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Performance of yearling bunaji bulls fed diets containing graded level of palm kernel cake

Sani R.T.[1]*, Lamidi O.S.[1], Dung, D.D.[1], Hassan, M.R.[2]

[1] National Animal Production Research Institute, Ahmadu Bello University, Shika - Zaria.
[2]Department of Animal Science, Ahmadu Bello University, Zaria

***Corresponding Author:** geowife4life@gmail.com

Target audience: Animal scientists, livestock farmers, Extension agents and Researchers.

Abstract

A growth trial was conducted for 90 days using 20 yearling Bunaji Bulls with live weight range of 110-150kg and aged 1-1.5 years. They were balanced for weight and allotted to five dietary treatments with four bulls per treatment in Completely Randomized Design to determine growth performance of Bunaji Bulls fed diets containing varying levels of Palm Kernel Cake (PKC). Concentrate and basal diets of Digitaria smutsii were offered at 2% body weight. The CP contents of the experimental diets varied between 14.19 and 17.75% while ME ranged from 11.79 to 11.81MJ/kg DM. The crude fibre varied from 26.36-38.77%. Average feed intake ranged between 5.38-5.61Kg/day with animals on 10%, 20% and 40% PKC being statistically similar (P>0.05). Average daily weight gain was highest for animal on 0% PKC while those on 10, 20, 30%, 40% PKC inclusion where similar (P>0.05). All the experimental Bulls attained an average weight gain of between 0.66Kg to 0.75Kg. Cost per kg gain was similar at 0% and 20%PKC inclusion and lowest at 40% PKC. Value of gain (VWG) were similar (P>0.05) for Bulls on 10%, 20%, 30% and 40% PKC inclusion. There was positive Net Benefit and Return on Investment on feed across treatments. The inclusion of PKC lead to reduction in feed cost from N 19598 to a range of N 18761.00- N 15609.00 (about 4.27%-20% reduction in feed cost) therefore it was concluded that Palm Kernel Cake can be included in yearling diets up to 40%.

Key words: Bunaji bulls, Palm Kernel Cake, Growth trial, Partial budget.

Description of Problem

The high growth rate of human population resulting in inadequate land available for extensive production systems has led to increased utilization of crop residues and agro-industrial by-products as animal feedstuff. Current research efforts in most developing countries are therefore aimed at identifying potential feed sources that could be cheap, available for compounding livestock ration and have little or no demand by human so as to reduce competition between man and livestock (1). Research efforts in Nigeria have completely replaced maize with

maize offal as energy source and cotton seed cake has been the major protein source in the growing and fattening ration of Bulls (2) however the prices of this ingredients have gone up and hence the need for cheaper feed ingredients that can be used to bring down the cost of feed production since feed accounts for about two-third of the cost of meat production (3)

Addressing the problem of shortage of animal protein in Nigeria calls for total exploitation of all the ways of increasing the quantity of animal protein to meet the satisfactory level of intake; one of these ways is to increase the production of animals while reducing the cost of feed using agro industrial by-products (4). One of such alternative feed resources is Palm kernel cake (PKC). Palm kernel cake (PKC) is a product of oil palm processing. It is obtained after oil extraction from Palm kernel. Protein content is between 18 - 25% (5). PKC is deficient in lysine, methionine, histidine and threonine. PKC is gritty and high in fibre content (at least 9%).

In addition, there is no standardized commercial feed for growing or fattening cattle, therefore this study is targeted towards using a feed ingredient that is cheap, available, rich in nutrients with no competition with humans and less competition with monogastrics to compound a standard feed for growing cattle. This should be able to solve the problem of complete dependence on maize offal and cotton seed cake as a major source of energy and protein in the diet of ruminants. Hence, the need to re-evaluate the chemical composition, intake, the optimum level of incorporation as well as economics of Palm Kernel Cake in the diets of growing Bunaji yearling bulls.

Materials and Methods

Experimental Site

The experiment was conducted at the experimental pens of the Beef Research Programme of the National Animal Production Research Institute, Shika, Zaria, Nigeria. The study area falls within latitudes 11° 8' 19.56" N and longitudes 7° 45' 51.22" E, with an altitude of 640m above sea level (6). Shika is located within the Northern Guinea Savannah ecological zone with an average annual rainfall of 1,100 mm which starts from late April/early May and ends mid-October, the temperature range from 27-35°C depending on the season, while the mean relative humidity during the harmattan and wet seasons are 21%-72%, respectively (7).

