



REPORT

COOPERATIVE EXTENSION PROGRAM
LANGSTON UNIVERSITY
P.O. BOX 730, LANGSTON, OK 73050
Tel. (405) 466-3836 ☆ Fax (405) 466-3138 ☆
email: eescobar@luresext.edu www.luresext.edu

USE OF GOATS AS A VEGETATION MANAGEMENT TOOL

E.N. Escobar, F. Pinkerton (Retired) and T.S. McKinney

*Agricultural Research and Extension Program,
Langston University, Langston, OK 73050*

INTRODUCTION

Since 1990 Langston University has implemented a series of demonstration projects to evaluate the use of goats to manage unwanted vegetation. At the invitation of several federal agencies such as the Forest Service, goat specialists have planned and conducted several demonstration trials taking into account the invading species, land topography, weather and experimental site. Considering those factors helped in determining number of goats per area that are necessary for effective vegetation management.

As the general public and the academic community become aware of the adverse effects that inappropriate herbicide use represents, there is more demand for information about alternative methods for the management of unwanted vegetation. With adequate management, goats will utilize unwanted vegetation for production and at the same time the vegetation will be maintained at desired density.

The demonstration projects are intricate because there are uncontrollable factors and unpredictable incidents. Also, researchers are not encouraged to conduct this kind of project because of their complexity and limited opportunities of publication of data.

The main objective of the demonstration projects is to find a balance between vegetation management and goat production. Four examples of the sustainable use of goats for unwanted vegetation management follow.

USE OF GOATS IN NEWLY ESTABLISHED PINE PLANTATIONS

The objective of this study was to determine the effectiveness of goats for controlling woody competition in newly established pine plantations on the Ouachita National Forest, Jessieville, AR (259 mt above sea level, 1270 mm annual rainfall). The approach was to evaluate three brush control systems following timber harvest, ripping, and pine regeneration: (1) goats, (2) herbicides, and (3) none. Shortleaf pines (*Pinus echinata*) were hand planted in February 1991. Forty to 51 Alpine and Angora goats grazed the study area (April to September) from 1990 to 1993. Solar-powered electric fences contained the goats within the treatment area. During 1990, guard dogs were not used and 11 of 51 goats were lost to feral dogs; Great Pyrenees guarded the goats during 1991 and thereafter and no further predator losses occurred. Velpar was applied in the herbicide treatment with backpack metered equipment. Residual tree canopy cover averaged 9%, 3% and 4% on the goat, herbicide, and control treatments, respectively; species were mainly pine, oak, hickory, blackgum, and shinning sumac. Total understory plant cover average 14%, 4%, and 20% on the goat, herbicide, and control treatments, respectively, at the end of the first year. Herbaceous and woody plant utilization by goats averaged 20% and 50% respectively, during the first year. Averaged percentage of woody plant cover are presented in Table 1. General observations indicate that 32 to 41 kg goats gained weight (8-15%) from April to mid-summer when the vegetation was succulent but gained little or

Table 1.- Woody species coverage (%) in newly established pine plantations during the three year demonstration.

YEARS	1	2	3
GOATS	4	8	17
HERBICIDE	1	3	9
CONTROL	4	12	24

slightly lost (3-5% body weight) in late summer when plants were maturing and dry. Pine seedling survival in the goat treatment averaged 84% and 80% at the end of the first and second years, respectively; with a survival average of 71% at the beginning of the third year. Ungrazed pine seedlings were one- to five-inches taller than grazed seedlings; most seedling damaged occurred during late August and early September. Pine seedling heights were greatest on the herbicide treatment (3.2-ft), intermediate on the control (1.9-ft), and least on the goat treatment (1.1-ft) after 2 years. Goats provided an alternative to herbicides for controlling competing vegetation in pine plantations. The greatest value of this demonstration was to provide historical descriptions of vegetation control using herbicides and goats; these descriptions provide insights for further experimentation using goats for vegetation manipulations. Statistical analyses were not attempted because the treatments were not replicated.

