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Effect of Supplementation with Concentrate and Groundnut Haulm in Diets on Milk Yield of Dairy Azawak Cows

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Abstract
An experiment was carried out to determine the effect of feeding diet containing concentrate and graded level of groundnut haulms (GH) on the milk yield of Azawak cattle. Five concentrate-groundnut mixed diets were formulated to contain on average 15% crude protein. The ratio concentrate to groundnut was 100:0; 67:33, 50; 50, 33:67 and 0:100 respectively. Twenty Azawak multiparous lactating cow aged 5-6 years and averagely weighing 317-320 kg were randomly divided into five groups of four animals each and were allotted to the five experimental diets in a randomized complete block design. Data were collected for Dry Matter Intake (DMI), Average Daily Intake (ADI), Average Daily Weight Gain (ADWG), Total Milk Yield, Average Milk yield and Feed conversion efficiency in milk (FCEM) throughout the three months experimental period. Results indicated that the average daily weight gain was higher on diet containing 50% inclusion of groundnut haulm in concentrate diet fed to Azawak cattle. The DMI by cattle was significantly ($P<0.05$) higher on diet containing 67 and 100% groundnut haulm. The ADWG of lactating cows fed concentrate mixture was significantly higher on diet containing 33 and 50% inclusion levels but the feed conversion ratio was significantly higher at 50% level of groundnut haulm inclusion level. The total milk yield, average daily milk yield, the body score condition and the feed conversion efficiency in milk were not affected by the level of Groundnut haulms in the concentrate diets, but the highest values of these parameters were obtained at 50% inclusion level. It can be recommended that concentrate diet for Azawak cattle should be supplemented with 50% legume haulm for, better body score condition, feed conversion, feed conversion efficiency of milk and enhanced milk production during the long dry season.

Keywords: Groundnut haulm, Sorghum Straw, Feed intake, weight gain, Milk yield, Lactating cows

Introduction

In Niger Republic, livestock production is carried out by 87% of the population either as a primary activity or as a secondary activity often associated with agriculture and trading (Ministère de l'Elevage et des Industries Animales, 2012). The country has a huge and diversified livestock population composed of large ruminants (Cattle and Camels), small ruminants (Sheep and Goat) as well as non-ruminants animals such as Equine Donkey well adapted to the arid environment (Recensement General de l'Agriculture et du Cheptel, 2008). The estimated livestock population in 2018 was 14,363,595 Cattle, 12,746,788 Sheep, 17,411,65goatsat, 1,811,395 camels, 253,189 horses, and 1,874,178 million donkeys representing 18,998,658 Tropical Livestock Unit (TLU)

(National Institute of Statistic INS, (2013),. With 21% of the national livestock population, Tahoua State is the second-ranked livestock population after Zinder State out of which Cattle represent 22.5%, Sheep 30.9%, Goats 32.6%, Camels 7.52%, Equine 0.45%, and Donkeys 5.91%(Recensement General de l'Agriculture et du Cheptel, 2008).

The disaggregation of the livestock population revealed the predominance of small ruminant accounting for 63.64% of the state animal population and was occasioned by the repetitive drought, the traditional ways of livestock reconstitution and the national livestock reconstitution policy undertaken after heavy animal loss from the big droughts of 1974-1975 and 1983-1984 which gave more preference to small ruminants (high prolificacy) than Cattle highly sensible to drought. The dominant animal husbandry systems are agro pastoral system, Nomadic system and transhumant pastoral system representing respectively 66%, 18%, and 16% of the national livestock population (RGAC, 2008).

The contribution of the livestock sector to the household income, and household budget for food security is estimated respectively at 15% and 25%. It constitutes the second source of Niger export revenue with 22% contribution to the total export value (MEIA, 2012.), and 10% to the national Gross Domestic Product (GDP) while the entire Agricultural Gross Domestic Product (GDP) was 30% in 2017 (Institut National de la Statistique INS, 2018). In addition livestock provide traction to cultivate fields, manure to improve soil fertility and nutritious food products meat and milk) for human consumption, and income generation(Sere *et al.,* 2008, (Adamu, 2021).

Despite the large size of the livestock population, its economic importance and other advantages, the livestock sector is facing some challenges, mainly natural and human activities (degradation of natural resources as a result of both hydric and wind erosions, desertification, high cost of livestock veterinary drugs and feeds, non-rational distribution of boreholes and surface water across the pastoral zone to enable full exploitation of pasture especially during dry season when natural pastures are scarce, demographic pressure on the grazing land, and livestock corridors) which consequences include severe loss of vegetation cover, above ground plant productivity, soil erosion, elimination of soil seed bank, shift in species composition and conflict between farmers and pastoralists (RGAC, 2008; Bonnet, 2012 ; Ahmad *et al*., 2012).

The main feed resources for grazing ruminants are natural pastures and crops residues or fibrous by-products of crop cultivation (Amole, Augustine, Adesogoan & Balehegn, 2022) well distributed across the agro-ecological zones of Tahoua State and across seasons in terms of type, quantity, and quality. The major constraint of ruminant production is the marked variation in their availability, very poor quality and seasonal shortage or fluctuations (Khan *et al.*, 2009), Millam, 2016; FAO, 2012; Amole & Ayantunde, 2016; Amole *et al*., 2022). Feed therefore is the limiting problem to livestock production and productivity in the arid and semi arid zone where livestock nutrition is essentially based on the exploitation naturally occurring herbaceous grasses and dicotyledonous species, ligneous plants and crop residues with less or no supplementation (Samiredypalle *et al.*, 2014; Iinternational Fund for Agricultural Development IFAD 2015; Amole & Ayantunde, 2016). Protein, energy and minerals are therefore the most critical nutrients affecting milk and beef production in the semi-arid areas (Olawuye & Etuk, 2015; Kubkomawa, 2017).

Many researchers have directed their efforts toward the use of non-conventional feed source to overcome high production cost problem, quantity, quality of feed stuff for ruminants such as crop residues for use as livestock feeds., and at the same time ensuring the preservation of animal health, production yield and product quality (Aruwayo *et al.,* 2011; Millam, 2016). Another reason for the use of non-conventional feeds is the competitive demand for these conventional feed resources as food between livestock and man on one hand and between monogastric animals and ruminants on the other hand which limits the quantity of these conventional feeds available for ruminant feeding.

