

GOATS TO CONTROL THE ENCROACHMENT OF UNDESIRABLE BRUSH AND WOODY SPECIES IN CATTLE PASTURES

J-M. Luginbuhl^{1,2}, J. T. Green, Jr.¹, M. H. Poore² and A. C. Conrad¹

Departments of Crop Science¹ and Animal Science², North Carolina State University,
Raleigh NC 27695-7620, USA.

Abstract

Field studies were initiated in an abandoned, overgrown 8.4 ha orchard left untouched for 15 years to evaluate the effectiveness of using goats (*Capra hircus hircus*) to manage undesirable vegetation. Goats alone (G: 30 does/ha) or cattle (*Bos taurus*) with goats (GC: 17 does/ha and 3 steers/ha) were mob-grazed twice a year during four grazing seasons. Multiflora rose (*Rosa multiflora* Thunb.) canopy area decreased from 12 to 2.5 m² in grazed pastures and multiflora rose live canes were 100% in the control, 0% in G, and only 8% in GC at the completion of the study. Following two years of rest, cattle alone (C: 6 steers) or goats + cattle (GC: 9 goats and 6 steers) were rotationally grazed on the same site. Over four grazing seasons, brambles (*Rubus* spp.) and honeysuckle (*Locifera japonica*) vines were practically eliminated from grazed pastures. Multiflora rose bushes grew to a height of 1.8 m in C, but were kept low (avg .6 m) in GC (P < 0.01). Similarly, multiflora rose canopy area was well controlled in GC (avg .5 m²), but increased to 7 m² in C (P < 0.03). Black locust (*Robinia pseudoacacia* L.) trees were browsed by goats and cattle and were practically eliminated from grazed pastures.

Integrating goats into mountain grazing systems is a useful and environmentally-friendly management tool to keep these pastures in production.

Keywords: Browse, cattle, goat, vegetation management

Introduction

Much of hill-land pasture in the Appalachian region of the United States is infested by brush and multiflora rose (*Rosa multiflora* Thunb.) bushes imported as a rootstock for ornamental roses (Mays and Kok, 1988). In cases of heavy infestation, access to pasture and recreational areas has been completely eliminated. Multiflora rose plants can be killed by herbicides. However, viable seeds may remain in the soil for up to 20 years. New bushes may develop from these seeds and from seeds introduced by birds and other animals. Consequently, an effective management program is needed for years after eliminating the original plants (Kay et al., 1995). Low cost, low input and environmentally acceptable control procedures are needed to provide owners with ways to renovate and maintain these pastures (Pearson and Martin, 1991). Goats (*Capra hircus hircus*) are gaining importance as biological agents for the control of noxious plant due to increasing environmental restrictions and elevated costs of other control methods. The objectives of this study were to evaluate the effectiveness of grazing cattle or goats alone, or goats in combination with cattle to renovate hill-land pastures that have become overgrown with invading brush and woody species.

Material and Methods

Field studies was conducted at the North Carolina Department of Agriculture Research Station located in Waynesville NC (35° 50' N, 83° 00' W) . The study site was an abandoned, overgrown 8.4 ha orchard left untouched for 15 years. The orchard was located on a Hayesville Loam soil with slopes of 15 to 60%.

Study 1. The orchard was divided into six unequal sections consisting of two control (CTL) pastures, two replicated pastures grazed by goats (G: 30 mature does/ha) alone and two replicated pastures grazed by goats + cattle (GC: 17 mature does/ha with 2 to 3 steers/ha) for 4 grazing seasons. Grazing occurred for 52 days from May to July and for another 30 days in September and October. The grazing/browsing periods were dependent upon having at least 5 to 10 cm of available forage to graze within each pasture.

Study 2. Following two years of rest, the orchard was divided into nine unequal sections consisting of three replicated CTL pastures, three replicated pastures rotationally grazed by GC and three replicated pastures rotationally grazed by C alone for 4 grazing seasons. Control pastures from study 1 were not used. During the first grazing season, 6 steers were grazed alone or with 9 crossbred Boer goats. Because of increased forage growth in subsequent years, the number of steers was increased to 7 head per pasture, and the ratio of goats to cattle was increased to 2:1. Animals were rotated among pastures when the average available forage present was approximately 5 cm or less.

In each pasture, 8 multiflora rose bushes were identified and tagged to determine the effects of browsing on plant survival. Tagged rose bushes were scored for percent live canes (stems), plant height, and canopy area. In study 2, four squares measuring 3 x 3 m were also marked with wooden pegs in each pasture for black locust (*Robinia pseudoacacia* L.) measurements. The height of black locust trees found within each square was recorded. The

frequency of brambles (*Rubus* spp.) and honeysuckle (*Lonicera japonica*) vines were examined at numbered pegs along transect lines. Measurements and visual observations were recorded each spring and fall immediately prior to the start and following the end of the grazing season.

The experimental design was a randomized complete block with replicates and a factorial arrangement of treatments. Treatment and season effects were tested by the GLM procedure of SAS (1998) using repeated measures. Pre-planned orthogonal contrasts were used to determine differences among defoliation treatments.

Results and Discussion

Study 1. Goats and goats + cattle were very effective in controlling multiflora rose bushes (Table 1). Multiflora rose height and area declined steadily in the grazed pastures compared to CTL. Multiflora rose live canes decreased drastically and, by October 1994, none and only 8 % of the multiflora rose canes were alive in the G and GC pastures, respectively, whereas all were live in CTL. Recent observations have shown, however, that new shoots sprouted on the pasture following two years of rest. The size of the emerging shoots and the presence or absence of multiple basal shoots could indicate that some roots had survived, and that smaller, slender shoots appeared to have originated from new seedlings.

