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**Supplemental values of Poultry litter, *Leucaena leucocephala* and Groundnut haulms on growth, nutrient digestibility, and economy of Yankasa rams’ fattening.**

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**Abstract**

Fattening of sheep by small farm holders in Nigeria entails mainly feeding with crop byproducts. There is a need to evaluate other strategies such as incorporating leguminous crops and poultry wastes. Therefore, experiment to determine the growth performance, nutrient digestibility, and economic analysis of Yankasa rams fed a basal diet of *Panicum maximum* and groundnut haulms hay, with supplemental diets of dried poultry litter and *Leucaena leucocephala* leaf meal-based concentrates designated as T1, T2 and T3 was conducted.

The 12 weeks study involved fifteen (15) yearling yankasa rams with initial weights of 16-18.2 kg, randomly assigned in a completely randomized design of three treatments and five replicates. The result showed significant differences (p<0.05) among the means of total weight gain, average daily metabolic weight gain, and feed conversion ratio in T1 when compared to the other two treatments. Animals on T2 and T3 had statistically similar (p>0.05) values in total weight gain (5.33±0.2kg and 5.17±0.2kg), average metabolic weight gain (23.12 ±0.2gd-1 and 21.17±0.2gd-1) and feed conversion ratio (15.2±0.8 and 15.9±0.1). These values were significantly higher (p<0.05) than the values obtained for animals on T1(P<0.05). However, total feed intake in all the 3 treatments did not show any significant differences (p>0.05).

Animals on the groundnut haulms diet (T1) recorded significantly higher (p<0.05) cost of feed per kilogram weight gain than animals on T2 and T3 diets. Crude protein digestibility and CF in T2 and T3 were similar but significantly higher than the CP digestibility of T1(p<0.05). Supplementation of sheep diets with groundnut haulms hay or with dried poultry litter and *Leucaena leucocephala* leaf meal-based concentrate enhanced utilization and reduction in the cost of feed by sheep.

**Keywords**- Growth, Groundnut haulms, Poultry litter, Leucaena, Digestibility, Economic analysis.

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**Introduction**

Sheep production in southwestern Nigeria is centered on the West African Dwarf (WAD) breed. Even though Yankasa as a northern breed is not traditionally managed in this area, its seeming adaptability to the area and its bigger size compared with the traditional WAD, merits its fattening by smallholder farmers in southwestern Nigeria (Fasae *et al* .,2014)

Apart from supplying meat, sheep are important to the smallholders’ livelihood because it forms an integral part of the family unit as an asset and an emergency source of fund to meet financial needs. Sheep are also featured predominantly in the socio-cultural functions like ceremonies and religious feasts. Sheep and especially rams are favorite animals, during Muslim festivals of Id el-Kabir, because fattened rams command extremely high market prices during the festival. (Alfa *et al*., 2016)

Fattening has been defined as an intensive feeding of highly nutritious feed to promote fast growth and fat deposition to achieve desired carcass growth and quality (Alemu, 2007). The main aim of fattening is to achieve maximum growth and higher carcass in a short period with the intent to increase production per unit of land and the addition of value to the animal. Fattening can be applied to sheep because they can easily adapt to an intensive system of production under feedlots (Pasha, 2006).

Smallholder livestock fatteners/farmers especially in north and central states of Nigeria in an attempt to increase the live weight and quantity of meat in a relatively short time usually feed sheep with crop by-products and household wastes such as millet straw, cowpea hay and groundnut haulms (Ayantunde *et al*., 2008). Groundnut haulms are one of the cherished crop residues, tradable, and highly-priced in the fodder market because of its superior nutritional benefits than other by-products (Samireddypalle *et al*., 2017). But the sheep traders and butchers seem to be the only category of people who have better value addition from fattening because they have the resources to buy both sheep and feeds (Babale *et al*., 2018). This category of people fatten ram for the same reason that other men operate factories, mainly to make a profit by converting raw materials which are of low value in their natural form into a product for which there is a good demand and sell for better prices (Mbanasor, 2000)

Though sheep have a way of converting poor food into desirable products, the current traditional fattening practice by smallholder farmers make sheep offered for sale to have variable size, age, and body condition (Ayantunde *et al*., 2008). Besides, most of the crops by-products mentioned above are either in short supply or expensive in the southwest because of the cost of transportation (Adegun 2014). Because groundnut is not traditionally cultivated in southwestern Nigeria, so the haulms come at an increased cost in this area due to prohibitive transportation costs from north to southern Nigeria.

