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Fattening Performance of White Fulani Cattle Fed Different Energy Sources

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Target audience: Farmers, extension agents, nutritionist

Abstract

An experiment was conducted to compare the utilisation of maize offal, wheat offal, rice offal and sorghum panicle as energy sources in the diets of fattening beef cattle. Twenty White Fulani bulls with an average weight of 225kg were randomly allotted to four isonitrogenous diets formulated with maize offal, wheat offal, rice offal and sorghum panicle as the energy sources. Signal grass (Bracharia decumbens) hay was offered as the basal diet. A metabolism trial was conducted at the end of the feeding trial using 16 bulls to assess the effect of the diets on nutrient digestibility. The result showed that the energy content of the diets ranged from 2500.72 – 2677.46kcal/kg DM. Dry matter intake (DMI) was significantly higher (8.50kg/day) (P<0.05) in the wheat offal based diet and average daily gain (ADG) were significantly (P<0.05) higher in maize offal and wheat offal based diets (0.65 and 0.66kg/day) respectively. The utilization of maize and wheat offals based diets were significantly (P<0.05) higher compared to those of rice offal and sorghum panicle based diets. Wheat offal and maize offal based diets had higher utilization and similar feed to gain ratio. Rice offal had the least feed to gain ratio (22.40) and the highest feed cost/kg gain (N683.10/kg gain) The DM digestibility of all the by-products based diets ranged from 52.33 % in the rice offal based diet to 67. 48 % in the maize offal based diet. There was positive nitrogen balance across all treatment. It was concluded that maize offal and wheat offal based concentrates were better utilized by cattle compared to rice offal and sorghum panicle based concentrates in fattening of cattle.

Keywords: Agricultural-by products, fattening, White Fulani.

Description of problems

One of the major constraints of livestock industry in Nigeria in meeting consumer demand for meat, milk, eggs and other livestock products is the unavailability of regular supplies of appropriate, cost effective and safe animal feeds. This poor level of livestock nutrition has led to inadequate outputs of animal products in spite of the large livestock population of (Cattle 13.9million, Sheep 22.1million and Goats 34.5million) (1) in the country. The (2) report indicated that animal feeds have become an increasingly critical component of the integrated food supply chain. Efficient management of

ruminants in the country must, therefore, pay attention to the type and quality of forage available and supplementation required to provide adequate diet for the optimal production of cost effective livestock products. Beef producers rely heavily on forages as the basis of feeding programmes. The forages, however must be supplemented with energy and or protein in order to meet the nutritional needs of the animals. A rapid expansion of beef production in Nigeria could be achieved through the implementation, on a significant scale, of intensive growing and finishing schemes.

Crop and agro-industrial by-products have significant contributions in enhancing livestock production because they are cheap and renewable sources of animal feed. The use of agricultural by-products in animal feeding will help overcome periods of feed shortages and ensure a constant supply of livestock products. It is therefore, necessary, to exploit locally available feed resources and to develop feeding strategies compatible with the local environment. The cost of feeding cattle accounts for about two-thirds of the total cost of meat production and (3), indicated that the highest percentage of the total cost (85% - 90 %) is attributable to energy supply.

Over the years, it has become increasingly uneconomical to include grains in the diets of livestock due to increased consumption of grains by humans, however, industrial and lcally processed by-products of cereal grains such as maize, sorghum, millet, wheat, rice etc can be used as alternative source of energy for beef cattle. Myer (4) suggested that these alternative feeds can fit into a feeding program as primary roughage, supplement to a regular ration or replacement part of the ration in the diet. Conventional protein and energy concentrates such as cotton seed cake, groundnut cake and whole maize have no relevance under traditional small holder fattening operations. Although, the farmers can utilize locally available feedstuffs within the farming system. These locally available feedstuffs include maize offal ("dusa"), rice offal, sorghum panicle ("keikei") and wheat offal. This study is aimed at determining optimal combinations of these feed resources that will promote good live weight gains for cattle fattening.

