

10-1-2006

## Goats: A Tool for Controlling Spotted Knapweed

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### Recommended Citation

Williams, S., & Prather, T. (2006). Goats: A Tool for Controlling Spotted Knapweed. *The Journal of Extension*, 44(5), Article 15. <https://tigerprints.clemson.edu/joe/vol44/iss5/15>

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## Goats: A Tool for Controlling Spotted Knapweed

### Abstract

Spotted knapweed has invaded a number of habitats, and some of those habitats have restrictions on the tools used for control. An experiment was designed to examine the effects of grazing spotted knapweed with goats. The study explored the utilization of spotted knapweed by goats, the effects on plant cover, plant counts, and seed head production. Three years of study determined that goats would consume spotted knapweed, reducing plant cover, plant density, and seed head production. An extensive education outreach program has assisted with adaptation and recognition of goat grazing as a viable tool for noxious weed control.

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## Situation

Webster defines a weed as "any undesired, uncultivated plant, especially one crowding out desired plants." Noxious weeds are a regulated subset of weeds deemed particularly harmful to the economy and environment. Noxious weeds are regulated through state and federal laws that provide guidance and penalties for lack of management. Many noxious weeds were introduced from other countries and compete with desirable forages primarily for moisture and light and secondarily for nutrients. Noxious weeds thrive in part because their natural enemies, pathogens and herbivores from their native country, were not introduced along with them (Olson, 1999).

Spotted knapweed (*Centaurea biebersteinii*) is a noxious weed that infests 7% of the land in Lemhi County, Idaho and 18 of Idaho's 44 counties. Spotted knapweed is a perennial, deeply tap rooted plant from Eurasia. Spotted knapweed plants can live up to 9 years and produce seeds each year (Sheley, Jacobs, & Carpinelli, 1999). Seeds are viable in the soil for more than 7 years (Davis, 1993). Spotted knapweed contains a compound that inhibits growth of other plants (Bais, 2003). Its reduced biomass through winter leaves much of the soil exposed and susceptible to erosion in the spring (Lacey, 1989).

Spotted knapweed can be controlled using herbicides. There are also biological agents that suppress/control spotted knapweed plants. Ranchers and land managers are able to adjust their management strategy, taking advantage of multiple tools suitable to their situation. Having multiple tools allows construction of an integrated pest management plan to control spotted knapweed and improve forage production.

## Response

Grazing is a tool that has been utilized to manipulate the composition of forage on open rangelands. Grazing has been incorporated into the tool set for weed management and can reduce both biomass and seed production of targeted weeds. For example, sheep have been utilized to

control many noxious weeds and goats have been utilized to control leafy spurge. (Olson, 1994; Lacey, 1992) In May of 2001 an experiment was established to determine if goats could be utilized to control spotted knapweed.

## Methods

Questions to be answered by the demonstration included:

1. At what stage of plant growth would grazing reduce spotted knapweed cover?
2. At what stage of plant maturity would grazing reduce the number of plants per square meter?
3. At what stage of plant growth would grazing decrease seed head production?

Four grazing treatments for spotted knapweed were compared in the experiment. Treatments included grazing spotted knapweed at the following times: (1) non-grazed control (2) rosette to bolt stage (3) bud to bloom stage (4) grazed twice - rosette to bolt stage and seed set to fall rosette stage. Treatments were replicated three times in plots that measured 405 m<sup>2</sup> each. Thirty-six permanent measurement plots of 1.35 m<sup>2</sup> in size were established. Treatments within each plot were repeated each year. Individual plants were counted and percent canopy cover was measured in May of 2002, May of 2003 and May of 2004 after grazing treatments were completed the summer before. Seed heads were counted in September of 2001, 2002, and 2003. Each cell received the same treatment each year of the three year study. Five mature goats were utilized in each cell. Grazing time ranged from two to five days and goats were removed from a cell when consumption of spotted knapweed ceased and they started to consume other vegetation.

## Results

Goats readily consumed spotted knapweed, and plant maturity affected the grazing pattern of the goats. At the rosette to bolt stage, goats consume the plant from the top down, leaving the bottom 2 inches of the plant. At the bud to bloom stage, goats grazed the buds and blooms first, then stripped the leaves from the stems. When grazing at seed set to fall rosette stage, they grazed the rosette and green parts of the plant along with a few seed heads.