Different strategies are being designed for smallholder farmers in tropics to overcome feed problems. These include further processing of the highly lignified matured pasture and crop residue, supplementing the basal diet with leguminous plants and agro-industrial by-products, and /or production of multi-nutrient blocks (Bensalem and Smith, 2008; Adegun 2014; Adegun and Adelabu, 2016). Any strategy that must be adopted by the smallholder farmer needs to consider the cost. The high cost associated with the limited and seasonal supply of concentrates hampers their wide-scale use, especially by smallholder farmers, and as such, any strategy being considered for adoption by the livestock farmers must be relatively cheap while not compromising quality (Bello and Tsado, 2013).

Leguminous (herbaceous or tree) such as Leucaena leucocephala are widespread in the humid tropics and are cheap, readily available less competitive protein source for ruminants (Aye and Adegun 2013). By-product feeds such as poultry litter are other options in ruminant feeds. The high content of protein, energy, and minerals in poultry waste indicates its importance as a partial substitute for concentrates (Onimisi and Omage, 2006)).

Poultry litter is an agricultural waste from poultry farms. It is a non-conventional feed resource that can be incorporated into livestock feeds as a means of effective waste management and a low-cost protein source for animals. Studies show that it can be used as a protein supplement for ruminants. Sheep, being the most suitable ruminants for in vivo experiments, have been used in most studies involving the feeding of poultry waste (Onimisi and Omage, 2006; Agbor *et al*., 2013; Jokthan *et al*., 2013; Bello and Tsado, 2014). Sheep is an excellent converter not only of roughages but also of NPN sources. Poultry waste is utilized by sheep in the same manner as cattle, and because of their lower plane of nutrition, sheep can also utilize poultry manure of low quality with a higher portion of bedding, normally unsuitable for cattle under intensive feeding management (Tadele, 2015).

Trials on the response of ruminants to browse plants such as *Leucaena leucocephala* as good sources of quality food were conducted in the humid zone of West Africa. Animals’ responses to levels, times, and forms of browse plants compared with their utilization as mulch for crop production have been documented (Jabbar *et al.,* 1997). Results also indicate that at any level of supplement, sheep grew twice as fast as goats. The benefits of supplementation came through increased growth, survival, and economic considerations (Longo *et al*., 2008; Agbor *et al*., 2013).

Fattening must provide sheep with the ingredients it needs to live and function while meeting up with the required body weight with minimal cost and maximum profit. This study is undertaken to evaluate the growth, nutrient digestibility, and economic viability of feeding Yankasa rams with supplements containing *Leucaena leucocephala* and dried poultry manure as compared with groundnut haulms in southwestern Nigeria.

**Materials and Method**

**Experimental Site**

This study was carried out at the small ruminants’ section of the Teaching and Research Farm, Ekiti State University, Ado-Ekiti southwestern Nigeria. Ado-Ekiti lies between latitude 07º37’15’’ N and longitude 05º13’17’’ E, average humidity of 72%. It experiences a tropical with temperature ranges of 20ºC-28ºC and a bimodal rainfall distribution between April and October with peaks in June and September and a break in August. The dry season is between November and March. The average precipitation in this area is 1367mm. The experimental period was between April and July 2018.

**Experimental diet**

*Panicum maximum* was harvested in the university premises, wilted overnight, and fed as basal diet. Groundnut haulms were sourced from the ruminant market in Lokoja and fed to the animals on the basal diet. Two concentrate diets were formulated for this experiment. Concentrate 1 and Concentrate 2 varied with the inclusion of *Leucaena leucocephala* and dried poultry manure respectively as shown in Table 1. Poultry manure was collected at the teaching and research farm of Ekiti State University by spreading nylon under the layer’s battery cage overnight, sundried for 7 days, and stored in bags. *Leucaena leucocephala* leaves were harvested in the university premises sundried and milled into leaf meal. Other ingredients in the concentrate diets sourced from the local agro-allied shop in Ado Ekiti include maize, rice husk, groundnut cake, brewers’ dry grain, growers’ premix, and salt.

**Experimental animals and design**

Twelve (15) healthy yearling yankasa rams weighing 16 to 18.2kg were purchased from the ruminant market in Lokoja, Kogi State, a melting pot state between northern and southern Nigeria. The animals were tagged for easy identification purposes. The pen and equipment used for this experiment were thoroughly washed and disinfected to prevent any form of infection before the arrival of the animals. The animals were held in the quarantine unit for 30 days for acclimatization. Mandatory and prophylactic medications were given to animals during this period.

