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Leafy spurge control in North Dakota - 1989

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Evaluation of sulfometuron alone and applied with auxin herbicides, of mixtures of various auxin herbicides and of spray additives with picloram for leafy spurge control have been the primary emphases of the field program in 1989. Fluroxypyr amine formulations, BAS-514 and various glyphosate plus 2,4-D combinations are also being evaluated for leafy spurge control.

A GPC-14 regional screening trial of sulfometuron applied alone and with various herbicides in the spring and fall was planned by 14 cooperators following the 1987 meeting in Fargo (Table 1). The experiment was begun in 1988, which was a hot, dry year region-wide but especially in Minnesota and North Dakota. Picloram at 16 oz/A provided the best control of the spring-applied treatments; averaging 91% 3 MAT (Table 2). Sulfometuron plus 2,4-D at 3 plus 16 oz/A and sulfometuron plus picloram at 1.5 plus 8 oz/A averaged 71 and 69% control, respectively. Sulfometuron at 3 oz/A averaged 24% grass injury but one location reported 78%. An identical experiment was established in the fall of 1988. Initial evaluation indicated good control with all treatments but grass injury was also very high (80 to 100%) with all sulfometuron treatments (data not shown).

An experiment to evaluate leafy spurge control from sulfometuron plus auxin herbicides applied annually spring or fall was established on very mature leafy spurge stands near Chaffee and Dickinson, ND. Treatments were applied in spring (June) or fall (late-August to early September) in 1986, 1987, and 1988 (Table 3). Leafy spurge was in the true flower or fall regrowth stages when the original treatments were applied but was in the vegetative growth stage when the treatments were reapplied the following growing season.

Leafy spurge control averaged 49 and 90% at Chaffee and Dickinson, respectively, following three spring applications of sulfometuron plus an auxin herbicide (Table 3). Sulfometuron at 1or 2 oz/A alone resulted in only 11% control after three applications averaged over both locations. Control following the spring treatment was greatest with picloram or dicamba applied with sulfometuron and there was little grass injury.

Leafy spurge control was higher when sulfometuron was applied annually in the fall compared to the spring (Table 2). Control in the fall averaged 98% following three applications of sulfometuron plus picloram – or sulfometuron plus dicamba. Sulfometuron

alone or applied with 2,4-D generally provided poor leafy spurge control. Grass injury also was higher following fall compared to spring sulfometuron applications and averaged 92%.

Sulfometuron applied with picloram or dicamba in the fall has provided better leafy spurge control than either auxin herbicide applied alone at similar rates. Grass was injured severely when sulfometuron was fall applied but did recover by the following growing season in 1987 and 1988. Sulfometuron in combination with an auxin herbicide could be used in a leafy spurge management program to provide initial control but probably should not be applied annually because of the potential for grass injury. Previous research at North Dakota State University has shown an annual treatment of picloram plus 2,4-D for two years following the sulfometuron treatment provided nearly 100% leafy spurge control and the grass species recovered (data not shown).

Picloram plus 2,4-D at 0.25 to 0.5 plus 1 lb/A has become the primary treatment in the leafy spurge control program in North Dakota. The herbicides applied together provide 20 to 40% better leafy spurge control than either herbicide applied alone. The addition of dicamba to this tank mixture or a specific type of 2,4-D formulation may also increase leafy spurge control. Thus, the effect of dicamba and/or various 2,4-D formulations applied with picloram on leafy spurge control was evaluated in a three-year experiment (Table 4). Treatments were applied annually in the spring or fall in 1986, 1987, and 1988.

In general, leafy spurge control was similar with all 2,4-D formulations in combination with picloram and dicamba (Table 4). However, the 2,4-D mixed amine formulation occasionally did provide better short-term leafy spurge control in a combination treatment than the alkanolamine or ester formulations. Leafy spurge control with picloram improved by adding dicamba in the fall treatments at Dickinson only.

