UTILIZATION OF *Acacia mangium* AS SUPPLEMENT FOR GROWING SHEEP

Utilización de *Acacia mangium* como suplemento para ovinos en crecimiento

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ABSTRACT

Confined West African sheep were offered chopped sun-dried *Acacia mangium* leaves at levels of 0, 20, 40 and 60% in a diet with chopped hay of *Brachiaria humidicola* over a period of 21 days to evaluate intake and nitrogen metabolism. The experimental design was a randomized block with four replications. Dry matter intake (DMI) was affected by Acacia feeding ($P<0.05$). DMI increased with increasing level of Acacia in the diets. The corresponding DMI values were 2.2, 2.8, 3.5 and 4.1 kg per 100 kg LW. *Acacia mangium* supplementation had a highly significant ($P<0.01$) effect on nitrogen utilization by sheep. Nitrogen intake and percent of nitrogen apparently retained rose with increasing levels of Acacia. Nitrogen retention was negative for unsupplemented sheep but positive for Acacia-mixed diets.

Key words: *Acacia mangium*, nitrogen metabolism, feed intake, sheep.

RESUMEN

Ovinos West African confinados se suplementaron con diferentes niveles de harina de *Acacia mangium* 0, 20, 40 y 60% en una dieta basada en heno de *Brachiaria humidicola* durante un período de 21 días, para evaluar el consumo y el metabolismo del nitrógeno. El diseño experimental se realizó en bloques tomados al azar con 4 repeticiones. El consumo de materia seca (CMS) se afectó con la alimentación con Acacia ($P<0,05$). El CMS incrementó con aumentos de los niveles de Acacia en la dieta, observándose valores de 2,2; 2,8; 3,5 y 4,1 kg por 100 kg de peso vivo. La suplementación con *Acacia mangium* mostró un efecto altamente significativo ($P<0,01$) sobre la utilización del nitrógeno aparentemente retenido aumentaron con incrementos de los niveles de Acacia. El nitrógeno retenido resultó negativo en animales sin suplementación pero positivo para las dietas mezcladas con Acacia.

Palabras clave: *Acacia mangium*, metabolismo del nitrógeno, consumo, ovinos.

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INTRODUCTION

The value of feed for animal production depends of feed quality and level of voluntary intake by animal. Several workers in tropical America have suggested the use of protein concentrate to supplement existing pasture [4]. There is therefore a need to look for cheaper alternative sources of protein. The leguminous plant *Acacia mangium* is a fast growing tree specie of the sub-family Mimosoideae. The species is indigenous to Northern Australia, New Guinea and Eastern Indonesia. Mangium is a multipurpose specie suitable for timber, shade trees, living fences, green manure and livestock fodder with the particular ability to grow in acid soils. The objective of this study was to investigate responses of sheep fed with low quality hay (*Brachiaria humidicola*) and supplemented with different levels of *Acacia mangium*.

MATERIALS AND METHODS

Description of animals

Twenty West African sheep were used in the feeding trials. Weights average 16.20 ± 0.10 kg for sheep. The animals were treated for internal and external parasites prior to the trials. They were also given injections of a vitamin mixture consisting of vitamins A, D and E (1.5 ml contained 55000 IU vitamin A, 25000 UI vitamin D_3 and 25 mg vitamin E). Common salt and fresh clean drinking water was provided at all times.

Individuals animals were housed in a designed crate having provision for collection of faeces and urine separately [3]. Animals were fed during the pre-experiment period for 21 days, followed by experimental metabolic trial of 7 days.

Dietary ingredients

Brachiaria humidicola hay was harvested from a mature stand at the experimental farm of Agronomy faculty of The University of Zulia, Venezuela. This hay was the basal diet during the experiment. *Acacia mangium* was cut from established stand. This harvested material was sun-dried.

The leaves of Mangium and Brachiaria hay were put through a forage chopper set at 2 cm to minimize feed wastage and selectivity. Both forages were mixed in order to get four diets in which 0, 20, 40 and 60% of the dry weight was provided by Mangium forage.

Sampling procedures

Daily dry matter intake (DMI) of individuals animals was measurement. Samples of feed offered and weighed refusals, were collected daily.

Total faecal collections were taken daily and frozen for subsequent analyses. Urine production of the animals during the fecal collection periods was collected into containers to which had been added 30 ml glacial acetic acid, weighed, sub-sampled and bulked on an individual animal basis. Bulked samples of feed refusals and faeces were ground to pass through a 1 mm mash prior to analyses.

