IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 12, Issue 1 Ser. I(January 2019), PP 82-86
www.iosrjournals.org

Growth Performance and Economics of Production of Bunaji Bulls Grazing Natural Pasture Supplemented with Diets Containing Graded Levels of Sweet Orange Peels

Shittu H.A[1*]Oloche J[1].andAyoade J. A.[1]
[1] Department of Animal Production, University of Agriculture, Makurdi, Nigeria
**Corresponding Author: Shittu H.A.*

Abstract: *A feeding trial using 12 bunaji bulls, aged between eighteen months and having an average weight of 156kg were randomly divided into 4 treatment groups. The animal groups were allotted the treatment diets containing 0, 25, 50 and 75 % sweet orange peels as replacement for maize offal in a completely randomized design. Parameters measured were concentrate intake, weight gain, feed conversion ratio and economics of production. The experiment lasted for 203 days. Results showed that total concentrate intake was 223.40kg, 253.98kg, 250.14kg and 254.47kg for 0 %, 25 %, 50 % and75 % SOPM respectively. There were no significant differences (P>0.05) among the treatment groups for total concentrate intake, mean concentrate intake and feed conversion ratio. Total weight gain, mean weight gain and metabolic weight gain showed significant differences (P<0.05) between the experimental groups. Diet containing 50 % SOPM yielded significantly higher value (P<0.05) than the rest of the treatments, while T_1 (0% SOPM) gave the least value. This results show that the SOPM is safe and not harmful to the health of the animals. There were no significant differences (P>0.05) in all the production parameters such as cost of feed consumed by animals, cost/kg weight gained, total cost of production, revenue and benefit derived from the sales of the animals. However, treatment $_3$ (50% SOPM) had relatively more revenue than control. The result also show that SOPM favour better growth of the bulls and therefore livestock farmers can incorporate up to 50% SOP for both performance and economic gain in the diet of their animals.*

Keywords:*sweet orange peel meal, bunaji bulls, revenue*

Date of Submission: 12-01-2019 Date of acceptance: 26-01-2019

I. Introduction

Ruminant production in the tropical region is hampered to a great extent by nutritional limitation. This limitation manifests in forages growing very fast and lignifying early leading to loss in nutritional value and also a clearly defined dry season spanning over many months when the forages dry up and become unavailable [Kallah, 2004]. A major constraint of the livestock industry in meeting consumer demand for meat, milk, eggs and other livestock products in Nigeria is the unavailability of regular supplies of appropriate, cost effective and safe animal feeds. Animal feeds have become an increasingly critical component of the integrated food chain (FAO, 2004).

While beef producers rely heavily on forages as the basis of feeding programme, forages must of necessity be supplemented with energy and or protein if fast growth rates are to be achieved. In developed countries, production of quality beef is usually achieved through the feeding of high energy rations to cattle.Ruminants in the tropics in general, are raised predominantly on grasses which are inherently poor in digestibility, nutritive value and unavailability in off season (Babayemi*et al*., 2009). At this period, the performance of ruminant animals which is dependent on the native pasture is seriously impaired, and quality is associated with the fibrous and lignified nature of the pasture which limits intake, digestibility and utilization (Olafadehan*et al*., 2009). During this critical period the production level of animals are low and consequently result to the low income accruable from these animals. Farmers lose some of the animals through premature disposal or death in some cases.

The search for alternative feed ingredients therefore becomes the focus of most animal nutritionists. This search has led to the identification and evaluation of many agro-industrial by-products, agricultural by-products and lesser known plants as a means of addressing the seasonal shortages in the quality and quantity of natural pasture (Arigbede*et al*., 2010). One of such unconventional feedstuff is sweet orange peels (Oluremi*et al*., 2006). The utilization of most of these unconventional feedstuffs is limited as a result of high fibre content, low nutrient content and the presence of anti-nutritional factors or poison (Mc Donald *et al*., 1995). However, different treatments such as drying, fermentation, soaking in water e.t.c have been reported to improve unconventional feedstuff and improve their nutritional profile (Oluremi*et al*., 2007b, Orayaga, 2010 and Oyewole, 2011). This study was therefore designed to evaluate the response of bunaji bulls grazing natural pasture supplemented with diets containing graded levels of sweet orange peel meal (SOPM).