Various additives applied with picloram and picloram plus 2,4-D are being evaluated for leafy spurge control. Many of the commonly used additives were phytotoxic to leafy spurge and apparently decreased rather than increased absorption. Compounds that appeared to increase picloram activity (absorption) in the greenhouse experiments are being field tested in 1989 (Table 5). Initial evaluations indicate the additives are also increasing picloram activity in the field.

Fluroxypyr ester has shown limited phytotoxicity on leafy spurge. The ester formulation may cause too rapid leaf kill for optimum herbicide absorption and translocation. Two fluroxypyr amine formulations XRM–5196 (diisopropylamine) and XRM-5195 (triisopropylamine) are being field tested in 1989. Visual observations 7 DAT indicated 70 to 80% less phytotoxicity to the leaf with the amine compared to the ester formulation.

BAS-514 (Facet) is an auxin-like herbicide with soil residual activity. BAS-514 showed similar phytotoxicity to leafy spurge as picloram plus 2,4-D in greenhouse evaluations and is being field-tested in 1989. Glyphosate plus 2,4-D has provided good leafy spurge control when applied in late July and August.

Table 1. Cooperators, state, and application data for 1988 GPC-14 regional study.

Cooperator	State	Code	Estab-lished	Air temp.	Relative humidity	Cloud cover	Soil				Spray water pH	Plot size
							Temp 1-2 in.	pH	Organic matter	Sand-silt-clay		
				(F)	(%)				(%)	(%)		(ft)
George Beck	CO	01	8 June	72	45	30%	54	7.5	4.0	29-32-39	7.9	10x30
Peter Fay	MT	02	22 June	80	70	40%	58	—	—	—	—	10x30
Robert Callihan	ID	03	—	—	—	—	—	—	—	—	—	—
Ann Henson	CO	04	7 June	88	—	—	72	—	—	—	—	10x40
Rod Warner	MT	05	—	—	—	—	—	7.2	3.4	22-48-30	—	—
Galen Schroeder	ND	06	—	—	—	—	—	—	—	—	—	—
Tom Whitson	WY	07	14 May	—	—	—	—	6.8	1.8	22-58-20	7.2	10x36
Ron Frank	NO	08	15 June	—	—	—	—	—	—	—	—	—
Mark Peterson	SD	09	17 June	88	51	Clear	87	—	—	—	—	16x40
Deane Finnerty	MN	10	30 May	71	45	Clear	60	6.8	2.1	Sandy Loam	—	20x25
Tim Chicoine	SD	11	15 June	68	62	Clear	48	6.1	4.1	44-44-12	—	15x40
David Vos	SD	12	3 June	80	68	Clear	65	7.9	4.2	16-45-39	—	10x30
Bob Stougaard	NE	13	1 June	—	—	—	—	5.8	1.7	Valentine	—	15x50
	—	—	—	—	—	—	—	—	—	sand 97%	—	—
Jack Evans	UT	14	—	—	—	—	—	—	—	—	—	—
Roger Becker	14N	15	7 June	88	50	Clear	82	6.9	4.7	Sandy Loam	—	15x30
Rod Lym	ND	16	2 June	89	42	Clear	82	6.7	9.4	43-41-16	7.8	15x50
Gus Foster	CO	17	—	—	—	—	—	—	—	—	—	—

Table 1 (Continued).

Code	Evaluation date			Leafy spurge		Grass species present
	1 MAT	3 MAT	12 MAT	Growth stage	Height (in)	
01	7 July	8 Sept		Flower	—	Downy brome, few grass spp present
02	11 July	—		Mid-flower	—	Timothy and Kentucky bluegrass both headed
03	—	—		—	—	
04	8 July	8 Aug		Flower		
05	15 Aug	—		—	—	
06	—	—		—	—	
07	—	—		—	—	Island bluegrass and intermediate wheatgrass
08	8 Aug	—		Flower	—	Variety of native spp.
09	28 July	7 Sept		Seed set	36	Mostly smooth brome
10	1 July	25 Sept		Flower	18	Smooth brome and Kentucky bluegrass
11	28 July	—		30% flower	12	Bluegrass spp.
12	—	—		Flower	—	Bromegrass
13	7 July	7 Sept		Flower	—	Kentucky bluegrass, prairie junegrass[b] Smooth brome
14	—	—		—	—	
15	25 July	21 Sept		Late-flower	24	Bluegrass, bromegrass, all severe drought stress
16	18 July	23 Aug		Flower	24	Bluegrass spp., western wheatgrass
17	—	—		—	—	

