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Chemical control of leafy spurge – a summary

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Introduction

Leafy spurge is an aggressive invader of rangeland, crops, and non-crop areas. It is very difficult to control and eradication may be impossible particularly for large infestations. Several herbicides are currently registered for leafy spurge control each providing a level of control depending upon rate, application timing, and frequency of application. No single herbicide is ideally suited to use in every habitat for leafy spurge control. The user should integrate herbicides into management system where herbicide choice, rate, application timing, and frequency of application are tailored to the environmental situation. The most commonly used herbicides to control leafy spurge are picloram, dicamba, 2,4-D, and glyphosate, whereas fosamine, sulfometuron, and dichlobenil are used less often.

One of the most important aspects of using a herbicide to control leafy spurge, or other creeping perennials, is to apply the herbicide such that the target plant is stressed but desirable plant species are not injured and thus allowed to compete effectively with the weed. Unpublished research conducted at Colorado State University indicates that picloram at 0.5 lb/A provided better long-term leafy spurge control than picloram at 2.0 lb/A. Control averaged 83 and 52% with picloram at 0.5 and 2.0 lb/A, respectively approximately 2 years after treatments were applied. Crested wheatgrass injury was less with the low rate of picloram (3 v. 66%) and most likely effective grass competition allowed by the 0.5 lb rate aided long-term control.

Optimum timing to apply picloram, dicamba, or 2,4-D for effective leafy spurge control is in spring when the weed is in the flowering growth stage (Lym and Messersmith 1985a). Fall applications of these herbicides to leafy spurge regrowth appropriate, but control is not always equivalent to spring applications. Control longevity varies with herbicide and rate. Once leafy spurge topgrowth control falls to 70% or less, infestations resurge rapidly (Table 1) (Lym and Messersmith 1985a, 1985b; Lym and Whitson 1990).

Therefore, continual monitoring of sites is important to determine when to reinitiate control measures to maintain acceptable leafy spurge control.

Table 1. Longevity of leafy spurge control.

	Years without treatment		
Original control	1	2	3
-%-		%	
>95	85	70	<20
80	60	<20	0
70	<30	0	0
60	20	0	0

From Lym and Whitson (1990).

Leafy spurge control with various herbicides

Picloram, 2,4-D, and picloram plus 2,4-D. The traditional approach to control leafy spurge with picloram is to apply relatively high rates (1.0 to 2.0 lb ai/A) as a single application in spring or fall. Indeed, higher picloram rates provided better control than single applications of picloram at 0.25 or 0.5 lb (Table 2). However, high picloram rates are expensive in any given year and grass injury may occur. Lym and Messersmith (1990) found that annual applications of picloram or picloram plus 2,4-D at reduced picloram rates for 3 consecutive years provided 85% or better leafy spurge control 1 year after herbicide treatment (Table 3). Leafy spurge control may not always be equivalent among locations with similar treatments. Unpublished research conducted at Colorado State University indicated that 3 consecutive years of picloram plus 2,4-D at 0.25 + 1.0 lb ai/A applied in spring at the true flowering growth stage provided 59% leafy spurge control at the end of the third year. Drought conditions prevailed at this site for the duration of the experiment and most likely impacted results.

2,4-D. When 2,4-D is applied alone, biannual applications are recommended and typically represent a maintenance program to restrict vegetative spread and reduce seed set.

Table 2. Leafy spurge control with spring-applied picloram in North Dakota.

		Months after treatment		
Herbicide	Rate	3	12	24
	— lb ai/A —		%	
Picloram	0.25	56	30	---
	0.5	58	63	3
	1	76	74	21
	2	93	96	82
LSD (P<0.05)		12	11	26

Lym and Messersmith (1985a).

Dicamba and dicamba plus 2,4-D. Sandoz prescribes a programmed approach to controlling leafy spurge with dicamba where 2.0 lb ai/A of dicamba are applied in spring at the flowering growth stage for 3 consecutive years. Lym and Messersmith (1985b) found that a single application of dicamba at 4.0 lb ai/A provided equivalent leafy spurge control to biannual applications of dicamba at 1.0 lb ai/A over a 27-month period (data not shown). High rates (6.0 to 8.0 lb/A) applied once provided 80 to 90% leafy spurge control for 1 year but reinfestation occurred (Lym and Messersmith 1985a) and the risk of grass injury exists with high dicamba rates (Lym and Whitson 1990). Although applying dicamba at reduced rates over time may not provide better control than a higher rate applied once, grass safety and decreased herbicide expense in any given year are advantages of the programmed approach.

