volume (d^2h, mm^3), two months after application. Error bars are one standard deviation

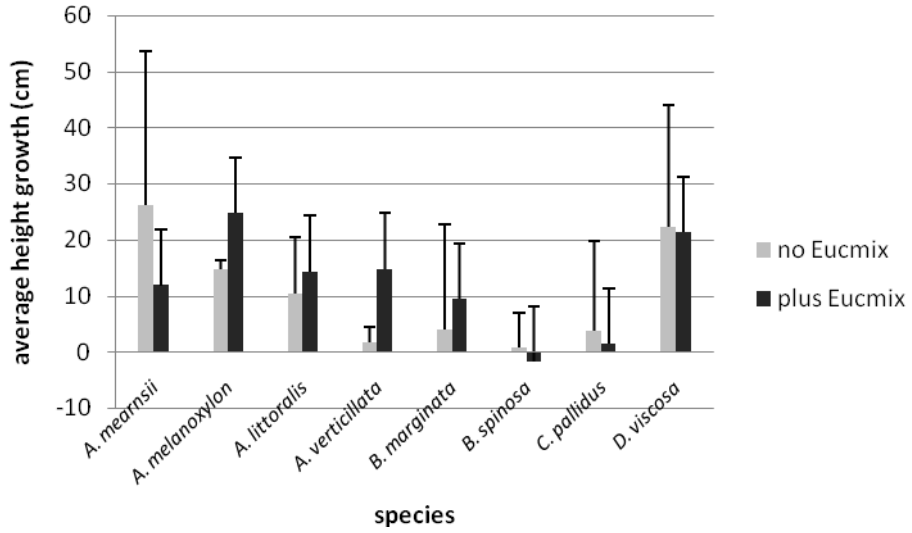

Figure 2. The effect of Eucmix® GR granular herbicide on plant growth indicated by average height increment (cm), two months after application. Error bars are one standard deviation

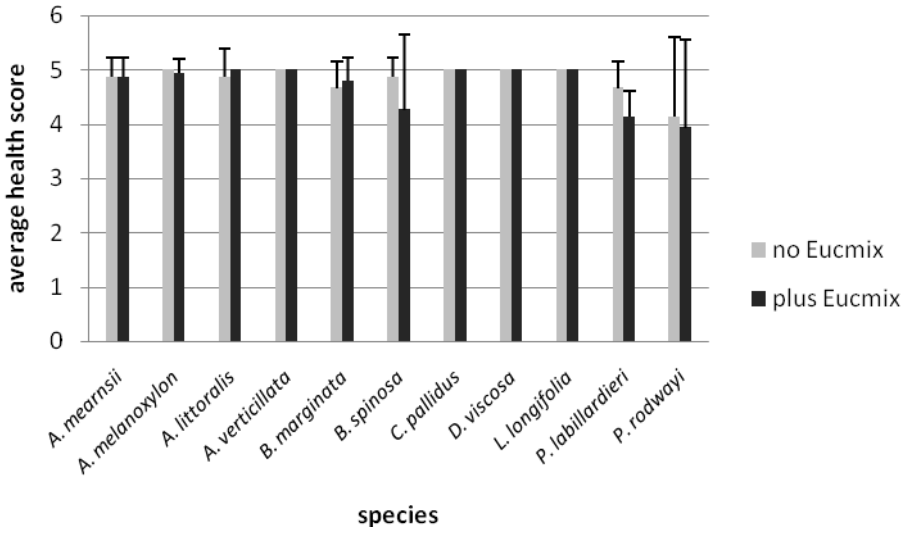

Figure 3. The effect of Eucmix® GR granular herbicide on plant health two months after application. Error bars are one standard deviation

Good health regardless of treatment is clearly illustrated in Figure 4. It was noted that the surface of the potting mix was maintained free of bryophytes and other weeds by the application of Eucmix® GR, whereas the surface of the control pots was covered in weeds (Figure 5).

Eucmix® GR applied at half the prescribed rate killed the pasture grass in the seedling flat trays within one month of application.

Figure 4. *Acacia melanoxylon* (blackwood) with or without Eucmix® GR, two months after application

Figure 5. With Eucmix® GR added, the pot on the right has dead dicotyledonous plants and bryophytes on the surface of the potting mix. The pot on the left, with no Eucmix® added, contains live dicotyledonous plants and bryophytes. The *Bursaria spinosa* in both pots are in good health

Discussion

Eucmix® applied under glasshouse trial conditions had no negative effect on the growth and plant health score for any of the species tested. The next logical step is to test Macspred Eucmix® GR Granular Herbicide on direct-seeding trials in the field at the prescribed rate for the age of the plants.

The findings from this trial have led to Eucmix® being used to successfully control a perennial grass weed, *Holcus lanatus* (Yorkshire fog grass), in a plantation seed orchard containing *Acacia melanoxylon* (blackwood).

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