The preliminary feeding period lasted for 7 days during which the animals could adjust to the experimental diets before randomly assigning them to their various treatments**.** The animals were allotted to three (3) treatments with five (5) replicates in a completely randomized design which lasted for 84 days. A basal diet of 3% *Panicum maximum* was fed to the animals. Rams on treatment 1 were given 400g of groundnut haulms (GHH), treatment 2 were rams fed dried poultry manure-based supplements (DPL) while treatment 3 had rams fed *Leucaena leucocephala* based supplement (LLM). The concentrates were also fed at 400g per replicate. Clean and freshwater was given *adlibitum* throughout the experiment.

**Data collection**

During the twelve weeks of the feeding trial, weights of sheep were taken weekly with a weighing scale. The sheep were fed weighed amount of feed and leftovers were collected and weighed to determine the amount of feed consumed by the sheep. Growth performance indices were taken by calculating the feed intake, weight gain, and feed conversion ratio. At the end of the feeding trial, three rams were selected from each treatment based on the group average weight and weighed into the metabolic units. Each animal was individually confined in a wooden metabolic cage where the animal had free access to feed, freshwater.

The first two weeks (14 days) were used as the adjustment period designed to allow the sheep to adjust to the environment. Thereafter daily feed intake was measured by offering the experimental diets to each animal and the leftover was weighed. Each animal was weighed before the commencement and the end of the digestibility trial. During the last seven days, the total feed refused, faeces and urine were collected and measured.

The total faeces voided were collected and weighed and 10% aliquot samples were taken and oven-dried for 48 hours. Urine samples were frozen while the faecal samples were dried at 65oc to a constant weight, milled using the laboratory hammer mill, to pass through 2mm sieve and stored in airtight polythene bag till required for laboratory analysis. The milled samples were subjected to proximate analysis for dry matter (DM) crude protein (CP), ether extract (EE), crude fibre (CF), ash, nitrogen-free extract (NFE) as described by AOAC (2005). The milled faeces and aliquots of urine samples were then analyzed for nitrogen. The results obtained were used to determine the apparent digestibility of the diets. The economics of the feeds were calculated by summing up the cost of feeds per weight gain in all the treatments.

**Statistical analysis**

The data obtained were analyzed using analysis of variance (ANOVA), followed by Duncan’s multiple range comparison at a 5% level of significance (P < 0.05). The computer software used to analyze is SAS.

**Results**

The composition of groundnut haulms hay (GHH), dried poultry litter (DPL), and *Leucaena leucocephala* leaf meal (LLM)based supplementary diets are presented in Table 1. The results showed that GHH (treatment 1) used in the study had 12.68% of CP, 1940 Kcal kg-1- metabolizable energy and crude fibre of 22. 62%. Treatment 2 (DPL) and treatment 3 (LLM) based concentrate diets had crude protein contents of 13.46 and 13.72%, metabolizable energy values of 2,359, and 2,249 Kcal kg-1 while the CF was 20.10 and 15.46% respectively.

Table 1: Ingredients (%) And Calculated Composition of Diets Formulated

|  |  |
| --- | --- |
| Ingredients | Treatment |
|  1Groundnut haulms | 2Poultry manure | 3Leucaena leucocephala |
| Maize | -- | 30 | 30 |
| Rice Husk | -- | 10 | 10 |
| Groundnut cake | -- | 2 | 2 |
| BDG | -- | 20 | 20 |
| Ground Nut Haulms | 100 | -- | -- |
| *Leucaena leucocephala* | -- | -- | 36 |
| Dried poultry manure | -- | 36 | -- |
| Growers Premix | -- | 1.5 | 1.5 |
| Salt | -- | 0.5 | 0.5 |
| Total | 100 | 100 | 100 |
| **Calculated analysis** |  |  |  |
| Crude protein | 12.68 | 13.46 | 13.72 |
| Energy (kcalkg-1) | 1940 | 2359 | 2249 |
| Crude fiber (%) | 22.62 | 20.10 | 15.46 |

Table 2 shows the proximate composition of the test ingredients used in this study. The dry matter ranged from 95.30+2.4% in Pm to 97.20+1.2% in GHH. *Leucaena leucocephala* leaf meal (LLM) recorded the highest CP (21.62 +2.0%) and EE (7.80+0.6%) while GHH had the lowest value of 12.76+0.8 and 2.62+0.1% respectively. Crude fibre ranged from 12.50+1.4% in LLM to 23.75+1.0% in GHH. Ash content was increased in DPL (19.20+2.0%) while LLM recorded the lowest value of 10.20+0.4%. Nitrogen free extract were 48.05+2.0, 41.75+3.0 and 47.88+1.6% in GHH, DPL, and LLM, respectively. The metabolizable energy of the test ingredients ranged from 1960. 0+2.0kcalkg-1 in GHH to 2537.6+3.0 kcal kg-1 in LLM.