[a]Prairie sandreed, little bluestem and sand bluestem also present.

Table 2. Leafy spurge control and grass injury 1 and 3 months after treatment, GPC-14 regional summary, November 1988.

State	Code	Sulfometuron 1.5		Sulfometuron 3		Sulf. + 2,4-D 1.5 + 16		Sulf. + 2,4-D 3 + 16		Sulf. + Pic. 1.5 + 8		Sulf. + Dic. 1.5 + 32	
		Control	Inj	Control	Inj	Control	Inj	Control	Inj	Control	Inj	Control	Inj
		%											
1 MAT													
CO	01	3	—	3	—	85	—	85	—	8	—	17	—
MT	02	0	0	0	0	53	0	53	0	22	0	12	—
ID	03	—	—	—	—	—	—	—	—	—	—	—	—
CO	04	28	21	62	34	95	33	95	33	87	22	78	28
MT	05	15	0	10	0	77	0	97	0	53	0	63	0
ND	06	—	—	—	—	—	—	—	—	—	—	—	—
WY	07	—	—	—	—	—	—	—	—	—	—	—	—
ND	08	13	0	27	0	93	0	95	0	81	0	68	0
SD	09	0	3	0	12	88	3	88	7	57	3	70	7
MN	10	8	5	10	7	92	10	77	10	53	5	38	5
SD	11	7	0	7	0	93	3	98	8	65	7	73	10
SD	12	40	3	53	7	92	27	93	37	89	23	85	20
NE	13	22	19	28	19	83	21	88	17	82	12	58	13
UT	14	—	—	—	—	—	—	—	—	—	—	—	—
MN	15	18	3	28	27	99	12	99	31	78	8	79	38
ND	16	5	0	5	0	75	0	93	7	49	0	13	0
CO	17	—	—	—	—	—	—	—	—	—	—	—	—
Trt.	mean	13	5	19	9	85	9	88	13	60	7	55	10
3 MAT													
CO	01	13	—	37	—	82	—	93	—	65	—	42	—
MT	02[a]	—	—	—	—	—	—	—	—	—	—	—	—
ID	03	—	—	—	—	—	—	—	—	—	—	—	—
CO	04	7	10	13	5	89	27	85	23	92	17	47	20
MT	05	—	—	—	—	—	—	—	—	—	—	—	—
ND	06	—	—	—	—	—	—	—	—	—	—	—	—
WY	07	10	0	12	0	17	0	13	0	33	0	15	0

