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NUTRIENT UTILIZATION BY BUNAJI BULLS FATTENED ON VARYING INCLUSION LEVELS OF GROUNDNUT HAULMS AND MAIZE OFFAL IN FEEDLOT.

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ABSTRACT

Twelve bulls aged between 24 and 36 months weighing 242- 279 kg, representing 5 Bunaji bulls per treatment in a fattening trial were used to investigate nutrient utilization of diets containing varying inclusion levels of groundnut haulms and maize offal. The bulls were fed Signal grass (*Brachiaria decumbens)* hay *ad libitum* and concentrates containing 80:20, 60:40, 40:60 and 20:80% GH: MO respectively. Total dry matter intake ranged from 6.92 to 7.59kg/d or 2.71 to 2.86% of liveweight and from 6.20 to 7.20 kg/d for organic matter. Total dry matter intake increased ($P<0.05$) with increase MO inclusion. Intake of crude protein, organic matter and ether extract also increased ($P<0.05$) with increase MO inclusion while acid detergent fibre and crude fibre intake ($P<0.05$) decreased. There were no dietary differences ($P>0.05$) in the digestibility of dry matter and crude protein. Digestibility of organic matter was highest ($P<0.05$) on 40: 60% GH: MO while neutral detergent and acid detergent fibre digestibility was highest ($P<0.05$) on 80: 20% GH: MO inclusion. It was concluded that supplementation with less proportion of GH and higher proportion of MO of 20: 80% GH: MO would be a better feeding strategy to improve the nutrients intake and digestibility of Bunaji bulls on fattening.

Key Words: Groundnut haulms, maize offal, intake, digestibility, Bunaji bulls.

INTRODUCTION

Feed constitutes about 70-80% of the variable cost of fattening cattle (Olayiwole *et al.*, 1981, Okoruwa, *et al.*, 2005). Farmers in West Africa are reported to feed their livestock mostly on sorghum, millet and maize stovers as basal diet, while cowpea and groundnut haulms are fed as protein supplement during the dry season (Russo, 1990). Other agricultural by-products such as brans, oil seed cakes which are generated when crops are processed are also fed to livestock as energy, protein and mineral supplement (De Leeuw, 1997). Groundnut tops (haulms) after pod harvesting is extensively fed to ruminants especially in the dry season (Powell, 1985, Njie and Reed, 1995; Olorunju *et al*., 1996). Groundnut haulms is reported to have CP content of between

10.88 and 19.3%, depending on preservation method (Alawa and Umunna 1993, Larbi *et al.*,1998, Ayantunde, *et al.*,*2007*).

Maize offal (MO) is a by-product of maize grain processing. It is a mixture of bran and middling. Maize offal is commonly used as feed for livestock in northern Nigeria where maize is largely produced. It is moderate in CP (10.82%) and is high in energy (3,432 $Kcal^{-1}$Metabolizable energy) (Vantsawa *et al.*,2007). Munthali (1986) reported that adequate live weight gains by cattle can be achieved by supplementing maize Stover and restricted (3.6 kg) maize bran diet with groundnut tops, cotton seed cake or leucaena. However, no much work has been done on the use of GH and MO in fattening operation. Therefore, this study was carried out to evaluate feed intake and digestibility in Bunaji bulls fed concentrates containing groundnut haulms and maize offal and to develop groundnut haulm: maize offal supplementation strategy for farmers to reduce cost and improve production of beef cattle.

MATERIALS AND METHODS

Study site

The study took place at The National Animal Production Research Institute (NAPRI) Ahmadu Bello University, Shika-Zaria, Nigeria during the dry season (April-June). Shika is located within the Northern Guinea Savanna ecological zone of Nigeria between Latitudes 11 and 12^0N and Longitudes 7 and 33^0E at an altitude of 640m above sea level. The zone is characterized by a raining season that starts in April/May, which stabilizes in June and ends in October. The mean annual rainfall is 1100mm; maximum temperature varies between 27^0 C and 35^0 C depending on the season and relative humidity is about 72%. The dry season begins with a period of cool weather (harmattan) which last from November to January. This is followed by a dry hot weather that begins from February to April. The relative humidity at this period is 37%. The study was conducted between April and June 2013.

Experimental diet

The experimental diet consisted of *Brachiaria decumbens* grass hay as the basal diet and a concentrate mixture which was composed of groundnut haulms and maize offal at 80: 20, 60: 40, 40: 60 and 20: 80% inclusion. Urea was added to the various treatments at 0.94, 1.09, 1.20 and 1.30% respectively to correct the wide variation of crude protein content of the supplements (Table 1)

Table 1: Ingredient (%) of concentrate diets.

	Inclusion levels of GH and MO (%)			
Nutrients				
	80: 20	**60: 40**	**40: 60**	**20: 80**
Groundnut haulms	80.00	60.00	40.00	20.00
Maize offal	19.06	38.91	58.80	78.70
Urea	0.94	1.09	1.20	1.30
Total	100.00	100.00	100.00	100.00

Animals' management and design

Three Bunaji bulls each per treatment weighing 242- 279 kg and aged between 24 to 36 months were selected from a ninety days fattening trial and used to investigate the utilization of diets composed of varying inclusion levels of groundnut haulms and maize offal in concentrate diets. The bulls were housed each in metabolism crates and fed their respective treatment diets.