USE OF GOATS TO CONTROL WILD PLANTS SPECIES

The Toecane District of the USDA/Forest Service at the Pisgah National Forest in North Carolina (2286 mm annual rainfall, annual snow fall more than 732 mm), requested assistance of Langston University on the use of goats to manage wild blackberries (*Rubus sp.*) and wild cherry (*Prunus serotina*). *Rubus sp.* invades in the form of dense thorny briars in the Blue Ridge Mountain. At 2,000 m above sea level thousands of tourists and hikers visit the Apalachian Trail every year for the natural beauty, however the uncontrolled invasion of the wild species threaten the traffic of hikers. The use of herbicides or prescribed fire were dismissed due to the danger for wildlife and visitors. Eighty Angora goats grazed 0.8 Ha plots which were encircled with Electroner® fence during the summer of 1993 and 1994. Preliminary observations revealed control of *Prunus serotina* and *Rubus sp.* Plant species counting and sampling was conducted during Summer/96 to compare with plant population data from 1992. Such comparisons establish control percentages and wild species disappearance (Table 2).

TABLE 2.- CHANGE IN VEGETATION COMPOSITION AND STRUCTURE FOLLOWING TWO YEAR GOAT GRAZING ON ROUND BALD, NC AND TN.

SPECIES	VEGETATIVE COVER (%)				% of Area Where the Species was the:			
					Primary Dominant		Secondary Dominant	
	1992	1994	1995	'92-'95	1992	1995	1992	1995
SHRUBS								
Wild Blackberry	29	15	10	down 65%	26	1	41	44
GRASSES								
Hairgrass	4	7	20	up 500%	8	23	2	16
Bentgrass	1	3	5	up 500%	0	0	0	3

EFFECT OF GOAT GRAZING AT ROUND BALD, NC

- ♦ Vegetation was sampled before and two years after grazing (1992 and 1995)
- ♦ Grazing years :1992 and 1993

♦ OTHER SPECIES:

Hairgrass: *Deschampsia flexuosa*

Bentgrass: *Agrostis perennans*

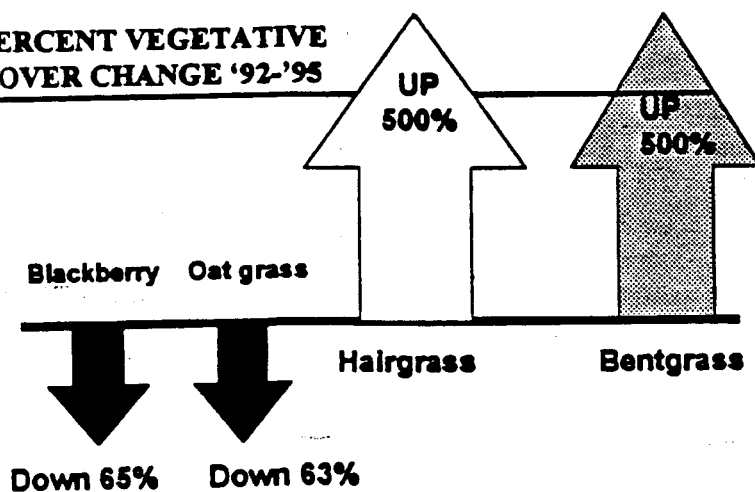
TARGET SPECIES:

Blackberry:
Rubus alleghaniensis

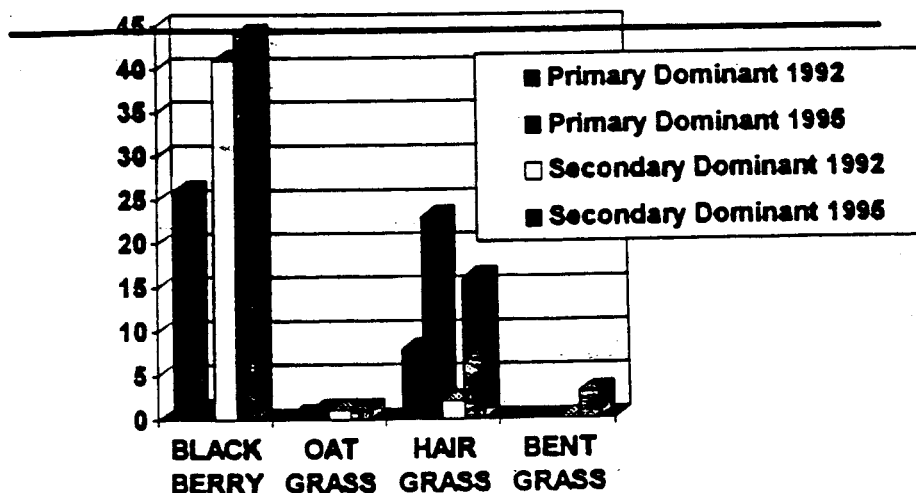
Pennsylvania sedge: *Carex pennsylvanica*