Materials and method

Feeding trials

Ninety days fattening study was conducted using 20 White Fulani bulls with an average weight of 225kg purchased from Sheme cattle market in Katsina State. The bulls were allotted to four treatments in a Completely Randomize Design to compare diets based on maize offal, wheat offal, rice offal and sorghum panicle. There were 5 animals per treatment. The diets were formulated to be isonitrogenous.

On arrival, the bulls were dewormed with (*Albendazole*® – 10mls per animal), given prophylatic antibiotics (*Terramycin* L/A – 5mls per animal) and treated against ectoparasites by dipping. The bulls were tagged and housed

individually for identification. The bulls were fed 5kg/head/day for 14days to allow the animals adjustment to the treatments diets. At the commencement of the study, the concentrate diets- rations formulated withmaize offal (MO), wheat offal (WO), rice offal (RO) and sorghum panicle (SP) were fed at 2.5% of body weight daily. Signal grass (*Brachiaria decumbens)* hay and water were provided *ad libitum*. The rations were adjusted at regular intervals of two weeks to reflect changes in live weight. The bulls were weighed at the beginning of the experiment for their initial weight and subsequently every fortnight. Weight of feed left over was subtracted from total feed offered to obtain feed consumed. Feed consumption and weight gained were used to compute the Feed Conversion Ratio (FCR). Fresh water of known volume was offered each day; and before each offer, the previous day's left over was measured, daily water consumption was thus computed. Two control drinkers were placed in the experimental house at different locations to determine water loss by evaporation. The individual feed ingredients (maize offal, wheat offal, rice offal, sorghum panicle, cotton seed cake, poultry litter), formulated diets, *Brachiaria decumbens* hay and feacal samples were analyse for proximate components (5). Energy was determined by the equation developed by (6).

Digestibility study

At the end of the fattening study, four bulls were randomly selected from each treatment and housed in metabolic crates for total feacal and urine collections. The animals were allowed ten days of adjusting to the conditions of the metabolic crates before the commencement of the digestibility study which lasted seven days. Known weights of the experimental diets were offered daily and water was given *ad libitum*. Daily feacal and urine outputs were weighed and 5% of each day's collection was stored. This was later bulked and taken to the laboratory for proximate (5), Neutral Detergent Fibre and Acid Detergent Fibre of Van Soest (7) analysis. Urine samples were analysed for their nitrogen content using Kjeldahl Procedure (5).

Feed cost analysis

The cost of the various feed ingredients were used to compute the feed cost, total feed consumed within the fattening period and feed cost per kilogram weight gain. This was used to determine how profitable it is to fatten bulls with the by-product supplements of maize offal, wheat offal, rice offal and sorghum panicle roughage feed materials.

Data analysis

Data from the experiment were subjected to ANOVA as described by (8) using the SAS General Linear Model (9). Significant levels of differences among means were also determined using Duncan's Multiple Range Test (10).

Results and Discussion

Nutrient composition of energy sources

The nutrient composition of cereal by-products used in the study is presented in

Table 1. The DM, CP, ADF and NDF (91.97 %, 12.69 %, 33.41 % and 55.15 %), respectively content of maize offal obtained in this study were higher than 88.9% DM, 9.6% CP reported by (11) and 10.08%CP, 26.31% ADF and 21.64% NDF reported by(12). However, the CP was similar to 12.7% reported by (13).

The CP (16.16 %) and CF (12.71%) of wheat offal were found to be lower than 18% earlier reported by (14), but similar to 11.30 % reported by (12). The DM (94.40 %) of sorghum panicle obtained in the study was lower than 98.27 % reported by (15). This may be due to the high humidity (72 %) recorded at the time of the study. The CP was however, higher than 2.38 % reported by the same author. This could be due to the unthreshed sorghum grains left in the panicles which may lead to the increase in CP content. The CP and NDF were found to be within the range of 3.2% - 7.4% and 36.9% - 80.5%, respectively obtained by (16). Aina *et. al*., (17) had indicated that agricultural by-products contain higher fibre than forages. The variations in the nutrient composition of these by-products can be attributed to differences in varieties used, agronomic practices employed, time of harvesting and processing methods (18). These variations should, therefore, be noted when making generalised recommendations on nutrient status of agricultural by-products and levels of inclusions in diets.

