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# Effect of feeding concentrate diets containing graded levels of groundnut haulms on nutrient composition of diets and performance of Friesian x Bunaji heifers

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**Abstract**

*An experiment was conducted to determine the effect of feeding concentrate diets containing varying levels of groundnut haulms (GH) on intake and growth performance of Friesian x Bunaji cattle. Four concentrate mixed diets formulated to contain on average 14.45- 14.65% crude protein. Groundnut haulms in the concentrate diets were on nitrogen basis at 0, 25, 50 and 75% levels with control diet having 0% inclusion of GH. Twenty Friesian x Bunaji pre-pubertal heifers aged 14-16 months and weighing 160-180kg were randomly divided into four groups of five animals each and were allotted to the four experimental diets in a completely randomized design. Data were collected in order to determined Dry matter intake (DMI), Average daily intake (ADI), Average Daily Gain (ADG) Feed to gain ratio (FCE) and cost benefit analysis. Result showed that varying the levels of GH in concentrate diet significantly (P<0.05) increased DMI at 25%; this value was similar (P>0.005) to those at 0 and 50%. At 75% DMI of concentrate significantly declined. The ADG of heifers fed concentrate mixture containing 0% GH were significantly (P< 0.05) higher; although, there was no significant (P>0.05) difference between those fed 0 and 25%. Increasing GH level in concentrate diet to 75% depressed gain and ADG of heifers. Heifers fed 0 and 25% GH levels had similar feed to gain ratio but were significantly (P<0.05) lower than those fed 50 and 75% levels. Net benefit declined across treatments with increased levels of GH in concentrate diet up to 50%, although they remained positive indicating it was beneficial replacing concentrate diet with GH. The net benefit of feeding GH at 0% GH (control) over 25% is fi 37384.9; 0% over 50% is fi 91084 and over 75% is fi 83246.60. It is concluded that GH supplementation on Gamba hay appears to improve the feed intake, growth and efficiency of concentrate utilization by heifers at 25% level and cost of concentrates in heifers generally.*

**Keywords:** Groundnut haulm, Gamba, Feed intake, weight gain, Friesian x Bunaji Heifers

## Introduction

Supplementation with concentrate mixtures including cereal grains, cereal bran, or oil seed meals has resulted in increased intake in intensive production systems and has been the subject of several excellent reviews. Unfortunately, these supplements are often not fed due to their unavailability and non affordability. Forage legumes as supplement has been suggested as an alternative to use of concentrate (Ehoche *et al*., 1998; Etela and Dung, 2011). Groundnut haulm (*Arachis hypogaea L*) is an excellent source of feed during the dry season. Etela and Dung (2011) observed that groundnut (GH) supplementation supported adequate nutrient intake, digestibility, daily live weight changes and nitrogen balance when six dual-purpose groundnut cultivars were used as sole diets in WAD sheep. The availability of groundnut hay among arable farmers who keep small livestock and the variation in results obtained from ruminants fed groundnut haulms underscore the need for this study. The objective of this study

was to determine the effect of feeding concentrate diets containing graded levels of groundnut haulms on chemical composition of diets, intake and growth performance of Friesian x Bunaji cattle. It is hoped that the result of this investigation will contribute towards better utilization of GH as supplement in dairy cattle production.

**Materials and methods**

The study was carried out in the Dairy Research Programme Farm of the National Animal Production Research Institute, Ahmadu Bello University, Shika- Zaria. A basal concentrate mixture consisting of maize, cottonseed cake, wheat bran, mineral mixture and common salt was formulated to contain 14% crude protein. The GH replaced the basal concentrate mixture at 25.0, 50.0, 75.0 and 100.0% levels (T1-T4) levels. The test mixtures were both iso-nitrogenous and iso-caloric to the basal control concentrate mixture (C).Twenty Friesian x Bunaji crossbred heifers aged 14-16 months and weighing 160-180kg were randomly divided into four groups of five each and allotted to four dietary treatments in a completely randomized design. During trial, the heifers were fed Gamba hay a*dlibitum* and the basal or particular test concentrate mixture at 40% of estimated DM intake. The low metabolizable energy content in the GH containing concentrate mixtures (T1 to T4) was compensated by daily mixing of molasses. Experimental animals were kept in individual pens and fed their respective diets for 112 days and only left pens fortnightly, on weighing days. The heifers were fed individually in the mornings and afternoons. Feed was analyzed for proximate sample (AOAC, 1995), and cell wall constituents (Goering and Van Soest, 1970). Data collected were analyzed using the least square method of SAS (1990) package. The differences between means were separated using the Duncan Multiple Range Test (Duncan, 1955).

