Recommendations for the control of artichoke thistle (*Cynara cardunculus* L.) with dicamba and picloram

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SUMMARY

Recent screening trials have shown that lowering the recommended dilution rate of picloram (5% a.i.)/2,4-D amine (20% a.i.) formulation from 1:150 to 1:300 for overall spot spray application to artichoke thistle (*Cynara cardunculus* L.) did not adversely affect the levels of control achieved. Control of mature thistle and establishment of seedlings in the year following spraying did not differ between dilution rates used. Dicamba, which is a much less persistent herbicide than picloram was also highly effective when applied at dilutions of 1:300 of a 20% a.i. liquid formulation or as 2.5 g of a 10% a.i. granular formulation applied at the centre of the developing crown.

INTRODUCTION

Artichoke thistle (*Cynara cardunculus* L.) is an erect perennial growing to heights of 1.8 m. It reproduces from both seeds and a long perennial taproot. In Victoria the most heavily infested areas are poorly managed pastures on heavy, basaltic clay soils.

In the past, effective control of artichoke thistle has been achieved by overall spot spraying using a liquid formulation containing a mixture of picloram (5% a.i.) and 2,4-D amine (20% a.i.) at dilutions of 1:150 (Parsons, 1973). Levels of seedling survival following germination in the following season are also much reduced by this treatment. However, at this rate the high levels of picloram which may persist in the soil for up to two years following treatment may be undesirable. Dicamba is a much less persistent herbicide than picloram and may be effective against artichoke thistle.

Two screening trials conducted in November/December 1975 and November 1976 were designed to test the effectiveness of dicamba and dicamba formulated with 2,4-D amine compared with various dilutions of a picloram/2,4-D formulation for control of artichoke thistle.

METHODS AND RESULTS

In the first trial three dicamba amine formulations, a 20% a.i. liquid, a 10% a.i. granule and a mixture of dicamba (8% a.i.) and 2,4-D amine (30% a.i.) were compared with the presently recommended picloram (5% a.i.)/2,4-D amine (20% a.i.) formulation (Anon, 1975).

The second trial was designed to confirm the results obtained in the first trial and to establish whether the recommended dilution of 1:150 for the picloram/2,4-D formulation when applied as a high volume spot spray could be reduced without adversely affecting the degree of control achieved.

Both trials were conducted at the Organ Pipes National Park situated on the volcanic plains north-west of Melbourne. Soil type at the trial sites was a heavy black volcanic clay. The area had an almost total cover of thistles with an average of 9 established plants per m^2 at the first site and an average of 15 established plants per m^2 at the second trial site.

Trial No. 1

The plot size was 3 m x 5 m and there were two replicates. Artichoke thistle foliage was sprayed to the point of run-off using a Drake and Fletcher mistifier knapsack fitted with a single hollow cone jet on a hand wand. For the granular treatments, 20 plants were marked in each plot and herbicide was placed onto the crowns of the plants. Granules were applied in November and plots were sprayed in December. At the times of application mature plants were beginning to grow flowering stalks. Rates of herbicides used and the control level achieved 9 months after spraying, are presented in Table 1.

Seed germination was tested on seed collected from five flowering heads per treatment 8 weeks after spraying. Fifty seeds chosen at random from the seed collected from each treatment were placed on moist seed test paper in glass petri dishes and their germination tested at 30^0C/12 hr light alternating with 15^0C/12 hr dark. Germinated seeds were counted and removed at weekly intervals.

A germination of 80% occurred with seeds from untreated control plots. No seed was produced in the picloram/2,4-D, dicamba/2,4-D (1:150) and dicamba granular (1.25 g, 2.50 g and 5.0 g per plant) treatments. Seed collected from the other treatments was found to be non-viable.

Trial No. 2

Unreplicated 5 m x 25 m plots were sprayed in November 1976. The foliage was wetted to the point of run-off using a high volume spot sprayer fitted with a Spraying Systems D45-6 cone nozzle and operated at 700 kPa. The rates of herbicide used, and the levels of control assessed 7 months after treatment, are presented in Table 2.

The residual effect of the herbicides 7 and 9 months after treatment was assessed by counting the number of artichoke thistle seedlings which had emerged. The percentage ground cover of other species was also estimated at this time. The results presented in Table 3 are the mean percentages of ground cover (visual assessment) in five 1 m x 1 m quadrats at 7 and 9 months after treatment.

DISCUSSION

All the herbicides screened gave good control of artichoke thistle. Dicamba liquid and the picloram/2,4-D formulation gave in excess of 85% control at concentrations down to 1:750. The dicamba/2,4-D formulation also gave in excess of 85% control at concentrations of 1:500 or higher. Over 90% control was achieved using dicamba granules when applied to the crown of the thistle at a rate of 2.5 g or higher.