Nutrient composition of experimental diets

The nutrient composition of the experimental diets is presented in Table 2. The ME of the diets (10.93 – 11.21MJ/kg DM) was within the range of 10 – 11.6MJ/kg DM recommended for bulls (19). The CP range of (12.31% - 15.91%) of the experimental diets was within the range considered adequate for bulls fattening (20).

Table 1: Nutrient composition of cereal by-products and hay

	Cereal By-products				
Nutrients (%)	MO	WO	RO	SP	Hay
Dry Matter	91.97	91.57	93.34	94.40	94.18
Crude Protein	12.69	16.13	6.13	4.89	4.25
Ether Extract	16.43	10.99	9.01	6.44	7.07
Crude Fibre	10.12	12.71	45.90	29.29	38.17
Ash	2.62	5.08	15.41	17.31	4.77
NFE	58.14	55.09	23.55	42.07	45.74
ADF	33.41	47.50	48.14	59.46	57.23
NDF	55.15	65.06	75.37	71.76	81.85
ME (kcal/kg DM)	2660.74	2687.02	2371.74	2586.70	2538.93

MO= Maize Offal, WO = Wheat Offal, RO = Rice Offal, SP =Sorghum Panicle, ME= Metabolizable Energy NFE=Nitrogen Free Extract ADF= Acid Detergent Fibre, NDF= Neutral Detergent Fibre

Feed intake and weight changes in the fattened bulls

There was no significant difference in concentrate intake in the MO, WO, RO based diets. Bulls performance on the SP based diets, had significantly (P <0.05) lower concentrate intake. The intake of *Brachiaria decumbens* hay was similar across all the treatments diets. The higher concentrate intake compared with the basal hay intake could be attributed to the better palatability of the concentrates over the hay. The presence of cottonseedcake in the concentrates could also have influenced intake. Yahaya *et al.,* (21), had reported positive effect of cottonseed cake on intake in the diet of ruminants. Generally the weight gains obtained in this study were low. Higher gains of 0.87kg/day (22), 1.07kg/day (23), and 0.69-0.91kg/day (24) had been reported. Aduku (20) had, however, reported similar low values in bulls. The total feed intake/day in all the diets (7.82-9.14kg/day) were higher than 6.26-6.45kg/day obtained in fattening trial conducted by (24).

Table 2: Nutrient composition of the experimental diets

	Cereal Based diets			
Nutrients (%)	MO	WO	RO t	SP
Dry Matter	92.61	91.81	92.94	93.88
Crude Protein	15.91	13.94	12.31	14.50
Ether Extract	10.64	10.58	9.39	7.45
Crude Fibre	13.96	12.48	30.09	22.54
Ash	10.93	9.80	18.34	21.17
NFE	48.74	53.20	29.87	34.34
ADF	61.32	23.59	50.87	47.53
NDF	75.72	35.72	53.06	68.86
TDN	79.58	80.10	63.19	61.09
ME(kcal/kg DM)	2660.74	2677.46	2500.72	2610.59

MO= Maize Offal, WO = Wheat Offal, NFE = Nitrogen Free Extract RO = Rice Offal, SP = Sorghum Panicle, ADF= Acid Detergent Fibre, NDF= Neutral Detergent Fibre, TDN= Total Digestible Nutrients, ME= Metabolizable Energy

