HERBICIDE GELS FOR CONTROLLING OLD MAN'S BEARD (*CLEMATIS VITALBA*) IN ECOLOGICALLY SENSITIVE AREAS

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ABSTRACT

Old man's beard (*Clematis vitalba*) is a significant environmental weed and can completely smother the growth of native vegetation in many New Zealand parks and reserves. Current herbicide application techniques are either not effective on the weed or can have non-target effects on adjacent native plant species. HortResearch has developed herbicidal gels for the direct application to cut stems to selectively kill target plants. The gels were formulated with a range of active ingredients. Picloram-based gels were the most effective treatments on old man's beard without causing any non target effects.

Keywords: old man's beard, herbicide, gel, plant ecology.

INTRODUCTION

The invasive vine old man's beard (*Clematis vitalba*) is wide-spread throughout New Zealand and infestations can be found in urban and rural areas, native reserves and national parks from Auckland to Southland (Owen 1997). The vine was introduced to New Zealand from the United Kingdom in the early 1900's (West 1992) and grows vigorously in the New Zealand climate. It has had a significant impact in many reserves because of its climbing and smothering growth habit (West 1992). It has been listed as a noxious plant by most territorial authorities in New Zealand (Southland Regional Council 1999; Environment Waikato 1996).

Blanket spraying of herbicides is the most common technique recommended for controlling the weed (Environment Bay of Plenty 1998) but the over-spray can potentially contaminate the environment, impact on the local ecology, affect human health (Wheeler 1999) or damage non-target plant species (Ryan 1985). All these issues are becoming increasingly important when deciding on the most appropriate strategy or herbicide application technique for controlling weeds. Some urban councils have, or are looking to introduce, weed management policies to restrict or even ban the foliar application of herbicides in designated areas (Davis and Billingham 1999). There is strong desire now from many territorial weed managers for targeted herbicide application technologies to selectively kill weeds growing in environmentally sensitive areas.

The development and application of herbicidal gels to the cut stem of weeds for selective control has been described previously (Ward and Henzell 1999). The benefit of gels is that they adhere to cut stems and allow the active ingredient to be absorbed directly into the plant. The product can be provided in a ready-to-use form which avoids the mixing of chemicals and handling of concentrated solutions by the operator. Sufficiently high concentrations of active ingredient can be incorporated into the gel to help ensure effective control is achieved with a single application. This is important for effective weed control within the conservation estate as many areas are only visited occasionally (every 3-5 years) by DOC staff. This paper summarises results from three trials over the 1995-99 period on the efficacy of a range of herbicidal gels for killing old man's beard.

METHODS

Efficacy trial 1 (late spring application)

Twenty treatments were applied on 27 and 28 November 1995 to mature vines in different areas of native bush in the Taihape Scenic Reserve. Each treatment was applied at about 1 m above ground level to 10 individual cut stems of old man's beard canes growing up trees within an approximately 5 m² plot. Three replicates of each treatment were used giving a total of 30 canes per treatment). Only the lower part of canes ascending trees were treated to ensure the treatment was applied to cut-stems attached to the crown. The cane length from the treated stem to the crown varied from 2 to 5 metres. Technical products of picloram (potassium salt), triclopyr (amine salt), metsulfuron, phosphorous acid and sodium chlorate plus a commercial formulation of Tordon 50-D (picloram + 2,4-D) were used at rates shown in Table 1. Treatment effects were observed 11 and 17 months after application.

Efficacy trial 2 (winter application)

Twenty one gel treatments were applied at 3–5 mm thick over the cut stems of canes on 30 August 1996. The trial site was also in the Taihape Scenic Reserve close to the spring application site. The trial layout and treatments tested were the same as those used in the spring trials except that Tordon 50-D was tested over a wider concentration range and sodium chlorate was omitted. Treatment effects were observed at 7 and 24 months after application.

TABLE 1: Effect of a range of herbicidal gel treatments applied in late spring 1995 to cut stems of old man's beard vines at 17 months after treatment.

Treatment	Rate (a.i. %)	Dead canes (%)
picloram	4.0	100
	2.0	44
	1.0	100
	0.5	50
	0.25	30
Tordon 50-D ¹	8.0	70
	4.0	57
	2.0	80
	4.5	44
triclopyr	2.0	50
	1.0	30
	1.0	56
	0.5	33
metsulfuron	0.25	67
	0.13	20
	5.0	30
	1.0	30
sodium chlorate	5.0	13
	1.0	33
	0	29
pruned control	0	29
Maximum LSD (P<0.05)		49

¹Gels containing 8% active ingredient contained 1.6% picloram and 6.4% 2, 4-D

Management trial (late spring application)

The site chosen for the management trial was a circular area of approximately 1000 m² densely covered in native trees at the Taihape Reserve. The trial area was divided into four quarters. All the vines in two quarters were cut and treated with 5% picloram gel and all vines on the other two quarters were cut and treated with 1% picloram gel. The treatments were applied on 25 November 1997 by four DOC field

staff using TIPIT™ gel pruners and prototype loppers, or TIPIT™ gel pruners and a pruning saw. Before any treatments were applied, staff were instructed on how to use the pruners and loppers along with health and safety issues associated with the use of picloram. DOC staff were then paired and each pair applied the 1% and 5% picloram gel treatments. The treated canes varied between 3 and 50 mm diameter. At 2 hours after application all the gels appeared to have been absorbed by the cut stem.