Sample collection

The bulls were allowed 7 days to adjust to the metabolism creates after which seven days collection was done as described by Osuji *et al.* (1993). At the end of the 7 days collection period, faecal samples for each animal were bulked, mixed properly and 10% aliquot taken for proximate analysis. The urine samples for each animal were similarly bulked and sample taken for nitrogen analysis. Representative samples of individual feed ingredients, roughages on offer, supplements and feed remnants were taken and milled with a Christy and Norris mill to pass through 1 mm mesh and stored in air –tight container for proximate analysis

Chemical analysis

The proximate analysis of feeds and faeces followed the procedure of AOAC (2005). Nitrogen content of the feed samples and urinary samples were determined using the Kjeldahl procedure (AOAC, 2005). The acid detergent fibre (ADF) and neutral detergent fibr (NDF) of the feed and feces were determined according to the procedure of Van Soest (1991).

Statistical analysis

To determine the response of the animals to treatments, all data collected were subjected to Analysis of Variance using the General Linear Model Procedure (GLM) of SAS (2002). Significant levels of difference among treatment means was separated by Duncan Multiple Range Test (Duncan, 1955) at 5 and 1% level of significance. The model used for the analysis was $Yij = \mu+Ti+eij$

Where μ = Overall means

Ti = effect of i^{th} treatment (i=1, 2, 3, 4)

eij= random error (The random effect assumed to be normally distributed with mean zero and equal variance σ^2 i.e $\sum \sim N(0, \sigma_I^2)$

RESULTS AND DISCUSSION

The chemical composition of the individual feed ingredients is presented in Table 2. The crude protein (CP) content of the individual feed ingredients ranged from 4.44% for *Braciaria hay* to 14.19% for groundnut haulms. The CP content of *Brachiaria* used for this study agrees with the report by Sampaio *et al.*,(2010) and was below the 7-8% required for maintenance of body weight and, therefore, can be regarded as a low quality feed (Leng, 1990). The CP content of GH was within the range reported by Adegbola, (2002) and Addass *et al. (2011*), but higher than the value of (11.22) reported by Lakpini and Adu (1987). It has been reported that the digestible CP value of GH is superior to non-leguminous hays and can be safely fed along with wheat bran to meet the entire nutritional requirement of lactating cow producing 5 liters of milk per day (Ranjhan, 1993). The CP content of maize offal (MO) (12.65%) was in agreement with the report by Vantsawa *et al.* (2007). The ingredients and chemical composition of concentrate

supplements is presented on Table 3. The dry matter content of supplemental diets ranged from 94.29 to 95.71%. There was no significant difference (P>0.05) in CP content between treatments which ranged from 16.25-16.43%.

Table 2: Chemical composition (%) of individual feed ingredient (% DM Bases)

	Signal grass Hay	**GH**	**MO**
Dry matter	96.13	95.14	95.65
Crude protein	4.44	14.19	12.56
Crude fibre	37.86	28.64	13.13
Ether extract	2.28	8.59	11.64
Organic matter	89.33	88.96	90.91
Neutral detergent fibre	71.10	44.95	26.71
Acid detergent fibre	55.04	34.95	9.54
Ash	5.81	6.18	4.74
ME(MJ/kg DM)	11.38	10.78	11.74

GH =Groundnut haulms
MO = Maize offal
ME= Metabolisable energy
ME values of feed ingredients and experimental diets were calculated as per Alderman and Cottrill (1985) as follows: ME (MJ/kg DM)=11.78 + 0.00654CP + $(0.000665EE)^2$ - CF(0.00414EE) – 0.0118A where DM=Dry Matter, C= Crude Protein, EE= Ether Extract, CF= Crude Fibre, A= Ash

Table 3: Ingredients and Chemical Composition of the Concentrates with Inclusion Levels of Groundnut Haulms and Maize offal (%)

	Inclusion levels of GH and MO (%)			
Nutrients	80: 20	60: 40	40: 60	20: 80
Groundnut haulms	80.00	60.00	40.00	20.00
Maize offal	19.06	38.91	58.80	78.70
Urea	0.94	1.09	1.20	1.30
Total	100.00	100.00	100.00	100.00
Chemical composition				
Dry matter	95.71	95.20	94.46	94.29
Crude protein	16.38	16.41	16.43	16.25
Crude fibre	24.94	21.17	17.01	13.53
Ether extract	8.17	10.71	11.15	12.15
Organic matter	88.16	94.78	94.99	95.81
Neutral detergent fibre	40.04	36.46	31.08	32.21
Acid detergent fibre	30.30	22.21	19.75	15.91
Ash	11.84	5.22	5.01	4.19
ME (MJ/Kg DM)	10.98	10.89	11.04	11.16