The Average Daily Gain (ADG) was significantly (P<0.05) higher in the MO and WO based diets. Jokthan (25) had earlier reported high content of silica in rice offal and sorghum panicle which might have accounted for the poor utilisation. In both MO and WO based diets, there was better nutrient availability. Silica is not only indigestible, but it also prevented the digestibility of other nutrients by encrusting them. The bulls were, therefore, able to utilize the nutrients of MO and WO better than RO and SP

based diets. Water intake was significantly (P<0.05) higher in bulls on the WO based diets. Jokthan (25) had reported that water intake could be affected by the nature of the fibre contained in the feed. Different fibrous material are reported to have different water holding capacities which could be reflected in water intake when use in compounding livestock feeds. The water intake of the bulls on all the treatments diets were between the range of 29.54L – 33.78L/day. Only the bulls fed wheat offal based diet achieved the minimum recommended (32L/day) water intake (26). The low water intake could also have been due to the high relative humidity (72%) recorded within the experimental period.

Table 3: Effect of the experimental diets on the performance of fattened bulls.

	Cereal based diets					
Parameters	MO	WO	RO	SP	SEM	LOS
Conc. Intake (kg/day)	4.96[a]	5.23[a]	4.83[a]	4.28[b]	0.15	*
Hay Intake kg/day)	3.53	3.91	3.87	3.54	0.14	NS
Total Feed Intake (kg/day)	8.49[a b]	9.14[a]	8.70[a b]	7.82[b]	0.29	*
Dry Matter Intake (kg/day)	7.93[a b]	8.50[a]	8.14[a b]	7.36[b]	0.27	*
Water Intake (l/day)	30.54[b]	33.78[as]	29.54[b]	28.69[b]	1.01	*
Initial Weight (kg)	254.80	263.20	254.40	242.60	11.35	NS
Final Weight (kg)	309.00[a b]	319.00[a]	288.00[a b]	280.00[b]	10.94	*
Total Weight Gain (kg)	54.20[a]	55.80[a]	33.60[b]	37.40[b]	4.62	*
Average Daily Gain (kg/day)	0.65[a]	0.66[a]	0.40[b]	0.45[b]	0.06	*
Feed : Gain ratio	13.71[a]	14.30[a]	22.40[b]	19.27[a b]	2.18	*
Cost of Feed Intake (₦ /day)	288.59[b]	328.88[a]	265.35[b c]	238.63[c]	9.17	*
Feed Cost/kg gain (₦)	466.14	514.74	683.10	587.60	69.11	NS

a, b, c, means bearing different superscript in a row differ significantly. SEM = Standard Error of Mean, LOS = Level of Significance, *=P<0.05; NS = Not Significant

Nutrient digestibility and nitrogen balance

Except for the bulls on the RO based diets which had 52.33 % DM digestibility, the DM digestibility across the MO, WO and SP based diets were good and ranged from 61.76 % - 67.48 %. Total digestible nutrients also ranged from 57.12 % - 57.17 %. The high percent digestibility of CF, ADF and NDF of maize offal, wheat offal and sorghum panicle based diets indicate high digestible fibre in the diets. Rice offal based diet, which had the highest fibre content (18.34%CF, 50.87%ADF and 53.06%NDF) had the lowest fibre digestibility. This was due to the high fibre content of rice offal (45.9%CF, 48.14%ADF and 23.55%NDF) which could have affected its digestibility. Rice offal based diet also had the lowest TDN and ME digestibility which may also have been due to the content of silica in rice offal. Percent digestibility of all the nutrients in wheat offal based diet was higher than those of the rice offal based

diets. Aina *et al.* (17) had indicated that wheat offal nutrients were more readily available for utilization than rice offal nutrients. They reported wheat offal nutrients to be more readily degradable in the rumen compared to rice offal nutrients.

There was no significance difference ($P<0.05$) in the feed cost/kg gain. However, bulls on the RO based diets had the highest (N 638.10/kg gain) feed cost/kg gain while those on the MO based diets had the least (N466.14/kg gain). This result indicated a poor efficiency for the utilisation of RO in fattening rations.

