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Angora goat grazing as a biological control for leafy spurge: A three-year summary

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Leafy spurge (*Euphorbia esula*) continues to be a serious problem in North Dakota, infesting over 1.5 million acres of land, predominately rangeland. Chemicals continue to be the primary method for control and attempts for eradication. Biological control methods have received much interest in recent years. Grazing with sheep has been a control method since the 1930's, but utilized sparingly (Helgeson and Thompson 1939, Helgeson and Longwell, 1942). A new animal receiving much attention today is the angora goat. Studies conducted on the use of goats as a leafy spurge control method have been limited, but have shown consistent results (Hanson and Kirby 1993, Sedivec and Maine 1993).

Angora goats were introduced to the 560 acre Hawk's Nest Butte area in southeastern Wells County as a biological control method for leafy spurge. Hawk's Nest Butte has been grazed by cattle in the past, but has provided little available forage due to a heavy infestation of leafy spurge.

Project objectives were to determine 1) if angora goats will significantly reduce the stem and herbage density of leafy spurge, 2) if angora goat grazing will stimulate the growth of graminoids through reducing the leafy spurge canopy, and 3) recommended stocking rate of angora goats on leafy spurge infested pastures.

Study area and methods

The study was conducted on the 560 acre Hawk's Nest Butte located approximately 10 miles southwest of Carrington, North Dakota. The butte is situated in Sec. 26, T. 145 N., R. 68 W., 5th Principal Meridian. Hawk's Nest Butte is classified as a morainic coteau of hills situated in front of the Missouri Plateau. Vegetation on the Hawk's Nest Butte was typical of the mixed grass prairie of the Missouri Coteau prior to the introduction of leafy spurge.

Leafy spurge stem counts were conducted prior to the introduction of angora goats on June 1, 1990 to achieve initial stand counts. Stems were counted using 1 ft. × 1 ft. frames on two line transects in the spring of the year prior to grazing in 1990, 1991, 1992, and 1993. A control site was developed in 1991, which has been ungrazed throughout the duration of the study. Stem counts were collected on about June 1, 1991, 1992 and 1993 on

the ungrazed control site. The paired plot technique was used comparing grazed and non-grazed sites using 2.5 ft. × 5 ft. cages to determine forage production potential and degree of use for leafy spurge, graminoids, shrubs, and other forbs.

Stocking rate was 567 animal unit months (AUMs) from June 1 to Sept. 20 (900 angora goats), or 1.01 AUMs/acre in 1990. The stocking rate was 505 AUMs from May 20 to Oct. 5 (660 angora goats), or 0.90 AUMs/acre and 637 AUMs from May 15 to Oct. 1 (828 angora goats), or 1.13 AUMs/acre in 1991 and 1992, respectively.

Leafy spurge stem counts were tested for significant ($P<0.05$) main effects using multi-response permutation procedure (MRPP) (Biondini *et al.* 1988).

Results and discussion

Initial leafy spurge stem counts for June 1, 1990 on the grazed transects was 38.7 stems per square foot. After one year of angora goat grazing, stem counts were collected on May 15, 1991. Leafy spurge stem density was reduced to 36.2 stems per square foot or a reduction of 6.3 percent ($P>0.05$) (Table 1).

Leafy spurge stem counts were collected on May 15, 1992, that period following two years of grazing. Stem densities were 30.4 stems per square foot in 1992, a significant reduction of 21.3 percent ($P<0.05$) (Table 1). May 20, 1993, leafy spurge stem density counts were collected to achieve three years of grazing response. Leafy spurge stem density counts were 29.6 stems per ft^2, a significant reduction from 1990 and 1991 (Table 1).

Table 1. Stem density counts of leafy spurge, forbs and shrubs in 1990 through 1993 at the Hawk's Nest Butte, near Carrington, ND.

Date Collected	Leafy Spurge[1]	Forbs	Shrubs
	per sq. foot		
May 31, 1990	38.7[a]	3.4	1.0[a]
May 15, 1991	36.2[a]	1.6	0.3[a]
May 15, 1992	30.4[b]	2.5	0.5[a]
May 20, 1993	29.6[b]	1.7	0.6[a]
Percent reduction from 1990 to 1993	23.5	50.0	40.0

[1] Percentages with the same letter are not significantly ($P>0.05$) different.

Data collected from the paired plots were collected in mid-August, 1990 and 1991, and late August, 1992, that time period when forage production tended to peak in North Dakota (Whitman *et al.* 1951). Forage production on the nongrazed plots of the paired plots had a leafy spurge-to-grass density ratio of 56.5:43.5% in 1990 (Table 2).

Herbage production using the paired plots technique was collected for all years during peak production. After one year of grazing, the ratio of leafy spurge-to-grass density was 37.1:62.9%, an increase in grass density of 44.6% and reduction of leafy spurge density of 37.1%. Herbage production following two years of grazing had a ratio of leafy spurge-to-grass density of 31.6:68.4%, an overall increase in grass density of 57.2% and reduction of leafy spurge density of 44.1%.

Table 2. Percentage change in canopy cover from 1990 to 1992 at the Hawk's Nest Butte near Carrington, ND.

	Percent of Canopy Cover by Weight			
Year	Percent[1] Leafy Spurge	Percent Change	Percent[1] Grass	Percent Change
1990	56.5[a]		43.5[a]	
1991	37.1[ab]	- 34.3	62.9[ab]	+ 44.6
1992	31.6[b]	- 14.8	68.4[b]	+ 8.7
Percent total change		- 44.1		+ 57.2

[1]Percentages with same letter are not significantly (P>0.05) different.

Degree of use on the leafy spurge and grass species was determined in 1991 and 1992. Over 84 and 65% of the leafy spurge was utilized in 1991 and 1992, respectively, with the remaining percentage almost completely standing stems (Table 3). Grass utilization was plus 16.6 and 11.1% in 1991 and 1992, respectively, thus an increase in grass production occurred on the grazed plots as comparing with the nongrazed plots. As the leafy spurge canopy was removed through grazing, grasses increased in production faster than the goats could utilize it.

Table 3. Herbage production and degree of use on leafy spurge and graminoid species by angora goats in 1990, 1991 and 1992.

Treatment	Herbage Production lbs/acre					
	Leafy Spurge			Graminoid Species		
	1990	1991	1992	1990	1991	1992
Ungrazed	960	1277	501	739	2165	1084
Grazed		201	176		2526	1206
Degree of use		- 84	65		+ 17	+ 11

Summary

Angora goats did an excellent job in controlling the spread of leafy spurge. Leafy spurge stem counts were significantly reduced after two years of grazing while grass production increased due to the removal of the leafy spurge canopy. As the canopy of leafy spurge is opened, forage is improved for cattle grazing during summer and fall months.

Recommended angora goat stocking rates as it correlates to leafy spurge control was difficult to measure based on our data. Stocking rates ranged from 505 to 637 AUMs, or 5.3 to 6.7 goats/acre/month. These rates achieved our goal in reducing leafy spurge production and density without over-utilizing the graminoid species. Recommendations would be at least 6.7 goats/acre/month or 1.5 goats per acre for 4.5 months due to a more efficient leafy spurge utilization earlier in the grazing season while acheiving little utilization of the graminoid species in North Dakota. The lighter stocking rates allowed a

zation of the graminoid species in North Dakota. The lighter stocking rates allowed a larger percentage of leafy spurge plants to flower and set seed.

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