Experimental design and Animal Management.

A total of twenty (20) Bunaji yearling Bulls with age range of 1-1.5 years (110-150kg) were balanced for weight and allotted to five (5) dietary treatments in Completely Randomized Design. Palm Kernel Cake was included in the formulated ration at graded levels of 0, 10, 20, 30 and 40% and this constitutes treatments 1 to 5.

The animals were treated against both endo and ectoparasite before the commencement of the experiment. They were individually penned and fed diets containing graded levels of Palm Kernel Cake (PKC) and *Digitaria smutsii* (Wolly finger grass) hay at 4% of their body weight, 2% for concentrate and 2% for hay. The animals were weighed fortnightly and the ration was adjusted

in line with changes in their body weight. Water intake was measured and evaporative loss was also determined. The growth trial was carried out for 90 days. The diets were formulated to be isonitrogenous and isocaloric (Table 1).

Table 1: Percent feed composition of yearling's Concentrate diets.

Ingredient %	Levels of inclusion				
	0	**10**	**20**	**30**	**40**
Palm kernel cake	0.00	10.00	20.00	30.00	40.00
Cotton seed cake	22.00	18.50	16.00	13.00	10.00
Poultry litter	25.00	23.50	21.00	19.00	17.00
Rice offal	12.00	12.00	12.00	12.00	12.00
Maize offal	40.00	35.00	30.00	25.00	20.00
Salt	1.00	1.00	1.00	1.00	1..00
Total Calculated Analysis	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Crude Protein	15.25	15.28	15.33	15.36	15.38
Metabolizable Energy(MJ/KgDM)	11.81	11.80	11.80	11.81	11.79
Total Digestible Nutrients	65.76	65.55	65.40	65.22	65.04
Cost/Kg(₦)	38.07	33.47	29.29	24.9	20.51

Source of test ingredients

The palm Kernel cake used for this experiment was purchased from Rebson feedmil, Samaru, Zaria in Kaduna state.

Data Collection for the three experiments

Parameters measured include: Initial body weight, Final body weight, Weight gain, Feed intake, Water intake, Feed to gain ratio, Feed cost per Kg gain.

Chemical analysis.

Analysis of individual feed ingredients (Palm Kernel Cake, Maize Offal, Rice Offal, Cotton Seed Cake, Poultry Litters and Hay) and concentrate diets were carried out according to (8) procedure. Also, Acid Detergent Fiber (ADF) and Neutral Detergent Fiber (NDF) was determined in all the feed ingredients according to (9) at the Central laboratory of National Animal Production Research Institute (NAPRI), Shika, Zaria. Metabolizable energy (ME) was be determined by the equation of (10). ME (MJ/Kg DM) = 11.78 + 0.0064 CP + $(0.000665EE)^2$ - CF (0.00414EE) - 0.0118A. Where ME = Metabolizable energy, DM = Dry matter, CP = Crude protein, EE = Ether Extract, CF = Crude fiber.

Economic analysis

The market price of the various feed ingredients as at the time of the studies was used to compute the total cost of feed consumed within the feeding period and feed cost per Kilogram weight gain. This was used to determine how profitable or otherwise it is to include Palm Kernel Cake in the diet of yearling Bunaji Bulls.

Data analysis

The data collected from the experiments was analysed using General Linear Model procedure of (11) to see the response of the animals to measured parameters. Significant levels of difference among treatment means was compared using Duncan Multiple Range Test (12). The Models is as follow:

$Y_{ij} = \mu + t_i + E_{ij}$

Where

Y_{ij} = j^{th} observation of i^{th} graded level of Palm Kernel Cake inclusion.

μ=overall mean

t_i = effect of i^{th} graded level of Palm Kernel Cake inclusion on performance

E_{ij} = random error .

Result and Discussion

The Chemical Composition of individual feed ingredients and hay used for this trial is shown in Table 2.

