

## THE USE OF *GLIRICIDIA SEPIUM* IN THE SUPPLEMENTARY FEEDING OF CROSSBRED FEMALE CALVES

### Utilización de *Gliricidia sepium* en la Alimentación Suplementaria de Becerras Mestizas

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#### ABSTRACT

To evaluate the effect of supplementation in female calves with flour of *Gliricidia sepium* leaves (GS) on partial and final body weight (BW) and average daily gain (ADG) a study was undertaken in the "San Pedro Farm" located in Zulia State, in a tropical sub-humid forest environment of Venezuela. The data were analyzed by the least-square analysis of variance-covariance of The Statistical Analysis System, testing effects of treatment on 7 weaned Holstein crossbred female calves, 5 months old at initiation, and supplemented with a growing ration (2% of body weight): (a) supplementation with 100% of feed concentrate (TA) and (b) a mixture of 60% corn meal + 40% of dehydrated GS flour + 50 g./animal/day of complete mineral mixture (TR). The female calves supplemented with TA reached a higher BW (106.65 ± 2.51 kg.) and ADG (334.61 ± 42 g/d) than the female calves fed with TR (BW=96.06 ± 2.51 kg, ADG=157 ± 42 g/d). The apparent cause for these results was the cutting age (5 months old) of the plant used to make the ration and the lower feed intake in TR. It is important to cut the GS plant green and very young (between 6 and 12 weeks old) because it has the best rate of digestibility at this stage. It is suggested prepare a ration with a minor proportion (30%) of GS flour, adding edible molasses to improve the palatability.

**Key word:** *Gliricidia sepium*, leguminous shrubs, fodder crop, feeding, calves.

#### RESUMEN

Par evaluar el efecto de la suplementación en becerros con harina de hojas de *Gliricidia sepium* (GS) sobre el peso corporal al final del ensayo (BW) y ganancia diaria de peso vivo

(ADG) en becerros, se realizó un experimento en la finca "San Pedro" ubicada en el estado Zulia (Venezuela), bajo condiciones de bosque sub-húmedo tropical. Los datos fueron sometidos a un análisis de Varianza-Covarianza y procesados por el sistema de análisis estadístico del SAS. Cada tratamiento estuvo compuesto por 7 becerros mestizas Holstein de 5 meses de edad suplementadas con una ración de crecimiento (2% de su peso vivo): (a) suplementación con un concentrado comercial (TA) y (b) 60% de harina de maíz + 40% de harina de GS + 50 g/animal/día de mezcla mineral completa (TR). Las becerros suplementadas con TA mostraron un mayor BW (106,65 ± 2,51Kg.) y ADG (334,61 ± 42 g/d) que las becerros que consumieron TR (BW= 96,06 ± 2,51Kg, ADG= 157 ± 42 g/d). El BW y la ADG en el grupo TR fue bajo, siendo la razón aparente la edad de corte de las hojas de GS, lo cual disminuyó la aceptabilidad y la digestibilidad de la ración. Se recomienda realizar los cortes del material verde a procesar con rebrotes de plantas que oscilen entre las 6 y 12 semanas de edad. Se sugiere preparar la ración con menor proporción de GS (30%), además de añadir melaza para mejorar la palatabilidad.

**Palabras clave:** *Gliricidia sepium*, leguminosas, forraje, alimentación, becerros.

#### INTRODUCTION

In recent years, it has been established that cattle production should make full use of pastures, since these represent the most abundant and economic feed resource to which producers in developing countries have access. In this sense, the incorporation of leguminous shrub as a supplement, whether exclusively or accompanied by other fodder, constitutes an alternative means of attaining production increases for grazing animals in bovine breeding units. The need to generate cost-reducing alternatives for feeding has fostered the study of legu-

minous shrubs in order that these be incorporated into bovine feeding systems. This is the case with *Gliricidia sepium*, which is a specie native of Central America, where it probably originated [16], and South America [4]. It has, however, spread to different parts of the world, including West Africa, the West Indies and Southern Asia [16]. In Colombia, Guyana and Venezuela it is known as '*matarratón*' ('mouse killer'), and it is widely distributed throughout a great variety of terrain, very dry tropical forest, dry tropical, humid and pre-mountainous humid [4]. This leguminous plant presents nutrient levels which are superior to minimum critical levels required for ruminants, and is comparable to other leguminous shrubs considered as having a high fodder quality [6]. This leguminous tree produces a high quality fodder and is a potential substitute of others feed resources [1, 3]. A good example of this is the content of crude protein in its leaves, which varies between 26.8% and 30% and that of the stem, which varies between 13.9% and 20.5% [5, 11], with a good digestibility [8]. Additionally, it is a resource that can be mechanically harvested, with production levels of up to 150 metric tons of green matter/hectare/year [2].