In recent years, the use of forage legumes in ruminants livestock production systems in the tropics as alternative to oil seed cakes has increased(Finangwai, Ehoche, Jokthan & Barje, 2018) in order to provide high quality proteins as well as digestible cell wall carbohydrate. Groundnut (*Arachis hypogaea*) is an important legume

crop grown for seed and forage in smallholder crop livestock farming systems in West Africa (Oloranju *et al*., 1996). The haulms after pod harvesting is fed to ruminants, mostly during the dry season and its supplementaion contributes fermentable energy to the rumen in the form of available cellulose and hemi cellulose which stimulate fibre digestion (Silva & Orskov 1988). Despite their availability in large quantities, they are high in ligno cellulose and low in readily available carbohydrate and nitrogen (Leng, 1990) and their utilization depends largely on their nutritive values, method of processing, feeding strategies and eating behaviour of the animal.

In Niger, groundnut is the second most important legume crop after cowpea (*Vigna unguiculata* L. Walp) (Hampson *et al*., 2001) and there is need to improve its production in terms of seed and forage, storage, and value addition through processing.(Ousmane *et al*., 2019). The production yearly production of the crop is about 453,577 tons per year (Food and Agricultural Organization FAO, 2016), and Niger is ranked 7th among the major groundnut producers in Africa after Nigeria, Sudan, Chad, Cameroon, Senegal, and Tanzania.

The study area is characterized by a long dry season of 9 months often marked by serious feed scarcity for maintaining milk production, the chief food of pastoralist. The maintenance of animal performance particularly milk is much more dependent on the quantity and quality of feed eaten rather than on the genetic make up of the animal (Khan *et al.*, 2009). Therefore to overcome the shortages and seasonal fluctuation in terms of quantity and quality of feeding maerials there is need to search for better methods and optimal level of utilization of stored available crop residues. The present study therefore was designed to substitute graded levels groundnut haulms in the concentrate diet of lactating cows as feeding strategies and to assess the eating behaviour of the animal, the growth performance and the milk yield.

Materials And Methods

The Study Location

The study was conducted in the Secondary Livestock Multiplication or Breeding Centre of Ibecetan (SLMCI). The SLMCI is located between 5.78° and 6.04° East longitude and 15.26° and 15.52° North latitude in the middle of the pastoral zone (Repertoire National des Localités RENALOC, 2012). The Ibecetan Center is a livestock selection/breeding center of the dominant breed of the area (FAO, 2002) and was created in 1975, after the big drought of 1972-1973 the country faced during which Niger republic lost 47% of its Cattle population, 36% of Sheep herd, 15% for Goat and Donkey, 12% Equine and 17% Camels. The SLMCI (Figure 1) has a perimeter of 84.5 km and an area of 42,065 ha.

The climate is a Sahelo-Saharan type an average rainfall of 318.6 mm in 201. Three main types of soil are encountered and include sandy and sandy-loamy soils at the level of dune formations; Clay to clay-loamy soils in the valleys and lowlands and lastly Glacis and rocky soils on the slopes of the hills (PDC, 2018).
The vegetation is steppe type, and the main herbaceous species encountered were: Cenchrus biflorus, *Dactyloctenium aegyptium, Cenchrus preurii, Aristida mutabilis, Alysicarpus ovalifolius, Zornia glochidiata, Eragrostis tremula and Tribulus terrestris*. As for woody species, there are *Balanites aegyptiaca, Ziziphus mauritiana, Maerua crassifolia, Sclerocarya birrea, Acacia seyal, Acacia nilotica, Acacia senegal, Calotropis procera, Bauhinia rufescens* and *Boscia senegalensis (*PDC, 2018).

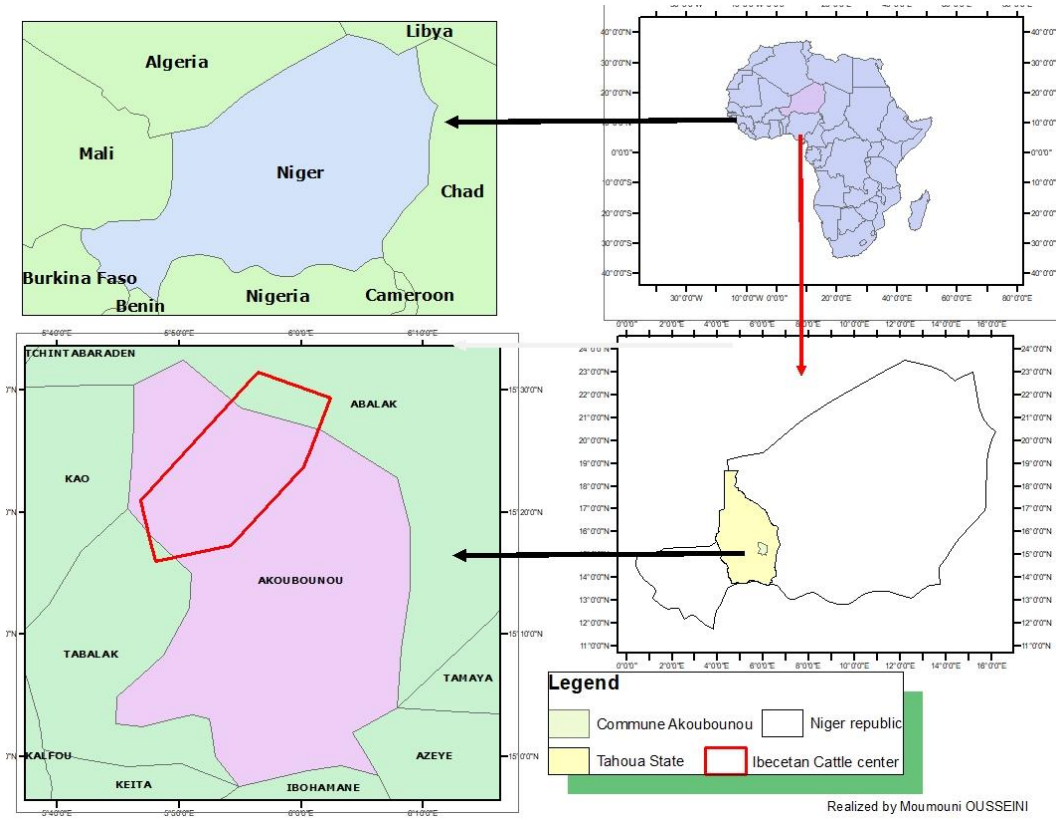

Figure1.Localisation of the Study Area.

