

PHYTOTOXICITY OF SULPHONYL-UREA HERBIDICES TO RADIATA PINE

G Dutkowski

Woods and Forests Department, Forest Research Branch,
PO Box 162 Mount Gambier SA 5290

Summary. Metsulfuron, sulfmeturon and chlorsulfuron were screened for their post-planting phytotoxicity to radiata pine using a logarithmic sprayer. Applied alone none caused death. Applied with siloxane, metsulfuron caused death from 10 g/ha, and chlorsulfuron from 6 g/ha. Sulfmeturon caused damage but not death to 340 g/ha. All depressed tree height growth. Metsulfuron and sulfmeturon were screened for their pre-planting soil residue phytotoxicity by application with a logarithmic sprayer to bare ground at three intervals before planting. Metsulfuron, applied two months and one month before planting caused few visual symptoms of damage but depressed growth above 30 g/ha. Both metsulfuron and sulfmeturon, applied one day before planting, caused significant damage and severe growth depression. Death occurred from 7 g/ha with metsulfuron and from 40 g/ha with sulfmeturon.

INTRODUCTION

Sulphonyl-urea herbicides have potential for use against a range of weeds present in plantations of radiata pine (*Pinus radiata*) in the south-east of South Australia. The normal prescription for general weed control at plantation establishment is to apply hexazinone at 1.5 kg/ha and atrazine at 5.0 kg/ha just before planting and again one year later. Resistant weeds such as bracken (*Pteridium esculentum*) require a separate treatment in autumn before planting (2). Metsulfuron and chlorsulfuron have potential for use against bracken, but it has been reported that soil residues of metsulfuron may damage radiata pine (3, 4, 1). Sulfmeturon may be able to replace hexazinone or atrazine for broad spectrum residual control of weeds.

It is necessary to ascertain the phytotoxicity of these herbicides towards our crop species, radiata pine, before they can be used for plantation establishment. Two tests were made: the first aimed to examine the post-planting phytotoxicity of all three herbicides and the second examined the phytotoxicity of soil residues of metsulfuron and sulfmeturon applied to the ground at three intervals before planting. Metsulfuron was applied two months, one month and one day before planting. These intervals represent possible application times for bracken control. Sulfmeturon was applied one day before planting as this is the most likely timing for its use for general weed control.

METHODS

A Chesterfield Logarithmic Sprayer was used to apply the herbicides in both trials. This delivers a negative exponential dose rate. When used at a walking speed of 1 m/s it sprays a strip 20 m long and 1 m wide at 300 l/ha. Measurement of walking speed, measurement of tree position within the strip and knowledge of the amount of chemical initially present enabled calculation of the dose that each tree planted in the treatment strip received. Trials were established on a deep podsolised sand, locally prevalent and known as Mount Burr Sand (5).

In each trial height to the green tip of the tree was measured and tree damage was assessed on the nine point scale shown below.

1. No effect; tree perfectly healthy.
2. Very slight effect; yellowing just visible.
3. Slight effect; yellowing visible, effects reversible.
4. Substantial chlorosis and/or some necrosis; probably no effect on growth; effects probably reversible.
5. Strong chlorosis and necrosis; some loss of growth expected.
6. }
7. } Increasing severity of damage.
8. }
9. Death.

Trial One. Trial One was established in a routine plantation area which had been treated with the standard weed control prescription and planted at 2.5 x 2.5 m spacing in June, five months prior to treatment in November. Six treatments were applied:

Treatment	Chemical	Rates	Adjuvant
1	Metsulfuron	18 to 1.5 g/ha	
2	Metsulfuron	18 to 1.5 g/ha	Siloxane 0.75 l/ha
3	Sulfmeturon	340 to 28 g/ha	
4	Sulfmeturon	340 to 28 g/ha	Siloxane 0.75 l/ha
5	Chlorsulfuron	22 to 2.0 g/ha	
6	Chlorsulfuron	22 to 2.0 g/ha	Siloxane 0.75 l/ha

Plots were 25 m long with an untreated tree at the start of the plot, a treated strip approximately 20 m, and one to four untreated control trees at the end of the plot, the number varying according to walking speed and tree spacing. Each treatment was replicated ten times so that each treatment was applied to approximately 80 trees and 70 trees were untreated.