*Gliricidia sepium* is a leguminous shrub with great potential, and its introduction could represent an alternative means of minimizing nutritional deficiencies that are presented in young animals, still in the process of growth [14], during periods of fodder scarcity. In this sense, it was considered interesting to evaluate growth (partial and final body weight and average daily gain) of predominantly Holstein crossbreed female calves fed with two different supplementation sources, under the same grazing management by the farm.

## MATERIALS AND METHODS

The trial was carried out in the San Pedro farm of the Faculty of Veterinary Science, University of Zulia. The farm is located in the municipality of Machiques (Perijá), in the State of Zulia, Venezuela. The environmental characteristics of the area have been described in a previous paper [10].

Fourteen (14) Holstein crossbreed female calves, weaned at five months of age, were used for the trial, and were grouped into two 7-female calves groups and these groups were randomly assigned one of two treatments:

- Treatment TA = Supplementation with a commercial concentrate.

- Treatment TR = 60% cornmeal + 40% *Gliricidia Sepium* flour (GS) + 50 g/animal/day of complete mineral mixture.

The GS flour was obtained by sun-drying (72 hours) the plant's leaves; these were taken from plants in the same terrain area that contained branches with new shoots older than 150 days' growth (5 months), collected during the dry season. The cornmeal and feed concentrate were acquired in a distribution outlet close to the farm, stocked by a trustworthy company.

Throughout the day, the female calves grazed in *Brachiaria brizanta* pastures and were fed the supplementation on a daily basis via a morning ration (7-9 a.m.). The amount of supplement provided for each treatment was based on the 2% of live body weight. Live body weight was determined individually, using a ranch steelyard with a capacity of 1,500 kg and a precision of 1 kg. Feed was provided daily to the female calves in collective feeding stables, and the consumption was measured by assessing the difference between the weight of feed supplied voluntarily to each trough and the weight of remaining feed taken away each day. Readjustment of the amount of supplement provided was carried out every 14 days. In the same way, samples of TA, GS flour and TR were taken every two weeks for a proximal analysis sequence (TABLE I), in order to verify their nutritional composition throughout the trial.

The experimental design corresponds to an entirely random analysis, the feeding ration being the independent variable for evaluation. A variance-covariance analysis was undertaken by use of the minimum squares method, including trial-initial weight as a continuous variable. As dependent variables, partial and final body weight (BW) and average daily gain (ADG) were studied. Data were analyzed through the General Lineal Model (GLM) procedure in the SAS statistics package [12] and for the subsequent detection of significant differences between treatments undertaken, the PDIF test was used to compare square averages [12].

## RESULTS AND DISCUSSION

The TABLE II illustrates the results obtained, which show that the experimental units supplemented with TA demonstrated greater BW and ADG than those female calves that were fed on TR 14 days after having initiated the trial ( $P < 0.01$ ). This was due to the lower feed intake in TR (TABLE III).

TABLE I  
PROXIMAL ANALYSIS OF THE RATIONS AND *Gliricidia sepium* FLOUR

Ration/Feed	DM (%)	CP (%)	EE (%)	CF (%)	NFE (%)	TDN (%)	AS(%)
TA	88.17	15.64	6.61	10.94	57.33	74.03	9.48
TR	82.53	19.55	1.38	21.73	48.87	71.78	8.47
GS	90.53	22.7	2.20	20.81	43.66	70.26	10.63

TA: Supplementation provided through a commercial concentrate. TR: 60% cornmeal + 40% GS flour + 50 g/animal/day of complete mineral mixture. GS: *Gliricidia sepium* plant. DM: dry matter, CP: crude protein, EE: ether extract, CF: crude fiber. NFE: nitrogen free extract, TDN: total digestible nutrient, AS: ashes.