Gray's Lilly: *Lillium grayi*

PERCENT VEGETATIVE COVER CHANGE '92-'95



AREA WHERE THE SPECIES WAS DOMINANT (%)



USE OF GOATS IN WATER RESERVOIRS

In 1994 the City of Guthrie, OK confronted a dense infestation of shrubs, small trees and weeds on the dam of the city's water reservoir. The vegetative growth was such that regular inspections to the dam had not been performed for several years, and more seriously, the roots threaten the soundness of the dam. The use of herbicides was not considered because of possible water contamination. On the other hand, the slope was a hindrance to the use of machinery. The man power required for effective control was out of the financial capabilities of the city. A mesh wire fence was set up around 1.4 Ha to contain the goats to the length and width of the lake bank. Initially, 15 goats were confined to the area; however, the vegetative mass was such that vegetation intake was not sufficient to diminish the cover. After 60 days, 75 more goats were added to the working group for 30 more days. During the first year (May to October, 1994), 100% control of black locust (*Robinia pseudoacacia*) was observed. The damage to the plants included defoliation, bark removal, and mechanical damage to limbs. In 1995, 12 goats kept the shrubs and weeds at 20 cm above ground level from April 14 to October 10.

USE OF GOATS TO MANAGE SAND SHINNERY IN CHEYENNE, OK

Recognizing the natural aptitude of goats to browse and the presence of sand shinnery oak (*Quercus havardii*) on thousands of acres in Northwestern Oklahoma, the Great Plains RC&D Council provided initial funding for the Soil Conservation Service, Langston University, Forest Service and Upper Washita Conservation District, to conduct a demonstration on the use of goats to manage sand shinnery. Atwoods Country Stores and private ranchers also joined in this demonstration project.

Sand shinnery, native to many thousands of acres in Oklahoma and Texas, occurs on coarse sandy soils. It is an important plant on these soils, but has thickened to densities much greater than normally occurs. Total crude protein content in sand shinnery leaves do not reflect what is available for digestion. Tannins in the oak leaf make protein unavailable for absorption, reducing protein digestibility. Many methods of managing shinnery have been used such as chemicals, fire, mowing and mechanical removal. Goats have not been commonly used for sand shinnery management,

but are commonly used in Texas on the hill country type of shinnery.

The physiological principle is very simple. Grasses grow from their bases while shrubs grow from their tips. Whenever more than half a growing leaf is removed, a plant uses its reserves to maintain itself. This difference in growth physiology allows grasses to withstand grazing pressure better than shrubs. Shrubs will deplete their food reserves first. To ensure success in managing unwanted vegetation, livestock species that prefer shrubs to grasses must be identified. For this demonstration goats were chosen.

The demonstration started in the Spring of 1992 by dividing 80 acres of the Black Kettle National Grasslands, Cheyenne, OK, into 8 pastures (768 mts above sea level and 620 mm annual rainfall). Both Spanish goats and Angora goats were introduced at two different stocking rates and grazing strategies. The project goals were to change the land to about an 80-20 percent grass-shinnery ratio, hold goat death loss to $\leq 3\%$ and achieve 7 pounds/goat of mohair growth, within a 3-year period. Adjustments were made each year based on what was learned from the previous year. During the second year of the project (1993) an equilibrium between animal production and vegetation management was pursued. About 200 Angora goats provided by a local mohair producer were used for this demonstration. In 1994, 75 meat-type goats were rotated through several plots, targeting one plot to apply pressure to the sand shinnery forcing it to use up its reserves.

