

Control of *Delairea odorata* (Cape Ivy) in native forest with the herbicide clopyralid

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Summary

Two exploratory trials were carried out in the Sherbrooke Forest to evaluate the selective herbicide Lontrel (active constituent 300 g L⁻¹ clopyralid) for the control of *Delairea odorata* Lemaire (syn. *Senecio mikanioides* Otto ex Walp.) (Cape Ivy). This introduced plant is a widespread bushland weed in southern Victoria and elsewhere in Australia.

Within 11 weeks of treatment, good control was obtained with Lontrel applied using either hand-held rope-wick or controlled-droplet applicators. Summer and winter applications resulted in similar levels of control. However, in the absence of follow-up treatment, *D. odorata* had re-colonised the plots to 50-70% of the original extent within 12 months. For long-term control, follow-up chemical or manual/mechanical treatment within 6-9 months of the initial treatment is clearly essential.

The trials and the literature show that Lontrel has the potential to cause damage to at least some plant species in the following families: Asteraceae, Mimosaceae, Fabaceae, Solanaceae, Monimiaceae, Urticaceae and Bignoniaceae. Accordingly, where native species in these families occur in association with *D. odorata*, any application of Lontrel should be carried out carefully. Though further research is needed to confirm the most appropriate Lontrel application rates and timing, this study has identified an effective control method for *D. odorata*.

Introduction

Delairea odorata (syn. *Senecio mikanioides*)* (Cape Ivy, Ivy Groundsel or German Ivy) is a perennial, semi-climbing plant that is indigenous to South Africa. It occurs as a weed in South Australia, Tasmania, New South Wales and Victoria (Willis 1972). In Victoria it is now widespread in southern districts from Portland and Warrnambool on the western coast, to Wilsons Promontory, and to Mallacoota in far East Gippsland (Flora Survey Group, Dept. Conservation, Forests and Lands (CFL), unpubl.). *D. odorata* grows and spreads most vigorously in moist, semi-shaded environments, such as damp gullies with tree cover. In these situations it forms a loose mat up to 30 cm deep,

and may climb up (and cover) taller vegetation and tree trunks to heights of about 5 m (Figure 1). The leaves usually have six, pointed lobes and are distinctively light green and fleshy; the dense yellow flower heads are conspicuous during flowering in winter (Lamp and Collet 1984, FOSF and CFL 1985).

D. odorata is distinguishable from the similar but more common *Hedera helix* L. (English Ivy) by its lighter green and softer leaves and stems, and its yellow flowers. *D. odorata* belongs to the Asteraceae plant family which is botanically unrelated to that of *H. helix* (Araliaceae).

In recent years, *D. odorata* has apparently increased in extent and intensity of infestation in many forest areas, and Adair (1987) has classified it as one of Victoria's more serious 'environmental' weeds.

In Sherbrooke Forest (within the Dandenong Ranges National Park) there are severe infestations of both *H. helix* and *D. odorata*, especially along roadsides. Although manual removal methods (by voluntary workers) have been used against *H. helix* in the Park, a less resource-demanding method for the control of *D. odorata* was sought by the Department of Conservation, Forests and Lands.

This report describes two small, exploratory trials established in Sherbrooke Forest near Kallista, designed to provide preliminary information on (i) whether the selective herbicide Lontrel was active against *D. odorata*, (ii) if so, the best method, rate, and season of application, and (iii) any adverse effects of Lontrel on native plant species growing in association with *D. odorata*. Lontrel (active constituent 300 g L⁻¹ clopyralid) was selected for the trials because it effectively controls many species in the Asteraceae family (Dow 1981).

Study area

The 811 ha Sherbrooke Forest lies 36 km east of Melbourne. The area has a high annual rainfall (1400 mm at Kallista) and deep, fertile soils. In the experimental area, 50-60 m tall *Eucalyptus regnans* F. Muell. (Mountain Ash) is the dominant species, with *Acacia dealbata* Link. (Silver Wattle), *Olearia argophylla* (Labill.) Benth. (Musk Daisy-bush), and *Cyathea australis* (R. Br.) Domin. (Rough Tree-fern) being three of the most common, native understorey species.

