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The effect of *Leucaena* leaf supplementation to maize residues on village goat performance

Fasae O.A. [+], Adesope A.I. and Ojo V.O.A.*
Department of Animal Production and Health, University of Agriculture, P.M.B. 2240, Abeokuta, Nigeria.
**Department of Pasture and Range Management, University of Agriculture, Abeokuta, Nigeria.*
[+] Corresponding author email: animalexp@yahoo.co.uk
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1 SUMMARY

The maize producing areas in the south west Nigeria offers some potential for raising goatsAA 56 day feeding trial studied the effect of Leucaena leaf supplementation on maize residues on goats. Twenty West African Dwarf goats randomly selected from a village herd were stratified according to their weight, and then randomly allocated to four dietary treatments namely: village feeding (VF) containing free ranging with crop residues supplementation, village feeding with maize residues (VF+MR), village feeding with dried Leucaena leaves (VF+LL), village feeding, maize residues and *Leucaena* leaves (VF+MR+LL) for diets 1 to 4, respectively. Leucaena leaf supplementation significantly increased (P < 0.05) the Dry Matter intake and body weights of goats. Diet 4 containing (VF+MR+LL) produced the best performance for optimum growth of goats. *Leucaena* leaves could therefore play a valuable role in supplying supplemental nitrogen to goats fed maize residues under the village system of management.

2 INTRODUCTION

Goats play an important socio-economic role in the rural areas, where most of the resource poor farmers in Africa live (Anaeto *et al.,* 2009) and form an integral part of the cultural life and system of Nigeria's peasantry (Ajala, 2004). Improved goat nutrition appears to be a more critical factor in increasing small stock productivity. Native rangelands provide the cheapest source of nutrients for goats and for a greater part of the year, grasslands do not supply sufficient nutrients to stock for greater productivity (Ndlovu, 1992). It has been emphasized that most tropical forage species have low dry matter digestibility and intake (Aregheore, 2001), hence the need for supplementation with high quality forages.

Maize is one of the most important cereal crop grown in south west Nigeria. Every part of the maize plant has economic value (FAO 2001) and maize residues that comprise of mainly leaves, straw, husks, skins and trimmings, cobs and bran which often are either burned or ploughed into the soil, could serve as feed energy suitable for ruminant livestock (Adebowale, 1985; Oji *et al.* 2007). Maize residues have not found their way into stock feeding even though they have been shown to be potentially useful and readily available in smallholder farming system in south west Nigeria (Fasae *et al,* 2009).

Leucaena Leucocephala as a tree legume is noted for its highly nutritive value for ruminant production (Osakwe, 2006; Babayemi and Bamikole, 2006) and readily available in smallholder settlements in South west Nigeria. *Leucaena* has proved to be a valuable multipurpose tree and the dried leaves have shown to have reduced mimosine content (Mero and Udén, 1990). It is a relatively fast growing tree in production of forage (Szyszka *et al*., 1983).

This project evaluates the performance of village managed goats fed maize residues supplemented to with *Leucaena leucocephala* leaves.

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3 MATERIALS AND METHODS

3.1 Experimental location: The experiment was carried out at Ogboja village, in Odeda Local Government Area of Ogun State, South west, Nigeria (Latitude 7^0 13'49. 46"N and Longitude 3^0 26' 11. 98"E). The major occupation of goat rearers in the village is arable farming, majorly in maize and cassava production and processing.

3.2 Goat management: Goat management system adopted in the village is semi-intensive. Animals were fed during the early morning under the village system of feeding with crop residues such as cassava peel, cassava leaf, household wastes, yam peels and plantain peels. The animals were then allowed to graze on natural pasture. The dominant grasses in the natural pasture within the study area were *Panicum maximum (Guinea grass), Pennisetum purpereum (Elephant grass) and Cynodon dactylon (Bermuda Grass).* In the evening after grazing, the animals were provided shelter in which they were confined. Twenty (20) West African Dwarf goats with an average weight range of 6 to 8kg were randomly selected from the farmers' herd. The animals were divided into four treatments balanced for weight of five goats per treatment as follows:

Treatment 1: Village feeding (control)
Treatment 2: Village feeding + Maize residues
Treatment 3: Village feeding + *Leucaena leucocephala* leaves
Treatment 4: Village feeding + Maize residues + *Leucaena leucocephala* leaves.

The farmers' farms were visited and maize residues made up of stems, cobs and leaves collected immediately after crop harvest. They were chopped with a cutlass into pieces of approximately 1 cm length. *Leucaena leucocephala* leaves were harvested within the village community, dried for three days to reduce the mimosine content before feeding to the animals. The feeds were given to the animals *ad libitum.*

3.3 Data collection*:* Daily feed offered *ad libitum* and refusals were recorded in order to ascertain the feed intake. Body weight changes of the animals were taken at around 8am using the spring balance at the onset of the experiment and subsequently on a weekly basis for a period of 56 days. Live weight changes of the goats were calculated as the difference between the starting and the final experimental weight and averaged in each group.