Dry Matter (DM) contents of palm kernel cake (PKC) is 96.4% which is similar to value of 95.12% reported by (13) but higher than 91.66%, 93.21% and 94.00% reported by (14) (15) and (16) respectively. Crude Protein (CP) of 18.80% reported by (17) is similar to 18.19% obtained in this study but higher than 14.12% reported by (16) and 14.71% by (18) but lower than 23.33% and 20.15% reported by (13) and (14). These variations probably result from difference in processing method to get the cake.

The CP of 11.44% reported for maize offal in the study falls within the range of 11.26 -12.19% as reported by(19), 11.88% by (20) and 10.93-11.98% by (2) but higher than 9.88% (21) but lower than 12.69% and 14.31% reported by (22) and (23) respectively. The NDF value of 48.08% is higher than 21.61% reported by (20), 21.64% by (24), 33% (25) but lower than 55.15% (22) and 53.92% (23).

The DM (95.04%), CP (30.75%) and ME (11.84 MJ/Kg) in cotton seed cake (CSC) is similar to 92.99%, 30.88% and 11.51 (MJ/Kg) reported by ***(2***3) but higher than DM (89.94%), CP (23.69%) and ME (9.14 MJ/Kg) reported by (20), DM (91.64-92.56%), CP (24.63-25.94%) and ME (21.97-23.05 MJ/Kg) obtained by (2). The DM of 94.82% reported by (4) is similar to 95.04% reported in this trial. ADF of 35.29% is similar to 94.17% reported by (4) and 21.64-34.42% by (2). These variations probably resulted from differences in year of production and varieties used.

The CP (20.88%) obtained in this study for layers litters is similar to CP of 19.58% and 19.00% reported by (2) and (20) .The EE of 12.48 is higher than 4.40% reported by (23). The Ash of 13.53% is lower than (21.28%) by (20) and (28.16%) reported by (2). ME of 11.75 MJ/Kg is similar to the value of 11.48 MJ/Kg reported by (20) but lower than values of ME (16.90 MJ/Kg) reported by (2). The DM of present study (97.62) is similar to the value (97.39%) reported by (21) but higher than 92.71%) reported by (23). Hemicellulose (HC) of 18.9% reported in this trials is close to the value of 17.7% reported by (20).The CP content of 5.25% obtained in this study for rice offal is similar to 5.33% (21) and 5.10% reported by (26) but lower than 6.84% and 6.06% by (27) and (26) respectively. The dry matter (DM) content 98.35% is similar to 97.20% reported by (21) but higher than 92.6% and 92.60% reported by (28) and (29). EE of 10.59% % is similar to 10.75% by (20). Variation in results may result from differences in seasons, variety, processing methods; proportion of broken grains in samples utilized and soil condition of rice crops.

In general, the differences observed in the proximate composition of these by-product was in the line with the views of (30) who reported that, the protein, fibre

and energy of these by-products differ within themselves according to source and variety as well as processing methods

Table 2. Proximate and cell wall composition of feed ingredients.

Parameters	Ingredients					
	PKC	**MO**	**CSC**	**P.LITTER**	**RO**	***D. smutsii***
DM (%)	96.4	97.70	95.04	97.62	98.35	95.65
CP (%)	18.19	11.44	30.75	20.88	5.25	5.25
CF(%)	55.89	15.86	34.07	18.86	39.44	36.75
EE (%)	12.38	15.63	13.26	12.48	10.59	8.81
Ash (%)	3.98	1.31	4.11	13.53	20.49	7.8
NDF (%)	71.08	48.08	44.73	43.49	56.94	70.54
ADF (%)	51.34	16.7	35.29	24.59	56.94	45.21
HC (%)	19.74	32.08	9.44	18.9	8.69	25.33
GE	3187.45	3780.99	3926.69	3247.41	3326.95	
ME(MJ/KgDM)	11.85	11.93	11.84	11.75	11.57	11.72

CSC = Cotton Seed Cake, MO = Maize offal, D. *smutsii* = *Digitaria smutsii*, P .litter=Poultry litter, PKC = Palm kernel cake, RO= rice offal, ME=Metabolizable Energy. ME for the feed ingredients was determined by equation of Alderman and Cottrill, 1985. ME (M J/Kg DM) = 11.78 + 0.0064 CP + (0.000665EE) ^{2} - CF (0.00414EE) - 0.0118A. Where ME = Metabolizable energy, DM = Dry matter, CP = Crude protein, EE = Ether Extract, CF = Crude fibre and A = Ash.