Study 2. The effects of repeated defoliation by goats on multiflora rose height and canopy area were clearly observed (Table 2). Multiflora rose height and canopy area declined with grazing season in the GC pasture. Conversely, multiflora rose height and canopy area increased in both CTRL and C pastures, but the rate of increase was slower in the C pasture. Cattle were not observed defoliating multiflora roses bushes, but trampling around the bushes during grazing may have reduced multiflora rose growth. After four grazing seasons, only 41% of multiflora rose canes were still alive in the GC pasture, compared to 96% in both CTRL and C pastures. The reduction in height, canopy area and percent of live canes of the multiflora rose bushes in the GC pasture after four growing seasons indicated that their condition was severely affected. Repeated defoliation by goats and(or) cattle very effectively controlled the height of black locust trees, whereas in the CTRL pasture black locust trees increased in height from 1.4 m to 5.3 m. Cattle have been categorized as non selective roughage grazers (Hoffman, 1985), but in the present study they were observed defoliating the tender shoots of black locust trees. Therefore, when given the opportunity cattle will alter their eating behavior and become opportunistic browsers. Cattle and goats grazing with cattle were also very effective in controlling brambles and honeysuckle vines (Table 2). Brambles and honeysuckle vines were grazed to a similar extent in both C and GC pastures, whereas their frequency increased substantially in the CTRL pasture. Research in West Virginia has shown that brambles were reduced from 39 to 9% by grazing hill land pastures with cattle, sheep and goats (Mills and Bryan, 1983). These results showed the importance of integrating goats in mountain pasture systems. When grazed with cattle, goats demonstrated their biocontrol potential by effectively reducing the encroachment of mountain pastures by multiflora rose bushes and other woody and brush species. Manipulating goat

numbers to strike a balance between grazing livestock and the plant community would be worthy of investigation.

References

Hofmann, R.R. (1985). Digestive physiology of the deer - their morphophysiological specialization and adaptation. The Royal Soc. New Zealand, Bull. **22**:393-407.

Mays, W.J. and Kok L.P. (1988). Seed wasp on multiflora rose, *Rosa multiflora* in Virginia. Weed Technol. 265-268.

Kay, S.H., Lewis W.M. and Langeland K.A. (1995). Integrated management of multiflora rose in North Carolina. 17 p. North Carolina Cooperative Extension Service Publication No. AG-536.

Mills, T.A. and Bryan W. (1983). Improving hill pastures with grazing animals. Proc. Symp. Foothills for Food and Forest. pp 341-344. Corvallis, OR.

Pearson, H.A. and Martin Jr.A. (1991). Goats for vegetation management on the Ouachita National Forest. In: S. G. Solaiman and W. A. Hill (Ed.) Using Goats to Manage Forest Vegetation: A Regional Enquiry. pp 59-73. Tuskegee University, Tuskegee, AL.

SAS. (1998). SAS/STAT User=s Guide (Release 7.0). SAS Inst. Inc., Cary, NC.

Table 1 - Effects of grazing mountain pastures in the Appalachian region of North Carolina with goats alone or with goats in combination with cattle on multiflora rose bushes during four grazing seasons (Study 1)

Item	Spring Year 1			Fall Year 1			Spring Year 4			Fall Year 4			SE ^c	CTL vs	G vs
	CTL	G	GC	CTL	G	GC	CTL	G	GC	CTL	G	GC		G & GC ^a	GC ^b
														P <	P <
Rose height, m	2.7	2.0	2.0	2.5	2.0	2.0	2.0	.4	1.0	2.0	.4	.7	6	0.2	0.8
Rose area, m ²	15	6	17	15	7	14	17	.3	5	16	.3	5	3	0.01	0.4
Rose live cane, %	- ^d	-	-	-	16	23	94	4	21	100	0	8	5	0.01	0.2

^aOrthogonal contrast: Control vs goats and goats+cattle.

^bOrthogonal contrast: Goats vs goats + cattle.

^cStandard error derived from the statistical model.

^dData not taken.

Table 2 - Effects of grazing mountain pastures in the Appalachian region of North Carolina with cattle alone or with goats in combination with cattle on multiflora rose bushes, black locust trees, honeysuckle vines and brambles during four grazing seasons (Study 2)

Item	Spring Year 1			Fall Year 1			Spring Year 4			Fall Year 4			SE ^c	CTL vs	C vs
	CTL	C	GC	CTL	C	GC	CTL	C	GC	CTL	C	GC		C & GC ^a	GC ^b
Rose height, m	.6	.6	.6	1.0	.9	.8	2.0	1.5	.6	2.5	1.8	.5	.3	0.01	0.01
Rose area, m ²	.5	.6	.6	4.5	3.1	1.5	9.4	4.5	.9	10.7	6.6	.4	2.5	0.01	0.03
Rose live cane, %	- ^d	-	-	-	-	-	94	96	68	95	96	41	10.2	0.5	0.02
Locust height, m	1.4	.5	.7	2.7	1.0	.8	4.8	.2	.2	5.3	.1	0	.4	0.01	0.9
Honeysuckle, %	0	0	0	17	4.1	16	52	6.7	9.7	35	5.7	5.6	6	0.01	0.4
Brambles, %	33	38	40	7	6	3.5	37	3	1	80	4.5	2	5	0.01	0.5

^aOrthogonal contrast: Control vs cattle and goats+cattle.

^bOrthogonal contrast: Cattle vs goats + cattle.

^cStandard error derived from the statistical model.

^dData not taken.