Methodology

A basal concentrate mixture consisting of Sorghum grain, Wheat offal, cottonseed cake, Bone meal, Di-calcium Phosphate, and common was formulated to contain 15% crude protein. Intromin a mineral lick block of 10*2 kg ad libitum through oral administration was provided to the animal throughout the experimentation. The Intromin mineral lick bloc is composed of Vitamin A: 100 000 U, Vitamin D3:20 000UI, Vitamin E: 40UI, Sodium (Na):380g, Magnesium (mg):5 000mg, iron (Fe):2000mg, Cobalt (Co):50mg, Iodine (I): 50mg, Manganese (Mn): 2000mg, Zinc (Zn):1000mg, Selenium (Se):10mg. The GH replaced the basal concentrate mixture at 0, 33.0, 50.0, 67.0 and 100.0% levels (T1-T5) levels. Twenty Azawak multiparous cow aged 5-6 years and averagely weighing 317-320 kg were randomly divided into five groups of four animals each and were allotted to the five experimental diets in a randomized complete block design. During the trial, the lactating cows were fed sorghum straw ad libitum. Experimental animals were kept in individual pens and fed their respective diets for 120 days and only left pens for drinking water, during milking and on weighing days. The cows were fed individually in the mornings and afternoons. Feed was analyzed for proximate sample (AOAC, 2016), and cell wall constituents (Van Sorest and Roberson, 1985). Data collected were analyzed using the least square method of SAS (2004) package. The differences between means were separated using Least Significant Difference LSD.

Table 1: Crude protein and Energy values of concentrate feed.

Ingredients	Level of inclusion (kg)	CP %	Metabolizable Energy Kcal
Sorghum grain	32.12	3.5	1026
Wheat offal	47.53	11.88	1019.77
Cotton seed cake	15.84	2.69	296
Bone meal	2.5		
Di-calcium Phosphate	2.5		
Salt	0.5		
Total	99.98	18.07	2341.98

The Unit contains/kg of the Intromin mineral lick bloc contained the following ingredients. Vitamin A: 100 000 U, Vitamin D3:20 000UI, Vitamin E: 40UI, Sodium (Na):380g, Magnesium (mg):5 000mg, iron (Fe):2000mg, Cobalt (Co):50mg, Iodine (I): 50mg, Manganese (Mn): 2000mg, Zinc (Zn):1000mg, Selenium (Se):10mg.

Results

Chemical Composition of The Experimental Diets and Sorghum Straw

Results of the chemical composition of the experimental diets fed to the lactating Azawak breed and that of sorghum straw are shown in Table 2. The variables DM, Ash, CP, CF, EE, ADF, NDF, NFE and Lignin of sorghum straw were 91.06, 4.66, 12.21, 12.66, 2.05, 25.66, 45.55, 78.60 and 11.61% respectively. The results revealed that there was a significant difference ($P<0.05$) among the experimental diets for the parameters evaluated with exception of CP and Ash.

The Dry matter content values range from 87.2 to 90.19%. The highest value was recorded in diets containing 100% groundnut haulm whereas, the least value was recorded in treatment containing 33% level of groundnut haulms. The values ranged for (CP) was 14.75% -15.89%, (CF) 11.76% - 17.64%, (EE) 2.02% -2.20%, (Ash) 7.43% - 9.17%, (NFE) 57.37%- 64.54%, (AD) 25.64% - 29.14%, (NDF) 38.83% - 47.81%, and (Lignin) 9.92% - 12.66%. Dietary treatments with 33% level of groundnut haulm (GH) substitution had the highest CP among the treatments and the lowest was noticed for treatment one (1) containing 0% level of substitution or control treatment.

Control diet containing 0% level of GH had the highest CF values and the lowest value was obtained in treatment five with 67% groundnut inclusion level. The CF was statistically ($P<0.05$) higher in T1 (17.64%) containing no groundnut haulm whereas T4 (11.76%) containing 67% GH registered the least value.

ADF was greater ($P<0.05$) in treatments T1 (27.86%) containing 0% groundnut haulms and T4 containing 67% groundnut haulm while NDF was observed to be greater in T2 (47.81%) containing 33% groundnut haulms. Nitrogen Free Extract was significantly greater (($P<0.05$) in T1 (64.54%) containing no groundnut haulm, while lignin in T3 (12.66%) containing 50% GH recorded the highest value. EE value was higher in treatment containing 33% substitution of GH and the smallest values was obtained in treatment five with 100%level of inclusion. Values for Ash were similar ($P>0.05$) among the treatments hence not significantly different. Similar trend was observed in the case of CP, however in absolute term Crude protein was observed to be higher in the treatment T2 (15.89%) containing 33% Groundnut Haulms.

Table 2 Chemical Composition of the Experimental Diets and Sorghum Straw (%/kg)

Treatments	DM	Ash	CP	CF	EE	ADF		NDF	NFE	LIG
T1 (0%)	88.41^{c}	8.07^{a}	14.75^{a}	17.64^{a}	2.02^{c}	27.86^{ab}		42.77^{c}	64.54^{a}	9.92^{e}
T2 (33%)	87.24^{e}	9.17^{a}	15.89^{a}	15.54^{c}	2.20^{a}	26.60^{bc}		47.81^{a}	57.37^{d}	12.02^{b}
T3 (50%)	87.59^{d}	8.53^{a}	15.61^{a}	13.49^{d}	2.04^{b}	25.64c		38.83^{e}	63.96^{b}	12.66^{a}
T4 (67%)	88.86^{b}	7.43^{a}	15.45^{a}	11.76^{e}	1.99^{c}	29.14^{a}		43.28^{b}	61.96^{c}	11.09^{c}
T5 (100%)	90.19^{a}	7.86^{a}	14.79^{a}	16.6^{b}	1.53^{d}	27.01^{b}		40.38^{d}	64.16^{ab}	10.74^{d}
Sorghum straw	91.06	4.66	12.21	12.66	2.05	25.66		44.55	78.60	11.61
P-value	0.000	0.086	0.060	0.0000	0.0000	0.011		0.0000	0.000	0.0000
SEM	0.025	0.002	0.089	0.003	0.003	0.145		0.003	0.043	0.003

$^{a,\ b,c,d,e}$ Means with different superscript on the same column are significantly different ($p<0.05$). DM=dry matter, CP=Crude protein, CF=Crude fiber, EE =Ether extract, NFE=nitrogen free extract, ADF = acid detergent fiber, NDF=neutral detergent fiber, LIG=lignin, SEM=standard error of means