Trial Two. The area for the second trial was rotary-hoed and treated with the standard establishment herbicide prescription to have bare ground at the time of treatment. Application to bare ground should give maximum soil residual phytotoxicity as, operationally, weed foliage spray interception would reduce the amount of chemical reaching the ground. Treatments applied were:

Treatment	Chemical	Rates	Timing
1	Metsulfuron	90 to 7 g/ha	Two months before planting
2	Metsulfuron	90 to 7 g/ha	One month before planting
3	Metsulfuron	90 to 7 g/ha	One day before planting
4	Sulfmeturon	750 to 40 g/ha	One day before planting

Each treatment was applied with siloxane at 0.6 l/ha. Plots were 24 m long with one untreated tree at the start of the plot, a treated strip of approximately 20 m and one to four untreated trees at the end, the number varying with walking speed. Trees were planted at one metre intervals within the plot on the same day in July. Each treatment was replicated six times. There were thus approximately 120 trees per treatment and 60 untreated control trees.

RESULTS AND DISCUSSION

Trial One. Figure One shows the effect of each chemical, with and without siloxane, on tree health three months after treatment and tree height seven months after treatment, at age one year. Trees treated with metsulfuron alone showed only slight damage. Trees treated with

metsulfuron and siloxane quickly displayed symptoms of severe damage and mortality resulted at 10 g/ha and above. Trees treated with sulfmeturon alone showed few symptoms of damage. Trees treated with sulfmeturon and siloxane quickly showed increasing symptoms of damage up to substantial chlorosis at 225 g/ha and above. Treatment with chlorsulfuron alone resulted in slight damage. The addition of siloxane quickly resulted in severe damage and death at 6 g/ha and above.

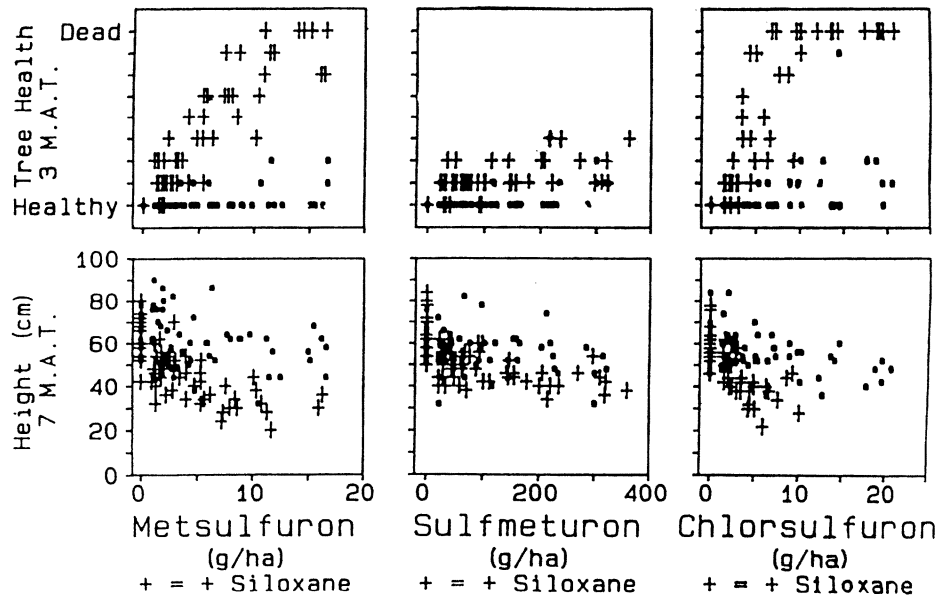


Figure 1. The effect of application to five month old radiata pine trees of metsulfuron, sulfmetron and chlorsulfuron, with and without siloxane, on tree health three months after treatment and tree height seven months after treatment.

All treatments caused depression in height growth. The amount of depression was related to the amount of damage observed. At one year of age the worst affected surviving trees were only one third the height of untreated trees.

The effect of the addition of siloxane indicates the importance of foliar uptake to the efficacy of these herbicides, especially metsulfuron and chlorsulfuron.

Treatments were applied only in spring to trees which had just started to grow. It is possible that trees may be more or less susceptible at other seasons of the year or stages of growth.

Operational and other experimental experience has shown that metsulfuron used with siloxane can kill trees (i) in June, one day after planting at 3 g/ha, (ii) in January, seven months after planting at 6 g/ha, and (iii) in April, ten months after planting by drift from an operation at 30 g/ha. The latter also damaged four year old trees. Application of sulfmeturon with siloxane in May to eleven month old trees at 50 g/ha and above has caused severe damage and growth depression.

All these observations confirm the phytotoxicity of sulphonyl-urea herbicides to radiata pine and indicate that none of the herbicides tested are suitable for use post-planting over young trees. Metsulfuron and chlorsulfuron can be seen to have potential application in the control of radiata pine natural regeneration because of the very low rates which are required to kill trees. Extreme care should be used to avoid off target damage to radiata pine.

