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Response of the prairie fringed orchid to herbicides for leafy spurge control

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Approximately 15 to 20% of the Sheyenne National Grassland in southeastern North Dakota is infested with leafy spurge. These infestations threaten habitat of the western prairie fringed orchid, which is on the federal threatened and endangered species list. The purpose of this research was to evaluate various herbicide treatments to control leafy spurge while sustaining western prairie fringed orchid populations and other non-target species.

The first experiment was established to evaluate various herbicides for leafy spurge control in an area likely to support the western prairie fringed orchid on the Sheyenne National Grassland. Herbicides included glyphosate plus 2,4-D, imazapic plus MSO plus 28% N and quinclorac plus MSO and were applied in September 1997 and reapplied in 1998 to the same plots. Treatments were applied using a hand-held 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 stem density and control was evaluated in July 1998 and 1999, 10 and 22 months after the first treatment (MAFT), respectively.

Quinclorac and imazapic provided the best leafy spurge control and reduced leafy spurge density to an average of 5 and 45 stems/m² 10 and 22 MAFT, respectively, compared to 158 and 314 stems/m², respectively, in the untreated control (Table 1). There was a tendency for leafy spurge stem density to decline as the herbicide application rate increased. Glyphosate plus 2,4-D reduced stem density less than quinclorac or imazapic and control was similar to the untreated check 22 MAFT.

A seed bank study was conducted in conjunction with the herbicide efficacy trial. Each plot was divided in half and five soil cores were taken from both the left and right side for a total of 10 cores per plot. The top 2.5 cm of the soil surface plus the litter layer was removed using a standard golf cup cutter (10 cm in diameter). Soil cores were taken in May 1998 and the soil was washed through a 4 mm sieve and a 0.2 mm sieve to remove coarse and fine materials. Samples were then spread 3 to 5 mm deep on a layer of sterile sand (approximately 1 cm deep) over a 2 inch layer of potting soil. Seed from a total of 56 composite (4 replications, 7 herbicide treatments, 2 subsamples) soil cores were grown in the greenhouse. Seedlings were counted and removed after identification.

Leafy spurge comprised 40% of all germinated seedlings, with grasses 25%, forbs 22%, grasslike 10%, and other species 3% (Table 2).

The second experiment was established at two locations in July 1998 to evaluate herbicide efficacy on the western prairie fringed orchid. The orchid populations were located in an exclosure located on the Sheyenne National Grassland and along a right-of-way of Highway 27 adjacent to the Grassland. A total of 48 orchids in the exclosure and 40 orchids along Highway 27 were tagged for treatment and later identification. The treatments included glyphosate plus 2,4-D at 0.4 + 0.6 lb/A, imazapic plus MSO plus 28% N at 0.125 lb + 1 qt + 1 qt/A and quinclorac plus MSO at 1lb + 1qt/A and an untreated control. The plots were 1 m² located randomly within the exclosure and along Highway 27 with 12 and 10 replications, respectively. Orchids were counted on July 6, 1999 (10 MAFT) in the exclosure. However, orchids could not be counted at the Highway 27 location because of persistent flooding during the growing season.

The growth of the western prairie fringed orchid was not affected by the herbicides evaluated in this study. At least one orchid reappeared in 9 of 11 replications of the quinclorac treatment (one plot was lost) (Figure 1). Orchids reappeared in 7 of 12 replications of the imazapic and glyphosate plus 2,4-D treatments with one or more orchids present where they reappeared. The orchid reappeared in 6 of 12 replications of the control with one or more orchids where they reappeared. Orchid numbers were highest following the quinclorac treatments with 21 orchids reappearing in 1999, while imazapic, glyphosate plus 2,4-D and the untreated control had 11, 16 and 13 orchids, respectively (Figure 2)

In summary, both quinclorac and imazapic controlled leafy spurge when fall applied with no affect on the western prairie fringed orchid. Leafy spurge likely will be the first and most abundant plant to appear following a disturbance of the soil surface or after removal of the current vegetation canopy using herbicides. Thus a long-term management plan is needed to control this weed in western prairie fringed orchid habitat.

Table 1. Effect of fall applied herbicides on leafy spurge stem density applied twice^a.

Treatment	Rate	Stem density MAFT ^b	
		10	22
	lb/A	%	
Quinclorac+MSO	0.8+1qt	10	62
Quinclorac+MSO	1+1qt	0	19
Imazapic+MSO+28% N	0.0625+1qt+1qt	9	77
Imazapic+MSO+28% N	0.125+1qt+1qt	1	22
Glyphosate + 2,4-D	0.2+0.3	140	300
Glyphosate + 2,4-D	0.4+0.6	78	296
Control		158	314
LSD (0.05)		57	111

^aTreatments applied in September 1997 and 1998.

