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Evaluation of various grass species to control leafy spurge at Fargo and Jamestown

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Traditionally, herbicides have been used to control leafy spurge. Control has been relatively successful following a long-term program. However, herbicides may not be acceptable due to their high cost, potential for groundwater contamination, and prohibition in environmentally sensitive areas. Consequently, non-chemical methods for control must be established. Recent research at the University of Wyoming has shown that several grass species are competitive with leafy spurge and have reduced the infestation density. The purpose of this research was to evaluate several grass species that may be competitive with leafy spurge at two locations in North Dakota.

The first experiment was established in a dense stand of leafy spurge (160 stems/m^2) on the NDSU experiment station at Fargo. The soil was a Fargo silty clay (fine, montmorillonitic, frigid, Vertic Haplaquolls; 3.5% organic matter and pH 8.0). Plots were 12 by 45 feet, and treatments were replicated four times in a completely random design. Initial leafy spurge stand counts were recorded on May 23, 1990, immediately before the first herbicide treatment. Glyphosate plus 2,4-D at 0.4 plus 0.6 lb/A was applied to all plots when leafy spurge was in the flowering growth stage and again on July 27, 1990, to regrowth that was flowering. The glyphosate plus 2,4-D alone treatment was applied in September 1990 through 1993.

The soilbed was prepared for seeding on August 6 and 28, 1990, and the grass was planted on August 29. The experimental site was irrigated with 1 inch of water on September 13 and 25, 1990, and 1.25 inches of rain fell on October 7. Initial grass stand establishment was estimated by counting seedlings in three 20-cm by 1-m quadrats placed over the rows on October 30, 1990.

Leafy spurge and grass species density were recounted in May 1991 through 1993. Bromoxynil plus 2,4-D at 0.25 plus 0.75 lb/A were applied in May 1991 and 1992, to control annual broadleaf weeds. The plots were harvested in mid-July 1991 through 1993 by clipping four 0.25-m^2 quadrats per plot. Herbage was separated into seeded grass species, weedy grass species, leafy spurge, and forbs; then oven-dried at 140 F. Herbage data are reported on a dry weight basis.

'Arthur' Dahurian wildrye, 'Bozoisky' Russian wildrye, 'Hycrest' crested wheatgrass and 'Reliant' intermediate wheatgrass established rapidly despite the dry conditions in Fall 1990 (data not shown). 'Killdeer' sideoats grama was the only species that failed to have at least a 10% stand prior to winter.

'Hycrest' crested wheatgrass had the highest stand density counts in May 1991 (data not shown) and reduced the leafy spurge stand equal to the herbicide treatment 1 year after planting (Table 1). 'Killdeer' sideoats grama failed to establish. All established grass species tended to reduce leafy spurge production compared to the control 1 year after planting (Table 2). 'Reliant' intermediate wheatgrass had the highest grass production at 2290 lb/A.

Table 1. Evaluation of various grass species competitive with leafy spurge at Fargo (Lym and Tober).

Grass species/or herbicide treatment[a]	Leafy spurge[b]					Total leafy spurge reduction[c]
	1990	1991	1992	1993	1994	
	no. 0.25/m^2					%
'Rebound' smooth brome	45	55	25	15	8	80
'Rodan' western wheatgrass	40	70	30	15	12	70
'Bozoisky' Russian wildrye	40	60	25	15	23	40
'Arthur' Dahurian wildrye	45	70	30	20	17	60
'Reliant' intermediate wheatgrass	40	50	35	30	27	30
T-17596 mountain rye	40	50	35	30	26	35
'Hycrest' crested wheatgrass	45	45	35	25	24	40
'Killdeer' sideoats grama	40	70	--	--	--	0
Glyphosate + 2,4-D	40	45	1	1	<1	99
Control	40	100	65	40	35	--
LSD (0.05)	NS	24	12	12	16	26

[a]Bromoxynil + 2,4-D at 0.25 + 0.75 lb/A applied to all plots except the control 24 May 91 and 26 May 92.
[b]Four 0.25-m^2 quadrats counted per plot in May of each year.
[c]Change in leafy spurge stand count from May 1990 until June 1994.