**Table 1: Ingredient composition of concentrate containing graded levels of groundnut haulms**

| | Graded levels of groundnut haulms in concentrate diets (%) | | | |
|---|---|---|---|---|
| **Ingredients** | **0** | **25** | **50** | **75** |
| Maize grain | 35.00 | 25.00 | 15.00 | 6.00 |
| Cotton seedcake | 20.00 | 17.00 | 14.00 | 12.00 |
| Wheat offal | 42.00 | 30.00 | 18.00 | 4.00 |
| Bone meal | 2.00 | 2.00 | 2.00 | 2.00 |
| Common salt | 0.75 | 0.75 | 0.75 | 0.75 |
| Vit-Min. premix | 0.25 | 0.25 | 0.25 | 0.25 |
| Molasses | 0.00 | 2.00 | 4.00 | 5.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 |
| ***Calculated composition*** | | | | |
| % CP | 14.65 | 14.64 | 14.63 | 14.65 |
| ME (Kcal/Kg) | 2133 | 2133 | 2121 | 2117 |

**Nagge mix® dairy cattle: High potency vitamins and Trace minerals premix for dairy cattle at recommended rate of 2.5kg/ ton of feed contains= Vitamins A 6250000IU, D3 875000IU, E 6250mg, K3 625mg, B1 625mg, B2 625mg, Niacin 25000mg, B6 625mg, Choline chloride 12500mg, Calcium 172500, Cobalt 75mg, Copper 7600mg, Iodine 107mg, Iron 23750, Zinc 396000, Magnesium 375000mg, Mn 63000mg,Phosphorus 135000mg, Selenium 80mg, Antioxidants 3750mg.**

**Result and Discussion**

Table 2 presents the chemical composition and ME content of Gamba, GH and concentrate diets supplemented at various levels with GH. The crude protein value averaged 14.45-14.65% showed that the diets were isonitrogenous. Nonetheless, the mean CP concentrations of the four experimental diets were all higher than the minimum of 8% necessary to provide the minimum ammonia levels required by rumen microorganisms to support optimum activity (Norton, 2003). The CP values for Gamba hay and GH were 2.63 and 14.41%, respectively. The CP content of GH is higher than the range of 7.4 to 8.8 % reported by Ndlovu and Hove (1995); 8.6-9.1% (Etele and Dung, 2011). It was however comparable to the values of 13.5 % and 12.8 % reported by Nouala *et al*. (2006) and Asaolu *et al.* (2010). The CF value of 48.66% obtained in this study for GH was also at variance with the corresponding values of 39.5 % and 0.5 % reported by Ahmed and Pollot (1977). The observed variations in GH nutrient composition could have been due to non-uniformity in their harvesting and collection methods from one source to another, thus, making the use of quality as described by Leng (1990) in classifying groundnut hay to be location-dependent. NFE which represent the carbohydrate value of diet had the least NFE content at 75% (37.71%). At 0, 25 and 50% GH levels NFE values were similar (47.19, 47.42 and 45.88% respectively. The NDF and ADF contents were highest at 50% levels of GH (48.01 and 33.02) however, while ADF was lowest at 25%, NDF was lowest at 0% GH level in concentrate diet. The Metabolizable energy content expressed in Kcal/kg of diets decreased with increase in GH level from 0-75%. Gamba hay and GH had ME values of 2095 and 1752 kcal/kg, respectively.

**Table 2: Chemical composition and metabolizable energy of diets, supplemented with GH**

| | Graded levels of GH in concentrate mixed diets (%) | | | | | |
|---|---|---|---|---|---|---|
| **Nutrients** | **0** | **25** | **50** | **75** | **Gamba** | **GH** |
| DM | 85.79 | 93.81 | 90.98 | 92.29 | 94.23 | 95.16 |
| OM | 78.51 | 84.53 | 79.82 | 75.49 | 89.93 | 72.88 |
| CP | 14.65 | 14.48 | 14.63 | 14.45 | 2.63 | 14.41 |
| ASH | 7.28 | 9.28 | 11.16 | 16.82 | 4.3 | 12.28 |
| EE | 11.89 | 10.1 | 6.7 | 11.78 | 9.49 | 8.73 |
| CF | 18.99 | 18.81 | 21.63 | 19.24 | 50.04 | 48.66 |
| NFE | 47.19 | 47.42 | 45.88 | 37.71 | 34.92 | 16.51 |
| NDF | 41.48 | 45.58 | 48.01 | 47.09 | 83.64 | 53.78 |
| ADF | 30.11 | 29.8 | 33.02 | 30.58 | 61.61 | 47.09 |
| ME(kcal/Kg) | 3166 | 3022 | 2695 | 2619 | 2095 | 1752 |
| Hemicellulose | 11.47 | 15.78 | 14.99 | 16.51 | 22.03 | 6.69 |

