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## **Comparison of various picloram formulations applied alone and with adjuvants for leafy spurge control<sup>1</sup>**

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Picloram formulated as the potassium (K) salt (Tordon 22K) is the most effective herbicide for leafy spurge control. However, application rates are relatively high because picloram is poorly absorbed by leafy spurge. The purpose of this research was to evaluate various formulations of picloram alone and with additives for improved leafy spurge control, compared to the picloram K-salt formulation.

A series of experiments was established in the spring or fall of 1991 at various locations in North Dakota. All treatments were applied with a tractor-mounted sprayer delivering 8.5 gpa at 35 psi either in June or September when the plants were in the true-flower or fall regrowth growth stages, respectively. All experiments were in a randomized complete block design with four replications, and plots were 10 by 30 ft. Treatments were evaluated visually based on percent stand reduction as compared to the control.

The first experiment evaluated picloram formulated as the K-salt or a water-soluble acid powder (XRM-5255) alone or with 2,4-D spring- or fall-applied (Table 1). Picloram K-salt provided a nearly 2-fold increase in leafy spurge control compared to the acid powder when applied at 0.25 and 0.5 lb/A and an average of 32% increase in control at 1 lb/A averaged over application and evaluation dates. In general, adding 2,4-D to picloram regardless of formulation increased leafy spurge control compared to picloram alone, but the K-salt formulation still provided much better control than the acid powder.

The second experiment evaluated picloram K-salt alone or with various adjuvants or 2,4-D and picloram ester for leafy spurge control. The adjuvants evaluated included the commercial surfactants Scoil (a methylated crop oil), LI-700 (an acidified lecithin), Raider II (pyro-phosphate surfactant blend), and the experimental additive BAS-090. Picloram isooctyl ester was formulated with triclopyr butoxethyl ester (1:2) as the commercial product Access. The experiment was established at Valley City and on the Sheyenne National Grasslands in June 1991.

Leafy spurge control increased when picloram at 0.25 lb/A was applied with an adjuvant at Valley City but not Sheyenne (Table 2). BAS-090 and Scoil increased or tended to increase control more than the other adjuvants evaluated and was similar to control

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from picloram plus 2,4-D at 0.25 plus 1 lb/A. No adjuvant increased control when applied with picloram plus 2,4-D compared to the herbicides alone. In general, picloram plus triclopyr ester did not control leafy spurge regardless of application rate. Plant leaves desiccated rapidly when the ester formulation was applied and regrowth began within 30 days of treatment.

**Table 1. Comparison of picloram formulated as the potassium salt<sup>a</sup> and the dry acid XRM-5255<sup>b</sup> at two application dates near Valley City, ND (Lym).**

Application date and treatment	Rate	Control		
		Aug 91	June 92	Aug 92
June 1991	lb/A		%	
Picloram	0.25	30	12	6
Picloram	0.5	60	48	22
Picloram	1	87	79	50
XRM-5255	0.25	16	6	4
XRM-5255	0.5	35	8	3
XRM-5255	1	53	33	11
Picloram+2,4-D	0.25+1	52	24	13
Picloram+2,4-D	0.5+1	55	36	17
XRM-5255+2,4-D	0.25+1	38	16	10
XRM-5255+2,4-D	0.5+1	45	15	15
LSD (0.05)		19	25	16
September 1991				
Picloram	0.25	–	21	4
Picloram	0.5	–	76	22
Picloram	1	–	95	62
XRM-5255	0.25	–	13	0
XRM-5255	0.5	–	14	4
XRM-5255	1	–	78	19
Picloram+2,4-D	0.25+1	–	50	12
Picloram+2,4-D	0.5+1	–	89	40
XRM-5255+2,4-D	0.25+1	–	6	1
XRM-5255+2,4-D	0.5+1	–	49	11
LSD (0.05)			27	11

<sup>a</sup>Picloram formulated as the potassium salt in Tordon 22K.