It should be emphasized that the BW and ADG reported for the TR group are very low, which could be attributable to the age of the plants used (20 weeks); this considerably affected consumption. It is also possible that the GS flour presents substantial quantities of certain anti-nutritional compounds, such as tannins, which (though not determined in this experiment) are widely known as bitter substances that diminish feed consumption, as may have occurred in this trial [16]. Smith and van Houtert [16] suggested that, when readily consumed, the GS distends the rumen, reducing intake of the basal diet. Low acceptability of GS plant has been suggested as a contributing factor towards lower intake [17]. In spite of the array of potentially toxic substances (coumarins, nitrates, cyanogens, alkaloids, tannins) reportedly present in GS plant, evidence of toxicity under normal feeding conditions has been rare [16]. Conclusively, toxic symptoms have been observed in non-ruminant, such as rodent, and horses [15] and poultry [9] fed low levels of GS, thus making it unsuitable for feeding non-ruminants [16]. Research using calves between 113 kg and 155 kg BW, grazing on *Cynodon plectostachyus* + minerals + GS mention ADG for calves varying between 360 to 650 g/d [4]; whilst Seijas et al [14] indicate post-weaning moderate ADG for calves (360-400 g/d) in critical periods with the use of GS plant and GS + multi-nutritional blocks. On the other hand, Seijas and Combellas [13] suggest that a better response from animals supplemented by GS is related to improving factors associated with leguminous plants, such as the slow release of degradable nitrogen, and of peptides and aminoacids to the rumen, as well as a greater digestibility in relation to staple feed. Kass et al. [7] indicated that ruminants without prior GS experience show less feed intake of this fodder, whereas Escobar et al [6] state that the suitable levels for addition are between 20 and 40%, therefore it is suggested to prepare a ration with a proportion of 30% of GS flour and adding edible molasses to improve the palatability.

## CONCLUSION

The female calves supplemented with TA reached a higher BW and ADG than the female calves fed with TR. The assumption of this cause for these results was the cutting age (5 months old) of the plant used to prepare the ration and hence the lower feed intake in TR. It is important to cut the GS fodder in a very young stage (between 6 and 12 weeks old) because it has the best rate of digestibility at this stage and the palatability improve. It is suggested to prepare a ration with a proportion of 30% of GS flour, adding edible molasses to improve the palatability.

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**TABLE II**  
**THE EFFECT OF SUPPLEMENTATION TYPE ON PARTIAL AND FINAL BODY WEIGHT AND AVERAGE DAILY GAIN**

Parameter	Treatment	
	TA	TR
Number of female calves	7	7
Weight at start of trial (kg.)	86.8±1.05 <sup>a</sup>	87.00±1.10 <sup>a</sup>
Weight at 14 days (kg.)	93.93±1.19 <sup>a</sup>	91.49±1.19 <sup>a</sup>
Weight at 28 days (kg.)	101.91±1.77 <sup>a</sup>	93.65±1.77 <sup>b</sup>
Weight at 42 days (kg.)	104.89±2.34 <sup>a</sup>	94.52±2.34 <sup>b</sup>
Final weight, 56 days (kg.)	106.65±2.51 <sup>a</sup>	96.06±2.51 <sup>b</sup>
Average daily gain (g/d.)	334.61±42.0 <sup>a</sup>	157.0±42.0 <sup>b</sup>

TA: Supplementation provided through a commercial concentrate TR: 60% cornmeal + 40% GS flour + 50 g/animal/day of complete mineral mixture. (a, b): Different letters within the same row imply statistically significant differences (P<0,01).

**TABLE III**  
**FEED OFFERED (FO) AND FEED INTAKE (FI) DURING THE EXPERIMENT**

Trial period (Days)	Treatment			
	TA		TR	
	FO (kg.)	FI (kg.)	FO (kg.)	FI (kg.)
0-14	1.74	1.74	1.73	1.49
14-28	1.89	1.89	1.82	0.97
28-42	2.04	2.04	1.86	1.59
42-56	2.10	1.80	1.88	1.08

TA: Supplementation provided through a commercial concentrate. TR: 60% cornmeal + 40% GS flour + 50 g/animal/day of complete mineral mixture.