**GB Hay= Gamba hay; GH=Groundnut haulms; ME= Metabolizable energy**

***Effect of diets on performance***

The DMI expressed in kg/h/d, kg/100kg body weight and g/kg $w^{0.75}$ is shown in Table 3. Result shows that varying the levels of GH in concentrate supplement significantly ($P<0.05$) increased DMI at 25%; although, this value was similar ($P>0.005$) to those at 0 and 50%. The non-significant ($P>0.05$) differences in DM intake levels of the animals on the three treatments (0, 25 and

50%) could be due to the fact that none of the three experimental feedstuffs suffered a nitrogen deficiency, with each of them containing greater than the critical CP level of 8% (Leng 1990). In diets with low-quality roughages, protein supplementation has been found to increase total DM intake (Church and Santos, 1981). Goodchild and McMeniman (1994) indicated that inclusion of 20 – 50% of plants rich in protein, in the diet results in 10 – 45% increase in intake of fibrous forage. At 75% DMI of concentrate in kg/h/d and kg/100kg body weight significantly declined. Although DMI in g/kgw$^{0.75}$ significantly declined too, when GH level in concentrate reached 75%, it was not significantly (P>0.05) different from DMI of heifers fed concentrate mixtures at 0 and 50%.

Result of initial weight gain, ADG, FCE and feed cost analysis is presented in Table 3. There was no significant (P>0.05) difference in the initial weight of Friesian x Bunaji heifers averaging 160.2-165.8 kg across treatment. The ADG averaged 0.51, 0.42, 0.3 and 0.3kg for 0, 25, 50 and 75% level of inclusion of GH in concentrate diet in this study were either above 0.11, 0.2 and 0.23 for heifers fed concentrate, GH silage and dried GH respectively reported by Bui Xuan An (1998); or similar to 0.30kg/day growth rate for tropical animals in the wet season (Denis *et al*., 1994). However, the body weight gains and the ADG of heifers fed concentrate mixture containing 0% GH were significantly (P< 0.05) higher than heifers fed concentrate diets containing GH. There was no significant (P>0.05) differences between heifers on 25% with those fed 50 and 75% GH in diets respectively. The significantly higher ADG of heifers fed concentrate mixture at 0% level of GH disagrees with the findings of Bui Xuan An (1998) who indicated that live weight gains of heifer supplemented with either ensiled or dried GH were higher than live weight gains of heifers supplemented with concentrate. Increasing GH level in concentrate to 75% depressed gain and ADG of heifers, these were not different significantly (P>0.05) from those fed GH at 25 and 50%. The significant declined in intake of concentrate mixtures at 75% level of GH could be responsible for the poor gain of heifers in addition to the increased CF, NDF, ADF in the diets at 50-75%. Heifers fed 0 and 25% groundnut haulms levels had similar feed to gain ratios (14.42 vs 13.46), but were significantly (P<0.05) lower than those fed 50 and 75% (18.84 vs 19.01) levels of groundnut haulms in concentrate diets. The significant improvement in feed: gain ratio at 25% level of groundnut haulm in concentrate diets meant that the ratio of absorbed amino acids to energy (VFA) available from digestion corresponded to the animal's requirements needed for efficient utilization of poor quality feed resources as in the control diet.

**Table 3: Effect of groundnut haulms supplementation on feed intake and weight gain of Friesian × Bunaji Heifers**

| | Levels of Groundnut haulms in concentrate diets (%) | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **0** | **25** | **50** | **75** | **SEM** | **LOS** |
| DMI (kg/d) | 4.99$^{a}$ | 5.09$^{a}$ | 4.54$^{ab}$ | 4.42$^{b}$ | 0.08 | * |
| DMI (g/kg W $^{0.75}$) | 88.61$^{ab}$ | 90.35$^{a}$ | 85.39$^{ab}$ | 83.82$^{b}$ | 0.82 | * |
| Initial Weight (kg) | 160.20 | 164.80 | 165.80 | 163.80 | 3.00 | ns |
| Final Weight (kg) | 216.60$^{a}$ | 211.40$^{a}$ | 200.00$^{b}$ | 197.20$^{b}$ | 3.53 | * |
| Total wt. Gain (kg) | 56.40$^{a}$ | 46.60$^{b}$ | 33.80$^{c}$ | 33.80$^{c}$ | 2.98 | * |
| A DG (kg/day) | 0.51$^{a}$ | 0.42$^{b}$ | 0.30$^{c}$ | 0.30$^{c}$ | 0.03 | * |
| Feed: gain ratio | 14.42$^{b}$ | 13.46$^{b}$ | 18.84$^{a}$ | 19.01$^{a}$ | 1.26 | * |