<sup>b</sup>Picloram acid formulated as a water soluble powder.

A similar experiment was established in September 1991 at Valley City and Hunter, ND except the commercial surfactant Silwett L-77 (an organosilicone) replaced LI-700 and the picloram rate was 0.5 lb/A. No adjuvant increased leafy spurge control compared to picloram or picloram plus 2,4-D applied alone in the fall (Table 3). Picloram plus triclopyr ester did not provide satisfactory leafy spurge control.

The final experiment compared the picloram K-salt, acid powder and ester formulations applied alone or with adjuvants, 2,4-D plus glyphosate, dicamba, and the experimental herbicide V-53482. The experiments were established near Hunter, ND when leafy spurge was in the early flowering and the flower to seed-set growth stages.

**Table 2. Picloram applied as a potassium salt or isooctyl ester formulation with adjuvants in June 1991 for leafy spurge control (Lym).**

Treatment	Rate — lb/A —	Location and evaluation date				Mean	
		Valley City		Sheyenne		Aug	June
		Aug 91	June 92	Aug 91	June 92	% control	
Picloram	0.25	19	2	68	17	44	9
Picloram+Scoil	0.25+1 qt	52	25	44	7	48	16
Picloram+BAS-090	0.25+1 qt	76	44	57	8	71	26
Picloram+LI-700	0.25+0.5%	47	23	39	5	43	14
Picloram+Raider II	0.25+1 pt	30	10	72	12	51	11
Picloram+2,4-D	0.25+1	68	35	59	19	63	27
Picloram+2,4-D+Scoil	0.25+1+1 qt	55	23	83	6	69	15
Picloram+2,4-D+BAS-090	0.25+1+1 qt	51	34	69	25	60	30
Picloram+2,4-D+ Raider II	0.25+1+1 pt	48	14	52	4	50	9
Picloram ester+triclopyr ester <sup>a</sup>	0.25+0.5	14	1	52	5	34	3
Picloram ester+triclopyr ester <sup>a</sup> +2,4-D	0.25+0.5+1	25	8	53	3	30	5
Picloram ester+triclopyr ester <sup>a</sup> +Scoil	0.25+0.5+1 qt	40	18	35	3	37	10
LSD (0.05)		25	23	31	17	20	14

<sup>a</sup>Picloram isooctyl ester plus triclopr butoxyethyl ester (1:2)-Access.

As in the first experiment, picloram K-salt provided much better leafy spurge control than the acid powder except when XRM-5255 was applied with 2,4-D LVE (Table 4). Leafy spurge control averaged 98 and 70% control 3 and 12 months after treatment (MAT), respectively, with XRM-5255 plus 2,4-D LVE at 4 + 16 oz/A compared to 92 and 38%, respectively, with picloram K-salt plus 2,4-D LVE. Leafy spurge control with 2,4-D amine was similar to 2,4-D LVE when applied with picloram K-salt but declined 50% or more when applied with XRM-5255.

Dicamba at 32 oz/A provided similar leafy spurge control to picloram at 4 oz/A and control was not improved by adding 2,4-D or Scoil (Table 4). Glyphosate plus 2,4-D provided only 40% leafy spurge control 3 MAT. Neither V-53482 nor picloram plus triclopyr ester provided satisfactory leafy spurge control as the topgrowth was killed quickly but the plant regrew within 30 days.

In summary, picloram K-salt formulation provided much better leafy spurge control than the acid powder formulation whether applied alone or with adjuvants or 2,4-D amine. XRM-5255 applied with 2,4-D LVE provided similar leafy spurge control to the K-salt formulation and should be further evaluated. Leafy spurge control, in general, was not improved when picloram was applied with a spray adjuvant: but when an increase did occur, it was similar to picloram applied with 2,4-D, and the latter is a less costly treatment. Picloram applied as an ester killed the top growth rapidly but the plants regrew within 30 days.