Here are some items that summarize what was learned about the use of goats to manage sand shinnery:

- Goats select what they eat based on quality and what they are familiar with.

- Goats that came from a background of grazing on grass, ate a higher proportion of grass and forbs that did the goats familiar with brush browsing.

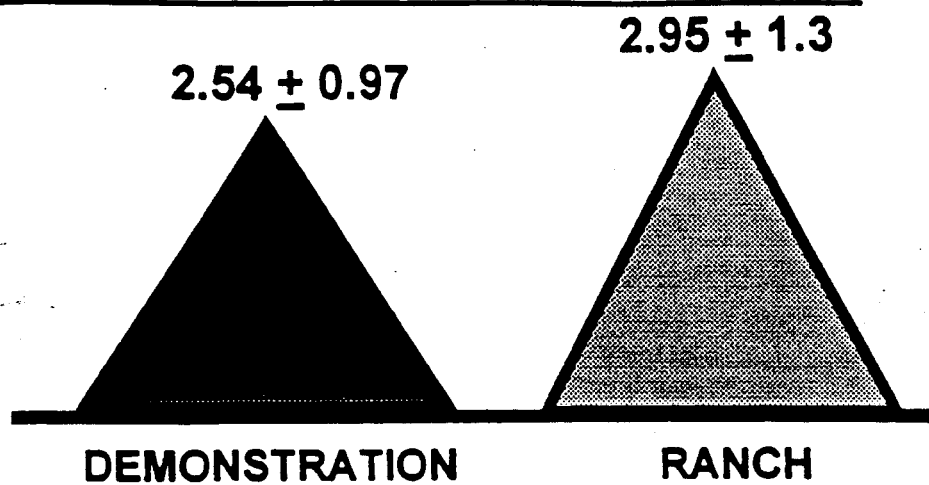
- Goats should be introduced to shinnery as soon after bud break as possible (early May). There is a small chance that some goats may get bud poisoning, but the toxicity is reduced after about two weeks.

- When the shinnery leaves mature, they become less succulent and goats will not eat them. Goats will shift to better forage.

- One pasture should be designated as a *target pasture*. Start a rotation system on the *target pasture*, leaving the goats in it until they have defoliated 80% of the shinnery. Manipulate stocking density to accomplish

RESULTS FROM THE DEMONSTRATION ON THE USE OF GOATS TO MANAGE SHINNERY OAK

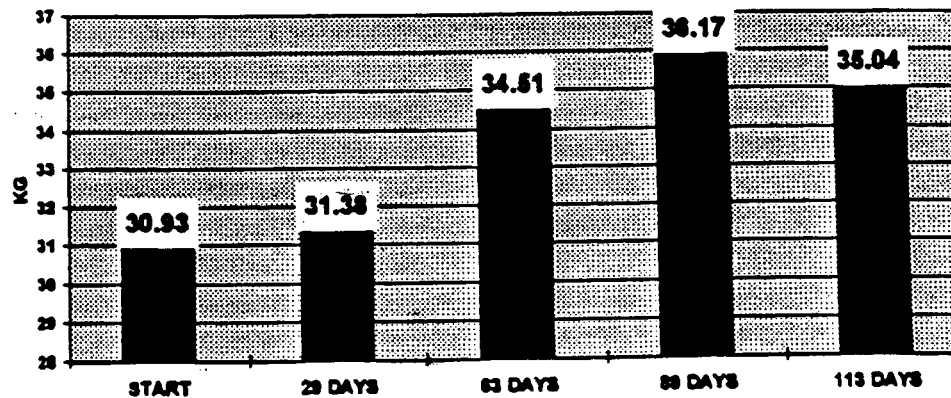
1993 Results Cheyenne, OK- Mohair production (kg/head)



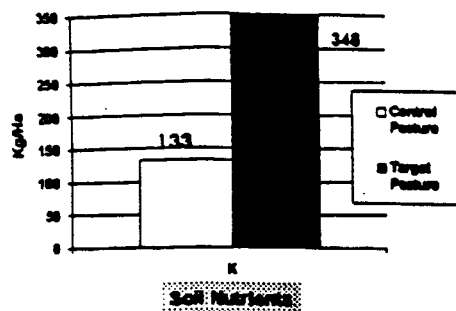
1994 Results:

