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USE OF ANGORA GOATS IN VEGETATION CONTROL

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ABSTRACT

Kudzu (*Pueraria lobata*) poses a serious threat to the timber industry in the southern United States and methods to control its growth are constantly being sought to improve forest management. Angora goat production is increasing in Alabama and are currently being used as biological control of kudzu in infested timberlands. Data obtained during the past three growing seasons show that angora goats can be raised on kudzu-infested forest lands, produce high quality mohair and control competing vegetation. While angora goats are able to control such persistent weeds as kudzu, they allow pine seedlings to develop more rapidly thereby producing more timber. Furthermore, angora goats do not have to be provided supplemental feed since kudzu, a warm-season legume, can provide nutrients adequate for growth and mohair production. It is now possible that by introducing angora goats in a forest management system, the farm family can generate additional income to augment the long-term investment in timber production.

INTRODUCTION

Kudzu (*Pueraria lobata*), honeysuckle (*Diervilla lonicerifa*) and other competing forest understory vegetation pose a serious threat to the timber industry in the southern United States (Geographia, 1990; McNabb, 1990). In order to control these weeds chemicals are used to control their growth in a timber plantaion (Miller and Edwards, 1983). However, this practice is being viewed with disfavor since it poses a threat to the environment. Other methods such as burning and mechanical control are associated with soil erosion and air pollution and the public's perception of such activities as not sustainable is being

reassessed. In order for the timber industry of the southern United States to maintain its employment base and at the same time be viewed as environmentally friendly, innovative management practices must be developed.

Conventional Control of Forest Vegetation:

Forestry programs have always used a combination of methods to control undesirable vegetation in forested areas. It is common practice to use herbicides and some of the most widely used are; glyphosate, 2,4-D, hexazinone and sulfometron. With clear-cutting, these herbicides are primarily used for site preparation but prescribed burning, mechanical and biological controls are sometimes recommended as alternative methods of weed control on forested lands.

Herbicides have replaced other methods because of the ease with which they can be applied, lower cost of application, and their selectiveness. Because new herbicides are not indiscriminate in killing vegetation, it is considered more environmentally friendly since erosion is reduced (Michaels, 1990). Control of weeds by herbicides in pine stands improves survival rate and provides a better opportunity for growth (Creighton et al., 1987; Nelson et al., 1985).

The Intensive Management Practices Assessment Center (IMPAC), located at the Southeast Forest Experiment Station in Gainsville, Florida, has been very instrumental in looking at the impact of herbicide use on forest lands. Several studies undertaken by scientists at this institution have brought new views to the wide-scale use of herbicides in our forest system. This has resulted in new forest management guidelines in certain areas (Neary et al., 1987; 1988; Bush et al., 1989). In order to reduce the risks associated with the use of herbicides, other scientists have embarked on the use of goats to control understory weed growth on forest lands (Bonsi et al., 1991; Pinkerton, 1991; Onokpise, 1990; Pearson, 1991).

Role of Goats in Forest Weed Control:

The need to fully utilize natural resources is recognized by forestry experts. This is true especially in developing a livestock enterprise in

a farming system that is primarily or solely devoted to the growing of trees. There is a great potential for using goats (angora) on forest lands to control weeds and at the same time provide an alternative enterprise and income for the landowner (McGowan, 1985). Goats can be utilized in removing understory weed growth that compete with economic forest plants for light, nutrients and moisture. According to Shelton (1990) goats can be used to generate income from scrubtype forests especially when commercial products are not possible and the soil is not conducive to planting pasture grasses. Because goats are browsers rather than grazers, they are considered less damaging to the ecology. By removing the excessive foliage on forest lands, they also reduce the incidence of fire outbreaks.

Work being conducted at Tuskegee University, Alabama is primarily geared at determining the effects of angora goats on kudzu in pine stands. Although Merrill and Taylor (1976) have suggested that Spanish goats might be more effective than angora goats in controlling brush on dry land, it is believed that angora goats would provide a higher rate of return to farmers under Alabama conditions. Bonsi et al., (1991) have shown that angora goats are effective in reducing kudzu growth in pine stands, thereby reducing the need for herbicides.

In evaluating the quality of kudzu as an animal feed, Small et al., (1991a; 1991b) reported that kudzu can adequately supply the nutritional requirements of angora goats. Woldeghebriel et al., (1992) have studied the biomass production of kudzu and have concluded that kudzu can supply the needs of angora goats without supplemental feed. Rhoden et al, (1991) have also reported that kudzu has the added advantage of not losing their leaves during periods of prolonged drought nor do their leaves shatter during harvest as compared to other legumes. The group has recommended that kudzu be considered as a major component of angora goats diets in the southern United States since kudzu's uncontrolled spread might be curtailed by this demand.