DM of 95.65 reported for Digitaria smutsii is similar to 95.2% reported by (31), 94.29% (31),94.42%(32) and 96.38% reported by (33) but higher than 93.1% (20) lower than 7% (34). The CP of (5.25%) is similar to 5.36% reported by (35) and 5.86% by (23) but lower than CP (8.06%) and (9.36%) by (20) and (4). EE of 8.81% is similar to 8.6% by (31) and 8.39% by (20).

Table 3 shows the proximate and cell wall compositions of concentrate diets containing varying levels of Palm Kernel Cake fed to Yearling Bunaji Bull.

The CP of the diets ranged from 14.19-17.75% which falls within the range of 15.38-16.18% reported by (4), 13-16% (36) and 16% CP recommended by (37) for growing Bulls. However it is higher than 13% reported by (38) but lower than the value of 19.64- 22.44% reported by (20), (19.63%) by (23) and 19.00 to 22.91% reported by (39) for matured bulls. The CF ranged from 26.36% for diet containing 10% PKC inclusion to 38.77% for the treatment with 40% inclusion level of PKC which are higher than the minimum level of 17% required for beef cattle (40). The increase in crude fibre as the level of PKC increases could be as a result of higher fibre content in PKC compared with CSC. The ether extract of all the diets were higher than the maximum recommended level of 6% for matured cattle (41). This increase might have resulted due to the presence of cotton seed cake and Palm Kernel Cake in all the diets. The ME of the diets was within the range of 11.79-11.81MJ/Kg DM. This is within the range of 10.85 - 11.16MJ/Kg DM reported by (20), 10 - 11.6MJ/Kg DM recommended for Bulls (38). NDF of 44.52-57.78% is similar to 43.61-52.78 reported by (4)

Differences in the grains used could

have been why the chemical composition of concentrate diets used in this study differed from other authors.

Table 3: Chemical compositions of concentrate diets containing varying levels of palm kernel cake fed to yearling Bunaji Bulls

	Levels of inclusion				
Parameter	**0**	**10**	**20**	**30**	**40**
DM (%)	97.74	97.81	98.25	98.13	98.8
CP (%)	17.75	15.82	17.44	17.44	14.19
CF(%)	26.50	26.36	29.35	34.93	38.77
EE (%)	18.41	20.57	13.31	12.46	11.36
Ash (%)	6.43	6.79	7.46	6.75	6.40
NDF (%)	44.52	52.64	49.24	57.78	54.46
ADF (%)	27.27	33.92	36.45	33.78	32.85
HC (%)	17.25	18.72	12.79	24.00	21.61
GE	3549.31	3428.93	3217.26	3423.91	3751.85
ME(MJ/KgDM)	11.81	11.80	11.80	11.81	11.79

Where ME = Metabolizable energy, GE = Gross energy DM = Dry matter, CP = Crude protein, EE = Ether Extract, CF = Crude fibre and A = Ash.,,NDF = neutral detergent fiber, ACF=Acid detergent fiber,HC = hemicellulose. ME = Metabolizable Energy. ME was determined by equation of Alderman and Cottrill, 1985. ME (MJ/Kg DM) = 11.78 + 0.0064 CP + $(0.000665EE)^2$ - CF (0.00414EE) - 0.0118A.

Effect of experimental diets on the performance of yearling Bunaji is presented in table 4. There was significant difference ($P<0.05$) on the performance of animals fed diets containing graded levels of Palm Kernel Cake in some of the parameters measured. The average concentrate intake (ACI) of 2.71 -2.81kg/day is higher than 2.55-2.76Kg/day and 2.54 - 2.78Kg/day reported by (4) and (21) while the hay intake of 2.27 -2.79Kg/day is lower than 3.49-3.71Kg/day by (4). Average feed intake (AFI) and average dry matter intake (ADMI) where not significant across treatment. The average weight gain (AWG) range from 0.66 - 0.75Kg/day which is similar to 0.70Kg/day reported by (42) but higher than 0.45- 0.61Kg/day (4), 0.22-0.35Kg/day by (21) and (43). Animals on 0% PKC has the highest weight gain but there is no significantly different at ($P>0.05$) for those on 10%, 20%, 30% and 40% PKC inclusions. The differences in average weight gain could be due to differences in the season the experiment was carried out, concentrate fed, temperature differences, and individual differences of the Bulls used. Feed efficiency of 7.11-8.08 obtained in this study is superior to 9.04-9.55, 13.71-22.4, 9.03-12.05,14.58%-21.81 and 10.6-13.71 reported by (23), (22), (2), (21)and (4) respectively but Feed Efficiency (FE) based on rice type (6.26-6.67), inclusion level (6.26-6.72) and interaction between rice type and inclusion level (6.26-6.93) reported by (20) for fattened bulls is more superior than what was obtained in this study. This could probably be as a result of differences in experimental diets, age and live weight of the experimental animals.