Minerals Composition of The Experimental Diets and Sorghum Straw

Table 3 presents the inorganic mineral content of formulated experimental diets fed to lactating Azawak cattle breed. The results revealed value obtained for the Calcium (Ca) ranged from 0.004- to 0.02%. Highest Ca was obtained in concentrate containing 33% groundnut haulms inclusion level compared to other treatments. The mean Phosphorus (P) values were similar ($P>0.05$) for all the treatments and T3 (50%) GH inclusion level

recorded the highest absolute value (2.96% g/kg). Treatments T1, T2, T3 and T4 with 0; 33, 50 and 67% inclusion of groundnut haulms had higher (P<0.05) Potassium (K) compared to T5 cows fed 100% legume inclusion level. The Magnesium (Mg) content was significantly (P<0.05) in T1, T2 and T5 with 0, 33 and 100% legume inclusion level. Similarly, Sodium (Na) was found to be significantly higher in diet containing 33% groundnut haulm inclusion level

Table 3: Mineral Composition of the Experimental Diets and Sorghum Straw in percentage.

Treatments	Ca (%g)	P (%)	K (%)	Mg (%)	Na (%)
T1 (0%)	0.019^{b}	1.603^{a}	0.258^{a}	0.0037^{a}	0.166^{b}
T2 (33%)	0.020^{a}	2.153^{a}	0.268^{a}	0.0034^{a}	0.189^{a}
T3 (50%)	0.013^{c}	2.964^{a}	0.258^{a}	0.0023^{b}	0.141^{c}
T4 (67%)	0.003^{e}	2.082^{a}	0.212^{ab}	0.0027^{b}	0.022^{d}
T5 (100%)	0.004^{d}	1.940^{a}	0.133^{b}	0.0036^{a}	0.058^{e}
Sorghum straw	0.004	0.004	0.003	0.004	0.018
P-value	0.0000***	0.3896^{ns}	0.0113**	0.0078***	0.0000***
SEM	0.0000	0.185	0.012	0.0000	0.001

$^{a, b,c,d,e}$ Means with different superscript on the same column are significantly different (p<0.05). Ca=calcium, P=phosphorous, K=potassium, Mg =Magnesium, Na=Sodium, SEM=standard error of means; ns= not significant.

Growth Performance of Lactating Azawak Breed Supplemented with Graded Level of Groundnut Haulms Diets.

The mean initial body weights of the lactating cows were similar (P>0.05) for all the treatments, however final weight gain was significantly different among the treatments. Treatments T2, T3, T4 and T4 with 33; 50, 67 and 100% inclusion of groundnut haulms had higher (P<0.05) final weight compared to T1 cows fed 100% concentrate with no legume inclusion. Total weight gain was greater (P<0.05) in animals fed T2 (13.75kg) and T3 (14kg) feed intake. Average daily weight gains were similarly higher on these treatments (0.229kg) and 0.231kg). Total dry matter intake was greater (P<0.05) in treatments T1 (557.59kg), T2 (561.03kg), T4 (559.22kg) and T5 (559.37kg) compared to T3 (542.16kg). Similarly for the average daily dry matter intake, feed conversion ratio was better in T3 ($39.07^{)}$ that is animals fed feed containing 50% legume.

Table 4. Growth Performance of Lactating Cows Supplemented with Graded Level of Groundnut Haulms Diets.

Treatments	IBW (Kg)	FBW (Kg)	TWG (Kg)	ADWG (g/day)	TDMI (Kg)	ADDMI (kg)	FCR
T1 (0%)	316.50^{a}	327^{b}	10.50^{c}	0.175^{c}	557.591^{a}	9.29^{a}	58.47^{a}
T2 (33%)	317.75^{a}	331.5^{a}	13.75^{a}	0.229^{a}	561.03^{a}	9.35^{a}	40.84^{bc}
T3 (50%)	318^{a}	332^{a}	14a	0.231^{a}	542.16^{b}	9.04^{b}	39.07^{d}
T4 (67%)	319^{a}	332^{a}	13^{b}	0.215b	559.22^{a}	9.32^{a}	43.50^{bc}
T5 (100%)	319.75^{a}	332.25^{a}	12.50^{b}	0.206^{b}	559.37^{a}	9.32^{a}	45.40^{b}
P-value	0.0806^{ns}	0.0024**	0.000***	0.0000***	0.005**	0.005**	0.000**
SEM	0.329	0.347	0.101	0.002	1.334	0.022	0.007

abdcMeans with different superscript on the same column are significantly different (p<0.05). IBW=initial Body weight, FBW=final body weight, TWG=Total weight gain, ADWG =Average daily weight gain, TDMI=total dry matter intake, ADDMI = average daily dry matter intake, FCR =Feed conversion ratio, SEM=standard error of means, NS= not significant

Milk Yield of Lactating Azawak Breed Supplemented with Graded Level of Groundnut Haulms Diets.

The milk yield of Azawak breed supplemented with graded level of groundnut haulms diets is presented in Table 5. No significant difference was observed among treatments in term of Total milk yield, however Treatment 3 recorded high value in absolute term (240.12kg). Daily milk yield was similarly not different ditto for feed conversion efficiency in milk.

Table 5: Milk Yield of Lactating Azawak breed Supplemented with Graded level of Groundnut haulms Diets.

Treatments	TMY (kg)	DMY (kg)	FCEM
T1	230.61	3.84	2.472
T2	231.49	3.86	2.473
T3	240.12	4.00	2.36
T4	222.06	3.70	2.586
T5	220.88	3.68	2.589
P-value	0.8278^{ns}	0.8278^{ns}	0.1014^{ns}
SEM	2..410	0.0402	0.005

ADDM=average daily dry matter, BSC=body score condition, TMY=total milk yield, DMY =Daily milk yield, FCEM= Feed conversion efficiency in milk, SEM=standard error of means; Ns=not significant.

Discussion

The nutrient content of sorghum straw is low and when fed alone is not sufficient enough to maintain an animal and favor the production of milk unless it is supplemented with feed sources of higher nutrient quality and quantity. Large quantities of crop residues including legumes roughages are available in Tahoua state, and are less costly compared to dairy concentrates imported from neighboring countries.