II. Materials And Methods

Experimental Site

The experiment was conducted at the Cattle Unit of the Livestock Teaching and Research Farm of the University of Agriculture Makurdi in Benue State. Makurdi is located at latitude $7^0 43'$N and longitude $8^0 3'$E and lies within the Southern Guinea Savanna Region of Nigeria. It has a temperature range of 17.3 to 35^0C with an annual rainfall ranging between 508mm and 1016mm. The relative humidity varies from 47 to 85% (TAC, 2002). The area is warm with a minimum temperature range of 24.20 ± 1.40^0C and a maximum temperature range of 36.33 ± 3.70^0C (TAC, 2009).

Experimental diets and proximate analysis

Orange peels were collected from orange sellers within makurdimetropolis, the peels were sundried till they became crispy and were then crushed and kept in bags for use. Four experimental diets in which sweet orange peel meal replaced maize offals at 0 %, 25 %, 50 % and 75 % were formulated and compounded and the diets designated T_1, T_2, T_3 and T_4 respectively as presented in Table 2.The sun dried sweet orange peels were milled using a hammer mill and analyzed for proximate constituents such as crude protein (CP), crude fibre (CF), ether extracts (EE) and ash according to AOAC (1995) method and nitrogen free extract (NFE) (Table 1). After the sweet orange peel was milled, it was mixed properly with other ingredients to make concentrate. 20grams of each samples of the concentrate were used for the determination of proximate constituents.

Experimental animal, housing and management

A total of twelve (12) bunaji bulls of about 1.5years and having an average weight of 156kg were used for the experiment. The animal house (shed) was made of wooden materials. The walls were basically strong pillars made of wood, supported by other wooden materials properly arranged to confine the animals. The roof was made of zinc sheets to protect the animals from inclement weather condition. The shelter was divided into individual stalls so that each animal was housed singly. The floor of each stall was rammed and covered with wood shavings of at least 10cm thick to act as litter and bedding for the animals.Two weeks to the arrival of the animals, the experimental stalls were thoroughly swept and disinfected while the water troughs were properly washed and allowed to dry before use. On arrival, the animals were treated against trypanosomiasis using samorin®, and dewormed with Albendazole. The animals were quarantined for a period of 30 days, thereafter, they were weighed and randomly distributed into four (4) treatment groups of three (3) animals and each animal was a replicate. Thereafter the experimental diets (T1-T4) were randomly assigned to four animal groups. The animals were given two weeks to adjust to feed and environment before data collection commenced. The animals were sheltered in the stalls at night and in the morning at about 8:00hrs, each animal was given 1.5kg of the concentrate supplement in their individual stalls, they were allowed to go for grazing at about 10.00hrs. Daily grazing was usually for 6hrs (normally grazing is usually 6-8hrs daily). Thereafter the animals were brought back into their stalls for the night. Large water troughs were stationed in front of the shed, such that the animals drank water before going for grazing, they also drank freely before they were shut in their individual stalls. The dimension of each stall was 3.6 m X 2.5 m (Length and width). Daily, the drinking troughs were washed and refilled with fresh portable water. Daily concentrate intake of each bull was calculated by subtracting the remnants from the quantity served. They were weighed on weekly basis to determine weight gain throughout the feeding trail. The experiment lasted for 203days.

Experimental Design

Data collected was subjected to one way analysis of variance (ANOVA) in a completely randomized design using the Minitab (1991) statistical software.

III. Result

Ingredient and chemical composition of experimental diets fed to bunaji bulls

The ingredient and chemical composition of the experimental diets fed to the experimental animals is presented in Table 8. The dry matter ranged from 93.08to 93.82%, crude protein was in the range of 20.76 to 22.01%. Crude fibre ranged from 8.67 to 12.86%, ether extract varied from 5.60 to 6.80% while ash varied from 7 to 10.45%. The variation in all experimental diets did not follow a definite pattern. The ME/Kcal/Kg varied from 2888.40 to 3029.73 ME/Kcal/kg.

Performance and economics of production of bunaji bulls on natural pasture supplemented with diets containing graded levels of sweet orange peel meal.