Table 3. Leafy spurge control from annual applications of picloram or picloram combined with 2,4-D at two locations in North Dakota.

		August			June
Herbicide	Rate	1982	1983	1985	1986
	-- lb ai/A --	%			— % —
Picloram	0.25	39	48	48	50
	0.38	65	62	75	72
	0.5	65	71	90	69
Picloram + 2,4-D	0.25 + 1.0	52	66	85	73
	0.38 + 1.0	69	72	91	82
	0.5 + 1.0	71	75	94	88
LSD (P<0.05)		18	14	16	17

From Lym and Messersmith (1986). Treatments began in August 1981 at Dickinson, ND and in June 1982 at Valley City, ND.
Final treatments were applied in 1984. Data averaged over locations.

Lym and Messersmith (1985a) found that biannual applications of dicamba at 1.0 lb or dicamba plus 2,4-D at 0.5 + 2.0 or 1.0 + 2.0 provided 70% or better leafy spurge control 27 months after treatment (Table 4). Unpublished research conducted at Colorado State University indicated that 3 consecutive annual applications at the true flowering stage of dicamba plus 2,4-D at 1.0 + 2.0 lb ai/A provided only 54% control at the end of the third year; however, these treatments were most likely influenced by drought.

Table 4. Leafy spurge control with annual applications of dicamba or dicamba combined with 2,4-D in North Dakota.

		Months after treatment				
Herbicide	Rate	3	12	15	24	27
	-- lb ai/A --	%				
Dicamba	0.5	47	49	38	45	33
	1.0	50	57	70	58	73
Dicamba + 2,4-D	0.5 + 2.0	68	69	84	65	70
	1.0 + 2.0	53	58	65	68	71
LSD (P<0.05)		15	NE	23	NE	NE

From Lym and Messersmith 1985a. Treatments applied biannually.
Non-estimable (NE) due to insufficient number of similar experiments.

Glyphosate and glyphosate tank-mixes. Fall applied glyphosate at 0.75 lb ai/A generally provides 80 to 90% leafy spurge control 1 year after application (Lym and Messersmith 1985a), but a follow-up 2,4-D treatment is needed the following spring to control leafy spurge seedlings (Lym and Messersmith 1990). Leafy spurge control ranged from 3 to 24% and 18 to 32% 12 months after treatment with glyphosate and glyphosate tank mixes when applied in August or September, respectively. In a five-state regional project, grass injury ranged from 0 to 3% with August applications and from 23 to 28% with September applications (Table 5) (Lym *et al*. 1991). Whitson *et al.* (1989) demonstrated that a single season of sequential glyphosate applications followed by seeding perennial grasses, resulted in 88 to 93% leafy spurge control four years after seeding.

Table 5. Leafy spurge control and grass injury 9 and 12 months after treatment (MAT) with glyphosate and glyphosate tank mixes.

		August application				September application			
		9 MAT		12 MAT		9 MAT		12 MAT	
Herbicide	Rate	Control	Grass Injury	Control	Grass Injury	Control	Grass Injury	Control	Grass Injury
	-- lb ai/A --	%				%			
Glyphosate	0.38	36	31	3	0	62	66	18	28
Glyphosate + 2,4-D	0.38 + 0.65	65	27	17	3	73	68	12	25
Glyphosate + Picloram	0.38 + 0.5	93	31	24	0	98	78	32	23
Picloram	0.5	91	13	21	0	96	17	30	17
LSD (P<0.05)		6	5	NS	NS	6	5	NS	NS

From Lym, R.G., K.G. Beck, P.K. Fay, M. Ferrell, and M. Peterson (1991).
NS is non-significant at P<0.05.

Fosamine. Leafy spurge control with fosamine has been inconsistent. Fosamine is typically applied at 6 to 8 lb ai/A in spring when leafy spurge is in the true flower growth stage. Fosamine will provide the best control when soil moisture is abundant and relative humidity is high (Whitson *et al.* 1989).

