Spanish Goat Diets on Mixed-brush Rangeland in the South Texas Plains

L.E. WARREN, D.N. UECKERT, M. SHELTON, AND A.D. CHAMRAD

Abstract

Microhistological analysis of feces from Spanish goats (Capra hircus) grazing in a mixed-brush complex in the South Texas Plains indicated that shrubs were their major foods during autumn, winter, and summer. Grasses were the major diet item during spring. Forbs, which were relatively scarce due to poor growing conditions during the 13-month study, were of minor importance in goat diets. The importance in Spanish goat diets of several problem brush species, including blackbrush acacia (Acacia rigidula), condalias (Condalia spp.), guajillo (Acacia berlandieri), guayacan (Porliera angustifolia), and wolfberry (Lycium berlandieri), suggests a potential for utilizing these animals in conjunction with other brush management practices for more effective shrub control and for increasing efficiency of forage utilization on mixed-brush rangeland.

The South Texas Plains are approximately 8 million ha which historically supported grassland or savannah type vegetation (Thomas 1975). Long-term continuous grazing, periodic droughts, and the reduced frequency and intensity of fires have resulted in a

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dense mixed-brush vegetation type in the central and western South Texas Plains, which is one of the most difficult-to-manage brush problems in the state. A variety of low-growing, xerophytic shrubs, including honey mesquite (*Prosopis glandulosa* Torr. var. glandulosa), acacias (*Acacia spp.*), condalias (*Condalia spp.*), spiny hackberry (*Celtis pallida*), cenizo (*Leucophyllum frutescens*), agarito (*Berberis trifoliolata*), and cacti (*Opuntia spp.*) dominate typical South Texas mixed-brush communities (Scifres 1980). The increasing costs of herbicidal and mechanical brush control practices are forcing ranchers in the South Texas Plains to seek less expensive practices for management of mixed-brush rangeland.

Goating has been used for many years in certain areas of Texas and the Southwest for control or suppression of undesirable brush (Vallentine 1971, Merrill and Taylor 1976, Scifres 1980). The effectiveness of goating as a biological brush management practice depends on the size and species composition of the brush population, as well as on proper adjustment of stocking rate, duration, and frequency of grazing periods to intensity of the brush problem. Management of predators is usually necessary in areas where goats are grazed.

Oates (1956) demonstrated that goats can kill certain brush species, such as Acacia spp., without harming desirable forage plants. Goats can also effectively control or suppress oaks (Quercus spp.) and juniper (Juniperus spp.) (Magee 1957, Norris 1968). Merrill and Taylor (1976) reported that Spanish goats completely consumed new growth of shin oak (Q. mohriana), hackberry (Celtis reticulata), and pricklyash (Zanthoxylum sp.), while Angora

Authors are research associate, professors, repectively with Texas Agricultural Experiment Station San Angelo 76901; and associate professor, Texas Agricultural Experiment Station, Uvalde 78801

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goats (Capra hircus) utilized only about 30% of the shin oak and 80% of the hackberry and pricklyash. Warren et al. (1984) also found that Spanish goats consumed more browse than did Angora goats. However, they reported that neither Spanish goats, Angora goats, nor Rambouillet, Karakul, or Barbado sheep (Ovis aries) consumed appreciable quantities of the major undesirable brush species, including honey mesquite, creosotebush (Larrea tridentata), tarbush (Flourensia ceruna), juniper, lotebush (Condalia obtusifolia), catclaw acacia (Acacia greggii), and agarita, on 3 study sites in western Texas. Goats feed over rugged terrain, and can be combined with other livestock to optimize utilization of vegetation (Campbell et al. 1962). Fraps and Cory (1940) concluded that goats, as compared to cattle or sheep, had a greater tendency to alter their diet with changing seasons and forage conditions.

Addition of goats to grazing management systems in the South Texas Plains could substantially improve total forage utilization and diversify income sources for ranchers. Ideally, goats would suppress, as well as provide a means of marketing brush, and the improvement in range condition and sale of goat products would pay for predator control practices required for maintenance of the goat herd. We conducted a study during 1979-1980 to determine the extent to which Spanish goats graze the native shrubs on mixed-brush rangeland on the South Texas Plains.