Materials and methods

Trial 1

In this initial trial, Lontrel was applied on 30 June 1983 using a hand-held rope-wick applicator (a Winstone Weed Wiper) to *D. odorata* on a 3 m x 3 m plot. The temperature was about 12°C and some rain fell about four hours after herbicide application. The dilution ratio was 1 part Lontrel to 2 parts water, which is the same ratio as that recommended by the rope-wick manufacturer for other herbicides. *Polystichum proliferum* (R. Br.) C. Presl (Mother Shield-fern), *H. helix*, and some *Rubus fruticosus* spp. agg. (Blackberry) occurred within and beneath the 'blanket' (90-95% cover) of *D. odorata* on the plot.

To check on their tolerance to Lontrel, stems and foliage of the following native species growing adjacent to the 9 m² plot were also deliberately treated: *O. argophylla*, *Coprosma quadrifida* (Labill.) B.L. Robinson (Prickly Currant-bush), *Pandorea pandorana* (Andr.) Steenis (Wonga Vine), and *Helichrysum dendroideum* N.A. Wakefield (Tree Everlasting). The exotic garden escape, *Crococsmia x crocosmiiflora* (Montbretia) which is common on road verges (FOSF and CFL 1985), was also treated.

The effects of Lontrel on treated plants were visually monitored at periodic intervals for the three years to June 1986.

Trial 2

This trial, established on 13 January 1984, was designed to build on the initially promising results from Trial 1. Lontrel was applied in summer (compared with winter in Trial 1)

Table 1. Details of trial 2 for *D. odorata* control, Sherbrooke Forest.

Method of application	Dilution of Lontrel with water	Approx. Lontrel application rate (L ha ⁻¹)	Approx. plot area (m ²)
Rope-wick	1:2	6 - 8	25
Controlled-droplet applicator	1:3	2.5 ⁺	65
Controlled-droplet applicator	1:1	5.0 ⁺	55

* Footnote: Botanical nomenclature in this report follows Forbes and Ross (1988).

⁺ Using the smallest nozzle (blue) the flow rate at both dilutions was 1.2 mL sec⁻¹, which, at an operator walking speed of 1 m sec⁻¹, would result in the indicated application rates.

Table 2. *Delairea odorata* cover (% of area) following Lontrel treatments in Trial 2, Sherbrooke Forest, 1984-86.

Treatment	Pre-treatment cover (13.1.1984)	Time(date) after treatment		
		11 wks (28.3.1984)	59 wks (28.2.1985)	121 wks (5.6.1986)
Rope-wick (6-8 L ha ⁻¹)	95	10	60-70	80
Controlled-droplet (2.5 L ha ⁻¹)	90	5	50-60	70-80
Controlled-droplet (5.0 L ha ⁻¹)	90	5	40-50	80

Table 3. Damage to native and exotic plant species 6-12 months after application of Lontrel herbicide at 2.5 - 8.0 L ha⁻¹, Sherbrooke Forest.

Species and family (classified by growth habit)	Common name	Observed damage category ⁺			
		1	2	3	4
Tall shrubs (1.5-5 m) incl. young trees and tree ferns					
<i>Acacia dealbata</i> (Mimosaceae)	Silver Wattle		x		
<i>Cyathea australis</i> (Cyathaceae)	Rough Tree-fern	x			
* <i>Cestrum elegans</i> (Solanaceae)	Cestrum			x	
<i>Eucalyptus regnans</i> (Myrtaceae)	Mountain Ash	x			
<i>Hedycarya angustifolia</i> (Monimiaceae)	Austral Mulberry		x		
<i>Helichrysum dendroideum</i> (Asteraceae)	Tree Everlasting			x	
* <i>Ilex aquifolium</i> (Aquifoliaceae)	Holly	x			
<i>Olearia argophylla</i> (Asteraceae)	Musk Daisy-bush			x	
<i>Prostanthera lasianthos</i> (Lamiaceae)	Christmas Bush	x			
Low shrubs (0.5-1.5 m) incl. ferns					
* <i>Berberis darwinii</i> (Berberidaceae)	Darwin's Barberry	x			
<i>Coprosma quadrifida</i> (Rubiaceae)	Prickly Currant-bush	x			
* <i>Crocsmia x crocosmiiflora</i> (Iridaceae)	Montbretia	x			
<i>Histiopteris incisa</i> (Dennstaedtiaceae)	Batswing fern		x		
<i>Pimelea axiflora</i> (Thymelaeaceae)	Bootlace Bush	x			
<i>Polystichum proliferum</i> (Dryopteridaceae)	Mother Shield-fern	x			
<i>Urtica incisa</i> (Urticaceae)	Scrub Nettle			x	
Ground creepers and climbing vines					
<i>Cynoglossum latifolium</i> (Boraginaceae)	Forest Hound's-tongue		x		
* <i>Hedera helix</i> (Araliaceae)	English Ivy	x			
<i>Pandorea pandorana</i> (Bignoniaceae)	Wonga Vine			x	
* <i>Rubus fruticosus</i> spp. agg. (Rosaceae)	Blackberry		x		
* <i>Delairea odorata</i> (Asteraceae)	Cape Ivy				x

