Performance and nutrient digestibility of West African Dwarf rams fed *Panicum maximum* and *Tridax procumbens* supplemented with *Cajanus cajan* leaves

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Abstract

*An experiment was carried out to investigate the performance and nutrient digestibility of West African dwarf growing rams fed mixture of *Panicum maximum* and *Tridax procumbens* supplemented with *Cajanus cajan* leaves for 56 days feeding trial. A total of twelve WAD rams were randomly allocated to three treatments with four animals per treatment while two animals served as replicate. The experimental diet was fed at 3% body weight of individual animals while *Cajanus cajan* leaves were supplemented at varied inclusion levels. The results revealed that animals fed T_1 recorded the least weight gain (36.96g/day) while the highest weight gain (56.42g/day) was recorded for T_3 . The daily weight gain of animals was significantly different across all treatments ($P < 0.05$). The highest DMI (18.30kg) was recorded on the T_1 , and the least value of DMI (17.40kg) was recorded in T_3 . The highest feed efficiency ratio (0.18) and the lowest value (0.11) were observed in animals fed T_1 and T_3 diet respectively. There were significant differences ($P < 0.05$) in the nutrient digestibility parameters of the experimental animals. The results showed that T_1 (100% sole *Cajanus cajan* leaves) promoted the best dry matter (DM) digestibility (89.56%) which was enough to meet the production and maintenance requirement of small ruminants while the lowest value (88.67%) of DMD was recorded in T_2 . The highest crude protein (CP) digestibility (13.20%) was observed in T_3 diet. The highest value for crude fibre digestibility (38.95%) and the lowest value (35.35%) were observed in animals fed T_2 and T_1 diet respectively. In conclusion, supplementation of *Cajanus cajan* leaves with mixture of *Tridax procumbens* and *Panicum maximum* as basal diet for feeding sheep enhanced nutrient intake, growth performance and improved nutrient digestibility without health challenges to the animals.*

Keywords: WAD rams; legume; tropical grass; performance; nutrient digestibility

Introduction

Small ruminants are relatively easier to manage and produce than other species of livestock. The critical problems of ruminant production in the developing countries today, apart from the incidence of disease and high cost of feeds are poor nutritive value of some post-harvest crop residues, rapid declining of quality and inadequacy of natural pasture during the dry season (Adegbola, 2002; Oladotun *et al.*, 2003). These problems tend to reduce the rate of

expansion of small ruminant production industry, and have contributed to the low-level of animal protein intake in Nigeria. In an attempt to ameliorate these feed problems, various research interventions have been advocated, among these are the treatment of poor protein quality crop residues using different forage as supplements. The use of legume or browse plants as supplement has been well documented (Larbi, 1996, 1999; Akinlade *et al.*, 2002). Period of dry season is always

a stressful circumstance for livestock, as the environment is characterized by insufficient feed, occasioned by scarce forage and fibrous standing hays. The negative effect of the period is obvious in the lost weight, reduced milk production and high mortality of the animals. Incidence of disease outbreak is rampant as a result of low immunity arising from malnutrition. Ruminants relish Guinea grass (Bamikole and Babayemi, 2004) but such forages become very scarce in the dry season. This situation causes the nomads to travel long distances in search of greener pastures for their livestock (Iyayi *et al.*, 2003) and in the process, losing their animals to snake bite and exposure to inclement weather. In the Southern part of Nigeria, livestock farmers make supplementary use of the common legume trees including *Leucaena leucocephala* and *Gliricidia sepium* (Babayemi *et al.*, 2006). Due to the scarcity of other known forages, there is always high pressure on these tree legumes and therefore become inadequate to sustain the usual prolonged dry season periods. The search for and revalidation of other known forages is necessary if livestock industry in Nigeria must grow and be sustained. There are a number of under used forages and browse plants that are well adapted and may be sustainable for Nigerian economy. Such forages have long been ignored and almost forgotten by the livestock keepers as research updates on their nutritive value is scanty. *Cajanus cajan* forage is standing legume, high in crude protein and well adapted to varying weather. Apart from being relished by ruminants, farmers often use these legumes for soil reclamation. The legumes are not only going into extinction, their utilization is limited to research stations. However the research for non-convectional feed as sole supplement is a continuous one, not all forage plants have