GH =Groundnut haulms, MO = Maize offal, ME = Metabolisable energy (MJ/Kg DM)
ME values of feed ingredients and experimental diets were calculated as per Alderman and Cottrill (1985) as follows:
ME (MJ/kg DM)=11.78 + 0.00654CP + (0.000665EE)2 - CF(0.00414EE) – 0.0118A where DM=Dry Matter, C= Crude Protein, EE= Ether extract, CF= Crude Fibre, A= Ash

The values were higher than 13-15% CP requirement of beef cattle (Rutheglen, 1995, Aduku, 2005). Metabolizable energy (MJ/Kg DM) values of the treatment diets which ranged from 10.89 to 11.19 MJ/Kg met the minimum ME requirement of 10.3MJ/Kg DM for beef cattle (Rutheglen, 1995). The values of dry matter intake from hay, concentrate, total dry matter and digestibility of nutrients is presented on Table 4. Inclusion levels of GH and MO did not (P>0.05) influence digestibility of dry matter and crude protein. Crude protein digestibility in this study (74.41-76.57%) was higher than the range of 50.11-68.48% reported by Yousuf *et al.*, (2013) for goats fed increasing concentrate supplement, and values reported for Bunaji bulls fattened on diets

Table 3: Dry matter intake and apparent digestibility (%) of nutrients of Bunaji bulls Fed on Diets Containing Groundnut haulms and Maize offal as Supplements.

	Inclusion levels of GH: MO (%)				
Parameters	**80 :20**	**60 :40**	**40 :60**	**20:80**	**SEM**
Dry matter intake (kg)					
Supplement	4.10[b]	4.09[b]	4.46[a]	4.53[a]	0.09[*]
Signal grass hay	2.83[b]	3.07[a]	3.03[a]	3.00[ab]	0.08[*]
Total	6.92[c]	7.16[b]	7.48[a]	7.57[a]	0.02[*]
Nutrients digestibility (%)					
Dry matter	66.49	68.72	67.79	69.11	1.11[ns]
Crude protein	74.84	76.57	75.03	74.41	1.20[ns]
Crude fiber	47.85[a]	39.40[b]	26.16[b]	24.23[b]	2.58[*]
Organic matter	68.24[b]	70.78[a]	70.83[a]	71.88[a]	1.08[*]
Ether extract	23.89[c]	38.04[ab]	32.01[b]	40.46[a]	3.12[*]
Neutral detergent fiber	44.23[a]	40.77[a]	30.51[b]	32.84[b]	3.10[*]
Acid detergent fiber	41.41[a]	34.64[a]	22.01[b]	19.29[b]	3.16[*]
Nitrogen balance(g/day)					
Nitrogen intake	131.11[c]	146.5[b]	160.64[a]	163.39[a]	3.44[*]
Urinary-N	20.12[ab]	17.60[b]	22.12[a]	18.44[ab]	1.88[*]
Faecal-N	43.75[b]	49.54[b]	64.39[a]	68.32[a]	3.09[*]
Total-N loss	63.87[b]	67.14[b]	86.51[a]	86.76[a]	3.57[*]
N-Retained	67.25[b]	79.37[ab]	74.13[ab]	76.63[a]	5.41[*]
N-Retained (% N-intake)	51.27[a]	53.64[a]	46.90[b]	46.83[b]	2.81[*]

[abc] Means with different superscripts along the row differ significantly ($p<0.05$)
*=$p<0.05$, **=$p<0.001$, ns= not significant
SEM= Standard error of means

containing sundried broiler litter as replacement for cottonseed (Lamidi *et al.*, 2007).

Dry matter digestibility which ranged from 66.49-69.11% was in agreement with 51-66% reported for sheep supplemented with grade levels of velvet bean hay (Mupangwa *et al.*, 2002). However, neutral detergent fibre digestibility was lower than reported by Mupangwa *et al.* (2002). Nitrogen intake increased ($P<0.05$) with decrease inclusion of GH ranging from 131.11 g/d for the bulls on 80: 20% GH: MO to 163.39 g/d for the bulls on20: 80% GH: MO inclusion probably due to slight differences in inclusion of urea (0.94, 1.09, 1.20 and 1.30% respectively) in the diets with decrease GH inclusion (Philips and Rao, 2001). Similarly, fecal nitrogen loss and total nitrogen loss increased with decrease inclusion of GH. Fecal nitrogen loss was higher

for the bulls on 40: 60 and 20: 80% GH: MO than for those on 80: 20 and 60: 40% GH: MO. This trend was probably due to the difference in dry matter intake and N concentration with increasing MO inclusion in the diets. High correlation (0.90) between nitrogen intake and fecal nitrogen has previously been reported in cattle (Stallcup *et al.*, 1975).

CONCLUSION

In conclusion, even though there was no difference in dry matter and crude protein digestibility between treatments, dry matter intake, organic matter digestibility and nitrogen retention was increased with increasing maize offal inclusion, indicating the influence of energy supply from non structural carbohydrate source on microbial growth and nutrients digestibility.

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