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National Animal Production Research Institute
Ahmadu Bello University
P.M.B 1096, Shika-Zaria,
Kaduna State, Nigeria.
Email: japr@napri-ng.org Website: www.naprijapr.org

THE EFFECT OF FEEDING VARYING INCLUSION LEVELS OF GROUNDNUT HAULMS AND MAIZE OFFAL ON FATTENING PERFORMANCE OF BUNAJI BULLS IN FEEDLOT.

[*1]Goska, D.Y., [2]Kibon, A. U., [3]Alawa, C. B. I., [1]Lamidi, O. S., [1]Madziga, I. I, [4]Alphunsus, C and [5]Mbahi, T. F.

[1]National Animal Production Research Institute Shika, Ahmadu Bello University PMB 1096, Zaria Nigeria.

[2]Federal University Dutse, Jigawa State.

[3]Department of Animal Health and Production, Faculty of Veterinary Medicine, University of Abuja, Abuja.

[4]Department of Animal Science, Ahmadu Bello University, Zaria.

[5]Department of Animal Production, School Agriculture and Agricultural Technology Modibbo Adama University of Technology Yola

**Corresponding Author:* goskady@gmail.com

ABSTRACT

An experiment was conducted to evaluate the effect of different inclusion levels of groundnut haulms (GH) and maize offal (MO) on fattening performance of Bunaji bulls in feedlot. Twenty bulls weighing 196±0.5 kg were randomly assigned to four treatments in a Completely Randomized Design. Bulls were fed *Brachiaria decumbens* (Signal grass) hay *ad libitum* and concentrate diets containing different inclusion levels of groundnut haulms (GH) and maize offal (MO): 80:20% GH: MO, 60:40% GH: MO, 40:60% GH: MO and 20:80% GH: MO respectively. Significant (P<0.01) differences were observed in total and average weight gain. The weight gains of the bulls on 40:60 and 20:80% GH: MO was significantly (P<0.01) higher than those on 80: 20 and 60: 40% GH: MO. The animals on 20: 80% GH: MO had the best weight gain. Similarly, feed conversion and body condition score of the bulls fed 40: 60 and 20: 80% GH: MO was (P<0.05) higher than for those fed 80: 20 and 60: 40%. Feed cost per kilogram gain was significantly (P<0.05) lower for the bulls on 40: 60 and 20; 80%GH: MO inclusion. The result of this study show that groundnut haulms could be fed with maize offal at 20:80% inclusion levels in cattle fattening diet to achieve daily liveweight gain of 0.92 kg at feed cost/kg gain of ₦ 400.03/d.

Key Words: Groundnut haulms, Maize offal, Weight gains, Body condition, Bunaji bulls.

INTRODUCTION

Feedlot fattening of cattle is an intensive system of beef production that involves confinement of a large number of cattle for intensive feeding (Price, 1981) over a short period. Feed constitutes about 70-80% of the variable cost of fattening cattle (Olayiwole *et al.*, 1981, Okoruwa, *et al.*, 2005). The rapid increase in population and demand for food is pushing animal agriculture to marginal lands in West Africa (Singh *et al.*, 2004). Farmers in West Africa are reported to feed their livestock mostly on Stover of sorghum, millet and maize 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 (haulm) 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 the nutritive value of groundnut haulms and maize offal and to develop groundnut haulm: maize offal supplementation strategy for farmers to improve liveweight gain and reduce cost of cattle fattening.

MATERIALS AND METHODS

Study site

The study took place at The National Animal Production Research Institute (NAPRI) Ahmadu Bello University, Shika-Zaria. 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 diets

Groundnut haulms and maize offal were incorporated into the four diets at various ratios. 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 (Table1).

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

Twenty Bunaji bulls with average live weights of 196±0.5 kg and aged between 24 to 36 months were used for the trial. The bulls were divided into four groups of five animals and the groups balanced by weight. Each animal served as a replicate in a Completely Randomized Design.

The groups were allocated to the four dietary treatments composed of maize offal and groundnut haulms. They were individually housed and fed. The animals were de-wormed with Albendazole 2500mg (Eagle Chemical Co. Ltd chungchongnamdo, Korea) and dipped in acaricides Amitix (Amitraz 12.5% by Alfasan) to control endo- and ecto- parasites a week to commencement of the trial. The study lasted 90 days.