The objective of this study is to evaluate the effectiveness of using angora goats to control understory growth, especially kudzu, on forest lands in central Alabama.

MATERIALS AND METHODS

This report is part of a three year study that was undertaken by Tuskegee University and the United States Department of Agriculture Forest Service in June, 1990. The study site is located off Highway 29 five miles northeast of Tuskegee in east central Alabama (Section 21, Township 17 North, Range 24). The site comprised 1.2 hectares divided into two equal plots with stocking rates of 10 (low intensity) and 20 (high intensity) goats/ha (equivalent to 4 and 8 goats/ac). The area was previously planted to longleaf pines but was clearcut in 1983 and treated with herbicides for site preparation purposes. Oust® was applied to the site in 1984 and Roundup® in 1985, 1986 and 1988. The site is presently planted to loblolly and longleaf pine seedlings. In 1990 the area can be categorized as heavily infested with kudzu, relatively level, devoid of woody vegetation or trees except in the southeastern corner where the shelter-corral was located.

Data on kudzu and soil were taken throughout the growing season (April-October) and compared for the high and low intensity grazing areas. Data on kudzu included percent dry matter, fiber and crude protein. Percent ground cover, forage yield and the rate of regeneration of the kudzu were also monitored. The effect of angora goat grazing on soil compaction was evaluated to see what effect, if any, it may have on soil erosion. Goats were placed on the site in mid-June and removed in late October. They were housed in sheltercorral areas for protection each night and were provided supplemental feed during the winter months. Mineral supplements were provided all year and protein and energy supplement given when needed to meet the animals' daily requirements. Animals were dewormed for internal, sprayed for external parasites regularly and vaccinated against common diseases of goats.

Analysis:

In order to determine the quality of kudzu each meter of vine harvested was divided into four sections:

1. 0-25 cm

2. 25-50 cm

3. 50-75 cm

4. 75- 100 cm

Zero centimeter was used to indicate the growing tip of the vine. Leaves and petioles were removed from stems and pooled by section (i.e. 0-25, 25-50 etc.). Both leaf and stem samples from each section were air-dried and ground (1 mm mesh) using a Wiley mill. Samples were dried at 100° C and dry matter (DM) determined. The samples were then ashed at 550°C according to the AOAC method (1984). Neutral Detergent Fiber (NDF) and Acid Detergent Fiber (ADF) contents of the forage material were determined using the Goering and Van Soest (1970) method. Each leaf and stem sample was also analyzed for its % nitrogen using the Kjeldahl analytical procedure (AOAC, 1984). Differences among the leaf and stem samples for percent DM, NDF, ADF and CP were analyzed by the analysis of variance (AOV) procedures. When treatment effects were significant ($P < 0.05$), differences among means were separated using Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

Growth Rate:

It has been recognized that kudzu is capable of very rapid growth. This rate of growth was not often documented or stated. However, the growth rate of kudzu in this study was characterized by both vine length and dry matter production in the springs of 1990 and 1992. In evaluating the increase in the length of kudzu vines, it was noted that regardless of the time of measurement the growth rate was similar. The rate of increase was as low as 5.9 cm/day measured on day 7 after initiation of the experiment to a high of 7.0 cm/day when measured on day 10 (Table 1). These data support the claims that kudzu is a rapidly growing legume and can become a weed problem readily. With growth rates like those obtained during this study, kudzu

vines are capable of growing over and smothering a 50 ft plant in seven months.

Even on areas that are devoid of trees, kudzu is capable of producing large biomass. After sixty days of growth, the fresh weight of herbage on the site was over 10,000 kg/ha (Table 2). Of this material, 53% was kudzu (dry weight basis). After using angora goats to graze the site for two consecutive years, the low intensity grazing treatment did not control the kudzu on the site. However, the percentage of kudzu detected on the site declined from 53 to 47%. On the other hand, for the high intensive grazing area, kudzu dry matter yield (%) was significantly decreased. The percentage of kudzu present on the site after two years of intensive grazing was reduced to 20%. There was no reduction in the other materials present on the study site because common ragweed (*Ambrosia artemisifolia*), lambsquarter (*Chinopodium album*) and dogfennel (*Anthemis cotula*) became pervasive on the site.

Soil Compaction:

In evaluating the benefits of using angora goats in the control of kudzu on forest lands, the impact of these animals must also be monitored. One of the arguments that is often used to prevent the use of angora goats as biological control agents is the destructive nature of these animals and their ultimate impact on soil erosion. Using soil compaction (bulk density) as a guide to the possible erosive nature of angora grazing on forest lands, it was noted that they caused significant compaction along pathways travelled. These animals followed the left and right fences after exiting their corral-shelter areas and therefore these had higher compaction rates than the center of the fenced areas (1.45 vs 1.50 and 1.49 gm/cm^3 in the high intensive grazed area; 1.39 vs 1.48 and 1.59 gm.cm3 in the low intensive grazing area - Table 3). These values were well above the 1.43 and 1.42 gm/cm^3 recorded for ungrazed areas in both sides A and B.