been discovered or exploited, one of such non exploited forage is Pigeon pea forage (*Cajanus cajan*). *Cajanus cajan* forage plays an important role in food security, balance diet and alleviation of poverty because it has been used in diverse ways as source of food, feed and fodder. In order to mitigate the problems associated with the lack of protein supplements due to reasons of availability and high cost, there is a need to look for alternative protein sources such as supplementation with forage legumes that farmers can produce at their own farms. Among the forage legumes, pigeon pea (*Cajanus cajan*), could be easily grown at farmers levels and play an important role in supplementing diets of growing rams as alternative to conventional feed supplements. *Panicum maximum* is a tropic grass, tufted and perennial grass. It is one of the most important tropic grasses and it occurs naturally in tropic and sub-tropic Africa. It is high yielding; very responsive to nitrogenous fertilizer application (Crowder and Chheda, 1992) and can withstand regular cutting. Physical characteristic such as high leaf production, low fibre content at an early stage of growth as well as relative availability are major factors that enhance the high intake and utilization of it by ruminant animals. It is one of the best fodder grasses in the tropics; a study by Aina and Onwuka (2002) showed that *Panicum maximum* was among the most frequently picked grasses by grazing animals. *Tridax procumbens* is known for several potential therapeutic activities like anti-viral, anti-oxidant, antibiotic efficacies, wound healing, insecticidal and inflammatory activity.

Materials and Methods

Experimental site

The experiment was carried out at the Sheep and Goat Unit, Teaching and Research

Farm, Oyo State College of Agriculture and Technology, Igboora located between latitude 7°15' North and longitude 3°30' East with an annual average rainfall of 1278mm and average temperature of 27°C.

Experimental animals

Twelve (12) growing West African Dwarf rams of 6-9 months of age were separated from the rams in the Sheep and Goat Unit of the college, weighed between 7.00-10.00kg were used for the experiment. The animals were acclimatized for two (2) weeks and treated against ectoparasites and endoparasites prior to the commencement of the experiment.

Experimental layout, design and feeding method

The animals were allocated by weight into three treatments of four rams per treatment and two animals as a replicate in a completely randomized design (CRD). The experimental diets were: T₁ (100% *Cajanus cajan* leaves), T₂ (40% *Panicum maximum* and 60% *Cajanus cajan* leaves with no *Tridax procumbens*) and T₃ (40% *Tridax procumbens*, and 60% *Cajanus cajan* leaves with no *Panicum maximum*). Each group of animals was assigned to an experimental diet, and were fed *ad libitum* while fresh water was made available.

Data Collection and Analysis

Adjustment period of one week was allowed before data collection commenced. Dry Matter Intake (DMI), the mean initial body weight, weekly body weight, feed intake, feed efficiency and conversion ratio were calculated. Data obtained were subjected to

one-way analysis of variance (SAS, 1999). Mean value variance showing significant (p<0.05) difference were separated using Duncan's Multiple Range Test (Duncan, 1955). Urine and faeces were collected separately from each animal daily throughout the last seven days of the experiment in metabolic cages. The faeces sample collected were oven dried at 80°C until constant weight was reached. The urinary output were collected in sample bottles with plastic cover containing 20% dilute tetraoxosulphate (IV) acid and then stored at -20°C for subsequent analysis. The faecal samples were chemically analyzed using A.O.A.C procedure (AOAC, 1995) while the fiber fractions (NFE, NDF and ADF) were determined using Van-Soest (1991) procedure. All nutrient digestibility data obtained were subjected to one-way analysis of variance (SAS, 1999). Differences among the means were separated using Duncan's multiple range test (Duncan, 1955).

Statistical analysis

All data obtained were subjected to one-way Analysis of Variance (ANOVA) (SAS, 1999). Differences among the means were separated using Duncan's Multiple Range Tests (Duncan, 1955). The statistical model was:

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where:

Y_{ij} = Variable of measurement

μ = overall mean

T_i = effect of *i*th treatment diet

e_{ij} = random residual error

Table 1: Composition of the experimental diet (%)

Forage	T ₁	T ₂	T ₃
<i>Cajanus cajan</i>	100.00	60.00	60.00
<i>Tridax procumbens</i>	0.00	40.00	0.00
<i>Panicum maximum</i>	0.00	0.00	40.00
Total	100.00	100.00	100.00

Table 2: Chemical Composition of *Cajanus cajan* leaves, *Tridax procumbens* and *Panicum maximum* (%)