The meat goats gained 5.24 kg/hd after 90 days on trial

BOB DY WEIGHT CHANGES OF ALPINE AND MEAT TYPE GOATS BROWSING SHINNERY AT THE BLACK KETTLE NATIONAL GRASSLANDS

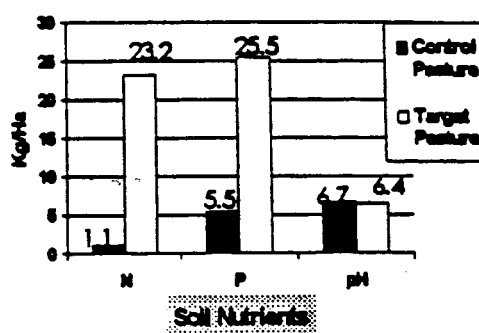


● Soil tests revealed an increase (kg/Ha) of K in soil samples from the Target pasture (Cheyenne, OK).



● The goats recycled vegetation elements to the soil.

Soil tests revealed an increase (kg/Ha) of N and P in soil samples from the Target pasture while pH was unchanged.



Plant species frequency counts (expressed as % of species occurrence in sampling spots) revealed that...

after three years of goat grazing the shinnery oak,
55% oak and 59% lovegrass in the target pasture
vs.
100% shinnery and 20% lovegrass in ungrazed plots.

defoliation within 7 days. Then move (rotate) the goats to an alternate pasture. When the leaves in the *target pasture* have regrown to about one-half mature size, put the goats back into the *target pasture*. Again, strive for 80% defoliation, then back into the rotation. Continue this cycle throughout the growing season.

⊃ During the three-year demonstration, the goats in the non-rotation system gained weight initially, but lost weight rapidly after mid-July. This was attributed to the fact that once the goats had grazed all the quality forbs and grasses from their pasture, they were left with low quality shinnery. In 1994, goats started browsing shinnery on May 25. The goats in rotation gained weight throughout the summer. The rotation pastures had a greater variety of forages, allowing the goats to select high quality forages.

⊃ The goats recycled nutritional elements back to the soil. Soil testing revealed a measurable difference in pounds per acre of the various soil nutrients (N, P and K) and changes in soil pH (Table 3).

Table 3.- Soil nutrient levels (kg/Ha) in the CONTROL and TARGET plots after three years of goat grazing

Pasture	N	P	K	pH
Control	1.12	5.54	133	6.7
Target	23.3	25.5	348	6.4

⊃ The vegetative production was near 3100 lbs/acre in both the control pasture and in the *target pasture*. However, the percentage production by weight by kinds of plants are shown in Table 4.

Table 4.- Percentage of vegetation production by type of plants after three years of goat grazing

Pasture	Oak	Grass Forbs
Control	95%	5%
Target	50%	50%

The *target pasture* had 11 species of plants (grasses and forbs) while the control pasture (pasture not grazed) had 7 species only.

⊃ Goat grazing reduced the competition between shinnery and others plant species, allowing native grasses to improve. This potentially increases the carrying capacity for cattle.