The results suggest that care has to be taken in the management of angora goats on forested lands. It is possible to graze goats on understory brush and weeds but caution must be exercised in not

allowing animals to travel prescribed pathways since this will result in channels being created that will accumulated runoff, thereby increasing rates of erosion.

Quality:

Air drying kudzu leaves did not affect dry matter content, however, dry matter content of kudzu stem increased when sampling from the growing tip (Table 4). The results show that leaves from the 75-100 cm section of the kudzu plants had less NDF while the 25-50 cm section had the highest level of ADF. However, for the stems sample analyzed, there was a general increase in both the ADF and NDF contents as material was sampled away from the growing tips. It was also noted that leaf crude protein increased as leaves matured. At the growing point, leaf CP was 15.3% and increased to 18.0% at the 75-100 cm section. The reverse was true for stem CP content. Stem CP declined from 14.3% at the meristem to 7.4% at the 75-100 cm portion of the plant.

In other work done at Tuskegee University comparing kudzu leaf and stem with alfalfa and bermudagrass hays, Corley et al. (1992) noted that kudzu leaf was comparable in crude protein to Alfalfa but higher than bermudagrass hay (19.97 vs 18.0 and 9.9%). They also noted that kudzu was comparable to the other forages mentioned in terms of their mineral content except Ca. Based on the chemical analysis of the kudzu that serve as the primary feed for angora goats in the project, it is apparent that kudzu is comparable with many of the forages presently being fed. Another advantage of kudzu as a feed source is, it is readily available in the southeast and is quite resistant to drought. In addition, kudzu is capable of growing on soils that are not otherwise suitable for other agricultural crop production. These are some of the factors that made kudzu very popular in the southeast and ultimately led to the weed problem that has to be dealt with presently. One method of controlling this pest and eventually eradicating it, is to

intensively graze it by angora goats for two or more consecutive growing seasons.

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Table 1. Growth rate of kudzu vines.

Date	D^S	Vine length (cm)	N^Y	Growth Rate (cm/day)
06/26/90	7	41.2 ± 2.1	53	5.9
06/29/90	10	69.7 ± 4.0	55	7.0
07/03/90	14	88.4 ± 3.0	47	6.3
07/10/90	21	125.7 ± 5.8	46	6.0

Data taken at the National Forest Land Site, northeast of Tuskegee, AL.
D^S Days after measurement began.
N^Y Number of observations.

Table 2. Effect of grazing intensity on kudzu regrowth.*

Intensity	Fresh wt	Dry Wt	Kudzu	Other Material	Percent Kudzu
	(kg/ha)				(%)
Original	10,288ab	3,236a	1,718a	1,518a	53
Low	15,320a	4,162a	1,964a	2,198a	47
High	6,075b	2,890a	565b	2,325a	20

Means within the same column with the same superscripts are not different ($p < 0.05$).
*Means based on 5 observations.

Table 3. Effect of grazing intensity on bulk density

Position[£]		Bulk Density (gm/cm^3)*
Side A:		
	Center	1.45 ± 0.05
	Right	1.50 ± 0.03
	Left	1.49 ± 0.04
Side B:		
	Center	1.39 ± 0.06
	Right	1.48 ± 0.01
	Left	1.59 ± 0.03
Ungrazed:		
	Side A	1.43 ± 0.04
	Side B	1.42 ± 0.05

Data taken at the National Forest Land Site, Tuskegee, AL. (June,1990)
[£]Side A, high intensity (8 animals/ac); Side B, low intensity (4 animals/ac).
*Means based on 19 observations (taken 5 meters apart)

Table 4. Percent dry matter, fiber and crude protein content of kudzu

Sample		Dry Matter	NDF	ADF	Crude Protein
		----------(%)----------			
Leaf	0-25 cm	86.7a	52.2a	24.5b	15.4b
	25-50cm	88.1a	46.3a	30.9a	18 .5a
	50-75cm	88.1a	47.8a	26.4b	18.2a
	75-100cm	87.6a	39.0b	26. ob	18.0a
Stem	0-25 cm	86.5b	44.4b	27.8C	14.3a
	25-50 cm	88.1ab	53.1a	31.9b	11.8b
	50-75 cm	88.7a	53.7a	38.6a	7.9c
	75-100 cm	89.1a	57.8a	39.1a	7.4a

Means within the same column (leaf or stem) with the same superscripts are not different ($p < 0.05$)