Table 3 shows the growth performance of yankasa rams fed groundnut haulms, poultry manure, and *Leucaena leucocephala* based supplements. There were no significant differences (p>0.05) in total feed intake (TFI) and average daily feed intakes (ADFI) in all the treatments. These values were 80.35±2.12kg, 83.93±1.12kg, and 78.51±1.02kg for T1, T2, and T3 respectively for TFI. The average daily intake ranged from 934.60+24.0gd-1 to 999.20+32.0gd-1 in T1 and T3. Significant differences (p<0.05) exist among the means of total weight gain (TWG), average daily weight gain (ADWG), average daily metabolic weight gain (ADMWG), and feed conversion ratio (FCR) in all the treatments. Animals on T2 and T3 had statistically similar (p>0.05) values in TWG (5.33±0.2kg and 5.17±0.2kg), ADMWG (23.12 ±0.2gd-1 and 21.17±0.2gd-1) and FCR (15.2±0.8 and 15.9±0.1). These values were significantly higher (p<0.05) than the values obtained for animals on T1 which were 3.96±0.2kg, 18.09±0.3gd-1, and 20.15±2.0 for TWG, ADMWG, and FCR, respectively. The result of ADWG showed significant differences (p<0.05) in all the treatments with animals on T2 (Pm) having the highest value of 65.87±3.0gd-1, followed by T3 (61.53±2.0gd-1) while T1 had the lowest ADWG of 47.45±4.0gd-1.

Table 2: Proximate Composition of Test Ingredients

|  |  |
| --- | --- |
| Parameters (%) | Ingredients |
|  Groundnut haulms | Poultry manure | *Leucaena leucocephala* |
| Dry matterCrude proteinCrude fibreEther extractAshNitrogen free extractEnergy kcalkg-1 | 97.20+1.212.76+0.823.75+1.02.62+0.112.82+0.648.05+2.01960. 0+2.0 | 95.30+2.415.72+2.020.52+2.22.80+0.219.20+2.041.75+3.01863.8+4.0 | 95.50+2.421.62+2.012.50+1.47.80+0.610.20+0.447.88+1.62537.6+3.0 |

Table 3. Growth Performance Of Yankasa And Balami Rams Fed Poultry Manure And Leucaena Leucocephala Based Supplements

|  |  |
| --- | --- |
| **Ingredients** | **Treatment** |
|  **1** | **2** | **3** |
| Total feed intake (g)Daily feed intake (g)Total weight gain (g)ADWG (g)ADMWG (g)Feed conversion ratio | 80345+0.0956+0.03956+0.0b47.45+0.0b18.09+0.0c20.15+0.0a | 83933+112.0999.20+32.05533+21.0a65.87+3.0a23.12+2.0a15.2+0.8b | 78507+102.0934.60+24.05167+24.0a61.53+2.0a21.97+2.0b15.9+1.0b |

Means with different superscripts a,b,c along the same row are significantly different.

ADWG – Average daily weight gain; ADMWG – Average daily metabolic weight gain

Table 4 depicts the economic analysis of yankasa rams fed groundnut haulms, poultry manure, and *Leucaena leucocephala* based supplements. There were significant differences (p<0.05) in the cost of feeds per kilogram, live weight gain, and cost of feed per live weight gain in all the treatments. The cost of feeds per kilogram was statistically similar in T2 (N48.60kg-1) and T3 (N50.80kg-1) but higher than that of T1 (N43.80kg-1). Animals on the groundnut haulms diet (T1) recorded significantly lower (p<0.05) live weight gain of 3.96kg and significantly higher (p<0.05) cost of feed per kilogram weight gain of N393.76±15.0 kg- than animals on T2 and T3 diets). There were no significant differences (p>0.05) in the mean values of live weight gains (5.53kg and 5.16kg) and cost of feed per kilogram live weight gain (N295±3.0 kg- and N309 ±3.0 kg-) in animals fed T2 and T3 respectively. The total feed consumed (35.60±2.8kg, 33.57±5.13kg, and 31.40±3.65 kg) and the cost of feeding per ram (N1,559±28.0, N1,631±12.0, and N1,595±12.0) in T1, T2, and T3 respectively did not show any significant differences (p>0.05).