Data collection

The bulls were individually housed and fed concentrates at 2% of their body weight and *ad libitum Brachiaria* hay. One half of the days' feed was fed in the morning at 8.00 am and the remaining half at 4.00 pm. Left-over feed and water were weighed and measured respectively. Feed and water intake were then determined by the difference between offered and weight back. The animals were weighed at the beginning of the trial and, thereafter, at weekly intervals usually before the morning feeding (i.e. 24 hours after the last concentrate feeding and 12 hours of water withdrawal) and their feed offer adjusted accordingly At the end of the experiment, average daily and total feed intake, average daily and total water intake, weight gain, feed to gain ratio, feed cost per kg gain and body condition score (using the scale of 1 to 9 procedure described by Nicholson and Butterworth (1986) were computed.

Chemical analysis

Proximate analysis of feed and faecal samples followed the procedure of (AOAC, 2005). Nitrogen content of feed, faeces and urine samples were determined using the Kjeldahl procedure (AOAC, 2005). The neutral detergent fibre (NDF) and acid detergent fibre (ADF) of the feed and faeces 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 (2000) to study the response of the animals to measured parameters. 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 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%. 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).

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 (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

Average daily and total dry matter intake, daily and total weight gain, feed conversion ratio, body condition score and feed cost per kilogram gain are presented on Table 4. The dry matter intake (DMI) of supplements were similar (P>0.05) for the diets with 40: 60 and 20: 80% GH: MO inclusion levels, but higher (P<0.05) than those on diets with 80: 20 and 60: 40% GH: MO inclusion levels. The range of supplement intake was between 4.09 and 4.53 kg /d for diets with 60: 40 and 20: 80% GH: MO inclusion levels respectively. The dry matter intake of signal grass hay were similar (p>0.05) for the diets with 60: 40, 40: 60 and 20: 80% GH: MO inclusion levels, but those fed 60: 40 and 40: 60% GH: MO inclusion levels were higher (p<0.05) than those on 80: 20% GH: MO inclusion. Total dry matter intake in kg/d of the diets with 40: 60 and 20: 80%GH: MO inclusion were similar (p>0.05), but higher (p<0.05) than for those on 60: 40%GH: MO which was higher (p<0.05) than those on the diet with 80: 20%GH: MO inclusion level. Total and average daily weight gain increased (P<0.01) significantly with decrease in GH

but increased with MO inclusion in the diets, ranging from 45.40 to 82.80 kg and 0.504 to 0.920 kg /d respectively. Total and daily weight gain for the bulls on 40; 60 and 20: 80% GH: MO was similar (P>0.05) but were significantly (P<0.01) higher than for those on 80: 20 and 60: 40% GH: MO. Average daily live weight gain of the bulls fed GH and MO is in agreement with the report by Lamidi *et al*, (2007) for Bunaji bulls fattened on diets containing dried poultry litter and the report of Preston and Leng (1986) for mature zebu bulls fed tef straw supplemented

with poultry litter and noug seed cake. The total weight change and daily weight gains of the bulls on 40: 60 and 20: 80% GH: MO were higher than the report by Osuji and Capper (1992) for drought oxen fed teff straw (*Eragrostis teff*) supplemented with wheat bran, wheat middling and cottonseed cake.

Table 4: Dry matter intake and performance of Bunaji bulls fattened on Diets containing Groundnut haulms, Maize offal and *Brachiaria* hay

	Inclusion levels 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^{*}
Brachiaria 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^{*}
Live weight changes (kg)					
Initial weight	197.00	196.80	197.20	196.80	3.61^{ns}
Final weight	242.40^{c}	252.60^{b}	276.60^{a}	279.60^{a}	4.26^{*}
Weight change	45.40^{c}	55.80^{b}	79.40^{a}	82.80^{a}	2.72^{**}
Average daily gain	0.504^{d}	0.620^{c}	0.884^{b}	0.920^{a}	0.03^{**}
FCR (kg feed/kg gain)	13.86^{b}	16.16^{b}	8.60^{a}	8.31^{a}	1.47^{*}
Water (L)	21.17^{b}	22.61^{a}	22.25^{a}	22.25^{a}	0.41^{*}
Body condition score					
Intial	3.72	3.90	3.88	3.86	0.09^{ns}
Final	5.96^{b}	6.09^{b}	6.99^{a}	7.18^{a}	0.12^{**}