**Means within the same row bearing different superscripts differ significantly.**
**LOS= Level of significance * =P<0.05; ns = No Significance**

**Cost benefit analysis**

At the prevailing market prices at the time of study, result showed that feed cost in Naira per kg and total cost of feed intake in naira declined with increase in groundnut haulms levels from ? 31.35/kg to ? 27.01/kg and ? 102195.28 to ? 72441.88 respectively. Supplementation to provide essential nutrients has been found to be the most feasible, economic and preferred method of improving the utilization of poor quality forage materials by ruminant animals in the tropics (Preston and Leng, 1987; Poppi and McLennan, 1995). The feed cost to gain ratio was higher at 50% groundnut haulms level in concentrate (? 475.03) and lowest at 0% groundnut haulms (? 362.39/Kg live weight gain). The net benefits were ? 179804.72, ? 142419.82, ? 88720 and ? 96558.12 for feeding crossbred heifers on 0, 25, 50 and 75% groundnut haulm diets respectively. Net benefit declined across treatments with increased levels of groundnut haulms in concentrate diet up to 50%, although they remained positive indicating it was beneficial replacing concentrate diet with groundnut haulms. Ehoche *et al.* (2001) earlier reported that supplementation with either groundnut haulms or Lablab haulms improved income of smallholder dairy farmers. The net benefit of feeding groundnut haulms at 0% groundnut haulms (control) over 25% is ? 37384.9; 0% over 50% is ? 91084 and over 75% is ? 83246.60

**Table 4: Costs benefits of graded levels of groundnut haulms in concentrate diets fed to Friesian × Bunaji heifers**

| | Graded levels of groundnut haulms in concentrate diets (%) | | | | | |
|---|---|---|---|---|---|---|
| **Parameters** | **0** | **25** | **50** | **75** | **SEM** | **LOS** |
| Concentrate intake (kg) | 1,597[a] | 1,596.20[a] | 1,419.96[b] | 1,382.84[c] | 0.56 | * |
| Gamba intake (kg) | 1,663[a] | 1,440.8[b] | 1,374.24[c] | 1,299.16[d] | 8.54 | * |
| Total feed intake (kg) | 3260[a] | 3037[ab] | 2794.20[bc] | 2682[c] | 1.40 | * |
| Cost of Feed/kg (? -kg) | 31.35 | 29.83 | 28.73 | 27.01 | | |
| Cost of Concentrate intake (? ) | 49,281.25 | 44,736.54 | 36,554 | 31,104.97 | | |
| Cost of Gamba intake (? ) | 52913.64 | 45843.64 | 43725.82 | 41336.91 | | |
| Total Cost of feed intake (kg) | 102195.28 | 90580.18 | 80279.82 | 72441.88 | | |
| Total gain (kg) | 282[a] | 233[b] | 169[c] | 169[c] | 11.9 | |
| Value of gain (? ) | 282,000 | 233,000 | 169,000 | 169,000 | | |
| Cost of feed/kg gain (? -kg) | 362.39 | 388.75 | 475.03 | 428.65 | | |
| Net Benefit (? ) | 179804.72 | 142419.82 | 88720 | 96558.12 | | |

**Means within the same row bearing different superscripts differ significantly.**
**LOS= Level of significance * =P<0.05; ns = No Significance.**
**Lwt= Live weight,* =Naira; kg=kilogram**
**NB: Cost of feedstuff (-/ton): Groundnut Haulms = 15,000; Gamba Hay = 31,818.18; Cotton Seed Cake = 40,000; Wheat Bran = 25,000; Maize grain = 40,000; Bone meal = 13,000; Common salt = 25,000; Premix=750,000; Molasses 125,000.00; Cost of live weight/kg (₦/kg) = 1,000.00**

**Conclusions**

Feeding concentrate diet containing groundnut haulms at 25% improved dry matter intake and efficiency of concentrate utilization in Friesian x Bunaji heifers by 9.65%. To reduce cost of cattle feeds, increase the income of smallholder farmers, groundnut haulms could replace concentrate diets up to 50%.

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