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Forage production in pasture and rangeland following three years of leafy spurge control

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An experiment to evaluate long term leafy spurge management with resulting forage production was established at four sites in North Dakota in 1980. The sites included a bluegrass pasture near Sheldon, an exclosure area on the Sheyenne National Grasslands near McLeod, and two sites on a federal game management area near Valley City. The main population of grasses was bluegrass (*Poa* spp.) with occasional crested wheatgrass, smooth brome, big bluestem or other native grasses. All sites were established in early June except one site at Valley City which was established in September 1980 (Table 3). The herbicides applied in 1980 (Year 1) included 2,4-D, dicamba, picloram liquid (2S), picloram granule (2%G), and picloram applied using the roller and 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. The roller and wick applicator height was adjusted to treat the top one-half of the taller leafy spurge stems. The additive in the roller and 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 replicated twice at each site in a randomized complete block design. In 1981 (Year 2) each plot was divided into six 7.5 by 50 feet subplots for retreatments of 2,4-D, picloram 2S, dicamba or no retreatment. Retreatments were applied in June 1982 (Year 3) at Sheldon and the fall Valley City site and in August 1982 at the Sheyenne and spring Valley City sites. In July 1981, a 3 by 25 feet section of each plot was harvested with a flail mower. A 4 by 15 feet section of each plot was harvested at Sheldon and the fall Valley City sites with a rotary mower. Sub-samples were taken by hand along each harvested strip so that leafy spurge and forage weight could be separated. The samples were oven dried and are reported with 12% moisture content.

Picloram 2%G and 2S at 2 lb/A provided the best leafy spurge control after 27 months averaging 43 and 40% control, respectively, without a retreatment, and up to 90% control with a retreatment of dicamba at 2.0 lb/A (Table 1). No other original treatment provided satisfactory leafy spurge control by August 1982 without a retreatment. The best retreatments for leafy spurge control were dicamba at 2.0 lb/A, picloram 2S at 0.25 lb/A alone or in combination with 2,4-D at 2.0 lb/A which provided 61, 59 and 53% control, respectively, when averaged across all original treatments. Retreatments of dicamba at 1.0 lb/A or 2,4-D at 1.0 lb/A did not improve control compared to no retreatment.

Forage yield increased significantly for 20 of the 59 treatments compared to the control in 1982 which is a decrease from 50 of the 59 treatments in 1981. (1981 N.D. Weed Control Research p 1-2). The forage yield in the check plots averaged 1491 lb/A in 1982

compared to 623 lb/A in 1981. This increase in production probably was due to a cool moist spring which allowed the cool season grasses to compete more effectively with leafy spurge. Also, it was observed that there was more grass in the control plots than in the areas adjacent to the experiment, so the increase in forage production due to herbicide treatment may be underestimated. A possible explanation is that each year the entire experiment is mowed to remove dead leafy spurge stems and other plant material. The removal of the trash may allow the native grasses to better compete with leafy spurge.

The five treatments which resulted in the highest yields were: picloram 2S at 2.0 lb/A plus dicamba at 1.0 lb/A, roller applied picloram at 1:7 (v:v) plus picloram at 0.25 lb/A, picloram 2%G at 1.0 plus (picloram + 2,4-D at 0.25 + 1.0 lb/A), wick applied picloram at 1:3 (v:v) plus 2,4-D at 1.0 lb/A, and control plus dicamba at 2.0 lb/A (Table 1). The treatment with the best overall leafy spurge control was picloram 2S at 1.0 lb/A plus dicamba at 2.0 lb/A but the forage yield was intermediate at 1760 lb/A. Picloram at 1:7 (v:v) applied with the roller applicator resulted in the highest forage production at 2,252 lb/A when averaged across all retreatments. All retreatments increased forage production significantly compared to the control when averaged across all original treatments except picloram at 0.25 lb/A plus 2,4-D at 1.0 lb/A.

Plots at the Sheyenne National Grassland and the second Valley City site were retreated in August rather than in June 1982 so a fall versus spring comparison of the various retreatment programs could be made. Thus forage samples were not taken in 1982 and the data reported are leafy spurge control 27 months after the original treatment with one retreatment in June 1981 (Table 2). Picloram 2%G and 2S at 2 lb/A provided fair leafy spurge control after 27 months averaging 52 and 49% respectively without a retreatment and up to 81% with a retreatment of picloram at 0.25 lb/A. The best retreatments were dicamba at 2.0 lb/A, picloram 2S at 0.25 alone or in combination with 2,4-D at 1.0 which provided 23, 27 and 28% leafy spurge control, respectively, when averaged across the original treatments.

