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Growth Performance Characteristics of Goats Fed Varied Levels of Poultry Manure in whole Cassava Plant Based Concentrate Diet

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Abstract

A 56-day feed intake, growth and digestibility trial was carried out to investigate the use of poultry manure as a fermentable nitrogen source in whole cassava plant-based concentrate fed to goats on basal *Panicummaximum* hay (9.18 % CP). Sixteen adult (2 years old; 12.48 – 16.72 kg initial body weights) West African Dwarf goats were blocked on the basis of body weights into four similar groups that were assigned randomly to four treatments. Treatments consisted of dried poultry manure that was included in a cassava-based concentrate at 0, 14, 18 or 22 % level. Average feed intake ($g/W^{0.725}$ kg) was reduced ($p < 0.05$) in goats fed poultry manure at 22 % inclusion level when compared with the other dietary groups. Effects of poultry manure treatments on digestibility of dry matter or crude protein, nitrogen retention and body weight gain were significant ($p < 0.05$). It was concluded that poultry manure could be used to complement cassava leaf meal in cassava plant-based concentrates for the goats. The use of poultry manure as a source of fermentable nitrogen would promote activities of rumen microbial populations for efficient fermentation and reduce the constraints associated with collection and processing of cassava leaf in sufficient quantity for inclusion in the diet.

Keywords: Whole plant cassava, poultry manure, goats, growth performance

Introduction

The practice of agriculture the world over, is presently in favor of mixed farming systems by which various aspects of livestock production are integrated with cultivation of arable crops for efficient utilization of resources and improved profitability. Cassava is undoubtedly one of the most popular arable crops in Nigeria and in several other African, Asian and Caribbean nations; it is the second most important calorie source, after maize (Nweke *etal*., 1997) in the regions. Cassava production has grown rapidly in Africa to around 50 percent of global production by the mid-2000s, with Nigeria surpassing Brazil as the world's largest producer (FARA, 2012). Current estimates of cassava production are around 34 million tons per annum (Markelova*et al*., 2009) with opportunities for processing into different staple foods, industrial products and livestock feed. The opportunities are not being effectively utilized in Nigeria leading to frequent glut periods in the cassava market. Akpan *etal.* (2012) reported that cassava farmers' economic efficiency in the south-east Nigeria could be raised by about 38 % using appropriate strategies.

Increased domestic utilization of cassava would be a viable option to improve the economic

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efficiency as Achoja *et al*. (2012) had noted that an export-led cassava production in Nigeria is capital intensive.

Productive feeds for the ruminant livestock could be prepared with the various components of cassava plant including the tuber as a non-structural carbohydrates and fermentable energy source (FAO, 2005); the stalk for the supply of dietary fiber and the leaves as a source of rumen by-pass protein (Sath *et al.*, 2008). Dried poultry manure would provide fermentable nitrogen required for optimum utilization of the readily fermentable carbohydrates of the cassava tuber in the concentrate diet.

The aim of the present study was to test the hypothesis that dried poultry manure would improve the feeding value of whole cassava plant based diet fed to the goat. Several previous studies had assessed the feeding values of cassava peelings (Ukanwoko and Ibeawuchi, 2009), cassava tuber (Chanjula *et al.*, 2007) or cassava stem (Thanh *et al.*, 2012) separately for goats production. Abad-ur-Rahman *et al*. (2012) had emphasized the unique roles of goat in the social-economic and religious life of man.

Materials and methods

Location of the Study

The feeding trial was conducted from the months of April-July, at University Teaching and Research farm located (14^o N 11^o E) in sub humid tropical environment with an annual rainfall range of 1500-1700 mm and average maximum and minimum temperature readings of 18^oC and 25^o C respectively.

Processing cassava for inclusion in the concentrate diet

Cassava tubers (unpeeled) and stalks obtained from TMS 30572 cassava variety were washed under running tap water, sliced into pieces (5-10 mm) and sundried for 5 days on polythene sheet. Cassava leaves also harvested from TMS 30572 cassava plants were dried under the shade, at room conditions ($25\text{-}32^0$ C). Dried cassava tuber and stalks were milled separately to pass through 5 mm sieve for inclusion in the concentrate diet. The cassava leaf meal was pulverized by hands to be included in the diet composition.

Animals and treatments

Sixteen adult male West African Dwarf goats weighing between 12.48 and 16.72 kg initially were divided into four groups, balanced for body weights. Goats were assigned to four dietary groups in a randomized complete block design. Goats in each group received a concentrate diet (Table 1) containing 0, 14, 18 or 22 % dried poultry manure. The concentrate diet was fed at 2 % equivalent of the goat body weight in two equal rations (0800 and 1600 hours) daily as supplement to basal *Panicum maximum* hay (9.18 % CP). Goats were housed individually in concrete floored pens (1×1.5 m^2) during the first 49 days and thereafter transferred into metabolic pens equipped with facilities for individual animal separate feeding, provision of water and collection of faeces and urine over the last seven days. The goats were treated against external and internal parasites before the commencement of the feeding trial.