Table 5 shows the nutrient digestibility of yankasa rams fed groundnut haulms or dried poultry manure and *Leucaena leucocephala* based supplemental diets. There were no significant differences (p>0.05) among the DM digestibility in all the treatments. The values were 82.08+3.0, 76.02+2.0, and 77.50+2.2% in T1, T2, and T3, respectively. Crude protein digestibility in T2 and T3 were similar (62.20+1.6% and 64.80+2.0%) but increased significantly (p<0.05) than the CP digestibility of T1 (58.68+2.0). The digestibility of CF also followed the same order with animals on T1 having a significantly lower (p<0.05) value of 60.62+1.6% than animals on T2 (72.06+2.5%) and T3 (70.88+2.7%). Significant differences (p<0.05) exist in EE digestibility across the treatments. Leucaena based supplement (T3) recorded the highest EE digestibility (75.77+2.8%), followed by T1 (69.82+3.2) with animals on T2 recording the lowest EE digestibility of 65.53+3.0%. The utilization of ash and NFE was comparable among the dietary treatments. Digestibility of ash were 70.02+2.0, 74.026+2.7 and 72.20+2.1% in T1, T2 and T3 respectively while for NFE 60.20 +0.8, 58.9 and+0.7, 59.6% +1.3 % were recorded for T1, T2 and T3 respectively

Table 4. Economic Analysis Of Yankasa And Balami Rams Fed Poultry Manure And Leucaena Leucocephala Based Supplement

|  |  |
| --- | --- |
| **Ingredients** | **Treatment** |
|  **1** | **2** | **3** |
| Cost/kg feed ( N)Total feed consumed (kg)Cost of feeding ( N /ram)Live weight gain (kg)Cost of feed/weight gain ( Nkg-1) | 43.80+0.035.60+2.810599+283.96+0.02b393.76+0.0a | 48.60+0.033.57+5.11,631+ 12.05.53+2.1 a295+3.00b | 50.80 +0.031.40+365.41,595+12.05.16+2.4 a309+3.0b |

Means with different superscripts a,b, along the same row are significantly different.

Table 5. Apparent Digestibility (%) of Yankasa Rams fed Groundnut Haulms or Poultry Manure and Leucaena-based Supplemental Diets.

|  |  |
| --- | --- |
| **Ingredients** | **Treatment** |
|  **1** | **2** | **3** |
| Dry Matter Crude ProteinAshEther ExtractCFNFE | 82.02+3.058.68+2.0b70.02+2.069.82+3.2b60.62+1.6b60.20+0.8 | 76.02c+2.062.20+1.6a74.02+2.765.53+3.0b72.06+2.5a58.90+0.7 | 77.50c+2.264.80+2.0a72.20+2.175.77+2.8a70.88+2.7a59.60+1.2 |

Means with different superscripts a,b, along the same row are significantly different.

**Discussion**

The result of the CP of DPL used in this study was like the CP of 15.4% reported by Lanyasunya *et al*. (2006) but lower than 21.88% by Bello and Tsado (2013). This could be due to the nature of bedding, age of bedding, processing, type of bird, level of feeding, presence of feather in the droppings used (Ogunsipe, 2014). The CP of GHH used in this study is lower than for 14.4% and 14.12% reported by Tekle and Gebre (2018) and Nuwan (2015). The CP of LLM used in this study is like 21.88% reported by Adedeji *et al.* (2013) but lower than 33% for LLM dried for 72 hours by Agbo *et al.* (2012). Lower NFE of 33.67% was observed for LLM (Agbo et al., 2012). The differences in the proximate analysis could be due to the age of plant and processing methods.