Visual observations 2 months after the establishment of the first trial indicated that the most promising treatments were granular dicamba at 1.25 g per plant or greater, the dicamba/2,4-D formulation

Table 1. Herbicide application rates and percent control 9 months after treatment (Trial 1)

Formulation	Active constituents	Dilution	Percent control*
Picloram/2,4-D	picloram 5% a.i.	1:150	99
	2,4-D amine 10% a.i.	1:300	96
		1:500	93
		1:750	89
Dicamba/2,4-D	dicamba amine 8% a.i.	1:150	95
	2,4-D amine 30% a.i.	1:300	91
		1:500	87
		1:750	76
Dicamba liquid	dicamba amine 20% a.i.	1:150	98
		1:300	96
		1:500	94
		1:750	85
Dicamba granules	dicamba amine 10% a.i.	5.00 g/plant	100
		2.50 g/plant	97
		1.25 g/plant	55
		0.6 g/plant	15

* Percent control

$$= \frac{\text{No. of plants in untreated - No. of plants in treated}}{\text{No. of plants in untreated}} \times 100$$

Table 2. Percent control and seedling emergence 7 and (9) months after treatment

Treatment	Dilution	Percent control	Average No. seedlings/m^2
picloram/2,4-D	1:150	99	50 (7)
picloram/2,4-D	1:300	92	70 (9)
dicamba liquid	1:150	94	170 (93)
dicamba liquid	1:300	87	160 (80)
untreated control	-	0	- (87)

Table 3. Analysis of ground cover 7 and (9) months after treatment

Treatment	Dilution	% bare ground	% ground cover		
			Thistle seedlings	grasses	broadleafs
picloram/2,4-D	1:150	95 (94)	5 (<1)	<1 (2)	1 (4)
picloram/2,4-D	1:300	40 (60)	9 (1)	15 (24)	15 (15)
dicamba liquid	1:150	50 (48)	20 (13)	10 (15)	20 (15)
dicamba liquid	1:300	25 (10)	19 (12)	15 (63)	50 (7)
untreated*	-	- (51)	- (19)	- (15)	- (12)

* these figures are the mean values obtained after mature (regrowth) artichoke thistle plants were removed from the quadrats.

at 1:150 and the picloram/2,4-D formulation at concentrations of 1:500 or higher. In all the dicamba liquid treatments more than half the flowering heads opened. However, germination tests on seeds from treated plants showed that no viable seeds were produced.

High levels of seedling germination occur during the autumn and winter in areas infested with artichoke thistle. One of the reasons for the Vermin and Noxious Weeds Destruction Board's recommendation of the picloram/2,4-D formulation spot sprayed at 1:150, was the suppression of seedlings in the year following spraying. The results in Table 2 show that the number of live seedlings on the plot sprayed with the recommended picloram/2,4-D rate was 50 seedlings per m^2 7 months after spraying. Nine months after spraying, the mean number of live seedlings had declined to 7/m^2.

These results were comparable to the lower picloram/2,4-D rate of 1:300. Seven months after spraying, the mean number of live seedlings was 70 per m^2, but this had declined to 9 per m^2 by 9 months after spraying. The level of seedling establishment on the dicamba liquid treated plots was comparable to that of the untreated control plots.

The analysis of ground cover made 9 months after spraying (Table 3) shows the adverse effects associated with picloram persistence. At the 1:150 dilution rate both grasses and broadleaf plants were affected and the total amount of bare ground was greater than for the other treatments. It was felt that an increased erosion hazard and a possible reduction in competition by other species on the artichoke thistle seedlings would occur. The long-term persistence of picloram may also adversely effect a future pasture improvement or cropping program especially where leguminous species are involved. Since excellent control was achieved using the lower rate of the picloram/2,4-D formulation, this rate is preferred to the higher rate for the control of artichoke thistle from the rosette to pre-flowering stage. Dicamba is a much less residual herbicide than picloram and is therefore a useful control method where long-term soil persistence is undesirable. The dicamba liquid formulation at a dilution of 1:300 is the preferred treatment where it is proposed to undertake pasture improvement or cropping in the autumn following spraying. Subsequent

seedling germination may necessitate further spraying with MCPA at 0.7 kg a.i./ha at the tillering to boot stage in oats, wheat or barley (Catt, 1976) or mid to late spring in pasture.

The dicamba/2,4-D formulation would be suitable for artichoke thistle control at dilutions of 1:150 or higher but is not as cost efficient as the dicamba liquid treatment at 1:300.

The 10% granular dicamba treatment at a rate of 2.5 g per crown is useful for the control of sparse infestations of artichoke thistle, cleaning up remaining plants in the second year of a control program or the control of the weed in hazardous situations such as orchards, market gardens or suburban subdivisions.

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