## REFERENCES

- [1] ABDULRAZAK, S.A.; MUIGA, R.W.; TORPE, W.; ØRSKOV, E.R. The effects of supplementation with *Gliricidia sepium* or *Leucaena leucocephala* forage on intake, digestion and live-weight gains of *Bos taurus* x *Bos Indicus* steers offered *napier grass*. **Ani. Sci.** 63: 381-388. 1996.
- [2] ADEJUMO, J.O. Effect of length and girth of vegetative planting material upon forage yield and quality of *Gliricidia sepium*. **Trop. Agric. (Trin.)** 68: 63-65. 1991.
- [3] BENNINGSON, J.J.; PATERSON, R.T. Use of trees by livestock. *Gliricidia*. **Natural Resources Institute publication**, Chatham, U. K. 262 pp. 1993.
- [4] CHACÓN, C. Utilización de matarratón (*Gliricidia sepium*) en la alimentación bovina. En: **IX Cursillo sobre bovinos de carne**. Facultad de Ciencias Veterinarias, Maracay. 21-22/10. Venezuela. 157-176. 1993.
- [5]

- DEVENDRA, C.; GOL, B.I. The chemical composition of Caribbean feedingstuff. **Trop. Agric. (Trin.)**, 47: 335-343. 1970.
- [6] ESCOBAR, A.; ROMERO, E.; OJEDA, A. El matarratón (*Gliricidia Sepium*) un árbol multipropósito. **Serie de Cuadernos Técnicos de la Fundación Polar**. Caracas-Venezuela. 71 pp. 1996.
- [7] KASS, M.; PEZO, D.; ROMERO, F.; BENAVIDES, J. Las leguminosas como suplemento proteico para animales. En: **I Simposio sobre leguminosas forrajeras arbóreas**. Facultad de Agronomía, Universidad del Zulia, Maracaibo. 29-30/4. Venezuela. 17pp. 1993.
- [8] MINOR, S.; HOVELL, D.F.D. Rate of rumen digestion of different protein sources using the in vivo nylon bag technique with cattle fed sugar cane. **Trop. Ani. Prod.** 4: 105-106. 1979.
- [9] MISHRA, M.; SINGH, I.; SAHOO, G. Effect of feeding *Gliricidia maculata* leaf meal on the performance of *White Leghorn* chicks. **Indian. J. Poultry Sci.** 12: 17-21. 1977.
- [10] QUINTERO-MORENO, A., ROJAS, N., ARANGUREN, J., SOTO, G.; DURÁN, D. Efecto de la suplementación y la época de nacimiento sobre el crecimiento predestete de becerras mestizas. **Revista Científica, FCV-LUZ**. VII(2): 75-82. 1997.
- [11] REVERÓN, A.; MONTILLA, J.; FUNES, A. Investigaciones preliminares sobre las características de la planta de rabo de ratón (*Gliricidia sepium*). **Zootec. Vet.** 22: 36-44. 1967.
- [12] SAS. SAS/STAT **Software**: Changes and Enhancements through Release 6.11. SAS Inst. Inc. Cary, NC. 1996.
- [13] SEIJAS, J.; COMBELLAS, J. Influencia de la harina de pescado y el follaje de *Gliricidia sepium* sobre las ganancias de peso en becerros postdestete. **VII Congreso Venezolana de Zootecnia**. Resúmenes. Universidad de Oriente. Maturín. Octubre. Venezuela. NR-38. 1992.
- [14] SEIJAS, J.; ARREDONDO BLANCA; TORREALBA, H.; COMBELLAS J. Influence of *Gliricidia Sepium*, multinutritional blocks and fish meal on live weigh gain and rumen fermentation of growing cattle in grazing conditions. **Livestock Research for Rural Development**. 6 (1): 90-100. 1994.
- [15] SKERMAN, P.J. Tropical forage legumes. Chapter 15. In: Leguminous browse. **Plant Production and Protection**, FAO. Rome, Series 2. 1977.
- [16] SMITH, O.B.; VAN HOUTERT, M.F.J. The feeding value of *Gliricidia sepium*: A review. **World Animal. Review**, 57: 57-68. 1987.
- [17] TANDRAATMADJA, M.; MACRAE, I.C.; NORTON, B.W. Digestion by sheep of silage prepared from mixtures of tropical grasses and legumes. **J. Agri. Sci.** 20: 407-415. 1993.