**Table 3. Picloram applied as a potassium salt or isooctyl ester formulation with adjuvants in September 1991 for leafy spurge control (Lym).**

Treatment	Rate — lb/A —	Location and / 1992 evaluation date					
		Valley City		Hunter		Mean	
		May	Aug	May	Aug	May	Tug
		%					
Picloram	0.5	92	11	89	46	90	28
Picloram+Scoil	0.5+1 qt	96	13	83	36	89	24
Picloram+BAS-090	0.5+1 qt	95	19	88	44	91	31
Picloram+Silwett L-77	0.5+0.5%	96	18	80	28	88	23
Picloram+Raider II	0.5+1 pt	98	16	74	15	86	15
Picloram+2,4-D	0.5+1	96	15	966	47	96	31
Picloram+2,4-D+Scoil	0.5+1+1 qt	97	32	94	39	95	35
Picloram+2,4-D+BAS-090	0.5+1+1qt	99	34	86	28	93	31
Picloram+2,4-D+ Raider II	0.5+1+1 pt	97	25	88	46	93	36
Picloram ester+triclopyr ester <sup>a</sup>	0.5+1	47	6	8	0	27	3
Picloram ester+triclopyr ester <sup>a</sup> +2,4-D	0.5+1+1	36	2	16	3	26	2
Picloram+triclopyr ester <sup>a</sup> + Scoil	0.5+1 +1 qt	42	4	3	0	22	2
LSD (0.05)		24	16	13	22	13	24

<sup>a</sup> Picloram isooctyl ester plus triclopyr butoxyethyl ester (1:2)-Access.

**Table 4. Herbicides applied at two growth stages for leafy spurge control near Hunter, ND (Lym).**

Treatment	Rate — oz/A —	Application growth stage and evaluation date			
		Early flower		Flower to seed-set	
		Aug 91	June 92	Aug 91	June 92
		%			
V-53482+Scoil	0.75+1 qt	18	0	47	0
V-53482+Scoil	1+1 qt	19	0	38	0
V-53482+Scoil	1.25+1 qt	11	0	15	0
V-53482+Scoil	1.5+1 qt	34	0		
Picloram	4	34	10	63	26
Picloram+Scoil	4+1 qt			77	39
Picloram+L-77	4+0.5%	46	15	84	18
XRM-5255 <sup>b</sup>	4	12	10	39	18
XRM-5255 <sup>b</sup> +Scoil	4+1 qt	22	10	42	4
XRM-5255 <sup>b</sup> +L-77	4+0.5%	16	6	30	9
Picloram+2,4-D LVE	4+16			92	38
Picloram+2,4-D amine	4+16	55	19	94	38
Picloram+2,4-D amine	8+16	98	65		
XRM-5255 <sup>b</sup> +2,4-D LVE	4+16			98	70
XRM-5255 <sup>b</sup> +2,4-D amine	4+16			49	14
Dicamba	32	51	14		
Dicamba+2,4-D amine	32+16	36	23		
Dicamba+2,4-D <sup>a</sup> +Scoil	32+16+1qt	16	30		
Glyphosate+2,4-D <sup>a</sup>	6.5+11	40	28		
Glyphosate+2,4-D <sup>a</sup> +picloram	6.5+11+8	93	65		
Picloram ester+triclopyr ester <sup>a</sup>	4+8	32	16	45	16
Picloram ester+triclopyr ester <sup>a</sup> +2,4-D amine	4+8+16			48	13
Picloram ester+triclopyr ester <sup>c</sup> +Scoil	4+8+1 qt			30	13
LSD (0.05)		31	20	31	25

<sup>a</sup> Commerical formulation (Landmaster BW).

<sup>b</sup> Picloram acid formulated as a water soluble powder.

<sup>c</sup> Picloram isooctyl ester plus triclopyr butoxyethyl ester (1:2)-Access.