The performance and economics of production of the bunaji bulls fed diets containing graded levels of SOPM is presented in table 3 and table 4 respectively. The total weight gain, average weight gain and metabolic weight gain (g/kg $W^{0.75}$) were significantly different ($P<0.05$) among treatment means. The final weight ranged from 224.67kg to 253kg, the highest was recorded in T_3 (50% SOPM). Metabolic body weight gain differed significantly ($P<0.05$). T_3 and T_4 differed significantly from T_1 and T_2. Total weight gain and mean weight gain followed the same pattern. There were no significant differences ($P>0.05$) in all the economics of production parameters. Cost per kg diet varied from ₦55.47 to ₦58.47, cost due to feed consumed by the animals also ranged from ₦13,062.00 to ₦14,596.42, cost per kg weight varied between ₦151.34 to ₦203.09, while total cost was ₦57183.33 across the treatments, revenue ranged from ₦106,261.00 to ₦119,661.00 and benefit varied from ₦49,077.00 to ₦62,478.00.

IV. Discussion

Proximate composition of test ingredient and dietary composition of experimental diets fed to the experimental animals

The crude protein content of the sweet orange peels (6.56%) was higher than 4.05% reported by Peter *et al.* (2013) but lower than 7.71% reported by Hon *et al.* (2009) for sweet orange fruit peel meal and 10.73% recorded by Agu*et al.* (2010). The difference in crude protein values could be as a result of the differences in soil type, age at maturity, genetic variation and differences in geographical location. The ether extract and crude fibre (1.38% and 8.28%) were comparable with 2.12% and 9.68% reported by Hon *et al* (2009). The ash value was 6.87% suggesting that SOP has appreciable amounts of minerals. The observed value was however higher than 5.18%, 3.17%, and 3.31% reported by Hon *et al*. (2009) and Kammoun*et al*. (2011). The NFE value of 76.91% in this study was higher than 56.91% reported by Agu*et al*. (2010), but comparable with 75.31% reported by Hon *et al*. (2009). NFE is the fermentable carbohydrate in the feedstuff, this means that SOP contains considerable amounts of energy. The Metabolizable energy of 3085.91kcal/kg was lower than 3756.14kcal/kg reported by Hon *et al.* (2009).

Dry matter values for SOPM varied from 93.08%-93.66%. These indicate that the experimental diets will have long shelf life. Observed values were higher than 88.67%-89.97% reported by Ngi*et al.* (2013), for WAD goat fed diets containing sweet orange peel meal. The crude protein values (20.76%-22.01%) were comparable with 19.94%-22.44% reported by Sani, (2014) when bunaji bulls were fattened with raw or parboiled rice offal as energy source and (19.00%-22.91%) reported by Lamidi*et al*. (2007) for diets of fattening bulls, Crude fibre values for the experimental diets varied from 8.67%-12.86%, this was lower than 14.59%-17.84% reported by Sani, (2014). However since the animals were not on a complete diet, but the experimental diets were supplements to grazing, crude fibre could not be said to be inadequate. Ether extract was between 5.60%-6.80%, and this was within the maximum recommended value of 6% for matured cattle (Parish and Rhinehart, 2008) cited by Sani (2014).

Performance and economics of production of bunaji bulls on natural pasture supplemented with diets containing graded levels of sweet orange peel meal.

There was no significant difference among the experimental treatments for final weight, total concentrate intake, mean daily concentrate intake and feed conversion ratio, whereas there were significant differences in total weight gain, mean weight gain and mean weight gain ($Kg/w^{0.75}$) among the treatments. The final weight did not show any statistical variation, meaning that the experimental diets containing SOPM were not in any way inferior to the control diet and that the diets with SOPM were also adequate for cattle production. It also implies that diets containing SOPM did not compromise the growth of the animals.

The mean weight gain showed significant variations among the treatment. Treatments with higher SOPM seemed to have better weight gains. This maybe as a result of the high NFE in SOPM as shown in the proximate composition of the diets in table 2, the metabolizable energy of diets containing the SOPM were higher than that of the control, the ether extract values were also higher for diets containing the test ingredients. This may have increased the available fermentable carbohydrates and consequently better gain. Observed values were comparable with 340-580g/day reported by Ayoade*et al*. (2015), for bunaji bulls supplemented with varying levels of agro-industrial by-products. This implies that SOPM in the diets of the cattle did not compromise weight gain but enhanced it better than the control.

The total weight gain, mean daily weight gain and metabolic weight gain showed a similar trend. The mean concentrate intake did not show any statistical variation, implying that all the treatments containing the test ingredient were acceptable and palatable to the animals and that the control diet was in no way superior to the other diets. The feed conversion ratio also did not show statistical variations. The FCR was generally good, however, the relative values also indicated that T_3 and T_4 which had higher levels of SOPM were better than the control. This contradicts Barje*et al*. (2013), who reported a significant decline ($P<0.01$) in concentrate intake by cross bred Friesian x bunaji calves with increased level of whole cotton seed meal.