The resultof the chemical composition of the basal and supplemental diets used in this study revealed that groundnut haulms, dried poultry manure, and *Leucaena leucocephala* based concentrate have crude protein values above 7% which is the optimum value for microbial growth in the rumen. These values were also adequate for the 10 to 12% CP recommended for growing sheep and goats (Gatemby, 2002). The CP of GHH is like the CP of the 2 concentrate diets but the energy is probably reduced in GHH due to other ingredients included in the concentrate diets. The intake of poultry manure-based diet obtained in this result was slightly higher to the value reported by Hadjipanayiotou *et al.,* (1993) who also compared Poultry manure to other diets. The slightly lower but insignificant response of yankasa rams to Leucaena based supplements compared to DPL in terms of intake may be due to palatability problems, presence of the toxic amino acid mimosine and its breakdown products and lignification which may affect both intake, digestibility, and growth (Kayouli *et al* 1993; Agbor *et al*., 2013). The significant increase in weight in T3 over T1 could be due to the condensed tannin in LLM, which may have promoted higher protein escape due to tannin binding at the rumen that protects the protein from excessive microbial degradation and make them more available posterior to the site of absorption (Longo *et al.,* 2008). The significant weight gain T2 compared with T1 could also be because of urea present in DPM. It is high in urea, a source of nitrogen, which improves the rumen environment making the feed more efficiently utilized and the animal better nourished with whatever feed that is made available. Uric acid present in DPL is also a major component of poultry excretions that can be efficiently utilized by rumen microbes for protein production. It is not easily dissolved in the rumen fluid and so the ammonia that is gradually and slowly released is efficiently utilized even more than other non-protein nitrogenous feed sources (Adegbola *et al*., 2010). Agbor *et al*. (2013) also recorded the highest intake of DPM compared with LLM when WAD goats were fed with these feed ingredients, but higher weight gain was obtained with LLM based diet compared with DPM in their trial. The work of Jokthan *et al*. (2013) revealed that 30% of broiler litter improved weight gain and feed cost in yankasa rams with CP and EE digestibility of 62.09 and 69.44%. However, the positive growth rate in all the treatment groups is in line with the need for supplementation of ruminants' diet with fodder crops and agro-industrial waste as a panacea for improved productivity of ruminants especially during the dry season (Lamidi and Ologbose 2014; Adegun, 2014). This result implies that the protein and energy levels of the feeds in all the treatment groups were above the maintenance level. The result obtained in this study from T1 confirms that GHH supplementation support moderate live weight and has a positive linear effect on DM, fibre digestibility, live weight gain, and feed conversion efficiency (Abdou *et al*., 2014; Addah *et al.,* 2019). The similar feed intake in the basal diet and the concentrate diets of T2 and T3 despite the lower weight gain in T1 could be because energy concentration is being compensated for in T1 (Bello and Tsado 2013). Higher CP digestibility in DPL and LLM based treatments could be due to the presence of NPN present in DPM and bypass protein present in LL. Reduced CP digestibility in groundnut haulms could be due to a decrease in caloric density of the diet coupled with increased dietary fibre in the diet (Bawa *et al* ., 2008). The result obtained in this study aligns with the one obtained by Agbor *et al*. (2013) that dry matter digestibility of CP and CF of the concentrate group was significantly higher than that of the control.

The reduction in the cost of feed per weight gain in rams fed DPM (T2) is in line with the result obtained by Mahmoud (2004) who reported reduced feeding costs when DPM was used as supplements in all trials involving Sudanese desert sheep. The reduced cost of feeding at positive weight gain supports the findings of other authors that the use of non-conventional feed sources such as DPM and LLM minimize feed costs and maximize productivity (Amata, 2014; Beigh *et* *al*., 2017). The increased cost of feed per weight gain in animals on T1 diet is as a result of the lower growth rate of the animals compared with those on concentrate diets and the high cost incurred in the purchase of groundnut haulms coupled with a transportation cost of the byproduct from the market to the farm.

**Conclusion**

This study shows that groundnut haulms hay and *Leucaena leucocephala* meal or dry poultry litter (DPL) based concentrates have similar nutritive values. These nonconventional feeds improved sheep performance and are potential sources of readily available energy and protein which would fill the gap in feed available to ruminant during the dry season. However, rams DPL and LLM based supplements had better weight gain, feed conversion, and feed cost per weight gain than those fed GHH. Supplementation with DPL or LLM enhanced utilization and reduced feed cost and can be used at 36% in concentrate diets for sheep fattening.

**References**

Abdou N, Nsahlai I. V, and Chimonyo M. (2011). Effects of groundnut haulms supplementation on maize stover intake, digestibility, and growth performance of lambs. Animal Feed Science and Technology. 169(3-4): 176-184.

Addah, W., Ayantunde, A., Larbi, A. and McAllister, T.A. (2019). Nutritional value of peanut haulm: effects on digestibility and on growth performance of sheep fed peanut hay or silage. Paper presented at the Seventh All Africa Conference on Animal Agriculture, Accra, Ghana, 29 July-2 August 2019.