^bMonths after first treatment.

Table 2. Evaluation of the seed bank in a leafy spurge infestation averaged over treatment^a.

Plant class	Total species present		Desirable	Undesirable
	— % —	— No. —	— % —	
Leafy spurge	40	NA	NA	NA
Grasses	25	13	15	85
Grasslike	10	2	NA	NA
Forb	22	28	14	86
Other	3	1	NA	NA

^aSoil was sampled for seed in approximately 9 months after the first herbicide treatment. Data are averaged over the treatments detailed in Table 1.

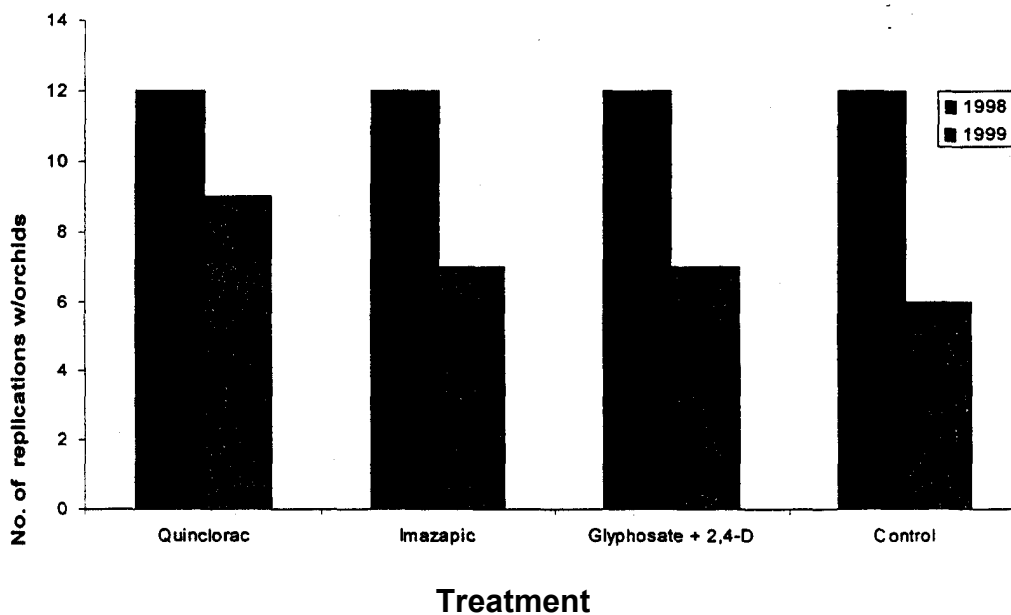


Figure 1. Effect of herbicide treatment on western prairie fringed orchid reappearance the following growing season.

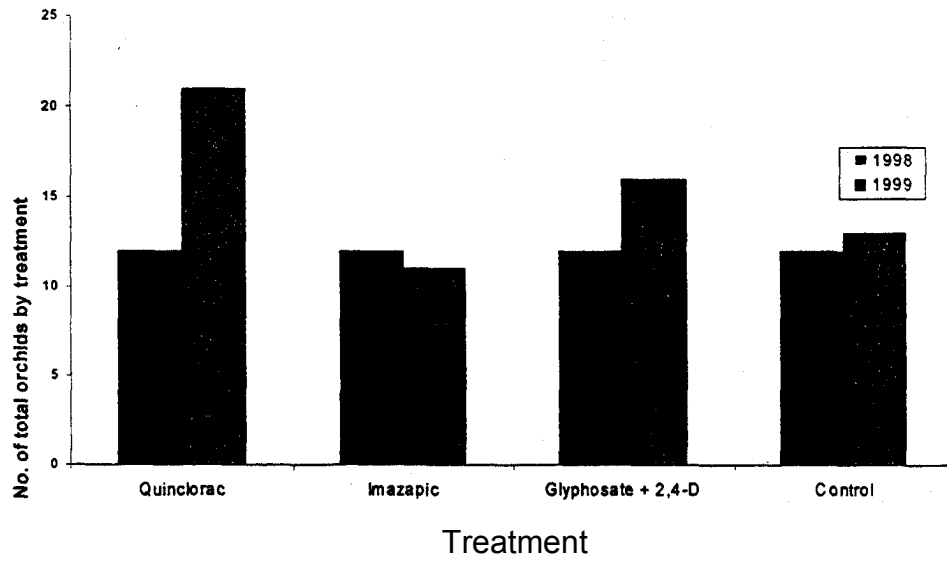


Figure 2. Total number of western prairie fringed orchids that regrew following a fall herbicide treatment.