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Picloram applied with various spray additives and 2,4-D for leafy spurge control[1]

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Previous research at North Dakota State University has shown that less than 30% of the picloram applied to leafy spurge is absorbed and approximately 5% reaches the roots. Picloram still remains the most effective herbicide for leafy spurge control and when applied with 2,4-D provides better control than picloram applied alone. The increase in control is due to decreased picloram metabolism not increased absorption or translocation. Thus, a likely approach for increased picloram efficiency for leafy spurge control is, by increasing absorption and thereby increasing the amount of picloram translocated to the roots. The purpose of this experiment was to evaluate various additives applied with picloram and picloram plus 2,4-D for increased leafy spurge control compared to the herbicides applied alone.

The first experiment was established on June 5 and 13, 1989 at Chaffee and Dickinson, ND, respectively. The second experiment was established only at Chaffee on the same date. There was a dense stand of leafy spurge in the full flower to early seed-set growth stages at both locations. The weather was overcast with 70º F and 56% relative humidity at Chaffee and clear, 61º F and 65% relative humidity at Dickinson. The herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. The plots were 10 by 30 feet in a randomized complete block design with four replications. Leafy spurge control evaluations were based on a visual estimate of percent stand reduction as compared to the untreated check.

The additives evaluated included: the fertilizer solutions ammonium sulfate, urea, and a commercial formulation of fertilizer plus surfactant equivalent to 15-3-3-2 (N-P-K-S) by weight plus 17% nonionic surfactant (Inhance); a sulfuric acid buffer (SCI-40); a soybean oil formulated with Atplus 300F emulsifier 90:10 (v/v); the commercial surfactants, X-77, LI-700, Silwett L-77, and Triton CS7; and the industrial surfactants, Emulphor ON877 (polyoxyethylated fatty alcohol), Gafac RA-600 and Gafac RS-710 (both are free acids of a complex organic phosphate ester), Igepal CO530 (ethoxylated nonylphenol), Mapeg 200 MOT (PEG 200 monotallate), Mapeg 400 MOT (PEG 400 monotallate), Mapeg 400 DO (PEG 400 dioleate) and Mapeg 400 MO (PEG 400 monooleate).

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Leafy spurge control increased or tended to increase when picloram at 0.25 but not 0.5 lb/A was applied with an additive compared to picloram alone at both locations (Table 1). Leafy spurge control with picloram at 0.25 lb/A alone was 37% averaged over both locations 3 months after treatment (MAT) compared to 60% when applied with a spray additive. All spray additives except Silwett L-77 decreased or tended to decrease leafy spurge control when applied with picloram at 0.5 lb/A compared to the herbicide applied alone. No treatment provided satisfactory leafy spurge control 12 MAT.

Table 1. Picloram applied with various additives for leafy spurge control in June 1989 at two locations in North Dakota (Lym and Manthey).

		Location/evaluation date				
		Chaffee		Dickinson		Mean
Treatment	Rate	Sept 89	June 90	Sept 89	June 90	3 MAT[a]
	lb/A	% control				
Picloram + Mapeg 200 MOT	0.25 + 1 qt	57	30	74	3	66
Picloram + Gafac RA-600	0.25 + 0.5%	64	37	65	3	65
Picloram + Emulphur ON 877	0.25 + 0.5%	53	43	47	0	50
Picloram + X-77 + AMSU[b]	0.25 + 0.25% + 2.5	52	33	58	3	55
Picloram + Silwett L-77	0.25 + 0.5%	55	31	75	8	65
Picloram + Mapeg 200 MOT	0.5 + 0.5%	49	19	72	0	61
Picloram + Gafac RA-600	0.5 + 0.5%	49	41	65	3	57
Picloram + Emulphur ON 877	0.5 + 0.5%	50	25	56	0	53
Picloram + X-77 + AMSU[b]	0.5 + 0.25% + 2.5	53	36	65	4	59
Picloram + Silwett L-77	0.5 + 0.5%	58	41	89	14	74
Picloram	0.25	44	32	29	3	37
Picloram	0.5	67	54	74	18	71
LSD (0.05)		16	NS	16	8	12

[a]Months after treatment
[b]Ammonium sulfate 2.5 lb N/A.