3.4 Chemical and Statistical Analysis: Feed samples were oven-dried at 65^0C for 48hrs, and analyzed for proximate compositions (AOAC, 1995). The concentration of the fiber components were determined by the method of Van Soest *et al.,* (1994). Data collected was subjected to one way analysis of variance in a completely randomized design (SAS, 1999) and significant means separated (Duncan, 1995).

4 RESULTS AND DISCUSSION

The proximate analysis of feeds used for the experiment is shown in Table 1. The CP content of maize residues was lower than requirement for ruminant maintenance. Norton (2003) observed that feeds containing less than 8% crude protein content could not provide the ammonia levels required by rumen microbes for optimum activity and suggested supplementation of such forages with appropriate nutrients to achieve high level of animal production. The CP values obtained for Leucaena are comparable to values reported in literature (Odeyinka, 2001; Osakwe, 2006). The high crude protein content of *Leucaena leucocephala* leaves would seem to suggest its suitability as fodder tree. The natural pasture used by the farmers under the village feeding in this study could be taken to represent a wide range of low quality feeds often available for goat production in the developing tropical countries especially during the dry season (Ojo *et al,* 2009). In most tropical regions, grasses are abundant and form the major feed for livestock. They are of low quality for most of the year especially after the flowering stage. They also contain high fiber and are poorly digested by animals (Leng, 1990).

Dry Matter intake and weight changes of the experimental goats were presented in Table 2.

Table 1: Chemical composition (% DM) of feed supplements fed to village Goats

Parameters	Natural pasture	Leucaena leaves	Maize residues+
Dry matter	91.45	90.78	81.31
Crude protein	4.07	23.12	8.25

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Neutral detergent fiber	76.61	34.98	68.5
Acid detergent fiber	51.65	20.67	47.78
Acid detergent lignin	9.50	8.23	7.78
Ether extract	1.45	3.78	1.93
Ash	11.13	12.38	5.61

[+]Maize residues – stem+ leaves+ cobs

Table2: Mean DM Intake and Weight Changes of Village goats fed maize residues supplemented with Leucaena leaf.

	Diets				
Parameters	**1**	**2**	**3**	**4**	**SEM**
Feed intake (g/day	-	231.65[b]	360.83[a]	402.84[a]	10.11
Initial weight (Kg	7.60	6.83	6.96	7.76	3.73
Final weight (Kg	9.33[b]	8.60[b]	9.70[b]	10.93[a]	2.78
Average weight gain (g/day)	24.03[b]	24.58[b]	38.06[a]	44.03[a]	7.31

[a,b,c] Means in the same row with different superscripts are significantly different (P<0.05).

The animals in treatment 4 had significantly (P<0.05) higher feed intake of 402.84g/day followed by goats on treatment 3 with an intake of 360.83g/day. The higher DM intakes of Leucaena leaf supplemented diets in goats were encouraging suggesting the palatability of Leucaena leaf. Earlier reports also showed a significant increase in daily total dry matter intake in ruminant animals fed various forages supplemented with *Leucaena* forage (Hulman and Preston, 1981 ; Mero and Udén, 1990).

Supplementation of maize residues with *Leucaena* improved total voluntary feed intake of the goats. The improved feed intake for Leucaena supplemented diets could have resulted due to faster rumen outflow rate and the provision of more degradable organic matter (Yousuf *et al.* 2007). *Leucaena* were readily consumed by the goats and was well accepted. Voluntary intake of maize residues was enhanced with incremental levels of supplementation with *Leucaena* leaf. This supports the findings of Aregheore *et al.* (2004) when goats were fed barka grass supplemented with Leucaena leaf.

There was no value reported for the DM intake in goats on treatment 1 as the animals were allowed to graze naturally with no supplementation. The low DM intake in goats on treatment 2 could be attributed to the low nutrient content of maize residues fed as supplements to the animals. Ruminants reared on maize residue alone have problems in meeting their maintenance need (Adebowale, 1985; Fasae, *et al,* 2011); therefore, it is imperative to balance their diet in terms of protein, vitamins and minerals through supplementation with leaves of browse trees such as Leucaena. The efficiency of the utilization of a diet are largely determined by the relative balances of glucogenic energy, long chain fatty acids and essential amino acids absorbed by the animals (FAO, 1995). It could then mean that diets 3 and 4 with Leucaena leaf inclusion contained a balanced of nutrients, which efficiently interacted to give a better daily weight gain in goats.

The goats on treatment 4 gave the highest (P < 0.05) weight gain (g/day) of 44.03 but not significantly different from animals on treatment 3 (38.06). The unsupplemented goats had reduced weight gain. There was no significant difference (P > 0.05) observed in weight gain of goats on treatments 1 and 2 with 24.03 and 24.58g/day, respectively.

The differences in weight gain (g/day) of goats could be attributed to the influence of Leucaena leaf in providing essential nitrogen and mineral elements both for effective rumen function and for body metabolism by the animals (Norton, 1994). This corroborates the findings of Kabatange and Shayo (1991) that rumen degradation of maize stover was significantly influenced by Leucaena hay supplementation.