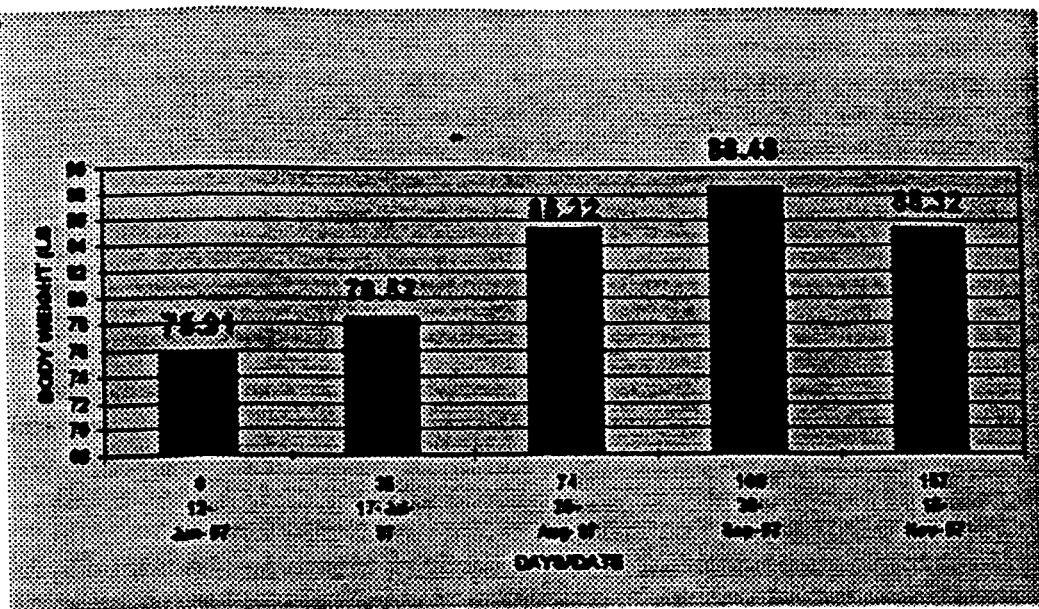
There is much to be learned when managing shinnery with goats. These points are highlights and do not provide all the discussion needed for a successful endeavor.

PERFORMANCE OF GOATS GRAZING ON SERICEA LESPEDEZA (*Lespedeza cuneata*), A KNOXIOUS WEED IN LEBO, KANSAS

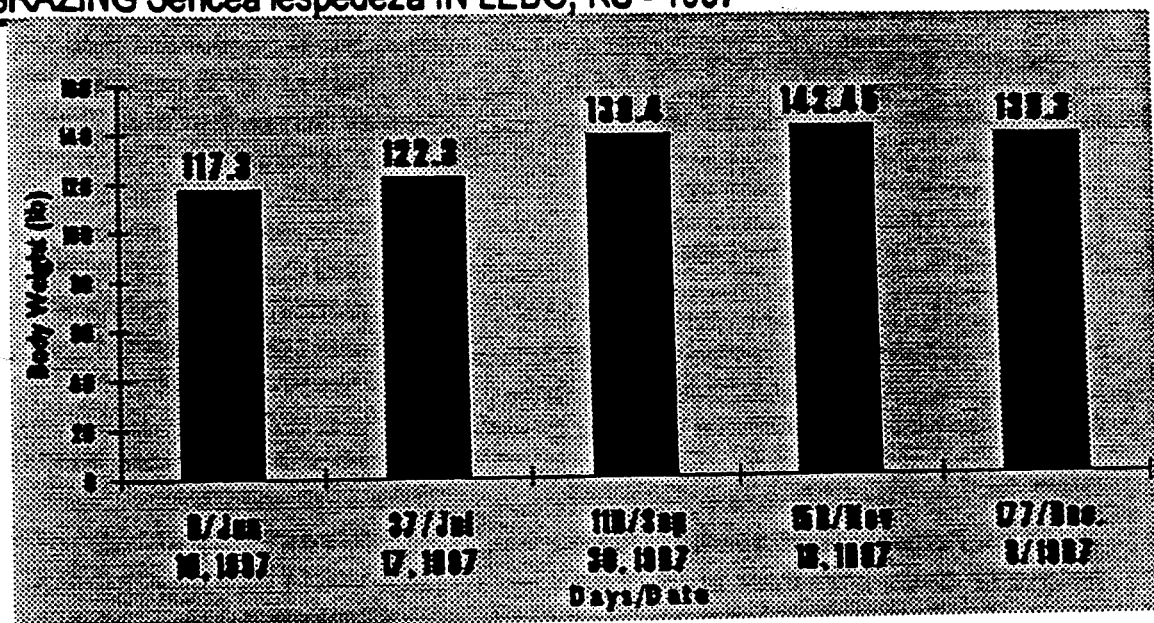
Responding to inquiries from a cattle rancher in Lebo, KS, the Cooperative Extension Program at Langston University, has sponsored a demonstration at Lebo, KS on the sustainable use of goats to control *Sericea lespedeza* (*Lespedeza cuneata*, fam. Fabaceae). *Sericea* has been regarded as a noxious weed in Kansas, because it is aggressive and persistent. The demonstration was set up in pastures with a > 30% infestation of *Sericea lespedeza*. *Lespedeza* is a legume with a high content of crude protein (16.4%) and with a high potential for reproduction, since each plant is capable of producing more than 500 viable hard shell seeds per stem. Bovines do not have a particular appetite for *sericea lespedeza* and do not graze it. Kansas Department of Agriculture's surveys indicate that pasture invasion in Kansas reaches at least 30% of the area used for cattle grazing (more than 300,000 acres).