Collection of samples and analyses

Average daily feed intake for the individual goat was measured as the difference between the amounts of feed offered and the amounts refused over 24hour during the 7-day collection period. Body weight measurements were recorded prior to early morning feeding on the first day of the 56-day feeding trial and subsequently at 14-day intervals. The difference between two consecutive measurements was used to estimate body weight gain over the interval period. Total faces voided by each goat were collected during the 7-day digestibility period and about 10 % preserved for chemical analyses.

Urine was collected into plastic bucket acidified with 100 ml of N HCl and about 10 % of the daily urine production composited for each goat. Samples of feeds and orts were composited every two weeks, oven dried (60^o C) to constant weights and allowed to air-equilibrate before being ground to pass through 1-mm sieve.

About 10 % of the ground feed and orts samples were preserved for later dry matter and proximate analyses. Preserved feed and faces subsamples were analyzed for dry Kjeldahl nitrogen, crude fiber, ether extracts and total ash (AOAC, 1990). Percentage nitrogen in the urine subsamples was measured (AOAC, 1990). Wet faecal samples were used for the determination

of dry matter digestibility. Empirical data were subjected to analysis of variance of a randomized complete block designed experiment (Steel and Torrie, 1980) with treatment means separated (Duncan 1955) where there were significant differences.

Results

The poultry manure which contained 89.35 % DM and 26.17 % CP was used to replace cassava leaf (90.52 % DM; 24.28 % CP) as the main nitrogen source in the cassava based concentrate diets.Proximate studies on the concentrate diets indicated crude protein and crude fiber ranges of 12.76-13.82 % and 9.86-10.14 % respectively.

Table1: Compositions of experimental feeds

Ingredient/ Manure, %	0	14	18	22
Cassava Tuber	48	46	46	44
Cassava Stalk	22	22	20	20
Cassava Leaf	28	16	14	12
Poultry Manure	-	14	18	22
Salt + Bone Meal (1:1)	2	2	2	2
Dry matter and proximate composition, %				
Dry Matter	93.42	93.88	92.74	93.16
Crude Protein	12.76	13.08	13.37	13.82
Crude Fiber	9.86	10.14	9.98	10.12
Ether Extract	3.68	3.15	3.07	2.93
Ash	8.15	8.02	7.97	7.64
Nitrogen Free Extract	12.09	13.11	13.18	13.21

A decrease ($p < 0.05$) in dry matter intake over the 56-day feeding period was recorded for goats fed concentrate supplement that contained poultry manure at 22 % inclusion level when compared with the control group. Average total dry matter intakes (g/W $^{0.725}$ kg) were 53.56, 56.43, 49.74 and 46.88 for goats fed poultry manure at 0, 12, 14 and 18 % inclusion levels respectively. Body weight gain (g/day) was similar ($p > 0.05$) for goats on the control diet and those fed poultry manure at 14 or 18 % inclusion level but reduced ($p <0.05$) at 22 % poultry manure treatment. Goats fed 22 % poultry manure were less efficient in the conversion of feed for body weight gain than the control group or those that received poultry manure at 14 or 18 % dietary level. Digestibility of dry matter (%) at 75.38 obtained for goats on 22 % poultry manure treatment was lower ($p < 0.05$) than the values of 88.26 for the control group or 86.84 and 88.84 for goats fed poultry manure at 18 or 22 % inclusion levels respectively. Crude protein digestibility was reduced ($p < 0.05$) by the effects of poultry manure treatment at 22 % inclusion level when compared with the other treatment levels or the control.

Table 2: Performance characteristics of goats fed poultry manure in cassava based diet

Item/poultry manure, %	0	14	18	22	± SEM
Number of Goats	4	4	4	4	
Mean Initial Live weight, kg	14.36	13.96	14.12	14.04	1.32
Mean Final Live Weight, kg	17.27	16.68	16.88	15.92	1.61
Live Weight Gain, /head/day	51.24a	48.57a	49.28a	33.57b	6.08
Dry Matter Intake, g/head/day					
Panicum maximum hay	160.12	164.39	159.69	157.91	12.18
Cassava-based Concentrate	264.64	272.36	228.73	198.81	16.73
Total	424.76a	436.75a	388.42b	356.72b	12.46
Dry Matter Intake g/W$^{0.75}$ kg	53.56a	56.43a	49.74a	46.88b	8.68
Efficiency of Feed Conversion,	8.29b	9.01b	7.88b	10.63a	1.03

