

THE PERFORMANCE OF GOATS BROWSING *Leucaena leucocephala* IN THE SEMI ARID AREAS OF NORTHWEST VENEZUELA

La productividad de cabras ramoneando *Leucaena leucocephala* en las áreas semi áridas del noroeste de Venezuela

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ABSTRACT

A field experiment was conducted in the dryland farming area of northwest Venezuela in order to evaluate three diets in grazing goats (grazing pasture only (buffel grass); grazing pasture + 0.3 kg of commercial concentrate/animal/d; grazing pasture + restricted browsing for two hours daily in *Leucaena leucocephala*) on milk production, milk composition and growth rate. The data showed significant difference ($P < 0.05$) between treatments. Daily milk yield increased in 35 and 52.7% when goats had access to commercial concentrate or browsing leucaena as well as grass pasture compared with the control treatment. Daily milk yield in goats with access to leucaena was insignificantly different than goats on concentrate. Treatments did not affect milk composition. The daily growth rate of goats was significantly higher in concentrate (50.5 g) or leucaena (48.4 g) compared to grazing pasture (35.8 g). The results suggest that *Leucaena leucocephala* can supply an adequate amount of nutrients with similar value to commercial concentrate for growth and milk production without adverse effects on tropical grazing goats.

Key words: *Leucaena leucocephala*, goat, growth rate, milk production.

RESUMEN

Un experimento de campo fue realizado en las áreas semiáridas del noroeste de Venezuela para evaluar tres tipos de dietas en cabras (pastoreo de gramíneas (pasto buffel); pastoreo de gramíneas + 0.3 kg/día de alimento comercial); pastoreo de gramíneas + ramoneo restrictivo de dos horas diarias en *Leucaena leucocephala*) sobre la producción y composición de la leche y la tasa de crecimiento. Los datos muestran diferencias

significativas ($P < 0.05$) entre tratamientos. La producción diaria de leche incrementó en 35 y 52,7% cuando las cabras tuvieron acceso a concentrado comercial o ramonearon en leucaena comparado al tratamiento control. La producción diaria de leche en cabras que consumieron leucaena no difirió de aquellas que recibieron alimento comercial. Los tratamientos no afectaron la composición de la leche. La tasa de incremento de peso diario en las cabras fue significativamente mayor cuando consumieron concentrado (50,5 g) o leucaena (48,4 g) comparado al de solamente gramínea (35,8 g). Los resultados sugieren que la *Leucaena leucocephala* puede suministrar una adecuada cantidad de nutrimentos con un valor similar a un alimento balanceado para crecimiento y producción de leche sin efecto adverso en cabras tropicales a pastoreo.

Palabras clave: *Leucaena leucocephala*, cabras, tasa de crecimiento, producción de leche.

INTRODUCTION

Feeding small ruminants in traditional systems in tropical regions is highly dependent of introduced or native pastures. However, the performance and growth of goats under these systems are largely limited by forage quality and this is reflected in the digestibility of pasture and low voluntary intake from available grasslands [2]. The use of concentrates, which provide protein and energy, is expensive and not easily available where the majority of goats are kept.

The importance of browse in the diets of tropical ruminants has been well documented [8]. *Leucaena leucocephala* is one of the most widely used forage tree legume because of its worldwide success as a long lived and cheap source of highly nutritious forage tree, and its great variety of other uses.

The utilization of leguminous multipurpose trees such as leucaena could be an alternative to unavailable and expensive protein concentrates [4]. The objective of this study was to determine the response of grazing goats fed with low quality grass (*Cenchrus ciliaris* L.) and supplemented with commercial concentrate and *Leucaena leucocephala* in a restricted browsing scheme.

MATERIALS AND METHODS

Location: The experiment was located in the dryland farming area of northwest Venezuela (10° 45'N; 75° 31'E), at 26 m elevation. The climate of this area is a very dry tropical forest with an average annual temperature of 28°C, a mean annual rainfall of 630 mm and 60% humidity, with a wet season from September to November and dry season from January to May.