The values obtained for weight gain (g/day) in this study for treatments 3 and 4 were higher than the range (23.33-28.57g/day) that was previously reported by Odeyinka (2001) for WAD goats fed *Leucaena* and *Gliricidia* leaves. Babayemi *et al* (2006) reported higher values for weight gain in WAD goats fed diets supplemented with lablab, Leucaena and Gliricidia foliage under stall feeding condition.

The DM intake and weight gain (g/day) obtained in goats on treatment 4 is similar to that obtained by Teniola (1990) where the highest weight gain was

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recorded in goats fed 75% *Leucaena* leaves. This could be as a result of the higher DM intake due to the endowed higher CP content of *Leucaena* leaves. Higher CP in diets has been considered an important factor that enables higher intake in feed (Oldham and Alderman, 1980).

The least (P>0.05) weight gain observed in goats on treatment 1 may be due to insufficient feed coupled with low nutrient content of feeds usually provided by the farmers to the animals under the village system of management that might have resulted into inefficient balance of nutrients. Also, low growth of goats on treatment 2 confirms the reports of Adebowale (1985) that observed a decrease in weight gain of goats fed untreated maize stover. The lignocelluloses and high fiber content in maize residues could be responsible for the low intake which had a resultant effect on the gain in weight of the animals (Silva and Orskov, 1988). The variations in average daily gains of the experimental goats could therefore be attributed to variation in nutrients supply from the diets (Oddy and Sainz, 2002)??

It was however, observed that goats on treatments 3 and 4 preferred the leaves of *Leucaena* to it stems as stem residues are usually found as leftover. This further confirms the selective feeding habits of goats (Lu, 1988) as well as reflecting the observations on farms that some goats fed *Leucaena* plants actively strip off the leaves from shoots even before eating the leaves (Palmer *et al.* 2010).

Leucaena leaves could play a valuable role in supplying supplemental nitrogen to goats fed maize residues. In terms of forage protein sources, *Leucaena* leaves are high in nutritive value and they could be incorporated as cheap protein sources for maintenance, growth, reproduction and lactation in the diets of ruminant livestock. However, Leucaena leaves should not be fed alone as reduced performance has been reported in goats (Girdhar *et al.,* 1991). Also, it should be fed wilted or dried so as to reduce the content of the anti nutritional factors namely mimosine and tannin. Dried and wilted Leucaena leaves have been effectively used in other tropical countries as supplements in the diets of cattle, goats and sheep (Abdulrazak *et al.*, 1997; Orden *et al.*, 2000; Ondiek *et al.*, 2000).

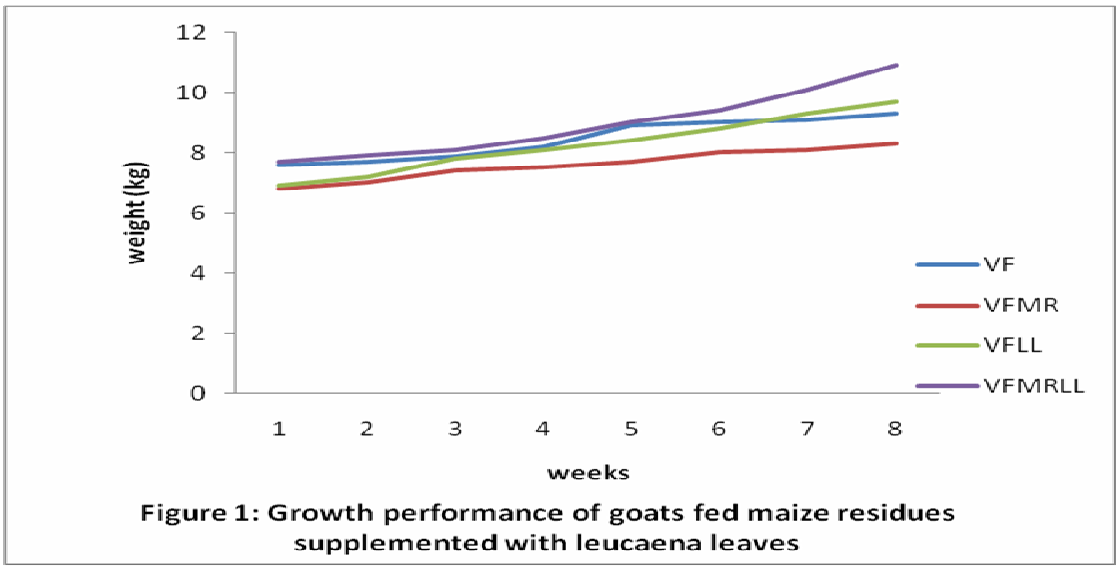

Figure 1: Growth performance of goats fed maize residues supplemented with leucaena leaves

5 Conclusion

The results of the study indicate that Leucaena leaf can be successfully used as a protein supplement for goats managed under the village system, fed low quality maize residues, thereby offering potentials for goat production in the maize based farming areas of south west Nigeria. Diet 4 containing maize residues with Leucaena leaf supplementation produced the best performance for optimum growth of goats under the village system of management. Supplementation with Leucaena leaves could perhaps be a cheaper and simpler way of feeding maize residues *in situ.* Further work is required to investigate other forage plants that could enhance the nutritive value of maize residues.

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