In the second experiment, leafy spurge control tended to increase when picloram at 0.25 lb/A was applied with Mapeg 400 MOT, Gafac RA-600 and LI-700 3 MAT (Table 2). Control averaged over all picloram plus additive treatments was 57% compared to 41% when the herbicide was applied alone. Control was similar regardless of treatment 12 MAT. In general leafy spurge control tended to decrease when picloram plus 2,4-D was applied with an additive compared to the herbicides alone except when picloram plus 2,4-D at 0.25 plus 1 lb/A was applied with Triton CS7 which averaged 71% 3 MAT compared to 52% when the herbicides were applied alone. Picloram plus 2,4-D plus Mapeg 400 MO averaged 68% leafy spurge control and was the only treatment that provided increased control compared to the herbicides applied alone (41%) 12 MAT.

Table 2. Picloram and picloram plus 2,4-D applied with various additives for leafy spurge control in June 1989 near Chaffee, North Dakota (Lym and Manthey).

		Herbicide/rate (lb/A)/evaluation date			
		Picloram 0.25		Picloram + 2,4-D 0.25 + 1	
Additive	Rate/A	Sept. 89	June 90	Sept. 89	June 90
		(% control)			
Mapeg 200 MOT	1 qt	46	41	36	53
Mapeg 400 MOT	1 qt	55	51	37	60
Mapeg 400 DO	1 qt	51	53	40	50
Mapeg 400 MO	0.5%	47	52	40	68
Soybean oil + Atplus 300 F	1 qt + 1%	47	48	42	50
SCI-40	1%	28	32	23	40
Gafac RS-710	0.5%	37	48	27	41
Gafac RA-600	0.5%	57	95	15	33
Emulphor ON 877	0.5%	47	63	33	49
Igepal CO-530	0.5%	37	49	43	55
X-77 + urea	0.25% + 2.5 lb	45	42	28	33
LI-700	1 qt	60	81	56	61
Triton CS7	0.5%	43	65	71	55
Silwett L-77	0.25%	39	41	63	53
Inhance	1 qt	47	59	51	44
None	–	41	34	52	41
Picloram (alone)	0.5 lb	57	59	40	71
LSD (0.05)		23	NS	29	25

The third experiment evaluated selected additives applied with picloram or picloram plus 2,4-D for leafy spurge control in the fall. The experiment was established near Hunter, ND on September 13, 1989 in a dense leafy spurge stand when the plants were in the fall regrowth stage. Plot design and size and application procedure were similar to previous experiments. The weather was clear, 70º F with 33% relative humidity. Leafy spurge control was similar regardless of treatment when additives were applied with picloram or picloram plus 2,4-D in the fall (Table 3). Control averaged 96 and 25% 9 and 12 MAT, respectively.

In general, leafy spurge control was occasionally increased when a spray additive was applied with picloram at 0.25, but not at 0.5 lb/A compared to the herbicide alone. All additives, except Triton CS7 and Mapeg 400 MO decreased leafy spurge control when applied with picloram plus 2,4-D in the spring. Control with picloram or picloram plus 2,4-D applied in the fall was not influenced by any additive evaluated. The additives that did increase short term leafy spurge control with picloram or picloram plus 2,4-D repre-

sent several groups of chemicals. Thus, it is not yet possible to narrow the focus for the "ideal" spray additive with these herbicides.

Table 3. Picloram and picloram plus 2,4-D applied with various additives in September 1989 near Hunter, North Dakota (Lym and Manthey).

		Herbicide/rate (lb/A)/evaluation date			
		Picloram 0.5		Picloram + 2.4-D 0.5+1	
Additive	Rate/A	June 90	Aug 90	June 90	Aug 90
		(% control)			
Mapeg 400 NOT	1 qt	92	10	–	–
Mapeg 400 DO	1 qt	–	–	99	41
Gafac RA-600	0.5%	92	13	–	–
Emulphor ON 877	0.5%	96	19	–	–
Igepal CO-530	0.5%	–	–	96	29
LI-700	1 qt	97	32	97	24
Triton CS7	0.5%	–	–	97	22
Silwett L-77	0.25%	92	15	98	38
Inhance	1 qt	94	22	96	26
None	–	96	25	97	34
LSD (0.05)		NS	NS	NS	NS