Sulfometuron and sulfometuron tank-mixes. Sulfometuron and sulfometuron tank-mixes were evaluated in a six-state regional study. Leafy spurge control averaged 11 and 14% 12 months after treatment with sulfometuron at 0.09 and 0.19 lb ai/A, respectively, when spring-applied and 40 and 59% when fall-applied (Table 6). Control was improved when sulfometuron was tank-mixed with picloram at either timing. Generally, fall-applied sulfometuron or sulfometuron plus dicamba or picloram provided satisfactory leafy spurge control, but grass injury was severe. Sulfometuron or sulfometuron tank-mixes are usable in non-crop settings where leafy spurge control is desired and grass injury can be tolerated such as around livestock holding areas, along railroad rights-of-way, and around power stations.

Table 6. Great Plains regional summary of leafy spurge control and grass injury 3 and 12 months after treatment (MAT) spring and fall applications.

		Spring application				Fall application			
		3 MAT		12 MAT		3 MAT		12 MAT	
Herbicide	Rate	Control	Grass Injury	Control	Grass Injury	Control	Grass Injury	Control	Grass Injury
	-- lb ai/A --	%				%			
Dicamba	2.0	32 de	5 cd	6 d	0 a	79 c	10 b	54 c	0 b
Picloram	0.5	57 bc	5 cd	54 b	0 a	92 abc	21 b	54 c	0 b
Picloram	1.0	90 a	5 cd	78 a	0 a	99 ab	27 b	80 abc	1 b
Sulfometuron	0.09	17 e	12 bcd	11 d	15 a	86 bc	84 a	40 c	88 a
Sulfometuron	0.19	24 de	30 ab	14 d	31 a	94 abc	85 a	59 bc	90 a
Sulfometuron + dicamba	0.09 + 2.0	41 cd	31 ab	26 cd	19 a	100 a	80 a	89 ab	86 a
Sulfometuron + picloram	0.09 + 0.5	68 b	24 ab	63 ab	13 a	100 a	85 a	92 a	89 a
Sulfometuron + 2,4-D	0.09 + 1.0	54 bc	22 abc	22 cd	17 a	90 abc	76 a	46 c	57 a
Sulfometuron + 2,4-D	0.19 + 1.0	68 b	38 a	42 bc	29 a	99 ab	89 a	72 abc	93 a
2,4-D	1.0	33 de	2 d	13 d	0 a	21 d	3 b	14 d	0 b

Means in the same column followed by the same letter are not significantly different according to Student-Newman-Kuels mean separation test ($P<0.05$).

Recommendations for various habitats

Open rangeland/pastures. On rangeland or pastures that are situated away from live or ephemeral water channels or where high ground water does not exist, picloram, picloram plus 2,4-D, dicamba, or dicamba plus 2,4-D are logical herbicide choices. Lym and Messersmith (1990) found that picloram plus 2,4-D at 0.25 + 1.0 lb ai/A spring-applied was the most cost-effective treatment in North Dakota (data not shown) yielding a net return of $115 and $44 per acre in eastern and western North Dakota, respectively, and averaged 80% leafy spurge control across all locations.

Near water. Fosamine, 2,4-D amine, and glyphosate are registered to apply near water. Alternative leafy spurge control measures, such as biological control, are appropriate considerations for leafy spurge management near water.

Among trees. Glyphosate and 2,4-D amine can be applied safely near trees because of limited soil activity and if drift onto tree foliage is avoided. Shelterbelts may be prime areas to develop leafy spurge insect predator insectaries and may represent a safer, more effective control strategy than herbicide use among trees.

Non-crop areas. Picloram, picloram plus 2,4-D, dicamba, and dicamba plus 2,4-D can be used to control leafy spurge in non-crop areas. Sulfometuron also can be used in non-crop areas to control leafy spurge if fall-applied and grass injury can be tolerated.

Conclusion

Many effective herbicides are available to incorporate into a leafy spurge management system Herbicides are only part of a good weed management system and herbicides are most effective when they are used in such a manner that the weed is stressed and desirable plants are not injured.

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