^{ab} Means with different superscripts along the row differ significantly (P< 0.05)
ns= not significant, *= P <0.05, ** =P <0.01
SEM= Standard error of means
FCR= Feed conversion ratio

The daily weight gains were however, lower than the report by Ikhatua and Olayiwole (1982) who reported 1.07 kg for indigenous breeds of cattle fattened on conventional feed (maize and groundnut cake).The higher weight gain of the bulls on 40: 60 and 20: 80% GH: MO was

probably due to higher total digestible nutrients in these diets from MO inclusion (Gilberry *et al.*, 2000). Improvement in liveweight gains of the bulls on these diets may also have been due to the ability of the supplements to provide sufficient fermentable nitrogen to ensure optimal microbial growth in the rumen. These will enhance the production of body tissues as reported by Leng, (1990). Feed conversion ratio was higher (P<0.05) for the bulls on 40: 60 and 20: 80% GH: MO than on 80: 20 and 60: 40% GH: MO. This was also probably influenced by total digestible nutrients intake from the diets (Gilberry *et al.,* 2000). Average daily water intake was significantly lower for the bulls fed 80: 20% GH: MO than other treatments which were similar (P>0.05). Daily water intake report in this study was higher than reported for Bunaji bulls fed diets containing maize offal, cottonseed cake and poultry litter by Madziga *et al* (2013) Final body condition scores for the bulls on40: 60 and 20: 80 GH: MO were significantly (P<0.01) higher than for those on 80: 20 and 60: 40% GH: MO. Body condition score is an excellent indicator of nutritional status of the animal and is an indirect reflection of the body energy reserves (Mekasha *et al.,* 2011), thus the bulls on 40: 60 and 20: 80% GH: MO had better condition score.

Economics of production

Total feed consumed, total cost of feed, weight gain and cost of feed / kg gain is presented on Table 5. Higher (P<0.05) values of total feed consumed were recorded for the bulls on 40: 60 and 20: 80% GH: MO. Similarly higher (P<0.01) weight gains were also recorded for these same treatments.

Table 5: Economics of Production of Bunaji bulls Fattened on Diets containing Groundnut Haulms and Maize offal

	Inclusion levels of GH and MO (%)				
Parameters	**80: 20**	**60: 40**	**40: 60**	**20:80**	**SEM**
Total concentrate intake (kg)	358.56^{b}	367.20^{b}	399.06^{a}	404.10^{a}	8.09*
Total hay intake (kg)	255.30^{b}	276.46^{a}	272.16^{a}	273.30^{a}	7.56*
Total feed intake (kg)	613.86^{c}	643.66^{b}	671.22^{a}	677.40^{a}	12.17*
Feed cost/kg (₦)	51.07^{b}	49.68^{a}	49.38^{a}	48.37^{a}	0.56*
Total feed cost (₦)	31354.14^{b}	31979.75^{ab}	33119.98^{a}	32767.85^{a}	605.88*
Weight gain (kg)	45.40^{c}	55.80^{b}	79.40^{a}	82.80^{a}	2.72**
Feed cost/kg gain (₦)	695.65^{b}	807.22^{b}	423.03^{a}	400.03^{a}	73.60*

^{ab} Means with different superscripts along the row differ significantly (p<0.05)
ns= not significant
*= p<0.05
SEM= standard error of means

Feed cost/ kg weight gain was (P<0.05) lower for the bulls on 40: 60 and 20: 80% GH: MO, signifying better feed efficiency resulting in higher weight gains on lower feed cost/kg gain.

Efficient utilization of feed resulting in high weight gain at low feed cost/ kg gain will result in high finishing weight of cattle that will increase profit and better the living standard of farmers.

CONCLUSION

From the result of this study, it can be concluded that Bunaji bulls can be successfully fattened on diets containing 40: 60 and 20: 80 % inclusion levels of groundnut haulms and maize offal resulting in appreciable daily weight gains of 0.88 and 0.92 kg/d. These diets were more efficiently utilized with higher weight gains and lower feed cost /kg gain which resulted in lower production cost, considering that feed cost accounts for about 70-80% of the variable cost of fattening cattle (Powell, 1985b, Olayiwola *et al.*, 1981 Okoruwa, *et al.,* 2005) and therefore higher profits.

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