Analytical procedures

Nitrogen (N) of feeds, faeces and urine was determined by standard Kjeldahl procedure [2]. Acid detergent fiber (ADF) and cell wall constituents (CWC) were measured by the methods of Goering and Van Soest [5].

Statistical procedures

Data were subjected to analisys of variance. Duncan's new multiple range test was used to test significant difference among means [8].

RESULTS AND DISCUSSION

Chemical composition of these diets are shown in TABLE I. Composition of the diets varied from a low of 6% of Crude protein (CP) and high of 43.9 ADF and 77.4 CWC for *Brachiaria humidicola* hay (test diet) to a high of 15.1 CP and a low of 33.8% ADF and 64.8% CWC.

It is evident that *Acacia mangium* is rich in crude protein (CP) and may be a good source of protein. Based on conventional measures of quality such as CP and ADF, the quality of diet improved by the addition of *Acacia mangium,* see TABLE I. Observation in many parts of the world have shown in other tree legumes to be a valuable protein supplement [6].

DMI increased as the percentage of Mangium in the diet was increased in conformity with previous finding with other tree legume [1]. *Brachiaria humidicola* hay used in this experiment was low of quality and its crude protein most likely did not meet requirement for nitrogen. Nitrogen utilization is shown in TABLE II. Acacia supplementation had a significant ($P< 0.05$)

TABLE I

COMPOSITION OF DIETS USED IN FEEDING SHEEP WITH *ACACIA MANGIUM* (G/100 G DM*)

Mangium level (%)	Crude protein	Acid detergent fiber	Cell wall constituents
0	6.0	43.9	77.4
20	10.8	38.3	73.1
40	13.9	35.6	69.5
60	15.1	33.8	64.8

*DM= Dry matter.

TABLE II

DRY MATTER INTAKE (DMI) AND NITROGEN BALANCE OF SHEEP FED WITH DIFFERENT LEVELS OF *ACACIA MANGIUM*

Item	*Acacia mangium* levels (%)				Mean ± SD
	0	20	40	60	
Initial BW (kg)	16.20	16.30	16.10	16.20	16.20 ± 0.10
Final BW (kg)	15.75	16.28	16.58	16.65	16.32 ± 0.41
Gain of BW (kg)	-0.45	-0.02	0.48	0.45	—
DMI (kg per 100 kg BW day $^{-1}$)	2.2^{c}	2.8^{b}	3.5^{a}	4.1^{a}	3.2 ± 0.15
Balances (g day $^{-1}$)					
N intake	3.45^{d}	7.90^{c}	12.51^{b}	16.07^{a}	9.94 ± 5.2
N excretion through					
Faeces	3.25^{c}	4.39^{b}	4.78^{b}	6.51^{a}	4.85 ± 1.75
Urine	1.58^{c}	2.26^{b}	2.58^{ab}	2.93^{a}	2.34 ± 0.71
Balance	-1.38^{c}	1.25^{b}	5.15^{ab}	6.63^{a}	3.25 ± 2.91

Mean in the same row not followed by the same letter are different ($P < 0.05$).

effect on nitrogen utilization by sheep. N intake (g/day) increased with increasing Acacia levels in the diet. Faecal and urinary nitrogen increased with Acacia levels. Nitrogen retention was negative for unsupplemented sheep but positive for those on Acacia. Unsupplemented sheep were in negative nitrogen balance, TABLE II, indicating that hay in the present study could not meet maintenance nitrogen requirements thus, protein supplementation of such low quality roughage is needed as suggested by Mtenga and Shoo [7].

Supplemented animals had high daily dry matter intake of supplements compared with unsupplemented animals. Early work has shown similar DMI by small ruminants [1]. The increased in N balance when Mangium was fed can be explained by increased suply of N to the rumen and energy and protein to the animals when *Brachiaria humidicola* hay was fed rumen microbes of sheep would not have had sufficient rumen digestible N. Correcting this deficient with Mangium resulted in increased digestible organic matter intake and probably Mangium and microbial amino acid flow to the intestines. Increased protein intake is often associated with high dry matter intake, resulting in faster rates of passage of digest though the gastro-intestinal tract.

This improved nutrient status should have allowed enhanced growth and hence N retention. The short experiment period did not allow for detection of significant changes in body weight.

CONCLUSION

It can be concluded hat the sun-dried *Acacia mangium* supplementation increase dry matter intake and nitrogen balance at the highest offer levels studied without any negative effect on the sheep.

There is a little literature of this legume like fodder fed so the data from this experiment could be compared. Further studies are needed to determine growth rate, carcass composition, milk yield and composition in ruminant species.

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