All established grass species reduced leafy spurge production compared to the control 2 years after planting (Table 2). The reduction was similar to the herbicide treatment with all species except 'Rodan' western wheatgrass and T-17596 mountain rye. 'Arthur' Dahurian wildrye, 'Rebound' smooth brome and 'Reliant' intermediate wheatgrass produced the most herbage and averaged 2830 lb/A. 'Rebound' smooth brome, 'Bozoisky' Russian wildrye, 'Arthur' Dahurian wildrye, and 'Hycrest' crested wheatgrass increased in production from 1991 to 1992.

'Rebound' smooth brome. 'Rodan' western wheatgrass, and 'Arthur' Dahurian wildrye provided the highest leafy spurge control in 1994 and averaged 80, 70, and 60%, respectively (Table 1). These grass species also had the highest total forage production during the study. Grasses were not harvested in 1994 because the plots were flooded in 1993 and a majority of the stands were lost.

Table 2. Competitive grass species and leafy spurge production at Fargo (Lym and Tober).

Grass species/ or herbicide treatment[a]	Yield[b]									Proportion[d] Leafy spurge		
	Grass			Leafy spurge			Total[c]					
	1991	1992	1993	1991	1992	1993	1991	1992	1993	1991	1992	1993
	lb/A									%		
'Rebound' smooth brome	510	3070	2120	290	45	190	2035	3170	2420	14	2	8
'Rodan' western wheatgrass	945	3260	2560	270	140	600	1990	3440	3280	14	4	18
'Bozoisky' Russian wildrye	540	1260	1170	230	95	440	1915	1630	1770	12	8	25
'Arthur' Dahurian wildrye	1180	3240	1400	220	65	580	2045	3350	2460	11	2	24
'Reliant' intermediate wheatgrass	2290	2180	1560	215	40	210	2700	2225	1950	8	2	11
T-17596 mountain rye	355	250	410	145	130	570	1810	830	1490	8	16	38
'Hycrest' crested wheatgrass	1100	1740	1060	210	95	390	2075	1935	1810	10	5	22
'Killdeer' sideoats grama[e]	1	…	...	320	...	...	2005	...	...	16	...	...
Glyphosate + 2.4-D	0	0	0	505	10	10	2380	1100	1020	21	1	1
Control	0	0	0	505	235	630	1330	965	1480	38	24	43
LSD (0.05)	770	1415	1015	NS	85	330	NS	1420	1110	17	8	15

[a]Bromoxynil + 2,4-D at 0.25 + 0.75 lb/A applied to all plots except the control 24 May 91 and 26 May 92.
[b]Four 0.25-m^2 quadrats harvested per plot 23-24 July 91 and July 92.
[c]Total yield includes weedy grasses and forbs.
[d]Percent of component in total yield.
[e]Killdeer sideoats grama did not establish and was not harvested in 1992.

A second experiment was established near the Pipestem dam north of Jamestown to evaluate competitive grass species in a soil type more typical of North Dakota than Fargo clay. The soil at Jamestown was a loamy sand with 6.8% organic matter and 6.8 pH. The experimental design and plot size were the same as at Fargo. The initial leafy spurge stand counts were recorded on May 26, 1993 and averaged 83 stems/m^2. Glyphosate plus 2,4-D at 0.4 + 0.6 lb/A was applied to all plots, except the control, in June and again in July. The soilbed was then prepared for seeding and the grass was planted on August 24. No irrigation was necessary as the soil moisture was high at seeding and 0.5 inches of rain was received weekly for the next 3 weeks. The grass species planted were similar to the first study except 'Killdeer' sideoats grama and T-17596 mountain rye were not re-evaluated (Table 3). 'Pryor' slender wheatgrass, 'Lodorm' green needlegrass and 'Mankota' Russian wildrye were added to the evaluation.

Table 3. Evaluation of various grass species competitive with leafy spurge near Jamestown (Lym and Tober).

Grass species/cultivar	Plants seeded	Leafy Spurge				
		Stand count[a]			Control[b]	
		1993	1994	1995	1994	1995
	lb/A	no./0.25 m^2			%	
'Rebound' smooth brome	10.5	15	14	3	40	91
'Rodan'western wheatgrass	8	33	16	11	25	63
'Bozoisky' Russian wildrye	11.3	20	13	10	40	67
'Arthur' Dahurian wildrye	15	16	9	5	60	83
'Mankota' Russian wildrye	11.3	17	12	11	45	65
'Reliant' intermediate wheatgrass	15	20	9	7	55	77
'Hycrest' crested wheatgrass	10.5	21	12	12	45	63
'Pryor' slender wheatgrass	9.8	24	11	9	50	72
'Lodorm' green needlegrass	10.7	28	20	13	10	57
'Manska' pubescent wheatgrass	15	18	6	9	70	70
Glyphosate + 2,4-D	--	16	20	2	10	93
Control	--	23	22	31	0	0
LSD (0.05)		8	5	5	22	17

[a]Four 0.25-m^2 quadrats counted per plot in May 1994 and 1905.
[b]Control based on stem density change compared to the untreated control each year.