F/G					
Dry matter/nutrient digestibility					
Dry matter	88.26a	86.94a	88.84a	75.38b	3.46
Crude Protein	71.84[a]	69.32[a]	68.27[a]	65.77[b]	2.12
Crude Fiber	57.24	57.94	59.18	58.96	1.32
Ether Extract	61.17	63.98	61.34	60.32	4.81
Nitrogen Free Extract	71.57	74.83	72.26	72.66	3.64
Nitrogen metabolism					
Nitrogen Intake, g/day	7.78[ab]	9.47[a]	6.91[b]	6.71[b]	2.87
Faecal Nitrogen, g/day	3.09[ab]	4.23[a]	2.87[b]	2.95[b]	1.06
Urinary Nitrogen , g/day	2.43	3.07	2.06	2.28	1.92
Nitrogen Digested, g/day	4.69[a]	5.24[a]	4.04[a]	3.76[b]	1.18
Nitrogen Digested, % Intake	60.28	55.33	58.47	56.04	4.28
Nitrogen Retained, g/day	2.26[a]	2.17[a]	1.98[ab]	1.48[b]	0.62
Nitrogen Retained, % Intake	29.05[a]	22.91[b]	28.65[a]	22.06[b]	4.46

A, b, c, d –Different superscripts in a row represent significant differences between dietary groups at the probability of $p < 0.05$.
SEM – Standard error of treatment means

Effects of poultry manure treatments on digestibility of crude fiber, ether extract of nitrogen free extract were not significant ($p > 0.05$). Urinary nitrogen excretion was similar ($p > 0.05$) in the four dietary groups. Goats fed poultry manure at 22 % inclusion level had reduced ($p < 0.05$) nitrogen retention when compared with those on 14 % poultry manure treatment or the control group. Retention of nitrogen expressed as percentage of nitrogen intake was reduced ($p < 0.05$) at the 22 % inclusion level for poultry manure in the concentrate supplement.

Discussion

Air-drying cassava was to minimize loss of nutrients and preserve the texture of the cassava feed products. Ajala *et al.* (2012) had recommended drying cassava at low temperature to reduce color change. Preparation of cassava leaf meal is a major limiting factor in the formulation of whole plant cassava concentrate because of the low dry matter content of the leaf. Cassava tuber, stalk and leaf meal in the concentrate supplement were the main sources of energy, fiber and protein respectively. FAO (2005) identified cassava tuber and leaf meal as potent sources of fermentable carbohydrates and fermentable protein that could promote the activities of the rumen microbes. Crude fiber levels of the concentrate diets were considered low for efficient rumen functioning hence, the provision of *Panicummaximum* hay (9.18 % CP) *adlibitum* to compensate for inadequacy in fiber intake. The values for dry matter intake ($g/BW^{0.75}$) obtained in the present study were within the ranges of values reported (Alikwe *etal*. 2011) for West African Dwarf goats of similar metabolic body weights fed dry poultry waste-based concentrate as supplements to *Cynodon nlemfuensis.* Reduction in feed dry matter intake in goats fed poultry manure at 22 % inclusion level could be attributed to a reduction in feed palatability as observed by MacDonald *etal. (*2002). The similarity in crude fiber digestibility among the dietary groups in the present study suggests that poultry manure had no adverse effect on the process of rumen fermentation in the goats. Ukanwoko and Ibeawuchi (2009) reported a decrease in crude fiber digestibility with increasing dietary levels of poultry manure in goats fed poultry wastes-cassava peels based diet. Poultry manure is rich in fermentable nitrogen that could promote rumen fermentation process to improve fiber digestibility at a moderate level of intake. Dry matter intake and digestibility are indexes of feed acceptability and quality. Lower nitrogen intake and nitrogen retention for goats fed 22 % poultry manure could be attributed to the lower dry matter intake and nitrogen digestibility obtained for the dietary group. Sarwar *etal*. (2003) observed that nitrogen retention is dependent on the intake of nitrogen and amount of fermentable carbohydrates. The retained nitrogen values for the four dietary groups

indicated that inclusion of poultry manure up to the level of 18 % in the cassava based concentrate had no adverse effect on nitrogen utilization by the goats when compared with the control group.

Conclusion

The findings from the study demonstrate that cassava plant based-concentrate with different levels of dry poultry manure is suitable for use as supplement to low quality *Panicum maximum* hay in the dry season feeding of the goat. All the animals consumed adequate feed dry matter, gained in body weight and showed no sign of intoxication. Poultry manure could therefore be safely used to replace cassava leaf meal in whole cassava plant concentrate supplements for the goat. Inclusion of poultry manure at 14 or 18 % level in the concentrate supplement promoted dry matter intake, nitrogen retention and body weight gain in the goats at levels comparable to those of the control group. The use of poultry manure would reduce labour and time required for the collection and processing of the cassava leaf.

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