All original treatments applied in 1980 required retreatments in 1981 and 1982 to maintain good leafy spurge control. The best retreatments for both good leafy spurge control and high forage production were picloram 2S at 0.25 lb/A or dicamba at 2.0 lb/A applied annually. The most economical long term treatment was picloram 2S at 0.25 lb/A in years 2 and 3 without a year one treatment which resulted in 63% leafy spurge control and 2409 lb/A forage production. Picloram at 2.0 lb/A will give good leafy spurge control for up to three years in areas where yearly treatments are unfeasible.

Table 1. Leafy spurge control in August 1982 and forage production in July 1982 at Sheldon and Valley City, ND after treatments applied in 1980, 1981, and 1982. (Lym and Messersmith).

			Years two and three treatment/rate (lb/A)						
Year one Treatment[a]	Rate (lb/A)	Soln conc	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
			(Percent control)						
2,4-D	2.0	1:15	4	33	48	56	48	12	33
Picloram 2%G	1.0	----	7	28	60	65	45	16	36
Picloram 2%G	2.0	----	33	52	65	66	63	43	53
Picloram 2S	1.0	1:15	52	43	91	47	56	34	54
Picloram 2S	2.0	1:7	72	77	90	67	69	48	71
Picloram (Roller)		1:7	5	30	51	50	41	3	30
Picloram+oil conc. (Roller)		1:7	26	47	63	62	63	29	50
Picloram (Wick)		1:3	12	11	48	52	35	4	30
Picloram+oil conc. (Wick)		1:3	2	49	42	67	75	15	41
Control ---		----	19	29	42	63	26	0	33
Mean			24	42	61	59	53	20	
LSD (0.05):Yr 1=12; Yr 2 & 3=9; Yr 1 x (Yr 2 & Yr 3)=29									
			(1982 yield lb/A)						
2,4-D	2.0	1:15	1928	1324	2429	2242	1251	1460	1772
Picloram 2%G	1.0	----	1759	1292	1525	2119	2825	1944	1911
Picloram 2%G	2.0	----	2457	2430	1719	1812	968	1297	1781
Picloram 2S	1.0	1:15	1322	3029	1760	1296	2386	1697	1915
Picloram 2S	2.0	1:7	1492	1542	1763	1548	2132	1434	1650
Picloram (Roller)		1:7	2306	2265	1752	3009	1909	2280	2252
Picloram+oil conc. (Roller)		1:7	1120	1358	1478	1213	1024	2020	1368
Picloram (Wick)		1:3	2660	1549	1835	2383	1296	1341	1842
Picloram+oil conc. (Wick)		1:3	1773	1495	1684	1024	1392	1061	1405
Control	---	----	2148	1819	2620	2409	2216	1491	2084
Mean			1890	1810	1836	1892	1727	1603	
LSD (0.05)=Yr 1=228; Yr 2 & 3=179; Yr 1 x (Yr 2 & Yr 3)=555									

[a]Broadcast in 8 gpa except when identified as roller or wick applied.

Table 2. Leafy spurge control in August 1982 with various herbicide treatments at the Sheyenne National Grasslands and Valley City, ND after treatments applied June of 1980 and 1981. (Lym and Messersmith).

			Year two treatment/rate (lb/A)						
Year one treatment[a]	Rate (lb/A)	Soln conc	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
			(Percent control)						
2,4-D	2.0	1:15	6	6	1	10	21	0	7
Picloram 2%G	1.0	----	16	21	13	19	29	6	17
Picloram 2%G	2.0	----	44	30	49	49	54	52	49
Picloram 2S	1.0	1:15	43	12	27	36	20	23	24
Picloram 2S	2.0	1:7	63	65	74	81	58	49	65
Picloram (Roller)		1:7	23	31	32	25	38	12	27
Picloram+oil conc. (Roller)		1:7	17	19	13	15	16	0	13
Picloram (Wick)		1:3	2	2	5	6	12	2	5
Picloram+oil conc. (Wick)		1:3	4	8	19	17	14	21	13
Control	---	----	0	0	0	22	18	0	5
Mean			20	20	23	27	28	16	
LSD (0.05)=Yr 1=7; Yr 2=5; Yr 1 x Yr 2=17									

[a]Broadcast in 8 gpa except when identified as roller or wick applied.

Table 3. Herbicide application and harvest dates at various sites of a long term leafy spurge management study. (Lym and Messersmith).

Location	Original treatment in year 1	Retreatment		Harvest	
		Year 2	Year 3	Year 2	Year 3
Sheyenne National Grasslands	11 June 80	27 May 81	17 Aug. 82	20 July 81	----------
Sheldon	16 June 80	4 June 81	10 June 82	6 July 81	12-13 July 82
Valley City (Spring)	26 June 80	23 June 81	11 June 82	9 July 81	15 July 82
Valley City (Fall)	2-3 Sept. 80	23 June 81	24 Aug. 82	10 July 81	