Trial Two. Figure Two shows the effect of each treatment on tree health seven months after planting and tree height increment from one to seven months after planting. Metsulfuron, applied two months before planting, caused no visual symptoms of damage. Applied one

month before planting, metsulfuron caused only slight symptoms of damage. Both metsulfuron and sulfmeturon, applied one day before planting, caused substantial damage and death. Metsulfuron caused death from 10 g/ha, and sulfmeturon from 40 g/ha.

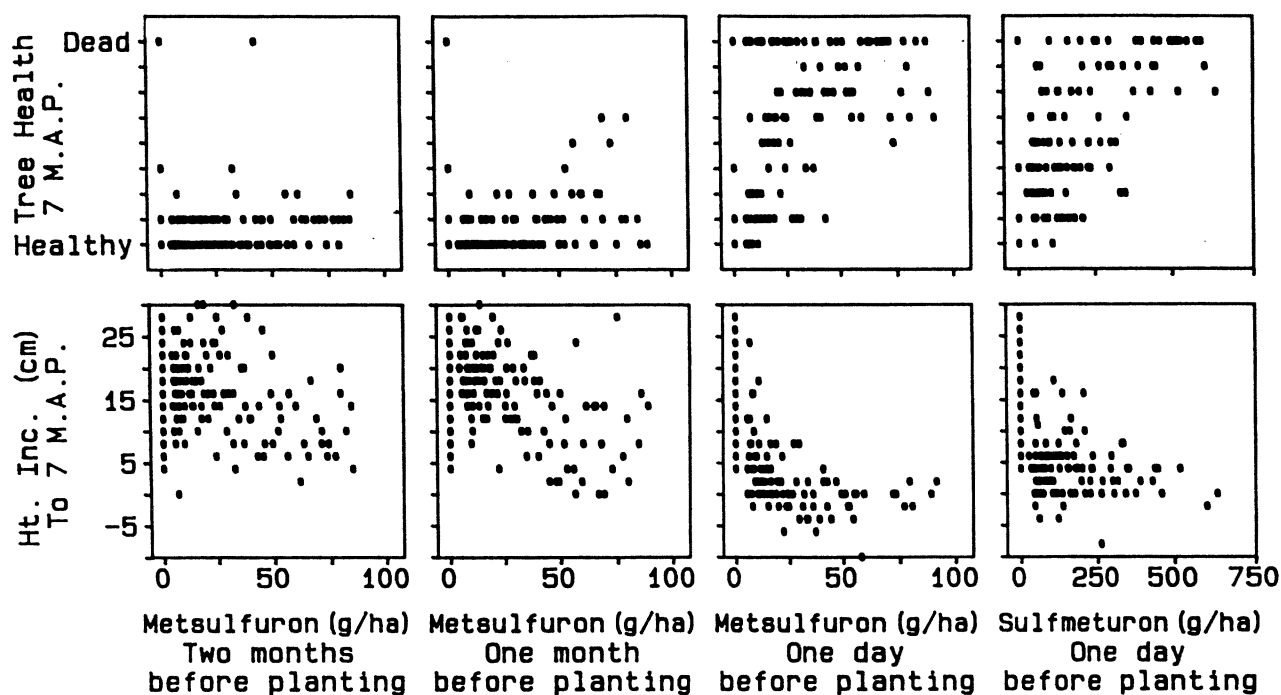


Figure 2. The effect of the application of metsulfuron two months, one month, and one day, and sulfmeturon one day, before planting, on the health of radiata pine seven months after planting and tree height increment to seven months after planting.

Tree height increment was depressed with metsulfuron above 30 g/ha applied one or two months before planting. Greater depression resulted from application closer to the planting date. All rates of metsulfuron applied one day before planting caused height growth depression. Some trees showed zero increment at 10 g/ha, with no increment for almost all trees at 50 g/ha and above. Sulfmeturon applied one day before planting caused similar growth depression, with height increment at 100 g/ha only one quarter that of untreated trees.

These results indicate that metsulfuron can be safely used as close as one month before planting up to 30 g/ha. For operational purposes it is recommended that this rate not be applied less than two months before planting. This rate is in accord with label recommendations for bracken control and is similar to the rate recommended from local trials (1). Treatment of bracken in autumn allows at least two months' separation between treatment and planting in winter. Sulfmeturon has potential for broad spectrum weed control in our plantations. Such weed control is applied as close to planting as possible to allow maximum length of residual weed control. This trial shows that sulfmeturon should not be used immediately prior to planting with radiata pine. This is not compatible with our current general weed control program.

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