Table 4 : Effect of feeding diet containing varying levels of palm kernel cake on performance of yearling Bunaji Bulls.

	Levels of inclusion					
Parameter	**0**	**10**	**20**	**30**	**40**	**SEM**
Initial weight(kg)	119.00	124.25	122.50	118.75	122.25	2.84
Final weight(kg)	186.75	187.25	182.00	180.25	185.50	4.49
ACI(kg/day)	2.76 [b]	2.81 [a]	2.72 [bc]	2.71 [c]	2.81 [a]	0.02
AHI(kg/day)	2.71 [a]	2.78 [a]	2.68 [a]	2.27 [b]	2.79 [a]	0.07
AFI (kg/day)	5.47	5.58	5.40	5.38	5.61	0.14
ADMI(kg/day)	5.35	5.46	5.30	5.28	5.54	0.14
AWI(L/day)	16.51 [a]	15.88 [ab]	15.61 [b]	16.51 [a]	16.43 [a]	0.32
AWG(kg/day)	0.75 [a]	0.70 [b]	0.66 [b]	0.68 [b]	0.70 [b]	0.02
FE(kg feed/kg gain)	7.11 [b]	7.85 [a]	8.08 [a]	7.80 [a]	7.98 [a]	0.17

where ACI = average concentrate intake, AHI = average hay intake, AFI = average feed intake, ADMI=average dry matter intake,AWI=average water intake, AWG=average weight gain, FE=feed efficiency, SEM=Standard Error of mean, l=litre

[abcd] means within the same row with different superscripts are significantly different ($P<0.05$).

Table 5: Partial budget analysis of yearling Bunaji Bulls fed diets containing graded levels of palm kernel cake.

	Level of inclusion					
Parameter	**0**	**10**	**20**	**30**	**40**	**SEM**
TWG (Kg)	67.75 [a]	63.00 [b]	59.50 [b]	61.50 [b]	63.25 [b]	2.12
AWG(Kg)	0.75 [a]	0.70 [b]	0.66 [b]	0.68 [b]	0.71 [b]	0.02
V G (₦)	40650.00 [a]	37800.00 [b]	35700.00 [b]	36900.00 [b]	37950.00 [b]	1272.56
CI (Kg)	248.68	252.48	244.70	243.74	253.04	6.10
HI (Kg)	243.93	250.05	240.71	240.25	251.94	6.27
TFI (Kg)	492.61	502.54	485.41	483.91	504.98	12.37
TWI (Litres)	1485.72 [a]	1428.83 [a]	1404.51 [b]	1486.01 [a]	1478.51 [a]	28.64
TCC (₦)	9467.30 [a]	8450.60 [b]	7167.20 [c]	6069.10 [d]	5189.90 [e]	159.61
Cost of hay(₦)	8942.50	9166.90	8824.50	8807.40	9236.00	229.76
Cost of feed (₦)	18410.00 [a]	17618.00 [b]	15992.00 [c]	14876.00[de]	14426.00 [e]	387.77
CW(₦)	1188.58 [a]	1143.06 [ab]	1123.60 [c]	1188.80 [d]	1182.80 [d]	22.91
TCF and W(₦)	19598.00 [a]	18761.00 [b]	17115.00 [c]	16065.00 [d]	15609.00 [d]	404.38
Cst of conc/kg (₦)	40.21	35.82	31.42	26.96	22.58	
C/KgG(₦/Kg gain)	289.51 [ab]	299.75 [a]	289.90 [ab]	263.98 [b]	249.70 [c]	5.98
Net Benefit (₦)	21052.00 [a]	19039.00 [bc]	18585.00 [c]	20835.00 [ab]	22341.00 [a]	1000.64
RIF	1.07 [c]	1.02 [c]	1.10 [c]	1.29 [b]	1.42 [a]	0.05