Pastures: The pasture was buffel grass (*Cenchrus ciliaris* L.) which was established on a sandy-loam soil, pH 5.6 with good drainage. The plot was fertilized with urea at a level of 160 kg/ha distributed in two applications. Prior to the start of the experiment the plot was divided into five sub plot of 3000 m² each. Each sub plot provided grasses for a period of one week. The numbers of pastures were available to permit a rotational grazing scheme with rest periods of four weeks.

Leucaena was used like a protein bank and had been established 24 months previously in continuous rows with 2 m spacing between rows. This plot was fertilized with 250 kg/ha of 12-24-12 in one application.

Animals: The experiment was conducted using a total of twenty-four crossbred goats (French Alpine and Nubian) which were divided into three homogeneous groups of eight animals each regarding weight, age and milk production.

Treatments: The treatments were a) the control treatment grazing only grass pasture, b) the same grass pasture grazing but an additional period of 2 hr/d browsing leucaena, and c) the same grass pasture grazing with individual supplementation with concentrate (300 g/animal/d) feed (20% crude protein). All animals had free access to mineral salt and water.

Measurements and analytical procedures: Animals were weighted weekly. Milk productions of the animals were recorded daily. Samples of milk were analyzed for fat by the method of Gerber [6]. Total solid were as described by AOAC [1], minerals were determined using an atomic absorption spectrophotometer and protein by a micro Kjeldahl procedure [1]. Samples of pastures grazed and leucaena were collected by hand picking for chemical analysis.

Statistical analysis: Growth studies, milk production and composition data were analyzed as a randomized complete block design [13]. General Linear Model (GLM) procedures were used to test differences between means [12].

RESULTS AND DISCUSSION

The chemical composition of the diet components used in the experiment is shown in TABLE I. Similar trend in organic matter was recorded in the diets used in this experiment with pasture, leucaena and commercial concentrate containing 92.1, 92.4 and 93.1%, respectively. The crude protein (CP) contents were within the range of 8.6-23.5%, *L. leucocephala* had the highest CP content while it was almost three times higher than buffel grass. Nitrogen free extract (NFE) content was similar for leucaena and buffel grass, while concentrate had more NFE (67.8%). Buffel grass had the highest values of neutral detergent fiber (NDF) and crude fiber. The composition of leucaena foliage was similar to that reported by Clavero and Razz [5] and Orden *et al.* [11]. Pasture was of low nutritive value as shown by the low crude protein and high crude fiber content. These values were within the normal range of values reported for tropical grasses [9] and were not expected to affect nutrient utilization.

The results of this experiment indicate that at the end of the common lactation period significant differences ($P < 0.05$) were found in milk production (TABLE II). In animal grazing buffel grass and supplemented with commercial concentrate and animal receiving leucaena, milk yield and daily milk yield remained relatively high throughout the experimental period compared with the pure grass alone. A 35% increase in daily milk

TABLE I
CHEMICAL COMPOSITION OF DIETARY INGREDIENTS

Attributes	Commercial concentrate	<i>Leucaena leucocephala</i>	Pasture
Organic matter (% DM)	93.1	92.4	92.1
Crude protein (%DM)	20.0	23.5	8.6
Crude fiber (% DM)	8.0	16.2	24.8
Nitrogen free extractives (% DM)	67.8	43.6	49.7
NDF (% DM)	—	38.6	56.0
Calcium (g/kg)	1.6	1.85	0.44
Phosphorus (g/kg)	0.30	0.22	0.10

TABLE II
MILK PRODUCTION AND COMPOSITION FROM CROSSBRED GOATS

	Pasture	Pasture + leucaena	Pasture + concentrate
Total milk yield (kg)	66 ^c	101.4 ^a	89.1 ^b
Daily milk yield (kg/day)	0.55 ^b	0.84 ^a	0.74 ^a
Milk composition (%)			
Fat	3.4	3.3	3.2
Protein	2.99	3.06	3.10
Total solid	17.8	17.5	17.9
Minerals	0.78	0.81	0.80

a, b, c values on the same line with different superscripts are different, LSD (P<0.05).