- + 1. No damage observed
 2. Minor damage, e.g. leaf distortion
 3. Substantial damage, e.g. dieback, but recovery evident
 4. Major damage, e.g. substantial mortality.

* Exotic species.

using both a controlled-droplet applicator (a Micron Herbi) and a rope-wick applicator (Figure 2). Treatment details are given in Table 1.

At the time of treatment, air temperature was about 20°C, relative humidity was about 50%, it was sunny, and foliage was dry; no rain fell for at least 24 hours after application. Because of the presence of logs and bushes, and undulating terrain, it was relatively difficult to achieve even coverage, par-

ticularly with the controlled-droplet applicator.

The three treated plots had 90-95% cover of *D. odorata* with common associated species being *P. proliferum*, *Cynoglossum latifolium* R. Br. (Forest Hound's-tongue), *Cestrum elegans* (Brongn.) Schlecht. (Cestrum), *R. fruticosus* spp. agg., *Urtica incisa* Poir. (Scrub Nettle), and *C. x crocosmiiflora*.

As in Trial 1, the responses of the plants in

the treated plots were visually assessed, at 11, 59, and 121 weeks after treatment.

Results

Trial 1

Eleven weeks (13 September 1983) after Lontrel application, the treated *D. odorata* was severely defoliated, with only a few green stems remaining. The associated species were unaffected, showing fresh growth. The treated branches of *O. argophylla* and *H. dendroideum* (both in the same family as *D. odorata*) were moderately to severely defoliated. *P. pandorana* had suffered tip dieback but was re-shooting. No damage to *C. quadrifida* or *C. x crocosmiiflora* was observed.

Inspection at 27 weeks (13 January 1984) showed that good control of *D. odorata* had been maintained, and no further dieback was apparent on the three species previously partly defoliated. A third inspection at 37 weeks (28 March 1984) showed that invading *D. odorata* had covered about 10% of the 9 m² plot. *R. fruticosus* had responded to the reduction of competition and had covered 30% of the plot. The final inspection, on 5 June 1986, almost three years after treatment, revealed that the *D. odorata* had re-colonised strongly and covered about 70% of the plot area.

Trial 2

D. odorata cover as estimated before and after treatment is shown in Table 2. By 11 weeks, cover had been dramatically reduced from the initial 90-95% to 5-10% in each treatment. However, not all stems and roots were killed and apparently it was from these organs that fairly rapid regrowth occurred (Table 2).

The native ground-creeper *C. latifolium*, which was smothered under the *D. odorata* 'blanket', was not damaged by the Lontrel treatment and responded to the reduction in competition by increasing in extent. However, by June 1986 the *D. odorata* had once again over-topped the *C. latifolium*. *R. fruticosus*, which was present to a limited extent prior to treatment, spread only slowly after the reduction of *D. odorata* cover.

The observed responses of the other species (both native and exotic) growing in the treated areas are given in Table 3, which also includes observations made during Trial 1.

Discussion

Control of *D. odorata* was initially equally effective with the rope-wick applicator and the controlled-droplet applicator. Experience with these two methods of application in this study and elsewhere (e.g. Fagg 1988), shows that:

- though the controlled-droplet applicator is 2-3 times faster, the herbicide can be more selectively applied with the rope-wick;
- the controlled-droplet spray can penetrate

weed-infested shrubs, which can be an advantage over the rope-wick; and iii) the rope-wick is cheaper, lighter, and easier to calibrate and maintain than the controlled-droplet applicator.

It should be noted that application with 'high-volume' equipment such as knapsacks or tank/pump sprayers, would involve much greater dilutions of herbicide than those used in this study. However, high volume applications would usually not be appropriate in situations where there are sensitive, non-target plant species.

There was no clear difference in the extent of *D. odorata* control between winter and

summer applications, indicating that year-round treatment is probably feasible. Further tests would be needed to confirm this.