Adedeji O S, Amao S R, Ameen S A, Adedeji T A, and Ayandiran T A. (2013). Effects of varying levels of *Leucaena leucocephala* leaf meal diet on the growth performance of weaner rabbits. Journal of Env. Issues and Agriculture in Developing Countries. 5: 5-9.

Adegbola, A.A., Smith, O.B. and Okeudo, N.J. (2010). Response of West African dwarf sheep fed cassava peel and poultry manure-based diets, FAO Corporate Document Repository produced by ILRI. pp. 1–8.

Adegun M K and Adelabu D B (2016). Effects of graded levels of Gmelina arborea and brewers dried grains on growth and haematology of West African Dwarf rams. Asian Journalof Anim. and Vet. Advances. 11. 725-731

Adegun M K. (2014). Voluntary Feed Intake and Nutrient Utilization of West African Dwarf Sheep Fed Supplements of Moringa oleifera and Gliricidia sepium Fodders, *American Journal of Agriculture and Forestry*. 2(3): 94-99.

Agbo A N, Balogun J K, Omale S J and Auta J. (2012). Effect of different processing methods on nutritional composition of *Leucaena leucocephala* (Lam de wit) leaves as inclusion in fish feed. Journal of Applied Science and Envtal. Management. 21(7): 719-725.

Agbor, E.B., Ndamukong, K.J.N. & Pamo, E.T (2013). *Leucaena* and dried poultry waste improve the performance of West African Dwarf sheep on a grass diet. *Trop Anim Health Prod* **45,**1025–1029. <https://doi.org/10.1007/s11250-012-0327-6>

Alemu, Y (2007). Short Term Intensive Fattening of Sheep and Goats for Rapid Improvement in Weight and Condition and Also Producer Incomes. ESGPIP Technical Bulletin 11. Addis Ababa: ESGPIP. <http://www.esgpip.org/PDF/Technical%20bulletin%20No11.htmlLimited>.

Alfa M, Aliyu U, Eze J N, Jiya E Z., and Mohammed I G. (2016). Performance of young sheep fed maize bran and groundnut hay supplemented with sodium chloride. International Letters of Natural Sciences., 60: 52-58.

Amata I. A. (2014). The use of non-conventional feed resources for livestock feeding in the tropics: A review. Jour. Of Global Biosciences 3(2): 604-613.

AOAC; Official Method of Analysis, 18th Ed. Association of Official Analytical Chemists, Washington DC, 2005.

Ayantunde A. A., Fernandez-Rivera S., and Dan-Gomma A. (2008). Sheep Fattening with Groundnut Haulms and Millet bran in the West African Sahel Sheep, Animal nutrition 2(5): 21-45.

Aye P A and Adegun M K (2013). Chemical composition and some functional properties of *Moringa oleifera, Leucaena leucocephala and Gliricidia sepium* leaf meals. Agric. And Biology Journal of North America. 4: 71-77.

Babale.D.M, A. Aliyu, Dazala I.U, and Wazamda.E.A. (2018). Introduction of Agricultural Crop Residues ss Supplement for Goats Fattening among Animal Rearers in Gipalma Mubi-South, Adamawa State. *International Journal of Research - Granthaalayah*, 6(6), 49-66. <https://doi.org/10.5281/zenodo.1299939>

Bawa G S, Ajide, S O, Adeyinka I A, and Ajala M K. (2008). Effects of Varying Levels of Groundnut Haulms and Cowpea Shells on Performance of Weaner Rabbits. *Asian Journal of Animal and Veterinary Advances, 3: 54-61.*

Beigh Y. A., Ganai A. M, and A. A Ataider. (2017). Prospects of complete feed system in ruminant feeding: A review. Vet. World. 10(4): 424 – 437.

Bello AA, Tsado DN (2013). Feed intake and nutrient digestibility of growing Yankasa rams fed sorghum stover supplemented with graded levels of dried poultry droppings-based diets. Asian Journal of Animal Science 7:56-63.

Bensalem, H., Smith, T. (2008). Feeding strategy to increase small ruminant production in dry environment. Small ruminant research. 77 (2-3): 174-194.

Fasae O A, Oduguwa B O, Adejumo C A, Makinde T E, Sanwo K A (2014). Carcass and meat characteristics of traditionally managed yankasa and West African Dwarf breeds of sheep. Pertanika Journal of Tropical Agriculture. 37(1): 101-108

Gatemby R. M. (2002). Sheep. Revised Edition. Tropical Agriculture Series. Macmillan Publishers Limited. 8-9.

