Effect of Grazing, Mowing, or Herbicide on Leafy Spurge Control[1]

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Introduction

Leafy spurge (*euphorbia esula* L.) is an herbaceous perennial which is deep rooted and can reproduce by seeds and rhizomes. First introduced into North America in the 1800's from Europe, it now covers 25 states in the USA and several provinces in Canada. It is a major concern in North Dakota, South Dakota, Wyoming, Montana, and Nebraska. Leafy spurge is considered a noxious weed that is extremely competitive, establishing itself in pastureland and roadsides. Bangsund et al. (1997) estimated that by 2005, uncontrolled leafy spurge acres would reach 18.5 million in the Northern Great Plains. The cost of leafy spurge is estimated to be in the 100's of millions of dollars due to lost grazing through a reduction of available AUM's (animal unit months) and treatment costs which may not be economically feasible. This is impart due to the fact that cattle avoid eating leafy spurge because of post-ingestive negative feedbacks from plant toxins (Kronberg et al., 1993) and avoid grazing in areas where leafy spurge canopy cover is high, thus reducing grass production and utilization (Hein and Miller, 1992).

Do to the high costs of herbicides and their ineffective control in the long-term (Lym and Messersmith, 1985), biological controls such as sheep and goats as well as the flea beetle have become more popular tools in controlling leafy spurge (Bangsund et al., 2000). In a pasture setting sheep and goats readily graze forbs and do not experience the build up of toxins that cattle do, making small ruminants ideal biological controls for leafy spurge.

The object of this trial was to measure the effectiveness of various control methods on leafy spurge.

Methods

The study site was located on a heavily leafy spurge infested pasture located 4 miles north of Brookings, SD. The topography and climate is characterized by rolling hills with an annual precipitation of 22.8 inches with an average temperature during the growing months (April – September) of a high of 73^{o}F and a low of 48^{o}F. Vegetation was dominated by predominately cool-season grasses such as smooth bromegrass (*Bromus inermis* Leyss. subsp. *inermis*), Kentucky bluegrass (*Poa pratensis* L.), quackgrass [*Elytrigia repens* (L.) Desv. ex Nevski] and leafy spurge.

The study was initiated in June of 2004. Experimental design was a randomized complete block design with four replications. Treatments were applied to 16 x 16 ft plots. Treatments consisted of 1) Control (only measurements taken from the plot site), 2) Mow – plot mowed and grass removed to simulate haying, 3) Graze – plot grazed with sheep at a stocking rate of 6.8 AUM/acre, and 4) Herbicide – plot sprayed with a 2% solution of Grazon (picloram, 2.3 oz/1.05 qt and 2-4-D 8 .5 oz/1.05 qt; Dow Agro Sciences, Indianapolis, IN) using a hand-held sprayer.

Estimates of grass and leafy spurge biomass and leafy spurge stem density were made prior to treatment application (June 2004, Year 1) and one year after treatments were applied (June 2005, Year 2) by clipping vegetation from four 0.19.5 in.^{2} quadrats per plot. Grass and leafy spurge were hand separated and the number of leafy spurge stems was counted. Samples were dried in a forced air oven at 140^{o}F for 72 hours and weighed.

Analysis of variance was used to analyze treatment effects from biomass and stem density estimates from Year 1, Year 2, and the difference of Year 1 from Year 2. A randomized complete block model was calculated using PROC GLM (SAS, 1999). Least square means

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and standard errors were calculated using the LSMEANS statement and separated using the PDIFF option (SAS, 1999). Mean comparisons were considered significantly different at $P \leq 0.05$.

Results and Discussion

Estimates of leafy spurge and grass biomass and leafy spurge stem density from plots prior to treatment application in Year 1 were similar (Table 1). Grass yield averaged 2300 lb/acre while leafy spurge contributed to 40% of the total herbage biomass. Productive cool-season pasture in Brookings County, SD without leafy spurge can yield 6000 lb/acre in late June (Smart unpublished data). In Year 2, herbicide treatment reduced ($P < 0.01$) leafy spurge biomass compared to the control (Table 1). This was a result of smaller stems since stem density was not significantly different in Year 2 (Table 1). Mow and graze treatments did not reduce leafy spurge biomass compared to the control. The difference between Year 1 from Year 2 resulted in an 850 lb/acre decrease ($P < 0.01$) in leafy spurge biomass, however, grass production did not increase compared to the control (Table 2). Leafy spurge density decreased ($P < 0.01$) by 6 plants per ft^2. Mow and graze treatments did not differ from the control.

Leafy spurge stem densities in this study were at levels that would hinder grazing utilization by cattle (Hein and Miller, 1992). Our results are typical of other herbicide studies, in that leafy spurge is reduced but not eradicated with herbicide application (Lym and Messersmith, 1985). The lack of reduction in leafy spurge biomass or stem density using mow and graze is also typical of first year results (Lacey and Sheley, 1996). Strategies that combine treatments may be more effective in reducing leafy spurge. Lacey and Sheley (1996) showed that sheep grazing in combination with picloram was more effective than either one alone.

Implications

Use of herbicide to control leafy spurge is a promising way to suppress leafy spurge in the first year of treatment. However, costs associated with this form of treatment may not be economically feasible for large infestations. Future research will focus on grazing strategies throughout the growing season in combination with herbicide treatment to suppress the growth of leafy spurge with analysis of the costs associated with the treatments.

References

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Tables

Table 1. Leafy spurge and grass biomass and leafy spurge stem density from Brookings, SD

Treatment	Year 1 Leafy Spurge, lb/acre	Year 1 Grass, lb/acre	Year 1 Leafy Spurge, No. of stems/ft^2	Year 2 Leafy Spurge, lb/acre	Year 2 Grass lb/acre	Year 2 Leafy Spurge, No. of stems/ft^2
Control	1440	2370	13	1640^a	2660	12
Mow	1390	2370	11	1470^a	2020	13
Graze	1450	2440	12	1530^a	2790	11
Herbicide	1870	2070	15	1030^b	2350	9
Std Error	162	207	1.3	90	160	1.7
LSD	519	661	4.1	288	514	5.3

[a,b] Means with different superscripts within a column differ $P < 0.01$.

Table 2. Change in leafy spurge and grass biomass and leafy spurge plant density from Year 1 to Year 2 near Brookings, SD

Treatment	Leafy Spurge, lb/acre	Grass lb/acre	Leafy Spurge No. of Stems/ft^2
Control	210^a	290	-0.4^a
Mow	90^a	-350	2.0^a
Graze	80^a	300	-0.6^a
Herbicide	-850^b	280	-6.1^b
Std Error	138	256	1.1
LSD	441	820	3.4

[a,b] Means with different superscripts within a column differ $P < 0.01$.