Initial leafy spurge control from the various grass species at Jamestown was much higher than at Fargo. This is likely due to the ideal soil moisture and timely rains before and after planting which led to rapid establishment of the grasses. Leafy spurge control averaged over all grasses was 44% at Jamestown, compared to only 12% at Fargo the season after planting (Tables 1 and 3). The highest leafy spurge control was from 'Manska' pubescent wheatgrass and 'Arthur' Dahurian wildrye which averaged 70 and 60%, respectively (Table 3). 'Arthur' Dahurian wildrye had the highest forage yield at 2415 lb/A. As in the Fargo study, 'Reliant' intermediate 'wheatgrass, 'Hycrest' crested wheatgrass along with 'Pryor' slender wheatgrass and 'Manska' pubescent wheatgrass provided good initial leafy spurge control and forage yield (Table 4).

Leafy spurge control 2 years after planting, averaged over all grasses was 71% at Jamestown (Table 4). 'Rebound' smooth brome, 'Arthur' dahurian wildrye, and 'Reliant' intermediate wheatgrass provided the best control and averaged 84%. These grasses were also among the highest in production. Both grass and leafy spurge production was higher in 1995 compared to 1994. This was likely due to increase in stand density of the grass species and recovery of the leafy spurge from the cultivation conducted for seeding in 1993. All grass species except 'Bozoisky' Russian wildrye reduced the proportion of leafy spurge in the total biomass similar to the glyphosate plus 2,4-D treatment.

Table 4. Competitive grass species and leafy spurge production at Jamestown (Lym and Tober).

Grass species/[a] herbicide	Yield[b]						Proportion[d] leafy spurge	
	Grass		Leafy spurge		Total[c]			
	1994	1995	1994	1995	1994	1995	1994	1995
	lb/A						%	
'Rebound' smooth brome	870	2565	5	130	1070	3090	1	4.5
'Rodan' western wheatgrass	720	1600	20	210	905	2875	3	7.2
'Bozoisky' Russian wildrye	390	800	25	250	605	2090	4	11.4
'Arthur' Dahurian wildrye	2415	2890	5	105	2560	4055	0.1	2.9
'Mankota' Russian wildrye	430	760	15	170	615	1950	3	8.4
'Reliant' intermediate wheatgrass	1585	2445	10	105	1715	3185	0.5	3.2
'Hycrest' crested wheatgrass	1365	2425	15	270	1440	3150	1	8.6
'Pryor' slender wheatgrass	1285	1170	20	295	1405	2695	1	10.3
'Lodorm' green needlegrass	440	990	40	275	760	2875	5	9.4
'Manska' pubescent wheatgrass	1515	2830	10	135	1660	3530	0.5	4.1
Glyphosate + 2.4-D	0	0	25	380	650	2330	4	4.1
Control	0	0	205	75	795	2660	26	16.9
LSD (0.05)	299	751	49	174	351	994	6	6

[a]Bromoxynil + 2.4-D at 0.25 + 0.75 lb/A applied to all plots but the control 24 May 94.
[b]Four 0.25-m^2 quadrats harvested per plot 14 July 94.
[c]Total yield includes weedy grasses and forbs.
[d]Percent of component in total yield.

All grass species evaluated at Fargo could be considered to be competitive with leafy spurge except 'Killdeer' sideoats grama. However, based on both herbage yield and leafy spurge reduction, 'Rebound' smooth brome, 'Arthur' Dahurian wildrye and 'Reliant' intermediate wheatgrass would be the best species to plant into a leafy spurge infestation in a clay soil. Initial evaluations at Jamestown indicated these same grasses along with 'Pryor' slender wheatgrass and 'Manska' pubescent wheatgrass will be very competitive in the sandy loam soil at Jamestown.