State	Code	Sulfometuron 1.5		Sulfometuron 3		Sulf. + 2,4-D 1.5 + 16		Sulf. + 2,4-D 3 + 16		Sulf. + Pic. 1.5 + 8		Sulf. + Dic. 1.5 + 32	
		Control	Inj	Control	Inj	Control	Inj	Control	Inj	Control	Inj	Control	Inj
		%											
[a]Experiment over sprayed and lost following initial evaluation.													
ND	08	—	—	—	—	—	—	—	—	—	—	—	—
SD	09	0	3	18	5	33	17	84	27	70	15	13	10
MN	10	20	0	17	47	50	0	33	37	63	25	50	35
SD	11	—	—	—	—	—	—	—	—	—	—	—	—
SD	12	40	7	43	7	96	27	94	37	90	15	82	27
NE	13	10	18	23	35	12	16	50	19	53	9	47	25
UT	14	—	—	—	—	—	—	—	—	—	—	—	—
MN	15	38	38	46	78	65	57	84	86	75	65	61	83
ND	16	13	11	10	34	40	10	75	48	65	24	15	13
CO	17	—	—	—	—	—	—	—	—	—	—	—	—
Trt.	mean	17	10	25	24	57	17	71	31	69	18	44	24
1 MAT													
CO	01	83	—	10	—	32	—	13	—	9	—	31	—
MT	02	65	0	13	0	25	0	5	0	14	NS	25	0
ID	03	—	—	—	—	—	—	—	—	—	—	—	—
CO	04	82	0	80	0	88	4	77	0	12	15	70	16
MT	05	93	0	57	0	80	0	77	0	27	NS	97	0
ND	06	—	—	—	—	—	—	—	—	—	—	—	—
WY	07	—	—	—	—	—	—	—	—	—	—	—	—
ND	08	62	0	88	0	97	0	67	0	24	NS	63	0
SD	09	88	0	59	5	94	20	37	7	42	10	53	6
MN	10	88	7	37	22	63	18	35	8	25	12	46	9
SD	11	80	3	83	0	93	0	65	5	15	8	60	3
SD	12	90	13	81	10	88	23	87	23	14	13	73	17
NE	13	75	0	83	0	85	0	78	3	22	9	62	10
UT	14	—	—	—	—	—	—	—	—	—	—	—	—
MN	15	93	40	54	7	84	25	64	43	17	33	63	21
ND	16	29	0	44	0	97	0	20	0	19	NS	39	0
CO	17	—	—	—	—	—	—	—	—	—	—	—	—
		—	—	—	—	—	—	—	—	—	—	[61	[41

Table is continued on the following pages.

State	Code	Sulfometuron 1.5		Sulfometuron 3		Sulf. + 2,4-D 1.5 + 16		Sulf. + 2,4-D 3 + 16		Sulf. + Pic. 1.5 + 8		Sulf. + Dic. 1.5 + 32	
		Control	Inj	Control	Inj	Control	Inj	Control	Inj	Control	Inj	Control	Inj
		%											
Trt. mean 3 MAT		77	5	57	4	77	8	52	7	6	4	—	—
CO	01	18	—	72	—	90	—	45	—	19	—	51	—
MT	02[a]	—	—	—	—	—	—	—	—	—	—	—	—
ID	03	—	—	—	—	—	—	—	—	—	—	—	—
CO	04	70	0	81	0	97	0	50	0	24	12	57	9
MT	05	—	—	—	—	—	—	—	—	—	—	—	—
ND	06	—	—	—	—	—	—	—	—	—	—	—	—
WY	07	8	0	33	0	80	0	10	0	14	NS	21	0
ND	08	—	—	—	—	—	—	—	—	—	—	—	—
SD	09	22	0	40	0	80	12	17	0	28	NS	34	8
MN	10	30	0	48	8	86	0	22	3	26	23	38	14
SD	11	—	—	—	—	—	—	—	—	—	—	—	—
SD	12	90	13	84	10	88	27	81	30	12	12	72	18
NE	13	7	0	35	7	99	0	25	2	29	15	35	12
UT	14	—	—	—	—	—	—	—	—	—	—	—	—
MN	15	51	10	68	0	97	0	29	0	20	28	56	37
ND	16	0	0	50	8	96	0	9	0	24	22	34	14
CO	17	—	—	—	—	—	—	—	—	—	—	—	—
Trt.	mean	36	2	60	4	91	4	36	4	7	6	[61	[51

[a]Experiment over sprayed and lost following initial evaluation.

Table 3. Leafy spurge control with sulfometuron applied annually either alone and in combination with dicamba, picloram, and 2,4-D applied in the spring and fall at two locations in North Dakota.