The cost of feed/kg diet is a reflection of the cost of feed inputs. This decreased as the level of SOP increased. Treatment $_4$ had the lowest cost/kg diet, the control which was without SOP had the highest cost of feed/kg diet.There was no significant difference ($P>0.05$) among the treatments in feed cost/weight gain in all the experimental treatment. Cost/weight gain was lower for diets containing SOP,thecontrol had the highest cost/weight gain (₦203.09). Feed cost/weight gain is a function of feed consumed and the feed conversion ratio.

Total revenue showed that, the revenue increased with increasing levels of SOP. This was more dependent in total body weight gain (Wuanor*et al*. 2014) because the unit price of cattle live weight was uniform across the dietary treatments. Dietary treatment with SOPM had the highest net benefit compared with the control (T1). Treatment $_3$ had the highest (₦62478.00) as compared with treatment $_1$ (₦49077.00).

Table 1: Proximate Composition of Sweet Orange (*Citrus Sinensis*) Peels

Parameters	Composition
Dry matter (%)	84.45
Moisture (%)	15.55
Crude protein (%)	6.56
Ether extract (%)	1.38
Crude fibre (%)	8.28
Ash (%)	6.87
Nitrogen free extract (%)	76.91
ME (Kcal/kg)	3085.91

Metabolizable energy: (37×%CP+81.1×%EE+35.5×%NFE). Pauzenga, 1985

Table 2: Gross Composition of Experimental Diets

Ingredients (%)	T1(0%SOPM)	T2(25%SOPM)	T3(50%SOPM)	T4(75%SOPM)
Soy bean meal	20	20	20	20
Palm kernel cake	20	20	20	20
Brewer dried grain	35	35	35	35
Maize offal	20	15	10	5
SOPM	0	5	10	15
Bone meal	3	3	3	3
Common salt	2	2	2	2
TOTAL	100	100	100	100
Calculated values				
Crude protein	20.90	20.91	20.87	20.86
Crude fibre	13.10	12.89	12.69	12.48
Ether extract	4.56	5.05	5.54	6.03
Ash	4.00	5.64	5.11	5.67
Nitrogen free extract	57.44	55.51	55.79	54.96
ME (Kcal/kg)	3185.42	3157.00	3206.91	3216.15

T1 = 0% sweet orange peel meal, T2 = 25% sweet orange peel meal, T3 = 50% sweet orange peel meal, T4 = 75% sweet orange peel meal, ME = Metabolisable energy, SOPM = sweet orange peel meal

Table 3: Performance of bunaji bulls on natural pasture supplemented with diets containing graded levelsofsweet orange peel meal

	Experimental diets				
Parameters	T1	T2	T3	T4	SEM
Average Initial weight (kg)	159.00	159.00	158.33	158.33	7.66^{ns}
Average Final weight gain (kg)	224.67	232.00	253.00	236.67	9.81^{ns}
Average Total weight (kg)	66.33^{b}	73.00^{b}	94.00^{a}	78.33^{ab}	5.76*
Average daily weight gain (ADWG g)	326.76^{b}	359.60^{b}	463.05^{a}	385.88^{ab}	28.4*
Metabolic weight gain (g/kg $W^{0.75}$)	76.69^{b}	82.57^{b}	99.76^{a}	86.94^{ab}	4.82*
Total concentrate intake (kg)	223.40	253.98	250.14	254.47	12.85^{ns}
Average daily concentrate Intake (kg)	1.12	1.25	1.23	1.25	0.06^{ns}

a b c means on the same row with different superscripts are significantly different (P<0.05). T1 = 0% sweet orange peel meal, T2 = 25% sweet orange peel meal, T3 = 50% sweet orange peel meal, T4 = 75% sweet orange peel meal, SEM = Standard error of mean, *= Significant (P<0.05) ns= not significant