Demonstrations were conducted using goats to manage *sericea lespedeza* for three consecutive years (1995 to 1997) in a 18 acre (7.2-hectare) pasture and in a 320 acre (128-hectare) pasture (1997 only). In 1995, two groups of Spanish goats grazed the plot. In 1996, three types of goats grazed the plot for 90 days. And, in 1997, 66 Boer x Spanish female yearlings grazed the trial plot for 157 days. Also, mature Spanish castrates grazed *sericea lespedeza* in a 320 acre (128-hectare) pasture. Annual plant counts in the

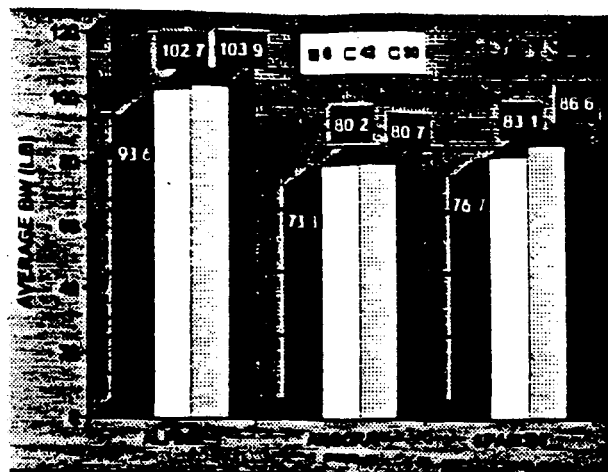
BODY WEIGHT CHANGES (lb) OF BOERxSPANISH DOELINGS GRAZING SERICEA LESPEDEZA IN LEBO, KS - 1997



AVERAGE BODY WEIGHT (lb) OF MATURE SPANISH/ALPINE GOATS GRAZING Sericea lespedeza IN LEBO, KS - 1997



BODY WEIGHT CHANGES (lb) OF GOATS (Alpine, Angora and Spanish) GRAZING *sericea lespedeza* IN LEBO, KS (1996)



trial plot indicated disappearance of mature *sericea lespedeza* plants after three years of goat grazing. Goat body weight gains show that goats utilized *sericea lespedeza*. The results from the

three-year demonstration (Table 5), are encouraging to Kansas ranchers because of the income that meat goats could bring to the ranch while eating *sericea lespedeza*.

Table 5.- Performance of several types of goat grazing *sericea lespedeza* in Lebo, KS (1995-1997)

YEAR	Type of Goats (N)	Days Grazing	Ave. Gain/ head (lb/kg)
1995	Spanish (12)	116	20.7/9.43
1995	Spanish (37)	37	8.0/3.64
1996	Alpine (15)	90	10.3/4.67
1996	Angora (33)	90	7.4/3.36
1996	Spanish (19)	90	9.9/4.52
1997	BRxSP Fem (66)	157	10.0/4.53
1997	Spanish (80)	179	22.0/10.01

ACKNOWLEDGMENTS

The authors would like to recognize the invaluable contribution of the following colleagues and ranchers for the demonstration projects recounted in this report:

- H. A. Pearson (Retired) USDA/ARS, Texas
- J. A. McLemore (Deceased) USDA/Forest Service, Ouachita National Forest, Hot Springs, AR
- J. M. Archer (Retired) USDA/Forest Service, Ouachita National Forest, Jessieville, AR
- M. Moseley USDA/NRCS Stillwater, OK
- R. Blackwell USDA/Black Kettle National Grassland, Cheyenne, OK
- M. Rose Great Plains RC&D, Sentinel, OK
- Joe Craig, Leede, OK, and
- Don Rogers, Lebo, KS.