Parameters	<i>Cajanus cajan</i> leaves	<i>Tridax procumbens</i>	<i>Panicum maximum</i>
Dry matter	86.60	9.95	32.80
Crude protein	19.00	3.44	5.30
Ether extract	1.70	0.92	2.90
Crude fiber	9.80	0.60	22.20
Ash	3.90	0.20	3.30
Nitrogen free extract	51.20	84.89	66.00
Gross Energy (Kcal/kg)	3252.34	336.83	4223.06

Results and Discussion

The chemical composition of *Cajanus cajan* leaves, *Tridax procumbens* and *Panicum maximum* are presented in Table 2. Dry matter content was lowest in *Tridax procumbens* (9.95%) and highest in *Cajanus cajan* leaves (86.60%). *Cajanus cajan* leaves recorded the Crude protein value of (19.00%) followed by *Panicum maximum* with Crude protein value of (5.30 %) and the least Crude protein value (3.44 %) was recorded in *Tridax procumbens*. The crude protein value recorded by *Panicum maximum* was lowered than that reported by Ukanwoko and Igwe (2012) for *Panicum maximum* (8.45%); this disparity might be attributed to the growth stage, maturity of the plants as well as the soil types and constitution.

The CP value recorded for *Cajanus cajan* leaves were above (8%) required to satisfy the maintenance requirement for ruminants (Norton, 2003) and above the minimum level necessary to provide sufficient nitrogen required by rumen micro-organisms to support optimum rumen activity (Mc Donald *et al.*, 2002) and also adequate intake of forages. Getachew *et al.* (2004) also stated that browse forages are higher in CP than tropical grasses and roughages such as hay, straw and stover. *Tridax procumbens* recorded the least crude fibre value (0.60 %) while *Panicum maximum* recorded highest Crude fibre value (22.20 %). Ash content ranged from

(0.20 % - 3.90 %) with the least value from *Tridax procumbens* and the highest from *Cajanus cajan* leaves. The Performance summary of growing West African dwarf rams fed *Panicum maximum* and *Tridax procumbens* supplemented with *Cajanus cajan* leaves were shown in Table 3. The highest average weight gain of 3.16kg was recorded in T₃ while the lowest value (2.07kg) was observed in T₁. The highest daily weight gain (56.42g/d) and feed efficiency ratio (0.18) was observed in T₃, this might be attributed to the high palatability, dry matter and protein intake that improve the digestibility of the diet while the lowest value of daily weight gain (36.96g/d) and feed efficiency ratio (0.11) was observed in T₁. This observation might be due to the dependent of weight gain on dry matter, protein intake and digestibility of the nutrients fed to the animal. The analysis showed that there was statistical differences in the dry matter intake (DMI) and Feed conversion ratio (FCR) of the three diets (P<0.05) with T₁ having the highest dry matter intake (18.30kg) and feed conversion ratio (8.84) which could be to the protein quality of the *Cajanus cajan* leaves supplement which tends to enhanced the DMI intake (Babayemi and Bamikole, 2006) as well as the stimulating effect associated with supplementation of green feed (Taiwo *et al.*, 1995) while the lowest DMI value (17.40kg) and FCR (5.51) was

observed in T₃. The highest DMI with T₁ was an evidence of high palatability and acceptability of it to the experimental animals.

Table 3: Performance of West African dwarf growing rams fed *Panicum maximum* and *Tridax procumbens* supplemented with *Cajanus cajan* leaves

Parameters	T ₁	T ₂	T ₃	SEM
Average initial weight (kg)	12.20 ^a	12.20 ^a	12.18 ^b	0.02
Average final weight (kg)	14.27 ^c	14.92 ^b	15.34 ^a	0.20
Average weight gain (kg)	2.07 ^c	2.68 ^b	3.16 ^a	0.20
Daily weight gain (g/day)	36.96 ^c	47.85 ^b	56.42 ^a	3.56
Dry matter intake	18.30 ^a	17.60 ^b	17.40 ^c	0.17
Feed conversion ratio	8.84 ^a	6.56 ^b	5.51 ^c	0.62
Feed efficiency ratio	0.11 ^c	0.15 ^b	0.18 ^a	0.01

a b c Means on the same row with different superscript are significantly different ($P < 0.05$).