Methods

The 81-ha experimental pasture, located on the Walker Ranch in southern McMullen County, was predominately a Shallow Sandy Loam range site typified by Randado and Hildalgo sandy clay loams. Average annual precipitation is about 50 cm but only 25 cm fell during the study period. The vegetation was a mixed-brush complex consisting primarily of guajillo (Acacia berlandieri), blackbrush acacia (Acacia rigidula), kidneywood (Eysenhardtia texana), and cenizo. Major grasses included threeawns (Aristida spp.), pink pappusgrass (Pappophorum bicolor), red grama (Bouteloua trifida), and curlymesquite (Hilaria belangeri). Associated forbs were Indianmallow (Abutilon incanum), verbena (Verbena sp.), ragweed (Ambrosia sp.), and pepperweed (Lepidium sp.).

The pasture, which was grazed by cattle prior to this study, was fenced with electrically charged smooth wires arranged to exclude coyotes (Canis latrans), then stocked with 50 Spanish goats in September 1979. A composite fecal sample comprised of 10 fresh, single defecations was collected each month from October 1979 through October 1980. Five microscope slides were prepared from each fecal sample. Approximate dry weight composition of Spanish goat diets was determined by examination of plant epidermal tissues at 100X magnification in 20 fields on each slide (Sparks and Malechek 1968). Plant tissues were identified by epidermal cellular characteristics from reference tissue of identified plants collected from the study area.

Fecal analysis generally results in higher estimates of grasses, trees, and shrubs, and lower estimates of forbs in herbivore diets as compared to estimated values obtained by other techniques due to differential digestibility of these foods (Anthony and Smith 1974, Vavra et al. 1978, Holechek et al. 1982, McInnis et al. 1983). However, dietary trends and relative importance value rankings of individual plant species in diets as determined by fecal analysis are accurate (Vavra et al. 1978). In the authors' opinion, the microscopic examination of fecal material was adequate for accomplishing the objective of this study.

Monthly diet data were grouped by seasons and subjected to multivariate analysis of variance to determine seasonal effects. Seasonal effects were masked by variation within seasons, consequently diet data for individual food items were subjected to oneway analysis of variance to determine seasonal differences.

Results and Discussion

Twenty-nine plant species were identified in Spanish goat diets

(Table 1). Grasses contributed over half of the goat diets during spring, but less than 20% in autumn. Grama grasses, primarily red grama, were the major grass food of Spanish goats. Curlymesquite and threeawns contributed 10% or more to goat diets in summer and spring. Panicums (Panicum spp.), a minor diet component, were more important in goat diets in spring, compared to autumn and summer ($P \le 0.05$). Differences among seasonal means for other grass foods were not significant at P < 0.05, although seasonal differences were detected for grama grasses and curlymesquite at $P \le 0.10$. McInnis et al. (1983) reported that fecal analysis overestimated the grass in sheep diets by 15% (65% grass in known diet mixture vs. 80% grass in feces). Thus our data may slightly overestimate the importance of grasses in Spanish goat diets.

Table 1. Mean seasonal diets (%) of Spanish goats grazing in southern McMullen County of the South Texas Plains.¹

Foods	Season			
	Autumn	Winter	Spring	Summer
Grasses				
Bouteloua spp.	10	20	29	17
Hilaria belangeri	3	7	7	10
Panicum spp.	<1 h	2 ab	3 a	0 Ь
Aristida spp.	ì	8	12	4
Other grasses ²	3	3	3	4
Total grasses	17	40	54	35
Forbs				
Abutilon incanum	2	<1	2	2
Other forbs ³	5	<1	ī	6
Total forbs	7	1	3	8
Shrubs				
Acacia spp.	24	11	0	10
Porliera angustifolia	10	7	4	6
Leucophyllum frutescens	10 ab	15 a	l c	4 bc
Condalia spp.	15	12	13	21
Acacia berlandieri	5	4	7	3
Eysenhardtia texana	<1	i	2	1
Aloysia lyciodes	3	Ó	Ō	1
Lycium berlandieri	0	Ó	9	6
Other shrubs ⁴	<1	2	4	<1
Total shrubs	68	52	40	52
Succulents				
Opuntia spp.	5	7	5	4