Where TWG=total weight gain, AWG =average weight gain, VG = value of gain, CI=concentrate intake, HI=hay intake,TFI= total feed intake, TWI= total water intake,TCC= total cost of concentraate, CW=cost of water, TCF and W= total cost of feed and water, CC/Kg = cost of concentrate /kilogram, C/ Kg G = cost per Kg gain, RIF = return to investment on feed. [abcde] means within the same row with different superscripts are significantly different ($P<0.05$) SEM=Standard Error of mean. , *Digitaria smutsii* hay=₦ 36.66/kg, price of water= ₦ 0.8/l, Price of weaner/liveweight=N600/kg. value of gain= total weight gain×N600,Net benefit=value of gain - total cost of feed and water consumed, Return to investment on feed-= net benefit/cost of feed and water.

Partial budget analysis of yearling Bunaji Bulls fed diet containing varying levels of palm kernel cake is presented in Table 5.

Feed cost was the major cost monitored during the study; the economic returns were based on this. The calculations of other cost such as capital required for pens, depreciation and purchase of stock and labour were not considered. The result of this study shows that feed cost (concentrate) in Naira per kg declined with increase in PKC levels from ' 40.21/kg to ' 22.58/kg. The feed cost to gain ratio was higher at 10% inclusion level (N 299.75/ Kg live weight gain) and lowest at 40% PKC inclusion level (N 249.70/Kg live weight gain) which implies that the 40% inclusion was economically better than the control. The net benefits were ' 21052.00, ' 19039.00,' 18585.00,' 20835.00 and ' 22341.00 for feeding Bunaji yearling Bulls on 0, 10, 20, 30 and 40% PKC diets respectively.

Net benefit was higher in the diets with 40% inclusion levels of PKC though statistically similar at 0% and 30%PKC inclusion. The income over feed cost (net benefit) which is the most important economic factor for the farmers and rate of return to feed investment *observed at the levels of inclusion were all positive.*

Conclusion and applications

From the result of this study, it can be concluded that:

1. Palm Kernel Cake can be incorporated up to 40% in the yearling Bunaji Bulls diets
2. Inclusion of PKC up to 40% lead to reduced cost of feed to gain ratio, positive Net benefit, positive return to investment on feed and improved weight gain.

References

1. Ulfina G., Jiregna D., Alganesh T., Shiv P., Mulugeta, K. (2013). Dairy Production Potential and Challenges in Milk Value Chain. *Journal of Agricultural Sustainability*. **2**(1):1-21.
2. Lamidi, O.S. (2005). The use of some conventional non protein sources for fattening cattle. Ph.D. Thesis. Department of Animal Science, Ahmadu Bello University, Zaria, Nigeria. Pp 67
3. Vecchiettini, M. and Giardini, A. (2000). Cattle fattening: The Italian example. CIHEAM Options Mediterraneennes. www.ressources.ciheam.org/om/pdf/a35
4. Yusuf, M (2016). Evaluation of Brewers' dried grain on the performance of Bunaji yearling bulls raised under intensive system" MSc.Thesis. Department of Animal Science, Ahmadu Bello University, Zaria, Nigeria.
5. Onwuka, C. F. I., Isah ,O.A., Oni, A.O. and Aderinboye, R.Y.(2014) Ruminant Animal Nutrition Ansn 503 lecture Note http://www.e-bookspdf/download/animalnutritionnotes
6. Google earth (2015), Google earth positioning system for geographical description.
7. Ovimap(2015), Ovimap software for geographical description.
8. AOAC. (2000). Official method of Analysis. Association of Official Analytical Chemists.

Official Methods of Analysis, Washington, DC.