The dry matter content of the experimental diets was quite high (87.24-90.19%). High dry matter content of the diets is generally regarded as an indication of better retention of nutrients in the diets. This result is comparable to the finding reported by Mahabile, (1988) in Botswana who reported 91.6% in an experimental diet composing of sorghum bran and groundnut haulms in sorghum straw based diets for crossbred cows. However, this finding was closer to that of Finangwai *et al* (2018) who reported a range of (85.79 to 95.16%) in feeding concentrate diets containing graded levels of groundnut haulms on nutrient composition of diets and performance of Friesian x Bunaji heifers.

Low ash content of sorghum straw (4.66 %) when compared to the groundnut haulms agrees with the finding of Lafudeji *et al., (*1992) who reported that poor quality roughages have low ash content.

The 12.66% CP of sorghum straw in this study was higher than the 2.8% reported by Pailam *et al* (2008) and 6.4% by Mahabile, (1988). The high CP content of the sorghum straw could be due the harvesting stage, soil fertility, fertilizer applications, agro ecology and drying process. The CP of the fifth treatment with 100% groundnut haulms is higher than the 8.6-9.1% reported by Etale and Dung (2011). The result is however slightly comparable to the CP of 14.70% reported by Finangwa et al (2018) and close to the finding of Murthy et al (2004). The inclusion of the groundnut haulms to the concentrate boosted the protein level of the diet by to 15.89%. The crude protein content of the concentrate diets fell within the limit recommended by NRC for end mid lactation (15-16%) and end of lactation (13-15%). The CP content of the entire diets under investigation were all sufficient enough for ruminants animals and are higher than the minimum of 8% necessary to provide the minimum required ammonia *by* rumen microorganism to support optimum microbial activity (Norton, 2003, Limidi ,Aina & Swande, 2010). Therefore, it is a good management practice to provide lactating cows as well as growing and finishing cattle supplement rations.

Fiber is a complex mixture of cellulose, hemicellulose and lignin that varies with plant species and maturity. ADF contains cellulose and lignin. NDF contains hemicellulose, cellulose, and lignin and can be a useful indicator of intake. The Crude fibre (CF) value of 11.6% obtained in this study for groundnut haulms was lower than the values of 48.66% reported by Finangwai *et al* (2018) and 39.5 % reported by (Ahmed and Pollot, 1977). The observed variations in groundnut haulms nutrient composition in this study could have been due to

non-uniformity in the stage of harvesting and the purchasing sources of groundnut haulms used in this study (from farmers and markets). It was also observed that as the level of groundnut haulms increased in the concentrate, the CF also reduced.

The ADF range (25.64-29.14%) of the concentrate diets haulms is close to the finding of Finangwai *et al* (2018) who obtained a range of 29.8-33.02% in study to determine the effect of diets containing graded levels of groundnut haulms of 0, 25, 50 and 75% inclusion level on dry matter intake, nutrient digestibility and Nitrogen balance of Friesian x Bunaji Bulls. However, the NDF range of 38.83-47.81% obtained in this study was similar to the range of 37.71-47.42% reported by Fiangwai *et al* (2018). The Neutral detergent fiber (NDF) of the fiber fraction range of 57.87-64.54% obtained in this study was higher than the range of 37.71-47.42% reported by Finangwai *et al.* (2018).

Ca and P as reported by McDowell *et al*, (1993) play a vital functions in almost all the body tissue and need to be present in animal diet in a balance amount and ratio. These minerals made up of more than 70% of the total mineral in the body. Data in the present study revealed that the Calcium (Ca) content (%) of the dietary treatments does not meet the requirement of the cows and therefore need to be supplemented. The mean values (%) recorded is lower than the recommended range of 0.37 to 0.66% reported by the NRC, (2001). The phosphorus range values obtained (1.60 to 2.96%) were all above the recommended level range (0.28-0.49%) reported by the NRC, (2001). The results corroborate the results reported y (Brodison *et al*. (1989); Brintrup e*t al*., (1993), Dhiman *et al.*, (1996), Wu and Satter, (2000), Wu e*t al*, (2000), who reported that feeding values higher than such as 0.24 versus 0.32 or 0.42 percent dietary phosphorus to lactating cows observed that none of the concentration increased the milk yield significantly. The range values of Potassium (0.133 to 0.268%) and Sodium (0.003-0.020) recorded were all above the recommended requirement of (0.001-0.002%) for K and (0.002) for sodium reported by the NRC, (2001).

The highest final weight obtained in this study was in lactating Azawak breed of fed 100% inclusion of groundnut haulms diet. The result did not agree with the report of Finagwai *et al* (2018) who reported a final body weight on animals fed 50% groundnut haulms but agrees with their reports on lowest final body weight of higher fed the control diet or 0% groundnut inclusion level. The body weight gain was significantly ($P<0.05$) affected by the treatment diets. The body weight gain on 33% and 50% inclusion level of groundnut haulm were similar and significantly ($P<0.05$) greater than the body weight gain of the control, 67 and 100% inclusion level of groundnut. This finding contrasts with the finding of the Finangwai *et al* (2018) who reported that animals on control diet recorded the best body weight gain. However this finding is similar to the finding of (Berhe, 2018) who reported that buck feed groundnut haulms had higher final weight. Similarly, the body weight gain of lactating animals on 67 and 100% diets were statistically higher than, the control diets. The higher weight gains of lactating dams fed 67% and 100% GH over those fed the formulated control concentrates indicated that dams in the latter group converted more of their feed to milk rather than meat as evidenced by their higher milk yield values.

The total feed intake of animal on 33% groundnut inclusion level agreed with the finding of Finangwai *et al*, (2018) who reported that cattle on 25% inclusion level recorded the highest total feed intake. The inclusion level of groundnut affected the total feed intake of the lactating animals, as the mean total dry matter intake, of the control, 33%, 67% and 100% inclusion levels were significantly greater than the mean recorded by lactating cattle on diet 3 with 50% inclusion level. Similarly the average daily feed intake (g/day) was significantly influenced by the treatment diets. The diets seemed to have produced better intake in the animals probably due the ration composition. The diet contained sorghum straw a low fiber content (Aluwa & Umunna, 1993) and groundnut haulms which has been demonstrated to be better quality legume roughages containing adequate protein to maintain ruminants without any form of supplementation during dry season when feeds are scarce (Ikatua & Adu, 1984). Reports of Ayayi, Adeneye and ajayi (2005) and Ososanya (2010) highlighted that feed intake is an important factor for the utilization of feed by livestock and therefore is a critical factor of energy and protein availability as well as performance of ruminants. The daily feed intake was observed to increase with increasing level of groundnut haulms compared to the control diets. This indicated that groundnut

haulms is palatable legume roughages which can improved dry matter intake and efficiency of concentrate utilization.