Table 4: Nutrient digestibility and nitrogen balance in bulls fed cereal by-product based diets

	Cereal Nased diets					
Digestibility (%)	MO	WO	RO	SP	SEM	LOS
Dry Matter	67.48 [a]	65.93 [a]	52.33 [b]	61.76 [a]	2.62	*
Crude Protein	66.48	68.56	65.28	65.70	1.74	NS
Ether Extract	82.93 [a]	81.46 [a]	69.36 [b]	70.94 [b]	3.39	*
Crude Fibre	74.15 [a]	71.99 [a]	61.80 [b]	72.02 [a]	0.86	*
Ash	41.92 [a]	43.86 [b]	42.38 [b]	55.59 [a]	2.94	*
NFE	80.30 [a]	79.24 [a]	73.32 [a b]	68.23 [b]	2.74	*
Acid Detergent Fiber	77.72 [a]	69.16 [b]	57.47 [c]	69.34 [b]	1.92	*
Neutral Detergent Fiber	81.28 [a]	74.39 [b]	66.32 [c]	73.06 [b]	1.26	*
Total Digestible Nutrient	65.66 [a]	67.17 [a]	57.13 [c]	61.06 [b]	1.11	*
Metabolisable Energy	78.45 [a]	77.81 [a]	69.80 [b]	68.79 [b]	1.15	*
Nitrogen Balance						
N Intake (g/day)	145.00[a]	134.28[ab]	116.07[b]	113.57[b]	10.20	*
Feacal N (g/day)	59.29[a]	53.21[b]	53.93[b]	45.71[c]	8.20	*
Urinary N (g/day)	50.71	70.00	49.64	42.86	13.79	NS
N-Retained (g/day)	35.00	11.07	12.50	25.00	8.04	NS
% of N-Intake	24.61	15.47	11.10	22.40	11.37	NS

Figures bearing different superscript in a row differ significantly. SEM = Standard Error of Mean, LOS = Level of Significance *=P<0.05; NS = Not Significant, ADF= Acid Detergent Fibre, NDF= Neutral Detergent Fibre, TDN= Total Digestible Nutrients, ME= Metabolizable Energy, N= Nitrogen, MO= Maize Offal, WO = Wheat Offal, RO = Rice Offal, SP = Sorghum Panicle

Conclusion and Application

The study established that:

1 Bulls fed on maize offal and wheat offal based diets had higher feed intake, feed utilisation and growth compared to bulls on the rice offal and sorghum panicle based diets.

2. The nutrient compositions and digestibility of nutrients in maize offal and wheat offal based diets were similar and higher, making them more nutritious and of benefit to beef cattle.

3. It is more efficient and cost effective to utilize Maize offal and wheat offal in cattle fattening

rations. The use of sorghum panicle and rice offal in concentrate rations may not result in good growth response and farmers' may not make good profit.

