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Leafy spurge control following an eight-year management program

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An experiment to evaluate long-term leafy spurge management was established at four sites (Sheyenne National Grassland near McLeod, Sheldon and two near Valley City) in North Dakota in 1980. All sites were established in early June except one site at Valley City which was established in September 1980. The herbicides applied in 1980 included 2,4-D as liquid and picloram as liquid (2S) and granular (2%G) formulations, and picloram applied using the roller and pipe-wick applicators. The conventional broadcast treatments were applied using a tractor-mounted sprayer delivering 8 gpa water at 35 psi. A granular applicator was used to apply the picloram 2%G treatments. Solution concentration in the roller was 0.25 lb/gal; this is the same solution concentration as picloram at 2 lb/A sprayed at 8.5 gpa. The solution concentration was increased for the pipe-wick applicator to picloram at 0.5 lb/gal because the pipe-wick applied about half the total volume per acre as the roller applicator. The roller and pipe-wick applicator height was adjusted to treat the top one-half of the tallest leafy spurge stems. The additive in the roller and pipe-wick treatments was a 5% (v:v) oil concentrate (83% paraffin based petroleum oil plus 15% emulsifier). The plots were 15 by 150 feet and treatments were replicated twice at each site in a randomized complete block design. Each plot was divided into six 7.5 by 50 feet subplots and retreatments of 2,4-D, picloram 2S, dicamba or no treatment were applied in June 1981 except the fall Valley City site which was retreated in August 1981.

Original 1980 whole plot treatments were reapplied in 1982 with several of the treatments changed (see Table). A carpet applicator was substituted for the roller applicator. The carpet applicator was designed by Magnolia Spray Equipment Corp., Jackson, MS, and consists of a 1 by 8 feet carpet attached to a rectangular spray box. The herbicide solution was sprayed onto the backside of the carpet through nozzles inside the spray box. Excess solution was returned to the spray tank. The picloram solution on the carpet applicator was 0.25 lb/gal and 0.4 lb/gal for two and one pass applications, respectively. The granular picloram treatments were replaced by picloram applied with the pipe-wick or carpet applicator with two passes, the second pass in the opposite direction to the first. Dicamba at 8 lb/A spray applied replaced the picloram plus oil concentrate pipe-wick applied treatment. The whole plots were retreated in 1982 with the original treatment except picloram at 2 lb/A was reapplied to the control subplot only since subplots receiving annual retreatments maintained satisfactory leafy spurge control. The experimental site at the Sheyenne National Grasslands was treated in the fall of 1982 to establish an equal number of spring and fall treatment sites. Subplot retreatments were applied again in 1983 through 1987. Evaluations are based on visual percent stand reduction as compared to the control.

In general, leafy spurge control was higher from spring-applied treatments compared to similar fall-applied treatments (Table). Previous research at North Dakota State University has shown spring- or fall-applied treatments to give similar leafy spurge control; however, in this study the fall treatments were applied to leafy spurge plants that had been harvested for yield in July of each year through 1984. Thus, the plants were shorter and in the vegetative growth stage compared to the normal fall growth stage. This reduced the plant leaf area treated and may have resulted in less herbicide uptake and translocation. Even though the plants were not mowed after 1984, the control in 1987 averaged 15% higher for spring- compared to fall-applied treatments, respectively. There was a 23% difference between the two averages in 1986 (data not shown). Thus, control from the fall-applied treatment is gradually increasing.

Picloram (2S) at 1 and 2 lb/A had provided the best long-term leafy spurge control regardless of retreatment in previous evaluations (Table). However, picloram at 1 and 2 lb/A without an annual retreatment (i.e. retreatment control) only provided 27% control when averaged over rate and application date in 1987 but control increased to 84 and 59% for spring and fall, respectively, when averaged over annual retreatments with dicamba at 2 lb/A and picloram + 2,4-D at 0.25 + 1 lb/A. Thus, when higher rates of picloram are applied every few years, there is little advantage in using more than 1 lb/A initially when annual retreatments are applied.

Dicamba at 8 lb/A alone spring applied averaged 4% control, but control increased to 80 and 96% with retreatments of dicamba at 2 lb/A or picloram + 2,4-D at 0.25 + 1 lb/A, respectively (Table). Leafy spurge control from fall-applied dicamba at 8 lb/A also averaged 4% and increased to an average of 68% following retreatments of dicamba at 2 lb/A and 50% following retreatments of picloram at 0.25 lb/A or picloram + 2,4-D at 0.25 + 1 lb/A.

Annual application of 2,4-D, the most economical treatment in the study, provided 3 and 22% leafy spurge control as a fall- and spring-applied treatments, respectively (Table). Leafy spurge control was increased to 96% when the 2,4-D original treatment was retreated with picloram + 2,4-D at 0.25 + 1 lb/A annually in the spring, but the same fall-applied treatment provided only 31% control.