The daily weight gain range (0.175-0.231kg was significantly ($p<0.05$) affected by the GH substitution level in the diet. The present result is lower than the average daily weight gain of 0.51, 0.42, 0.3 and 0.3kg obtained by finangwai *et al*, (2018) when fed into 0, 25, 50 and 75% levels of inclusion of GH in concentrate. The difference between these findings might be related to the physiological condition of the animals under investigation. However theses values recorded were either above or equal to the mean daily weight gain of 0.11, 0.2 and 0.23 kg reported by Bui Xuan An, (1998) for heifers fed concentrate, GH silage and dried GH respectively.

Feed efficiency shows the amount of one kg of certain nutrients to be converted into Live Weight. The lower the feed efficiency, the better the feed quality. The dams fed 33 and 50% GH had feed to gain ratios (39.07 vs 40.84), but were significantly ($p<0.05$) lower than those fed 67 and 100% (43.50vs 45.50) which were equal among themselves. Both animals fed 33, 50, 67 and 100% GH were statistically inferior ($P<0.05$) to those fed the control diet (53.47). The value range of values obtained were is higher those 13.46-19.01 obtained by Finangwai *et al*, (2018).

The results of the present study on the milk yield of lactating Azawak cattle breed was not significantly ($p>0.05$) affected by the inclusion level of groundnut haulms in the diets. The total milk yield of all the treatments under investigation were similar. However the highest milk yield in absolute term was recorded by dams on 50% inclusion level followed by 33%, control, 67, and 100% groundnut inclusion level. The daily milk values range (3.68 to 4 liters /day) were similar to the average milk production of 3.8 liters of kg per day registered by Zhaïrath Foukpê *et al*, (2020). The Azawak breed is considered as the best dairy cattle in West Africa (Issa *et al*. 2014). The daily milk yield was close to that (3.95 kg) recorded by Saidou (2004) at the Experimental Sahelian station in Toukounous (SSET) in Niger. The values were however lower than the figures (5.28; 6.88; 6.98 and 7.11 liters) reporded by Barthe (2014) at the Sahelian Experimental Station of Toukounous (SSET) in 2013 on cows in an experiment involving the replacing of cottonseed cakes by Acacia raddiana pods. The average milk production of Azawak in this study is also lower than that recorded by Abdou (2007) at the kirkissoye dairy cooperative in Niger. The difference could attributed to the nature of the supplements used in the feeding trial of cows. Indeed, the cows in this study received a supplement based on formulated concentrate replaced by varying level of groundnut haulms those of Abdou's experimentation (2007) received the fresh brewer's grain highly energetic and the medium wheat bran. In addition despite tropical animals are already well adapted to high ambient temperatures, the relatively high environmental temperature of 36°C might have contributed to reduce the feed intake and milk production as highlighted by the report of NRC (1981) which reported that ambient temperatures above 25°C affected feed intake and productivity. For example, in Shika, Nigeria, milk yield and feed consumption by Freisian-Bunaji crosses declined sharply at temperatures above 27°C during early and mid-lactation (Alhassan & Buvanendran, 1985) in order to reduce body heat production.

The feed conversion efficiency of milk is the amount of feed needed to produce one kg of milk, calculated based on the DM intake (kg) to milk (kg). The value of the feed conversion ratio is the amount of feed intake to increase by 1.0 kg/head/day of milk (Petty & Cecava, 1995). The higher of the FCR, the worse of the quality of the feed; and this is inversely proportional to feed efficiency. The feed conversion efficiency in milk (FCEM) was not significantly ($P>0.05$) affected by the dietary treatments meaning all the FCEM were statistically similar. Cows fed concentrate diet with inclusion level of 50% GH had better feed conversion efficiency of milk, while those fed 100% legume was the poorest. The range values in this stay was higher that the range of 1.39-1.49 obtained by Tesfaye e*t al*, (2016) when they fed Napier grass and natural grass hay on crossbred dairy cows supplemented with concentrate diet. However, the values were close to the value 2.08 DMI/ kg milk yield, reported by Olorunnisomo and Ibhaze (2013) when they fed Napier grass-cassava peel silage diet to Sokoto Gudali cows. The little variation observed might be due to intrinsic factors like level of production, parity, stage of lactation, external factors like environmental stress, and unequal intervals between milking and changes in feeding.

CONCLUSION

Crude protein value of concentrate was enhanced at different levels of inclusion of groundnut haulms.

Total weight gain was enhanced at 50% level of inclusion of groundnut haulms. All inclusion levels produced higher weight gain than the control diet (0% legume). Feed conversion ratio was also better at 50% level of inclusion of legume haulms.

Total milk yield was higher at 50% level of inclusion groundnut haulm in the concentrate. Similarly feed conversion efficiency of milk was better at the same level of inclusion ditto for daily Body score condition.

Based on the foregoing, it can be recommanded that concentrate diet for Azawak cattle should be supplemented with 50% legume haulm.

