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Ecological benefit of strip grazing with a solar mobile fence grazing system

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Abstract

A study was conducted on 14 ha of *Caducifolia* thorny forest with an average total dry matter yield of 800 kg/ha/year. The area of study was divided into two 7 ha camps. Thirty-five Alpine goats were allocated to one of the camps in a continuous grazing system, called the free grazing (FG) camp treatment. Another 35 goats were placed in the other camp where strip grazing was controlled by means of a solar mobile grazing (SMG) system. A high (163 AU/ha) and a low (40.8 AU/ha) stocking rate, allocating 625 m^2 and 1.250 m^2, respectively, were applied in the SMG treatment. The number of goats varied to adjust stocking rate daily. The goats were allowed to graze five hours/day. Herbage utilization was measured, using as initial markers the grass length of 24 to 30 cm and number of leaves (156 ± 17) on selected shrub branches, 40 cm long. The botanical composition was determined at the beginning and end of the grazing period. Chemical analyses of forage selected by the goats were performed monthly. In the SMG treatment the average grass height changed from 37.1 cm in June to 65.2 cm in February, while percentage leaves changed from 18.4% to 5.9%, compared to changes of 41.4 cm to 42.3 cm and 16.3% to 0.91% in the FG treatment, respectively. In the SMG treatment the goats spent 80% of their time browsing in July and August and 100% of their time from December until March. It is concluded that the economical and social status of the rural community would be improved using the SMG system.

Keywords: Nutrition, goats, growth, rangeland, pasture
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Introduction

Previous studies showed that milk goats can be managed economically through the feeding of agricultural products, by-products and rangeland grazing which otherwise would have been wasted. It was proposed that rangelands should be utilized seasonally, permitted by vegetation growth, and left idle in the dormant season (Galina *et al*., 1998a). Galina *et al*. (1998b) evaluated this system in terms of bio-sustainability. They found that rangelands contributed 33.0% of the dry matter (DM) intake, 28.2% of the energy and 39.4% of the annual protein requirements in the production of milk from goats. In north-eastern Mexico, Ramirez *et al*. (1990; 1991; 1995; 1996; 2001; 2003) studied seasonal changes in the nutrition of goats as related to range forages. However, few studies have used the vegetation as markers in rangeland studies with goats, even though information on the intake habits of goats on range pastures is essential to determine the competition for food or nutrients. The objective of this study was to compare the use of a solar mobile device in an intensive grazing system in a semi-arid rangeland with a continuous grazing system.

Materials and Methods

The study was conducted on the "Puma" farm in Cerro Prieto, Querétaro, Mexico, at 20º35' latitude North and 100º18' longitude west. The altitude is 1950 m above sea level. The region, Bs 1 Kw (w) (e), is described as semi-arid with isolated rain showers in winter and an average annual precipitation of 460 mm per year (García, 1973). The research was performed on a 14 ha paddock of *Caducifolia* thorny forest (Bek, 444). Grasses were: *Bouteloua curtipendula*, *Choris virgata*, *Bothriochloa saccharoides*, *Leptochloa saccharoides*, *Leptochloa dubia*, *Rhyncheltythurum roseum*, *Panicum obtusum*, *Bouteluoa repens*, *Aristida adscensionis*, *Staria parviflora*, *Urochloa fasciulata*; leguminous trees: *Prosopis leavigata*, *Acacia farnesiana*, *Acacia schaffneri*, *Mimosa bincifera*; shrubs: *Celtis pallida*, *Jatropha dioica*, *Zalazania augusta*, *Verbasina serrata* and cactaceae: *Opuntia affasiacantha*, *O. amyctaea*, *O. cretochaeta*, *O. hytiacantha*, *O. robusta*, *O. streptacanta*, *O. tomentosa*. Average total annual DM production/ha is 800 kg (Galina *et al*., 1998). Grazing management and techniques for shrubland evaluation were published by Puga (1998).

The area of study was divided into two 7 ha sections. On the one section, called the free grazing (FG) system, 35 Alpine goats (45 ± 3.5 kg/body weight, BW) grazed the pasture continuously. On the other

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section 35 goats (36.0 ± 4.5 kg BW) were placed in a system where grazing was controlled with the use of a solar mobile system unit (SMG). The SMG could be operated with a car battery when no sunlight was available. Two stocking rates were applied in the SMG system, a high (163 AU/ha) and a low (40.8 AU/ha) system consisting of 625 m^2 and 1.250 m^2, respectively. The number of goats changed daily to maintain the stocking rates. The grazing areas were separated with a plastic solar mobile fence, 96 cm x 50 m. The animals grazed five hours/day. In both systems 10 areas were set aside to measure the utilization of the vegetation. The initial markers were grass height, 24 to 30 cm (± 3), and number of leaves (156 ± 17) on selected shrub branches over a length of 40 cm. Grass length and number of leaves were measured before and after grazing. A second introduction of the goats into the SMG paddocks was allowed when the regrowth of grasses was 10 cm and re-foliation of branches 49%. During grazing, animal behaviour was determined by direct observation (Gutierrez, 1991). The botanical composition was determined at the beginning and end of the observations (Palma, 1996). Chemical analyses (AOAC, 1995) of forage selected by goats were preformed monthly.