¹Means within a row followed by similar lower case letters are not significantly different at P≤0.05

²Grasses that contributed less than 1% of Spanish goat diets included Sporobolus sp., Pappophorum bicolor, Bothriochloa sp., Stipa leucotricha, and unidentifiable grasses.

grasses. ³Forbs that contributed less than 1% of Spanish goat diets included Verbena sp., Lepidium sp., Croton sp., Lesquerella sp., and unidentifiable forbs. ⁴Shrubs that contributed less than 1% of Spanish goat diets included Bumelia celas-trina, Forestiera angustifolia, Schaefferia cuneifolia, Diospyros texana, Rhus microphylla, Koeberlinia spinosa, and Yucca sp.

Forbs, which were relatively scarce during the study due to poor growing conditions, were a minor component in the seasonal diets of Spanish goats (Table 1). Indianmallow was the most important forb in goat diets. Forbs contributed 13% of the diet in June 1980 and 18% during October 1980, but 5% or less during other autumn months and in winter and spring. McInnis et al. (1983) found that fecal analysis underestimated total forbs in sheep diets by 15% (35% forbs in known diet mixture vs. 20% forbs in feces). Our data may underestimate the actual amount of forbs in Spanish goat diets, but we believe they were accurately ranked in terms of relative importance.

Shrubs were the most important foods of Spanish goats, contributing over half the diet in summer, autumn, and winter (Table 1). Major shrubs in goat diets were blackbrush acacia, guajillo, other species of Acacia, condalias, guayacan (Porliera angustifolia), and cenizo. Browse made up half to three-fourths of the diets of Spanish

goats in all months except during February through May. Green foliage is usually present on most shrub species in the mixed-brush complex yearlong, due to mild winter temperatures. Two evergreen shrubs, guayacan and cenizo, were major foods of Spanish goats during the winter. Cenizo was significantly more important in goat diets in autumn and winter than in spring, and was more important in winter than in summer ($P \leq 0.05$). A seasonal effect was significant at $P \leq 0.10$ for the Acacia spp. group (A. rigidula and A. tortuosa), but no seasonal effects were detected for other shrubs. Blackbrush acacia retains some green foliage during most winters. Wolfberry (Lycium berlandieri), a drought-deciduous shrub, was a major food of Spanish goats during May (26%), June (8%), and July (10%).

Browse was more important than grasses in Spanish goat diets in all months except February, March, and May. Our data probably slightly overestimate the amount of browse in Spanish goat diets. Smith and Shandruk (1979) reported that fecal analysis overestimated the amount of sagebrush (Artemisia tridentata) in tame mule deer (Odocoileus hemionus) diets by about 19% (9.5% in known diet mixture vs. 28.8% in feces) and overestimated the amount of juniper (Juniperus osteosperma) by about 2.7% (0.34% in known diet mixture vs. 3.1% in feces).

Pricklypear (*Opuntia* spp.) was eaten by Spanish goats in all months except May and June, and made up 10% or more of the diet during January, April, and September.

These data confirm that Spanish goats readily eat a number of native shrubs that are common on the South Texas Plains. The importance of browse in Spanish goat diets during autumn, early winter, and late summer suggests that goats might compete with white-tailed deer (Odocoileus virginianus) during these periods. White-tailed deer also appear to prefer forbs when they are available (Chamrad et al. 1979). The importance of grasses in Spanish goat diets during February, March, and May suggests possible competition with cattle during these periods. However, since shrubs that are rapidly eaten by Spanish goats are so abundant, there appears to be a high potential for grazing goats, along with cattle and deer, to more efficiently harvest the available forage resource. Further research appears warranted to determine whether Spanish goats can be utilized for control or suppression of South Texas mixed-brush. It is the author's opinion that goating would be most effective when used to suppress brush resprouts following mechanical brush control practices, herbicide applications, or prescribed fire. The loss of 60% of the experimental goat herd to coyotes during this 13-month study emphasizes that effective predator management will be essential before goating can be considered as a feasible brush management practice on the South Texas Plains.

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