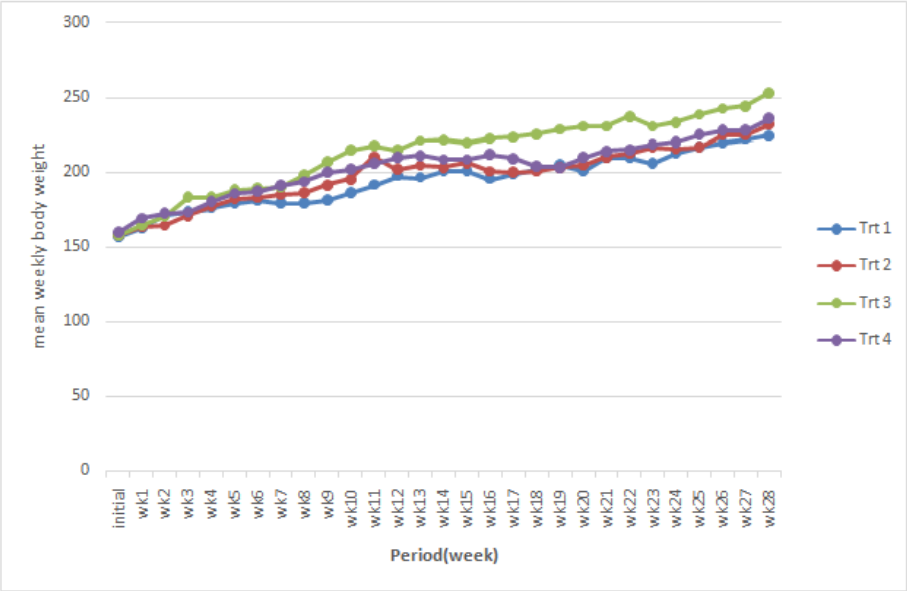

Figure 1: Cummulative weekly weight of bunaji bulls on natural pasture supplemented with diets containing graded levels of sweet orange peel meal

Table 4: Economics of production of bunaji bulls on natural pasture supplemented with diets containinggraded levels of sweet orange peelmeal.

	Experimental diets				
Parameters	T1	T2	T3	T4	SEM
Cost/ kg diet (₦)	58.47	57.47	56.47	55.47	-
Cost of conc. consumed by animal (₦)	13062.00	14596.42	14125.22	14115.45	748.57
Total cost (₦)	57183.33	57183.33	57183.33	57183.33	-
Revenue (₦)	106261.00	109729.00	119661.00	111936.00	4641.51
Benefit (₦)	49077.00	52546.00	62478.00	54753.00	4641.51

T1 = 0% sweet orange peel meal, T2 = 25% sweet orange peel meal, T3 = 50% sweet orange peel meal, T4 = 75% sweet orange peel meal, SEM = standard error of mean

Total cost consist of cost of bulls, medication, and miscellaneous

References

[1]. Agu, P. N., Oluremi, O. I. A. and Tuleun C. D. (2010). Nutritional evaluation of sweet orange (*Citrus sinensis*) fruit peel as a feed resource in broiler production. P 685

[2]. AOAC (1995). Official method of analysis (16th edition). Association of analytical chemists, Washinton DC.

[3]. Arigbede, O. M., Bolaji, O. J., Sanusi, I.M, Olanile, J.O and Jolaosho, A.O (2010).Nutrient intake and performance of West African Dwarf sheep fed graded levels of wild yam (*Achomonesdifformis*) and *Pennisetum purpureum*. Proceeding 35th Conference of Nigeria Society for Animal Production on the 14th – 17th March, 2010. University of Ibadan, Nigeria. Pp. 485 – 488.

[4]. Babayemi, O. J., Ekokotu, O. A and lyang, U. A (2009). Evaluation of ensiled Cassava peels together with *AlbiziaSamam* pods in: B. I. Umoh, A. B. I. Udedibie, L. P. Solomon, O. L. Obasi, B. I. Okon and E. J. Udoh (eds). Animal Agriculture and Global Food challenges. Proceedings of the 34th Annual conference of the NSAP held at University of Uyo, Uyo, Akwa Ibom State, Nigeria: 544 - 546.

[5]. Barje, P. P., Ehoche, O. W., Eduvie, L. O., Voh (jr), A. A., Akpa, G. N., Lamidi, O. S. and Goska, D.Y. (2013). Feedlot assessment of four indeginous breeds of cattle in Nigeria. *International Journal of Life Science and Medicinal Research*. Vol 3(1) pp. 35-38.

[6]. FAO, (2004). Food and Agricultural Organization of the United Nations, 00100, Rome, Italy. February, 2005.