A similar level of control was obtained with both rates of Lontrel applied with the controlled-droplet applicator. This suggests that a dilution in excess of 1:3 could be effective. Similarly, a greater dilution than the 1:2 used in the rope-wick applicator could be effective, but further replicated trial work is needed to ascertain the most effective rates.

Slight spray drift associated with the controlled-droplet application was probably responsible for the damage to *A. dealbata* and *H. angustifolia* (Table 3), as these species

were not deliberately sprayed, in contrast to *H. dendroideum*, *O. argophylla*, and *P. pandorana*, branches of which were intentionally treated as part of Trial 1. The only other native species identified as incurring more than minor damage was *U. incisa*: it was initially heavily defoliated, but vigorous basal regrowth was observed within 12 months of treatment.

Previous studies have also shown that several species in the plant families represented in this study (Table 3), and others such as Fabaceae, are susceptible to Lontrel (Dow 1981, Fagg and Borschmann 1985). Thus, any operational treatment of *D. odorata* with Lontrel, particularly with a spraying system, should be carefully planned and applied to minimise potential damage to native species in the following families: Asteraceae, Mimosaaceae, Fabaceae, Solanaceae, Monimiacae, Urticaceae and Bignoniaceae. However, several major families such as Myrtaceae, Poaceae, Brassicaceae, Rutaceae, Lamiaceae and Rhamnaceae are generally tolerant of Lontrel (Dow 1981, Fagg and Flinn 1983, Fagg, unpubl. data).

Apart from *D. odorata*, the only other exotic species to be substantially damaged by Lontrel was *Cestrum elegans*: Leaf distortion and tip dieback was still evident 59 weeks after treatment, though vigorous regrowth was present by 121 weeks.

No detailed observations of the means regeneration of *D. odorata* were made, though in Trial 2 it appeared that regrowth was originating from surviving rooted stems. As seed germinates readily and cuttings strike easily (Jones and Gray 1988), complete eradication of *D. odorata* is unlikely to be successful if any live stem material remains on the site.

It is suggested that a control strategy for *D. odorata* should concentrate on (a) new, isolated infestations that could feasibly be eradicated, and (b) advancing edges of an existing infestation. To control *D. odorata* adequately in the long term, it is clear that follow-up treatment is essential after the first Lontrel application, although this aspect was not investigated in this preliminary study. However, it is considered that the follow-up treatment could take the form of either a second Lontrel application 6 - 9 months after the first treatment or a manual/mechanical removal using the Bradley Method (Hickey 1981). It is apparent that native species such as *C. latifolium* and ground ferns, occupying the ground-cover niche, do not have the ability to compete successfully with *D. odorata* unless this species is effectively controlled for a lengthy period.

Lontrel is a herbicide of low toxicity to mammals, birds, bees and fish; the LD₅₀ (rats) is 4300-5000 mg kg⁻¹; for human skin it is classed as a mild irritant on repeated or prolonged contact, and the concentrate is a severe eye irritant (Worthing 1983). How-



Figure 1. *Delairea odorata* climbing and smothering other vegetation in Sherbrooke Forest. February 1985.



Figure 2. A 'blanket' of *Delairea odorata* in *Eucalyptus regnans* forest in Sherbrooke Forest being treated with Lontrel herbicide using a rope-wick applicator. January 1984.

ever, provided that the necessary protective clothing is worn, Lontrel presents no hazards to the user. It is moderately persistent in soil, having an average half-life of 73 days (Dow 1981). Stream-water is most unlikely to become contaminated above the recommended maximum limit for human consumption (1.0 mg L^{-1}) if adequate buffer strips beside running streams are left unsprayed (Leitch and Fagg 1986).

Conclusions

1. The herbicide clopyralid (as Lontrel) was effective in the initial control of the exotic weed *D. odorata*, without posing a threat to most native plants in the study area. However, follow-up treatment using chemical or manual methods would be essential for long-term control.
2. Any operational treatment of *D. odorata* with Lontrel should be carefully planned and executed, to minimise potential damage to native species in several families, such as Asteraceae, Mimosaceae, and Fabaceae.
3. Lontrel may be applied with a hand-held rope-wick applicator or a controlled-drop-let applicator (the latter is quicker but less selective) at dilutions with water of 1:2 or 1:3 respectively. Greater dilutions may be effective, but further research is needed to evaluate these, as well as other possible application equipment.

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