Assessment of herbicides for selectively controlling broom (*Cytisus scoparius*) growing with *Pinus radiata*

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Summary Broom (*Cytisus scoparius* (L.) Link) is an invasive weed in many commercial radiata pine (*Pinus radiata* D.Don) plantations throughout New Zealand. As broom competes strongly with newly planted pine seedlings and has an abundant seed bank that persists longer than the forest rotation cycle, ongoing broom control is essential to prevent significant loss of production. A variety of herbicides are available to selectively control the established broom seedlings during the first year after planting pines but there is little published information describing which are safest for pines and most effective as the broom grows older. In this study, we evaluated the efficacy of six selective herbicides: (1) 450/300 g a.i. ha^{-1} clopyralid/picloram, (2) 1500/300 g a.i. ha^{-1} clopyralid/triclopyr, (3) 1500/50/4/150 g a.i. ha^{-1} clopyralid/picloram/triclopyr/aminopyralid, (4) 500 g a.i. ha^{-1} fluroxypyr, (5) 10 kg a.i. ha^{-1} terbuthylazine, and (6) 6 kg a.i. ha^{-1} hexazinone, applied at three rates (the recommended rate shown above, half this rate and double this rate) in controlling broom of various ages (3, 6, 9 and 12 months). Effects of these herbicides on 12-month-old *P. radiata* plants were also assessed, and all treatments were compared against untreated broom and pine plants.

Broom seedlings were established from seed individually in 1.2 L planter bags of potting mixture at 3 monthly intervals prior to all plants being sprayed on 18 December 2008. Likewise, the pine seedlings were transplanted into planter bags as 9-month-old seedlings from a commercial nursery 3 months prior to spraying on the same date as the broom. All herbicide treatments were applied using a precision gas-powered plot sprayer at a rate equivalent to 300 L ha^{-1}, and all treatments apart from the hexazinone were applied with an organosilicone surfactant. Damage to plants was scored at regular intervals afterwards, and changes to plant height and stem diameter were also measured. All plants were cut at ground level in June 2009, dried at 80°C and weighed.

Our results indicated that excellent broom control was obtained using recommended rates of a clopyralid/triclopyr mixture and also a clopyralid/triclopyr/picloram/aminopyralid mixture, though both treatments did not quite give 100% control of the oldest and the youngest cohorts of broom. The clopyralid/picloram mixture also gave good control, although was not quite as effective as the above two mixtures. Terbuthylazine gave excellent control of the three youngest broom cohorts, but the oldest broom was quite tolerant. Hexazinone caused 80–100% mortality at the highest rate, but was not as effective as terbuthylazine at recommended rates. All of these herbicides caused no significant damage to radiata pine, even at double the recommended rates (apart from double the recommended hexazinone rate). Fluroxypyr is not registered for use in radiata pine or on broom but was also assessed. Although the highest rate used (900 g a.i. ha^{-1}) gave good control of broom, lower rates performed quite poorly. However, the damage caused to radiata pine was considered too great to make this chemical worth further consideration.

Keywords Selective herbicide, forestry, *Cytisus scoparius*, *Pinus radiata*.

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