Most canes growing up trees were cut and treated at around 1 m above ground level. On the larger canes or crowns present at ground level the canes were treated at ground level. The 1 and 5% treated plots contained an average of 2.9 and 1.9 canes/m² respectively. The average amount of gel applied in the plots varied between 2.0 and 2.5 g/cane. A final assessment of treatment effects was carried out at 14 months after application. The plots were assessed periodically prior to this assessment to monitor the efficacy of treatments and any effects on adjacent plant species.

RESULTS

Efficacy Trial 1 (late spring application)

Both the 1 and 4% picloram gel treatments were completely effective (Table 1). Of the remaining treatments, the Tordon 50-D formulations containing 2 to 8% active ingredient were marginally inferior to the picloram alone treatments, killing between 57 and 80% of treated canes. By the first assessment dieback up to 5 metres had occurred on canes treated with the picloram gels and this was generally back to the roots on the cane nearest the crown or to the crown itself. Root decay was clearly evident and the canes could be easily pulled out of the ground with roots intact. At the final assessment most of the dead canes from these treatments were found lying on the ground and in many cases were covered by undergrowth. There was no sign of toxicity around the base of these canes indicating all or most of the herbicide was taken up and confined within the target plant.

TABLE 2: Effects of a range of herbicidal gels applied in winter 1996 to mature old man's beard vines at 24 months after treatment.

Treatment	Rate (a.i. %)	Dead canes (%)
picloram	4.0	73.3
	2.0	10.4
	1.0	31.4
	0.5	10.4
	0.25	20.4
Tordon 50-D ¹	8.0	26.6
	4.0	15.7
	2.0	6.7
	1.0	29.5
	0.5	38.9
triclopyr	0.25	24.4
	4.5	21.7
	2.0	24.1
	1.0	20.0
	1.0	30.0
metsulfuron	0.5	37.0
	0.25	39.0
	0.13	17.4
	0.06	22.2
phosphorous acid	5.0	3.3
pruned control	0	3.3
LSD (P<0.05)		30.1

¹Gels containing 8% active ingredient contained 1.6% picloram and 6.4% 2, 4-D.

The herbicidal gels containing 1% metsulfuron or 2.0-4.5% triclopyr affected only about half the treated canes. For these treatments, root decay on canes was minimal with dieback in most cases back to the first roots where the cane touched the ground. Phosphorous acid and sodium chlorate, each at a 5% concentration in the gel, were ineffective.

Efficacy Trial 2 (winter application)

At the final assessment of the winter application trials, the 4% picloram gel treatment was the only effective treatment (Table 2) but the level of control achieved was less than the late spring application.

Management trial (late spring application)

At the final assessment, 98.8% of stems treated with the 5% picloram gel treatment by DOC field staff were dead and there were no viable crowns evident on the treated areas. This compared with an 81% kill of stems treated with the 1% picloram gel (Table 3). No dead, dying or epinastic effects were evident on any adjacent plant at any assessment.

TABLE 3: Efficacy of large scale applications of 1 and 5% picloram gel on cut stems of old man's beard at 14 months after treatment.

Picloram (%)	Stems treated (no.)	Dead stems (%)
1	425	81.2
5	480	98.8

DISCUSSION

At the initial assessment after one growing season, gels containing metsulfuron or glyphosate looked promising. By the final assessments after two seasons growth, canes treated with these gels showed no signs of root decay and had numerous regrowths mostly originating from the first roots in contact with the ground. The picloram-based gels were clearly the more effective treatments, with late spring a better time than winter to apply the gel treatment. The 4% picloram gel was still effective when applied in winter. At the final assessments all the treated canes were tracked back to their roots. On canes treated with the effective picloram gels, the length of dieback on some canes were up to 5 m from the point of treatment and all roots originating from nodes had rotted showing excellent translocation of the herbicide. For the Tordon 50-D (picloram + 2,4-D) gel formulations the maximum rate of active ingredients applied (8%), which contained 1.6% picloram and 6.4% 2,4-D, was no more effective than the gel containing 1% picloram alone.

The management trial was used to determine if a 1 or 5% picloram gel would be appropriate for general use in the field. This trial clearly showed that the 5% gel was the preferred option as it was almost totally effective with no viable old man's beard crowns remaining on the plot and very few shoots of old man's beard growing in the upper native bush canopy two growing seasons after treatment. No collateral effects on nearby untreated plants were identified on either the 1% or 5% treated plots. Furthermore, in field operations DOC staff can spend more time beating through the bush locating the vine than treating the infestation. For this reason it is important that the gel treatment used should be very effective to justify the time and effort spent in finding the vines. To achieve complete containment of old man's beard at a site follow-up treatment of seedlings is required.

DOC field staff mostly applied the treatments using the TIPIT™ gel pruner. They thought this was a practical tool for pruning and applying the gels to the cut stems which were mostly 3-25 mm diameter and generally very flimsy to treat. A two-handed operation is needed to prune and treat canes, with one hand holding the pruner and the other holding the cane. Some larger vines were cut using a pruning saw and then treated using the gel pruner to apply the gel.

The field staff considered gel pruning was an excellent technique for targeting old man's beard in native bush where typically the vine needs to be controlled without contaminating or affecting adjacent native plant species. An initial inspection at four weeks after treatment showed only 60-90% of old man's beard canes in the plots had been treated in the first pass. This highlighted the difficulty in locating and treating all canes in a single pass. As a result, a second treatment pass was carried out on the plots six weeks later to treat the remaining vines in the plots.

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