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References

1. Abdel Hameed, A.A., Fedel Elseed, A.M., and Salih, A.M. (2013). Growth Performance and Rumen Fermentation of Lambs Fed Untreated or Urea Treated Groundnut Hull with Different Protein Sources. *Journal of Animal Production Advances*, 3(3) : 86–96.
2. Abdou H., 2007. Influence de la complémentation sur la production laitière chez la vache Zébu Azawak de la coopérative laitière de Kirkissoye au Niger: cas de deux concentrés « Son de blé et drêche de brasserie». Mémoire de diplômes d'étude approfondie de production animales, Ecole Inter- Etat des Sciences et Médecine Vétérinaires de Dakar, 59 p.
3. Adamu., J. (2021). No titlegenetic and non genetic (environmental) factors affecting milk yield and composition of small ruminant (a review). 7(1), 45–60.
4. Ahmed, F. A. and Pollot, G. (1977). The performance of yearling Kenana (Sudan zebu) calves given three levels of crude protein as a concentrate supplement to ad libitum groundnut hay. *Tropical Animal Production* 4:1 (65 - 72).
5. Akpa, G.N., (1999). Evaluation of dairy characteristics and lactation curves of smallholder Red Sokoto goats. Ph. D Thesis, Ahmadu Bello University, Zaria, Nigeria, 150p.
6. Alhassan W.S. and Buvanendran, V. (1985). Weather variables and milk production in Friesian-Bunaji crosses reared outdoors in the dry tropics. *Agricultural and Forest Meteorology*, 34: 163 – 171.
7. Aluwa, J.P. and Umunna, N.N. (1993). Alternative feed formulation in developing countries: prospects for utilization of agro-industrial by-products. *Journal of Animal Production Resources.*13 (2):53-87.
8. Amole, T. A.and Ayantunde, A. A. (2016). Research Article Assessment of Existing and Potential Feed Resources for Improving Livestock Productivity in Niger Tunde Adegoke Amole and Augustine Abioye Ayantunde. *International Journal of Agricultural Research*, 11(2), 40–55. https://doi.org/10.3923/ijar.2016.40.55
9. Amole, T., Augustine, A., Balehegn, M.and Adesogoan, A. T. (2022). Special section : Developing fodder resources Livestock feed resources in the West African Sahel. August 2021, 26–45. https://doi.org/10.1002/agj2.20955.
10. AOAC. (2016). Association of Official Analytical Chemists approved by AOAC stakeholders panel on Strategic Food Analysis Method (SPSFAM). Final version. March 31 2016.
11. ARC (1980). The Nutrients Requirements of Ruminant Livestock. 4th edition CAB International, Wallingford. pp. 73 - 310.
12. Aruwayo, A., Maigandi, S.A., Malami, B.S. and Daneji, A.I. (2007). Performance of lambs fed fore-stomach digesta and poultry litter waste. *Nigerian Journal of Basic Applied Sciences*, 15(1&2): 86-93.
13. Asaolu, V. O., Odeyinka, S. M., Akinbamijo , O. O. and Sodeinde, F. G. 2010. Effects of Moringa and

bamboo leaves on groundnut hay utilization by West African Dwarf goats. Li*vestock Research for rural Development,* 22(1).
14. Ajayi, D.A., Adeneye, J.A. and Ajayi, F.T. (2005). Intake and Nutrients Utilization of West African Dwarf Goat Fed Mango (*Mangifera indica*), Ficus (*Ficus thimingii*), Gliricidia (*Gliricidia, Sepium),* Foliages and Concentrates as Supplement to Basal Deits of Guinea Grass (Panicum maximum. *World Journal of Agricultural Science*; (12); 123-128.
15. Babayemi OJ, Abu OA, Opakunbi A (2014). Integrated animal husbandry for schools and colleges. First edition, published in Nigeria by positive press Ibadan. pp. 1-299.
16. Barthe A.(2014). Effets d'une substitution du tourteau de graines de coton par les gousses d'Acacia raddiana(SAVI) dans l'alimentation, sur les performances laitières du Zébu Azawak. 33 p.
17. Berhe, G. G. (2018). The effect of haulms of groundnut and cowpea supplementations on growth performance of Abergelle goats. *ResearchGate*.
18. Berry, D. and Crowley,J.(2013).Cell Biology Simposium:Genetics of feed efficiency in dairy and beef cattle 1. *Journal of Animal science,* 91(4):1594-1613.
19. Bonnet, B. (2012) Vulnérabilités et efforts d'adaptation des familles de pasteurs face aux crises récurrentes. Enseignements tirés de l'analyse de l'activité pastorale dans les trajectoires familiales, ANR « *Vulnérabilité, Climat et Sociétés* » ECliS 2008, 21 p
20. Brintrup, R., T. Mooren, U. Meyer, H. Spiekers, and E. Pfeffer. 1993. Effects of two levels of phosphorus intake on performance and faecal phosphorus excretion of dairy cows. *Journal of Animal Physiology and Animal Nutrition,* 69:29– 36.
21. Brodison, J. A., E. A. Goodall, J. D. Armstrong, D. I. Givens, F. J. Gordon, W. J. McCaughey, and J. R. Todd. 1989. Influence of dietary phosphorus on the performance of lactating dairy cattle. *Journal of Agricultural Science,* Camb. 112:303– 311.
22. Commune Rurale Akoubounou. (2018). Plan de Développement Communal 124 p.
23. Conseil Régional de Développement. (2018). Plan de Développement Régional.2016-2020.
24. Dayo, P., Ephraim, N., John, P. and Omobowale, A.O. (2009). Constraints to increasing agricultural productivity in Nigeria. Nigeria Strategy Support Programme (NSSP) Background Paper No. NSSP 06, *International Food Policy Research Institute*, Washington D.C., USA.
25. Dhiman, T. R., L. D. Satter, and R. D. Shaver. 1996. Milk production and blood phosphorus concentrations of cows fed low and high dietary phosphorus. Pp. 105– 106 in U.S. Dairy Forage Res. Center 1995 Res. Summaries, Madison, WI.
26. Etela, I. and Dung, D. D. 2011. Utilization of Stover from six improved dualpurpose Groundnut cultivars by West African Sheep. *African Journal of Food Agriculture Nutrition and Development,* (1) 11: 4539-4545.
27. FAO. (2016). Retrieved from http://www.fao.org/faostat/en/#data/QC
28. FAO, 2002. Etat des Ressources Génétiques Animales dans le Monde. Rapport national pour la République du Niger. 104p.
29. Finangwai, H. I., Ehoche, O. W., Jokthan, G. E. and Barje, P. P. (2018). Effect of diets containing graded levels of groundnut haulms on Dry matter intake, nutrient digestibility and Nitrogen balance of Friesian x Bunaji Bulls. *Nigerian Society for Animal Production Nigerian,* 45(1), 342–350.
30. Hampson, D., Schuelke, J.and Quirein, J. (2001). Use of multi-attribute transforms to predict log properties from seismic data. *Geophysics,* 66(1), 220-236. https://doi.org/10.1190/1.1444899.
31. Hansard, S., H. Crowder, and W. A. Lyke. (1957). the biological availability of calcium in feeds for cattle. *Journal of Animal Science*, 16:437– 443.
32. International Fund for Agricultural Development. 2015. State of Food Insecurity in the World 2015. Meeting the 2015 Int. Hunger targets: taking stock of uneven progress. Rome, FAO.
33. Ikhatua, U. J. and Adu, I. F. (1984). A comparative evaluation of the utilization of groundnut haulms and *Digitaria smutsil* hay by Red Sokoto goats. *Nigerian Journal of Animal Production Research.*
34. Institue Nationale Statistique INS. (2013). Population du Niger : Projection démographique 2012 à 2035. Institut National de la Statistique. Direction des statistiques et des études démographiques et