Table 4 showed the summary of nutrient digestibility of growing WAD rams fed varying inclusion levels of *Cajanus cajan* leaves, *Panicum maximum* and *Tridax procumbens*. The highest DM digestibility (89.56%) was observed in T₁ (100% inclusion levels of *Cajanus cajan* leaves) which could be enough to meet the production and maintenance requirements of growing rams. There were significant difference ($P < 0.05$) in the DM digestibility values measured across the dietary treatments. The digestibility values obtained in this study might be an evidence of proper utilization of *Cajanus cajan* leaves by (WAD) rams than *Panicum maximum* and *Tridax procumbens*. DM digestibility increased progressively as the level of supplements inclusion increase probably reflects the better palatability and or acceptability of *Cajanus cajan* leaves by WAD rams than *Panicum maximum* and *Tridax procumbens*. CP digestibility of the diet ranged from 11.05% (T₁) to 13.20% (T₃), and this was adequate to support the maintenance requirement, growth and performance of small ruminants. The CP digestibility content was in line with the report of Getachew *et al.* (2000) which stated that the browse plants are higher in

crude protein than tropical grasses and roughages. However, the CP digestibility content of the plants studied were all above 8% (CPD) required to satisfy the maintenance requirement of ruminant animals (Norton, 2003), and above the minimum level necessary to provide sufficient nitrogen required by rumen microorganisms to support optimum activity (McDonald *et al.*, 2002). The high level of CP digestibility recorded in all the treatments in the study indicates that *Cajanus cajan* leaves could serves as potential protein supplements that will enhance the intake and utilization of low quality grass and fibrous crop residues by ruminants. The values of CF digestibility content ranged from 35.35% (T₁) to 38.95% (T₂), which was very good as it will have high hemicelluloses and cellulose for better utilization by the system of the ruminant animals. The ash digestibility content ranged from 17.28% (T₁) to 19.26% (T₃), which indicated that ash content was useful in assessing the quality grading of leaves, and also gives an idea of the amount of mineral elements present in the leaves (Smart, 1996). The recorded value in this study was higher than 10.90% reported by Ibeawuchi *et al.* (2002), thus, making

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Cajanus cajan leaves a better source of essential valuable and useful minerals needed for good metabolic which will enhanced small ruminants production .The highest EE digestibility (2.14%) was recorded for T₂ while T₁ has the least of 2.06%, these values fell below the range of 4-10% ether extract recommended by Preston (1995) and Campbell *et al.* (2006) for small ruminants. The highest NDF, ADF and ADL digestibility of 70.10%, 43.00%

and 26.00% was recorded in T₂, T₃ and T₁ respectively, which could be attributed to the fact that as the plant matures, the fibre fraction also increases. This observation was in accordance with the findings of McDonald *et al.* (1998) who reported that with advance in forage plant maturity; there is an attendant increase in its dry matter, ADF, NDF and NFE content with appropriate decrease in its crude protein.

Table 4: Nutrient digestibility of West African dwarf growing rams fed *Panicum maximum* and *Tridax procumbens* supplemented with *Cajanus cajan* leaves

Parameter (%)	T1	T2	T3	SEM
DM Digestibility	89.56 ^c	88.67 ^a	89.05 ^b	0.13
CP Digestibility	11.05 ^a	12.14 ^b	13.20 ^c	0.31
CF Digestibility	35.35 ^a	38.95 ^c	36.01 ^b	0.55
ASH Digestibility	17.28 ^a	17.54 ^b	19.26 ^c	0.31
EE Digestibility	2.06 ^a	2.14 ^b	2.08 ^a	0.14
NDF Digestibility	64.60 ^a	70.10 ^c	65.49 ^c	0.86
ADF Digestibility	42.00 ^b	40.00 ^a	43.00 ^c	0.14
ADL Digestibility	26.00 ^c	22.00 ^a	24.00 ^b	0.60

DM=Dry matter; CP=Crude protein; CF=Crude fibre; NFE=Nitrogen free extract; ND F=Neutral detergent fibre; ADF= Acid detergent fibre. ^{a, b, c} represents means in the same row with different superscript are significantly different (P<0.05).

Conclusion

The results of the study clearly showed that supplementation with *Cajanus cajan* leaves in sheep diet enhanced nutrient intake, growth performance and improved nutrient digestibility without health challenge to the animals. Therefore, leaves of this indigenous browse plant can be used as a protein supplements to poor quality roughage feeds under smallholder farmers' condition, where accesses to conventional protein sources are limited. Based on this study, it can therefore be recommended that farmers should incorporated *Cajanus cajan* leaves at 100% inclusion level for small ruminants as supplements during the period of feed scarcity to alleviate the effect of body weight losses usually experienced during the dry period .Hence, extensive cultivation of Pigeon pea (*Cajanus cajan*)

forage should be encouraged to the smallholder ruminant farmers because of their feeding values as supplements to ruminant production.

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