Timing of grazing was significant in each year, and density and cover changed each year. Plant density was highest in 2003, with greater survival than in 2002 and 2004. There was no timing by year interaction, so all treatments changed in the same way each year. Over all years, density was lower for the bloom time grazing (0.607 plants m<sup>-2</sup>) than for control (0.847 plants m<sup>-2</sup>) and rosette timing (0.976 plants m<sup>-2</sup>); bloom timing was not different from grazing at rosette and bloom (0.788 plants m<sup>-2</sup>); and grazing at rosette and bloom did not differ from any other treatment (Table 1). With respect to cover, bloom (19%) and rosette and bloom (19%) grazing reduced cover when compared to control (26%) and rosette timing (25%) (Table 2).

**Table 1.**

Timing of Goat Grazing Effect on Density of Spotted Knapweed

Grazing Time	2002	2003	2004
	plants m <sup>-2</sup>		
No grazing	0.927 a	1.183 ab	0.422 b
Rosette	0.637 bc	1.341 a	0.958 a
Bloom	0.472 c	0.973 b	0.375 b
Rosette and Bloom	0.864 ab	1.128 ab	0.370 b

Note: Mean separation was accomplished with Tukey's HSD at alpha = 0,05. Means within the same column with the same letter were not significantly different.

**Table 2.**

Timing of Goat Grazing Effect on Cover of Spotted Knapweed

Grazing Time	2002	2003	2004
	%		
No grazing	29 a	32 a	16 a
Rosette	27 a	32 a	17 a
Bloom	24 a	24 b	10 b
Rosette and Bloom	22 a	23 b	13 ab

Note: Mean separation was accomplished with Tukey's HSD at alpha = 0,05. Means within the same column with the same letter were not significantly different.

Grazing at the bloom period was better than grazing at the rosette timing for reducing plant density. In fact, grazing at the rosette stage resulted in more spotted knapweed plants in 2004 than were found in the plots not grazed. No treatment consistently reduced spotted knapweed plant density when compared with not grazing. Spotted knapweed cover did decline for the bloom timing in both 2003 and 2004. Grazing at the rosette timing was not beneficial even when followed with a second grazing period. Plant competition is associated with plant cover, so reduction in plant cover should eventually result in increased grass yield. If grazing at the rosette timing is necessary, it should be followed with grazing at bloom in order to avoid increasing plant density.

Grazing at all stages of plant growth reduced seed head production when compared to the control. Grazing at the bud to bloom stage and grazing twice consistently reduced the number of seed heads (Table 3).

**Table 3.**  
Timing of Goat Grazing Effect on Seed Head Production of Spotted Knapweed

Grazing Time	2002	2003	2004
	seed heads m <sup>-2</sup>		
No grazing	652 a	408 a	212 a
Rosette	303 b	177 ab	88 b
Bloom	174 b	27 c	70 b
Rosette and Bloom	77 c	116 b	39 b

Note: Mean separation was accomplished with Tukey's HSD at alpha = 0,05. Means within the same column with the same letter were not significantly different.

## Educational Outreach

The experiment provided numerous opportunities for education outreach. The experiment was discussed at tours hosted by the University of Idaho Nancy M. Cummings Research, Extension and Education Center, the Lemhi Soil and Water Conservation District, Lemhi Cooperative Weed Management Area, and Idaho Cattle Association. A poster was presented at University of Idaho All

College Annual Conference, University of Idaho Legislative Poster Display, Galaxy II National Extension Conference, and National Society for Range Management Conference. Presentations have also been made at the Lemhi Cattle and Horse Growers Annual Winter School and the Inter-tribal Agriculture Conference. Numerous informal tours have been conducted with interested private landowners and agency personnel.

## Application of Results

The knowledge and information gained from the experiment encouraged land management agencies and private land owners to utilize goat grazing for controlling spotted knapweed in areas where there is sensitivity to weed control using other tools. Salmon City has utilized goats for 3 years on 17 acres at the city's water supply and settling ponds. The area had a 75% spotted knapweed infestation. Based on demonstration results, grazing was focused on the bud to bloom stage. In 2002, a herd of 250 does and kids grazed for 10 days. In 2003, the grazing days was reduced to 7 days, and, in 2004, grazing required only 4 days. The reduction in days indicates a reduction in plant biomass with repeated grazings.

## Conclusion

Goats can be used as a tool to control spotted knapweed. When grazing is applied at the bud to bloom stage over a series of 3 years, a reduction of seed head production and plant biomass can be achieved. When spotted knapweed is reduced, desirable plants have an opportunity to increase.

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