9. Van Soest, J.P. (1991). The use of detergents in the analysis of fibrous feeds. Determination of plant constituents. *Journal of Association of Agricultural Chemistry.50:50-55.*
10. **Alderman, G. and Cottrill, B.R.** (1985). Energy and protein requirements of ruminants. An advisory manual prepared by the AFRC Technical Committee on Responses to Nutrients. Wallingford, UK, CAB International.
11. SAS (2002). INSTITUTE inc. SAS/STAT user's guide. 6.03 Edition, Gray NC, USA
12. Duncan, D.B. (1955). Multiple range and Multiple F-tests. Biometrics, 11: 1-42
13. Daudu, O.M .(2007). The evaluation of nutritive value of palm kernel meal on growth performance and nutrient digestibility of weaner rabbits. Unpublished MSc. thesis. Department of Animal Science, A.B.U, Zaria. Pp 24.
14. Akinyeye, R.O., Emmanuel, I.A., Olayinka, F and Adedunke, A. (2011). Physico- Chemical Properties and Anti-nutritional factors of Palm fruit Products(Elaeis guineensis Jacq.) Electronic Journal of Environmental, Agricultural and Food Chemistry, 2191-2198.
15. Wallace, P.A, Edu, E.K and Rhule, S.W.A. (2010). Optimal storage conditions for cocoa cake with shell, palm kernel cake and copra cake as poultry and livestock feed in Ghana. Livestock Research for Rural Development. Volume 22, Article No.32.Retrieved August 8, 2011, from http//www.irrd.org/irrd22/2/wall22032.htm
16. Sundu, B., Kumar, A. and Dingle, J. (2006). Response of birds fed increasing levels of palm kernel mealsupplemented with enzymes. *Australian poultry science symposium* 17: 227-228.
17. Aduku, A.O. (1993). Tropical feedstuffs analysis table. Department of Animal Science. Faculty of Agriculture, Ahmadu Bello University, Zaria. Pp. 196.
18. Adesehinwa, A.O.K. (2007). Utilization of Palm Kernel Cake as a Replacement for Maize in Diets of Growing Pigs: Effects on Performance, Serum Metabolies, Nutrient Digestibility and Cost of Feed Convrsion. Bulgarian Journal of Agricultural Science, 13:593-600.
19. Fadugba, A.A. (1990) Evaluation of the nutritive value of maize offal in poultry diets. M.Sc. Thesis. Department of Animal Science, Ahmadu Bello University-Zaria.
20. Sani, R.T. (2014). Evaluation of raw or parboiled rice offal as energy source in fattening Bunaji bulls. M.Sc. Thesis. Department of Animal Science, Ahmadu Bello University. Zaria, Nigeria. Pp 17-35
21. Adesote, A. (2013): Growth

response of White Fulani Cattle feed *Gliricidia sepium* foliage as replacement for cotton seed cake. M.Sc theses, Department of Animal Science, Ahmadu Bello University, Zaria.

22. *Idowu, O.O. (2011).* Comparative Evaluation of some cereal by-product as energy source for fattening beef cattle. M.Sc. Thesis submitted to Animal Science Department, Ahmadu Bello University Zaria, Nigeria. Pp 46
23. Madziga, I.I., Alawa, C.B.I., Lamidi, O.S., Goska, D.Y., and Adesote., A.A. (2013). Feedlot assessment of four indigenous breeds of cattle in Nigeria. International *Journal of Life Science and Medical Research. Volume 3, Issue 1, Pages 35-38.*
24. Lamidi, O.S., Adeyinka, I.A., Alawa, C.B.I., Balogun, A.R. and Barje, P.P. (2008). Survey of Dry season feed Resources for smallholder fattening schemes in Northern Nigeria. *Asian Journal of Animal and Veterinary Advances* 3(2): 92-97.
25. *Olorunnisomo, O.A., Adewumi,* M.K. and Babayemi, O.J. (2006): Effects of nitrogen level on the utilization of maize offal and sorghum brewer's grain in sheep diets. *Livestock Research for Rural Development, 18 (1)* http://www.cipav.org/irrd/irrd18/1/olor/18010.2006
26. Duru, S. (2010). Evaluation of three types of rice offal in broiler diets Ph.D Thesis. Department of Animal Science Ahmadu Bello University, Zaria. Nigeria.
27. Ocheja, J.O., Daikwo S.I., Okpe A.A. and Ikusemoro, S.O. (2008): Performance of weaner Rams fed with varying proportions of a mixture of Bambaranut waste and Rice offal as supplement to natural pasture. *Proceedings of 4th International Conference of the Nigerian Society of Indigenous Knowledge and development 5-8th November 2008,* Kogi State University, Anyigba.P.76-82.
28. Olomu, J.M. (1995). *Monogastric Animal Nutrition - Principles and Practices*, a Jachem publication. Benin City. Pp 320.
29. Ocheja, J.O., Ebiloma S.O., Ukwuteno S.O., Oguche, H. G. E., Lalabe B.C and Akuboh, C.A. (2011). Performance and Heamatological Parameters of Grower Rabbits Fed With Some Browse Supplemented With A Mixture of Bambara Nut Waste and Rice Offal. *Journal of Production Agriculture and Technology*. Publication of Nassarawa State University, Keffi. Issue 7 (2): 37-47.
30. Oyediji, G.A. (2001): Improving Poultry feed production and supply in Nigeria Proceedings of One-day workshop on improving feed supply and litter management. Obafemi Awolowo – University,Ile-Ife, Nigeria.
31. Barje, P.P. (2006). Utilization of whole cottonseed in the diets of Friesian and Bunaji and Bunaji Heifers. *Ph.D Thesis*, ABU