[7]. Hon, F. M., Oluremi, O. I. A and Anugwa F. O. I. (2009). The effect of dried sweet orange (citrus sinensis) fruit pulp meal on the growth performance of rabbits. *Pakistan Journal of Nutrition.* 8(8):1150-1155.
[8]. Kallah, M.S. (2004). Field methods for measuring primary productivity of pastures. In: Forage production and management in Nigeria. A training manual (Ed. J.O. Gefu and J.T. Amodu). A training workshop by National Animal Production Research Institute, Shika, ABU Zaria and Federal ministry of Agriculture and Rural Development, October, 2004
[9]. KammounBejar, A., Ghanem, N., Mihoubi, D., Kechaou, N., BoudhriouaMihoubi., N. (2011) Effect of infrared drying on drying kinetics, color, total phenols and water and oil holding capacities of orange (*Citrus sinensis*) peel and leaves. *International Journal of Food Engineering* 7: 5-11.
[10]. 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 for bunaji bulls. *Journal of Animal Production Research.* 20(1&2): 99-112.
[11]. McDonald, P., Edwards, R. A., Greenhalgh, J. F. D. and Morgan, C.A. (1995). Animal nutrition 5th Edition. Longman Group Ltd. Edinburg gate, Harlow Essex CM202JE UK. Pp. 444-510
[12]. Minitab (1991). Statistical software. V.16.2 minitabinc. P.A USA
[13]. Ngi, J. (2013). The nutritive potential of sweet orange (*Citrus sinensis*) peel meal for goat feeding. Ph.D Thesis Project report. Department of Animal Production, University of Agriculture, Makurdi, Nigeria. Pp 23-50
[14]. Olafadehan, O. A, Olafadehan, O. O., Obun, C. O., Yusuf, A. M., Adeniji, A. A., Olayinka, O. O. and B. Abdullahi (2009). in: J. A. Akinlade., T. B. Olayeni., T. A. Rafiu., A. O. Akinwunmi., O. A. Aderinola., O. O. Ojebiyi and Odunsi, A. A (eds.) Global Economic Recession and the Challenges to Livestock Production in Nigeria. Proceedings of the 14th annual conference of Animal Science Association of Nigeria held at LadokeAkintola University of Technology, Ogbomoso, Oyo State, Nigeria: pp572 -574
[15]. Oluremi, O. I. A., Ngi, J. and Andrew, I. A. (2007b). Phytonutrients in citrus fruit peel meal and nutritional implication for livestock production. *Livestock ResourceForRuralDevelopmentvol.9Article89.http//www.cipav.org.co.//lrr/19/7olur19089.htm*
[16]. Oluremi, O. I. A., Ojighen, V. O. and Ejembi, E. H. (2006). The nutritive potentials of Sweet orange (*Citrus sinensis*) rind in Broiler production. *International Journal of Poultry Science*, 5: 613-617.
[17]. Orayaga, K. T. (2010). Effect of duration of soaking of sweet orange (*Citrus sinensis*) fruit peel on its nutritional composition and maize replacement value in broiler diets. *M.Sc Thesis* submitted to the Department of Animal Nutrition, College of Animal Science, University of Agriculture, Makurdi. Pp 84
[18]. Oyewole, B. O. (2011). Nutritional potential of fermented sweet orange (*Citrus sinensis*) fruit peel meal in the diets of pullet chicks, grower and layers. A PhD Thesis submitted to the Department of Animal nutrition. University of agriculture, Makurdi. Pp. 91-93.
[19]. Parish J. A. and Rhinehart J. D. (2008). Energy in Beef Cattle Diets. Mississippi Agricultural and Forestry Experiment Station. www.thecattlesite.com/articles/1653/energy_in_beef_cattle_diets.
[20]. Pauzenga, U. (1985). Feeding parent stock. *ZootechnicaInternationa, Decembe, 1985, Pp:* 22-25.
[21]. Sani, R. T. (2014). Evaluation of raw or parboiled rice offal as energy source in fattening bunaji bulls. M.Sc. theses, Department of Animal Science Ahmadu Bello University, Zaria. Pp. 17-19.
[22]. TAC (2002). Tactical Air Command Meteorological Data. Nigeria Air Force Makurdi.
[23]. TAC (2009). Makurdi weather elements records. MakurdiMetereological station. Nigeria Air Force Makurdi, Tactical Air Command, Makurdi, Nigeria.

ShittuH.A..“Growth Performance and Economics of Production of Bunaji Bulls Grazing Natural Pasture Supplemented with Diets Containing Graded Levels of Sweet Orange Peels."IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS) 12.1 (2019): PP-82-86.