The annual retreatments averaged across all whole plot treatments, that provided the highest leafy spurge control was picloram + 2,4-D at 0.25 + 1 lb/A in the spring (93%) and dicamba at 2 lb/A in the fall (69%) (Table). Annual retreatments of dicamba at 1 lb/A averaged only 38 and 45% leafy spurge control as a spring- or fall- applied treatment averaged over whole plot treatments, respectively. Leafy spurge control was increased 31% when 2,4-D was added to picloram at 0.25 lb/A compared to picloram at 0.25 lb/A alone as an annual treatment spring-applied, but not when fall-applied. Thus, the most practical retreatments when considering both cost and control were picloram at 0.25 lb/A alone in the fall or picloram + 2,4-D at 0.25 + 1 lb/A spring-applied, but dicamba at 2 lb/A would be the retreatment of choice where picloram could not be applied such as in areas with a water table 10 feet or less below the surface.

No treatment using a reduced-volume applicator (i.e., carpet, pipewick, roller) maintained satisfactory control alone. The reduced volume applicators would not have an economic advantage if several annual retreatments were required for satisfactory leafy

spurge control. Several herbicide treatment alternatives provided 90% or more leafy spurge control 7 years after the initial treatment, but no treatment program had eradicated leafy spurge. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo.)

Table. Leafy spurge control in North Dakota following an eight-year management program (Lym and Messersmith).

Whole plot						Retreatment subplot 1981, 1983-87/Rate, lb/A						
Treatment[a] 1980	Rate	Soln conc	Treatment[a] 1982	Rate	Soln conc[b]	2,4-D 1.0	Dicamba 1.0	Dicamba 2.0	Picloram 0.25	Picloram +2,4-D 0.25+1.0	Control 0	Mean
	(lb/A)	(lb/gal)		(lb/A)	(lb/gal)	(% control)						
Spring applied												
2,4-D	2.0	0.24	2,4-D	2.0	0.24	22	40	64	55	96	0	47
Picloram 2%G	1.0	–	Picloram (carpet-2 pass)	–	0.25	72	20	70	69	96	0	54
Picloram 2%G	2.0	–	Picloram (wick-2 pass)	–	0.5	81	45	79	75	98	59	73
Picloram 2S	1.0	0.13	Picloram 2S	1.0	0.13	73	29	87	65	89	23	61
Picloram 2S	2.0	0.25	Picloram 2S[b]	2.0	0.25	59	72	73	68	95	15	64
Picloram (Roller)	–	0.25	Picloram (carpet)	–	0.25	48	25	80	42	93	5	49
Picloram+oil conc. (Roller)	–	0.25	Picloram (carpet)	–	0.25	49	53	77	79	97	23	63
Picloram (Wick)	–	0.5	Picloram (wick)	–	0.5	13	14	60	30	83	0	33
Picloram+oil conc. (Wick)	–	0.5	Dicamba	8.0	1.0	57	42	80	67	96	4	57
Control	–	–	Control	–		20	28	65	63	95	0	39
Mean						51	38	74	62	93	13	55

LSD (0.05): whole plot = 13; subplot = 10; whole plot × subplot 30.

Whole plot						Retreatment subplot 1981, 1983-87/Rate, lb/A						
Treatment[a] 1980	Rate	Soln conc	Treatment[a] 1982	Rate	Soln conc[b]	2,4-D 1.0	Dicamba 1.0	Dicamba 2.0	Picloram 0.25	Picloram +2,4-D 0.25+1.0	Control 0	Mean
	(lb/A)	(lb/gal)		(lb/A)	(lb/gal)	---------- (% control) ----------						
Fall applied												
2,4-D	2.0	0.24	2,4-D	2.0	0.24	3	27	53	42	31	0	26
Picloram 2%G	1.0	–	Picloram (carpet-2 pass)	–	0.25	6	56	75	39	63	7	41
Picloram 2%G	2.0	–	Picloram (wick-2 pass)	–	0.5	19	44	57	57	48	14	40
Picloram 2S	1.0	0.13	Picloram 2S	1.0	0.13	15	46	75	45	48	26	43
Picloram 2S	2.0	0.25	Picloram 2S[b]	2.0	0.25	28	65	80	60	70	44	58
Picloram (Roller)	–	0.25	Picloram (carpet)	–	0.25	9	28	69	47	42	8	34
Picloramr+oil conc. (Roller)	–	0.25	Picloram (carpet)	–	0.25	38	60	82	56	66	24	54
Picloram (Wick)	–	0.5	Picloram (wick)	–	0.5	8	41	70	44	30	14	34
Picloranr+oil conc. (Wick)	–	0.5	Dicamba	8.0	1.0	11	41	68	54	46	4	37
Control	–	–	Control	–	–	0	42	62	40	36	0	31
Mean						14	45	69	48	48	15	40
LSD (0.05): whole plot = 17; subplots = 14; whole plot x subplot 28.												

a Spray applied except the treatments identified as roller wick or carpet applicator applied.
b Applied to control subplot only.