Zaria: pp119 – 126.

32. Abu, H.T. (2014). **E**valuation of ficus leaf meal as a replacement for cotton seed cake in the diet of growing Bunaji Bulls. M.Sc. Thesis. Department of Animal Science, Ahmadu Bello University. Zaria, Nigeria. Pp 24-35

33. Sani, R.T (2010): Manure production by Yankassa Sheep grazing native pasture in northern guinea savannah. B.Agric theses, Ahmadu Bello University, Zaria.

34. Hassan, F.B. (2007). Comparative feeding value of *Cynodon dactylon* and *Digitaria smutsii* forages Supplemented with concentrate for weaned Female yankasa lambs. *M.Sc. Thesis. Department of Animal Science, Ahmadu Bello University. Zaria, Nigeria. pp 52-60*

35. Yashim, S.M. (2014). **Effect of inclusion levels of fig (Ficus sycomorus) leaf meal in** concentrate **diets on the performance of Yankasa rams fed Digitaria smutsii hay. PhD. Thesis.** Department of Animal Science, Ahmadu Bello University. Zaria, Nigeria. Pp 62

36. Aduku, A.O. (2005). Tropical Feeding stuff Analysis Table. Department of Animal Science, Ahmadu Bello University, Zaria-Nigeria.

37. NRC (1989). Nutrient Requirements of Beef Cattle. National Academy of Science, Nutritional research Council, Washington, and D. C.

38. Rutherglen, D.C. (1995). Energy and Protien Requirements of Beef cattle. Victoria State Government Agricultural Notes. AG0374 ISSN 1329-8062.

39. Lamidi, O.S., Adamu, A.M., Ehoche, O.W. and Alawa J.P. (2007). Replacement value of Sun-dried broiler litter for cotton seed cake in the fattening diets for Bunaji bulls. *Journal of Animal Production Research* 20(1&2):99-112.

40. NRC (National Research Council), (2000). Nutrient Requirements of Beef Cattle. 7th Revised Edition. National Academic, Press,Washington, DC, USA. Retrieved on 25th August, 2009 from http://www.nap.edu/books/0309069343/html

41. Parish, J.A. and Rhinehart, J.D. (2008). Energy in Beef Cattle Diets.Mississipi Agricultural and Forestry Experiment Station. Retrieved on 12th September, 2010 from wwwthecattlesite.com/articles/1653/energy in beef cattle diets.

42. Abdulrazak, S. A. ; Muinga, R. W. ; Thorpe, W. ; Ørskov, E. R., 1996. The effects of supplementation with *Gliricidia sepium* or *Leucaena leucocephala* forage on intake, digestion and live-weight gains of *Bos taurus* × *Bos indicus* steers offered napier grass. Anim. Sci., 63 (3): 381-388.

43. Gonzalez, D.V., Palomares Naveda R, Navarro A, rosa razz. G. SOTO CASTILLO, and

Quintero Moreno A.(2002). The use of Gliricidia sepium in the supplementary feeding of crossbreed female calves. Revista Cientifica, FCV-LUZ 12: 384 – 387.