TABLE III
EFFECT OF DIET ON BODY WEIGHT CHANGES

	Pasture	Pasture + leucaena	Pasture + concentrate
Initial live weight (kg)	34.3	33.8	35.1
Final live weight (kg)	38.6	39.6	41.2
Live weight gain (kg)	4.3	5.81	6.06
Average daily gain (g)	35.8 ^b	48.4 ^a	50.5 ^a

a, b values on the same line with different superscripts are different, LSD (P<0.05).

yield was noted when goats had access to pasture and received concentrate (0.74 kg/d) compared to those animals which had access to pasture without supplementation (0.55 kg/d).

Animals with access to the *L. leucocephala* protein bank produced an average 0.84 kg of milk/d, a production 52.7% higher than that obtained from animals grazed on pastures only but not different from the animals which received concentrate and pasture.

This advantage was possibly due to the higher crude protein levels and higher forage intake compared with grass alone as reported by Bhatta *et al.* [3] and Dutta *et al.* [7].

The higher consumption in supplemented groups could be attributed to higher outflow rate of both the liquid and solid phase of the rumen digest, probably due to enhanced cellulolysis, digestion of cell walls in the reticule rumen and metabolism in body tissues. Higher dry matter intake of diets with *Leucaena* was not only due to the effect of dietary crude protein but also to their readily fermentable fiber content [7]. The high content of fiber of buffel grass probably affected dry matter intake and subsequently its utilization by the goats. Plants with high content of fiber occupy a large volume in the rumen, therefore limiting gut capacity and the rate of break down of these materials determines their potential intake and utilization [2].

Based on conventional measures of quality such as crude protein, the quality of the diet improved by the addition of *leucaena*. Because of the high crude protein content in the treatments with commercial supplementation and the *leucaena* protein bank, the N intake of goats given these treatments doubled that of the control goats. According to Dutta *et al.* [7], goats exhibited a significant depression in potential digestibility due to nitrogen limitations. Mtenga and Shoo [10] reported that *L. leucocephala* supplementation increased protein intake and dry matter digestibility. This improved nutrient status should have allowed for enhanced milk yield production.

Fat, protein, total solids content of milk and minerals were not affected by treatments.

Results of this experiment indicate that daily live weight gain was highest in the treatments with concentrate (50.5 g/d) and *leucaena* (48.4 g/d) than the control group (35.8 g/d), TABLE III.

The higher growth rate of animals fed with either concentrate or *leucaena* could be associated with higher dry matter intake. According to Orden *et al.* [11] the faster flow rate of both solid and liquid ingest from the reticule-rumen contributed to more efficient synthesis of tissue protein. Buffel grass containing high cell wall show restricted voluntary intake due to their slow degradability and accumulation of fiber in the rumen. The inclusion of commercial concentrate or *leucaena* improved the N utili-

zation of the diet and provided rumen undegradable N that resulted to increase consumption with a corresponding increase in live-weight gain, feed efficiency and better performance in supplemented animals. This is consistent with the results of Yahaya *et al.* [14], who support the view of that favorable daily growth rate response depend mainly to improved N status as a results of *Leucaena* supplementation that also elicited higher intake.

CONCLUSION

The possible role of *leucaena* in a rotational browsing grazing system for goats in tropical areas is suggested from the foregoing results. Forage from *leucaena* has high nutritional quality and when managed as a browse supplement in grazing goats may lead to improvements in growth performance and milk production especially during periods when pasture quality is reduced. *Leucaena Leucocephala* supply an adequate amount of nutrient with similar value to commercial concentrate for goats consuming tropical pastures and developing sustainable agroforestral farming practices.

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