References

1. Bourn, D., Wint, W., Blench, R. and Woolley, (1994). Nigerian livestock resource survey. *World Animal Review*. 78(1): 49-58.
2. FAO (2004). *Protein Source for the Animal Feed Industry*. FAO Expert Consultation Workshop Report. FAO, Rome.
3 Vecchiettini, M and Giardini, A. (2000). Cattle Fattening: The Italian example. CIHEAM-Options Mediterraneennes. www.ressources.ciheam.org/om/pdf/a35
4. Myer, R.O. (2008). Alternative Feeds for Beef Cattle. AN128. http://edis.ifas.uil.edu
5. AOAC (2000). Official Methods of Analysis. 16th Edition. Association of Official Analytical Chemists. Arlinton, Virginia, USA.
6. Alderman, G. and Cottrill, B.R. (1995). Energy and Protein Requirements of Ruminants. An advisory manual prepared by the AFRC technical committee on responses to nutrients. CAB International, Wsllingford, UK. Pp 73-83.
7. Van Soest, J.P. (1991). The use of Detergents in the Analysis of Fibrous Feeds. Determination of Plant Cell Constituents. *J. Association of Agric. Chem.* 50: 50-55
8. SAS (2005). INSTITUTE inc. SAS/STAT User's Guide. 6.03 Edition, Gray NC, USA
9. Steel, R.G.D. and Torrie, J.H. (1980). *Principles and Procedures of Statistics*. A biometrical approach. Mc. Graw-Hill Book Company Inc. New York.
10. Duncan, D.B. (1955). Multiple range and Multiple F-tests. Biometrics, 11: 1 – 42.
11. Ayoade, T.A. (1989). The effect of maize bran on voluntary intake and digestibility of pigeaon pea (*Cajanus cajan*) pods by goats. FAO Cooperative Document Repository.
12. Lamidi, O.S., Adeyinka, I.A., Alawa, C.B.I., Ali-Balogun, R. and Barje, P.P. (2008). Survey of dry season feeding resources for smallholder fattening schemes in northern Nigeria. *Asian Journal of Animal and Veterinary Advances*. 3(2): 92-97.
13. Olorunnisomo, O.A., Adewunmi, M.K. and Babayemi, O.J. (2006). Effect of nitrogen level on the utilization of maize offal and sorghum brewer's grain in sheep diets. *Livestock Research for Rural Development. 18(1)*.
14. Roy, K.H. and Katting R.M. (1994). Value and Quality Assurance of By-product Feeds. Cattle Producer's Library. US

Department of Agriculture, Cooperative Extension Service.

15. Oyebanji, O.M. (1999). The use of sorghum panicle as a fibre source for growing rabbits. B. Agric Project. Department of Animal Science, Ahmadu Bello University, Zaria.

17. Aina A.B.J., Oluwasanmi O.R., Oyesanya N.K., Farinde A.O., Akanbi O.E., Fadipe T.A. and Sowande O.S. (2004). Comparative rumen degradability of forages, agricultural by-products and baobab bark in sheep. *Archives de Zootecnia, ano/* vol 53, numero 203:321 – 324.

18. Jokthan G. E. (2006) Effect of supplementing rice straw with pigeon pea forage on the performance of Yankasa Sheep. Ph.D Thesis Department of Animal Science Ahmadu Bello University, Zaria,

19. Rutherglen, D.C. (1995). Energy and Protein Requirements of Beef Cattle. Victoria State Government Agricultural Notes. AG0374 ISSN 1329-8062

20. Aduku A.O. (2005). *Tropical Feedstuff Analysis Table.* Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University , Zaria.

21 Yahaya M.S., Takahashia J., Matsuoka S. and Kibon A. (1999). Effect of supplementary feeding of cottonseed cake on feed intake, water consumption and work output of work bulls in Borno State, Nigeria. M.Sc thesis Department of Animal Science University of Maiduguri.

22. Olayiwole M.B., Buvanendran V., Fulani I.J. and Ikhatua J.O. (1981). Intensive fattening of indigenous breeds of cattle in Nigeria. *World review of Animal Production,* 17(2.)71-77

23. Ikhatua U.J. and Olayiwole M.B. (1982). Seasonal effect on performance of feedlot bulls. *J. Anim. Prod. Res.* 2 (2): 99-111

24. Lamidi, O.S., Adamu, A.M., Ehoche O.W. and Alawa J.P. (2007). Replacement value of sundried broiler litter for cotton seed cake in the fattening diets forBunaji bulls. *J. Anim. Prod. Res.* 20(1&2): 99-112

25. Jokthan G. E. (2000). The effect of source and level of fibre on feed utilization by rabbits. M. Sc thesis submitted to the Department of Animal Science Ahmadu Bello University, Zaria, in partial fulfillment for the degree of masters in Animal Science

26. NRC (2000). *Nutrient Requirements of Beef Cattle.* 7th Revised Edition. The National Academy Press