Treatment and application date[a]	Rate	Chaffee June 1989 Grass Control	Chaffee June 1989 Grass injury	Dickinson June 1989 Grass Control	Dickinson June 1989 Grass injury
	(oz/A)	(%)			
Spring					
Sulfometuron	1	0	53	18	25
Sulfometuron	2	5	78	20	21
Sulfometuron + picloram	1 + 8	70	44	63	25
Sulfometuron + dicamba	1 + 32	50	39	58	16
Sulfometuron + 2,4-D	1 + 16	28	40	28	16
Fall					
Sulfometuron	1	22	94	39	88
Sulfometuron	2	49	99	57	92
Sulfometuron + picloram	1 + 8	98	99	98	100
Sulfometuron + dicamba	1 + 32	95	98	95	95
Sulfometuron + 2,4-D	1 + 16	53	99	81	56
Picloram	32	99	50	100	44
LSD (0.05)		22	34	22	25

[a]Applied annually in 1986, 1987, and 1988.

Table 4. Leafy spurge control with picloram applied with dicamba and various formulations of 2,4-D applied annually since 1986 for leafy spurge control.

Application date/ treatment	Rate	Location/1989 evaluation date Valley City June	Dickinson June	Sheyenne June
	(lb/A)	(% control)		
Spring				
2,4-D mixed amine[a]+ dicamba + picloram	2 + 1 + 0.25	63	43	—
2,4-D mixed amine[a]+ dicamba + picloram	2 + 0.5 + 0.25	68	44	—
2,4-D mixed amine[a]+ picloram + dicamba	1 + 0.5 + 0.12	55	37	—
2,4-D alkanolamine+ dicamba + picloram	2 + 1 + 0.25	54	56	—
Dicamba + picloram	1 + 0.25	68	44	—
LSD (0.05)		NS	NS	
Fall				
2,4-D mixed amine[a]+ dicamba + picloram	2 + 1 + 0.25	91	73	98
2,4-D alkanolamine+ dicamba + picloram	2 + 1 + 0.25	81	—	98

Table 4 continued on following page.

Application date/ treatment	Rate	Location/1989 evaluation date Valley City June	Dickinson June	Sheyenne June
	(lb/A)	(% control)		
2,4-D mixed amine[a]+ dicamba + picloram	4 + 2 + 0.5	98	97	99
2,4-D ester[b] + 2,4-DP +picloram +dicamba	2 + 2 + 0.5 + 0.25	94	43	98
2,4-D ester[b] + 2,4-DP +picloram +dicamba	2 + 2 + 0.5 + 0.5	98	86	99
2,4-D alkanolamine+ dicamba + picloram	4 + 2 + 0.5	99	90	99
Dicamba + picloram	2 + 0.5	98	96	99
Picloram	0.5	97	59	98
LSD (0.05)		16	21	NS

[a]Mixed amine salts of 2,4-D (2:1 dimethylamine: diethanolamine)-EH 736.
[b]2,4-D isooctyl ester:2,4-DP butoxyethanol ester: dicamba (4:4:1)-EH 680.

Table 5. Spray additives field-tested with picloram and picloram plus 2,4-D in 1989.

Compound	Manufacturer	Remarks
Soybean oil + Atplus 300F	ICI	Only veg. oil not phytotoxic to leafy spurge
Emulpher ON-877	GAF	Polyoxy ethylated fatty alcohol
GAFAC RA-600	GAF	Emulsifier detergent, lowers pH
GAFAC RS-710	GAF	Free acid of phosphate ester complex
MAPEG 400 MOT	Mazer	Monotallate
MAPEG 200 MOT	Mazer	Monotallate
MAPEG 400 DO	Mazer	Dioleate
X-77 + NH4SO4	Chevron	Various free fatty acids
Silwett L-77	Union Carbide	Silicone copolymer
Igepal CO-530	GAF	Nonionic coupling agent
Triton CS7	Rohm and Haas	Blended surfactant
SCI-40	Sorber	Lowers pH
LI-700	Loveland	Lowers pH
Inhance	MCA Labs	Blended surfactants + fertilizer