Hadjipanayiotou, M.; Labban, L. M.; Abd El Rahman, Kronfoleh; Verhaeghe, L.; Naigm, T.; Al Wadi, M.; Amin, M., 1993. Studies on the use of dried poultry manure in ruminant diets in Syria. Livest. Res. Rural Dev., 5 (1): 39-45.

Jabbar M. A. (1997). Nutritional and economic benefits of Leucaena and Gliricidia as feed supplements for small ruminants in humid West Africa. Tropical Anim. Health Prod. 29(1): 35-47. Livestock Res. Rur. Dev. 18 (11): 5

Jokthan G E, Muhammed S A, and Osuhur C U (2013). Effect of cotton seed cake replacement with broiler litter on performance of yankasa rams fed maize husk basal diets. FUTA Journal of Researches in Sciences. 9(1); 147-155

Kayouli, C., Demeyer, D., & Accacha, M. (1993). Evaluation of poultry litter and olive cakes as an alternative feed for ruminant production in Tunisia. p. 420-440, in: Proc. Intl. Conf. on Increasing Livestock Production through Utilisation of Local Resources. Beijing, China, 18-22 October 1993.

Lamidi A. A and F. I. Ologbose. (2014). Dry season feeds and feeding: A threat to sustainable ruminant animal production in Nigeria. Journal of Agric. And Soc. Res. 14(11): 17-30.

Lanyasunya T, Rong W, Abdulrazak S, Kaburu A K, Makori J O, and Mwangi D M (2006). Factors limiting use of poultry manure as a protein supplement for dairy cattle in small holder farms in Kenya. Int. Journal of Poultry Sciences. 5(1): 75-80.

Longo C, Nozella E F, Cabral Filho S L S, Lavorenti N, Vitti D M S S and Abdalla A L. (2008). Voluntary intake, apparent digestibility and nitrogen balance by sheep supplemented with Leucaena leucocephala. Volume 20, Article #184. Retrieved July 30, 2019, from <http://www.lrrd.org/lrrd20/11/long20184.htm>

Mahmoud N S E. (2004). The use of sundried poultry litter in diets for fattening desert sheep. A Master’s thesis submitted to the Department of Animal Science, University of Khartoum, Sudan. 57 pages.

Mbanasor, J.A. (2000). “The future of livestock in Nigeria” in:Ukachukwu, S.N., Ibeawuchi, J.A., Ibe, S.N, Ezekwe, A.G.and Abasiekong S.F. (eds.). Animal Production in the New Millennium Challenges and Options, 8-16. Proceedings of the25th Animal Conference held at the Michael Okpara University of Agriculture Umudike, Nigeria, March 2000.Pg 58

Nuwam J (2015). Comparative study on the utilization of groundnut haulms and cowpea husks by lactating red sokoto does fed *Digitaria smutsii* basal diet. A thesis submitted to the School of Postgraduate Studies, Ahmadu Bello University, Zaria in partial fulfillment of the requirements for the award of a master’s degree in animal science.

Ogunsipe M H. (2014). Effect of poultry litter with or without enzyme supplementation on the growth performance, nutritional digestibility, and economics of rabbit production. International Journal of Livestock Production. 5(2): 23-29.

Onimisi P A and Omage J J. (2006).Evaluation of poultry litter as feedstuff for growing rabbits. Livestock Research for Rural Development.18(11): 5-10.

Pasha, T. (2006). Feedlot fattening of sheep and goats for quality mutton production. Islamabad: Livestock and Dairy Development Board.www.iddb.org.pk/forms/SHEEP BOOK.pdf.

Samireddypalle, A., Boukar, O., Grings, E., Fatokun, C. A., Kodukula, P., Devulapalli, R., Okike, I., and Blümmel, M. (2017). Cowpea and Groundnut Haulms Fodder Trading and Its Lessons for Multidimensional Cowpea Improvement for Mixed Crop Livestock Systems in West Africa. *Frontiers in plant science*, *8*, 30. https://doi.org/10.3389/fpls.2017.00030

Tadele Y (2015). utilization of farm animal organic waste as feeds for livestock and poultry. Advances in life science andTechnoogyvol 32; 73-83

Tekle D and Gebru G. (2018):The effect of haulms of groundnut and cowpea supplementations on growth performance of Abergelle goats. Livestock Research for Rural Development. Volume 30, Article #50. Retrieved Jan 2, 2020, from <http://www.lrrd.org/lrrd30/3/dest30050.html>

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