Results and Discussion

The botanical composition of the pasture is presented in Table 1. Sustainable use of vegetation was better for the SMG compared to FG treatment, as is evident in the degree of soil denudation. Lineal regression showed that the grass cover improved ($P < 0.01$) in the SMG compared to the FG system. The grazing behaviour of the goats is shown in Figure 1. Initial intake preference was for grasses, but changed to browse.

Table 1 Proportional botanical composition of the pasture as effected by two systems of grazing management

	Solar Mobile System Grazing			Free Grazing		
Sampling time	Grasses	Shrubs	Denudation	Grasses	Shrubs	Denudation
Months	%	%	%	%	%	%
1	37.1	18.4	44.7	41.4	16.3	50.5
2	50.0	2.3	48.1	48.1	1.85	49.7
3	53.0	2.7	44.2	45.9	0.00	54.1
4	45.7	2.79	51.5	36.2	0.43	63.3
5	43.9	2.01	55.1	41.9	0.67	57.4
6	44.1	1.4	55.2	36.9	0.81	62.2
7	41.8	2.9	56.3	33.8	0.46	65.6
8	51.2	1.2	48.3	38.3	1.55	60.1
9	65.2	5.9	27.2	42.3	0.91	56.7
Average	48.03^a	4.42^a	47.89^b	36.3^b	1.44^b	57.7^a
	± 8.1	± 5.44	± 8.95	± 4.65	± 8.1	± 5.59

Within the row superscripts a and b indicate difference between columns and treatments at $P < 0.05$

Chemical composition in the forages was evaluated from July to May, 2002-2003. Crude fibre (CF) levels in the grasses ranged from 255 to 309 g/kg DM. Maximum height was 36.3% in November. Level of crude protein (CP) diminished from 101 to 67 g/kg DM over the same period. Present results were similar to previous work in Northern Mexico (Ramirez *et al*., 2004), when all grasses studied were low in CP and increased most rapidly in spring and summer. These seasonal fluctuations in CP level may have been induced by spring (139 mm) and summer (144 mm) precipitations. The trees and bushes had low CF levels in autumn (October), *viz.* 209 mg/kg DM, probably because of late regrowth. Average CP levels peaked twice, one in October (215 g/kg DM) and the other in April (253 g/kg DM). The change to browsing could be explained from the increased fibre and CP levels in the leaves.

In the SMG system mainly grasses were grazed initially. Initial average grass length was 24 cm. After grazing, the high stocking area required 75 days to regain 20 cm growth in the grasses while recovery was 35 days in the low stocking area. For shrubs, the initial index was 145 leaves/40 cm of branch. Days to recover 80% were 60 and 75 for the low and high stocking rates, respectively. A second round of the grazing of a specific area did not allow vegetation to recover until the following year. After 240 days, precipitation stopped in September which terminated the regrowth of the grasses. The SMG system of range management

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allowed the use of 117 different strips of grazing which could be utilized twice per season. The utilization of grasses and trees in the FG system was similar but did not allow vegetation to regain initial length or percentage of leaves after 240 days. This suggests the deforestation of the area.

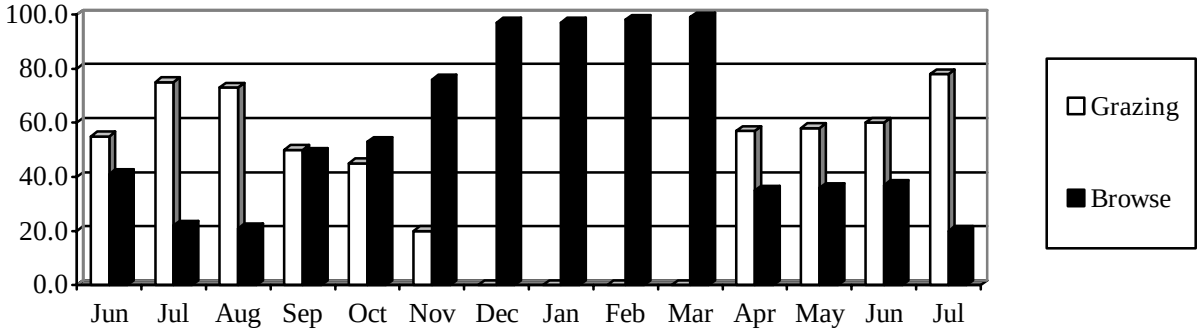

Figure 1 Grazing behaviour of goats in a solar mobile grazing (SMG) system

Conclusion

The use of the SMG system allowed pastures to be utilized twice per season, with an increase in the vegetation cover, compared to the FG system that did not allow re-vegetation, thus resulting in deforestation. Economical and social status of the rural communities could be improved with the use of the SMG system because reforestation of semi-arid scrubland is a key component to sustainability of a fragile ecosystem.

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