sociales de Niamey. 158 p.
35. Institue Nationale Statistique INS. (2018). Compte rapide du Niger 2018.
36. Issa I.A., Bada-Alambedji R. and Mainil J., 2014. Le Zébu Azawak dans l'élevage bovin au Sahel. *Revue Africaine Santé et de Production Animale*, 1271-779.
37. Kertz, A. 1998. Variability in delivery of nutrients to lactating dairy cows. *Journal of Dairy Science*. 81:3075– 3084.
38. Khan, M. J., Peters, K. J.and Uddin, M. M. (2009). Feeding strategy for improving dairy Cattle productivity. *38*, 67–85.
39. Kubkomawa, H, Olawuye, H. Nkrumah, L. J., Etuk, E. B.and Okoli, I. C. (2015). Nutrient requirements and feed resource availability for pastoral cattle in the tropical Africa: A review. *Journal of Agricultural and Crop Research*, 3(7), pp. 100-116.
40. Kubkomawa, H. I. (2017). *Indigenous Breeds of Cattle , their Productivity , Economic and Cultural Values in Sub-Saharan Africa : A Review*. *3*(1), 27–43.
41. Lamidi, A. A, Aina, A. B. J. and Sowande, S.O. (2010, March). Nutrients digestibility and nitrogen balance in West African Dwarf Goat fed blended diets for dry season. In; O. J. Babayemi, O. A. Abu and E. O. Ewuola (Eds) Fast -Tracking Animal Agriculture in a challenged Economy. Proceeding of the 35th Annual Conference of the Nigerian Society for Animal Production (NSAP) 14th -17th March held at University of Ibadan, Nigeria.Pp499-501.
42. Leng, R. A. 1990. Factors affecting the utilization of poor quality forage by ruminants particularly under tropical conditions Nutritional Research Review. 3: 277 – 303.
43. Lenka Krpálková , Niall O'Mahony , Anderson Carvalho , Sean Campbell , Gerard Corkery , Eilish Broderick , Daniel Riordan and Joseph Walsh . (2021). Efficiency, Feeding Rate, and Behavior with the Milk Performance of Dairy Cows. *Dairy* 2, 684–694. https://doi.org/10.3390/dairy2040053.
44. Lufadeju, E. A., Adamu, A. M., Eduvie, L. O., Ehoche, O. W. and Adeyinka. I. A. 1992. Effect of ammoniation on the nutritive value of botanical fractions of early millet straw fed to sheep. In: Adamu et al (eds.) Forage production and utilization in Nigeria Proc. of International Workshop held in Zaria, 11 – 15 February 1991. Pp. 177 – 1830.
45. Mahabile, W., Masilo, B. and Biflewahid, B. (1988). Use of sorghum bran and groundnut haulms in sorghum stover based diets for grossbred cows. Paper presented at fifth arnab/panesa workshop, Lilongwe, Malawi, 5-9 december, 1988.
46. Maigandi, S.A. (2001). Quantification and Utilization of Fore stomach Digesta in the Diets of Growing and Fattening Sheep. Ph D. Thesis. Department of Animal Science, Faculty of Agriculture, Usmanu Danfodiyo University, Sokoto, Nigeria. pp: 129. (Unpublished).
47. Mariyono, Y. N. Anggraeny, Antari, R., Krishna, N H, Sukmasari, P K and Putri A S. (2022). Feed Intake and Feed Conversion Ratio of Ongole Crossbred Cattle Fattened at Different Ages and Feed. 3rd International Conference on Advance & Scientific Innovation.348-359.
48. Millam, J.J. (2016). Effects of urea and lime treated groundnut shell in mixed diets on nutrient intake and in situ degradation in Yankasa rams. M. Sc Dissertation, Department of Animal Science, Ahmadu Bellow University, Zaria.
49. Ministère de l'Agriculture et de l'Elevage. (2018).Synthèse des résultats de la champagne pastorale 2017-2018.
50. Ministère de l'Elevage et des Industries Animales du Niger MEIA. (2012). Stratégie de Développement Durable de l'Elevage (2012-2035). 61 p.
51. Murthy, K. S., Dutta, K. S., Tajane, K. R., Ravikala, K. Shah, R.R. and Gajbhiye, P. U. 2004. Groundnut haulms based feeding regimes for calves. *Indian Journal of Animal Nutrition*, 21 (2): 130-132
52. National Research Council, NRC (1996). Nutrient requirements of beef cattle, 7th revised Edition. National Research Council Update 2000. National Academic, Press, Washington, DC, USA. pp. 36-97.
53. National Research Council. (2001). National Research Council. Nutrient Requirements of Dairy cattle. 7th rev. National Academy of Science, Washington.
54. Ndlovu, L. R. and Hove, L. 1995. Intake, digestion and rumen parameters of goats fed mature veld hay

ground with deep litter poultry manure and supplemented with graded levels of poorly managed groundnut hay. *Livestock Research for Rural Development*, (6): http://www.lrrd.org/lrrd6/3/8.htm.
55. Norton, B. W. 2003. Studies of the nutrition of the Australian goat. Thesis (D.Agr.Sc.) - University of Melbourne. http://worldcat.org/oclc/62538900.
56. Nuru, S., (1985). Strategies for improved production of fresh foods in Nigeria. Nigerian Institute Food Science and Technology, Federal Industrial Research Organisation (FIRO), Oshodi, Lagos, Nigeria, 12pp.
57. Olawuye, H. K. H. U., & Etuk, L. J. K. E. B. (2015). Nutrient requirements and feed resource availability for pastoral cattle in the tropical Africa : A review. *Journal of Agricultural and Crop Research*, *3*(November), 100–116. http://sciencewebpublishing .net/jacr/archive/2015/November/pdf/Kubkomawa et al.pdf.
58. Oloranju, P. E., Ntare, I. and Babalola, O. 1996. In proceeding Workshop in Nationally coordinated Groundnut Research project. 25-29 September, 1995, Zaria, Nigeria. Pp 47
59. Olorunnisomo, O. A. and Ibhaze, G. A., 2013. Original Research Article Milk Yield and Feed Conversion of Sokoto Gudali Cows Fed Napier Grass Ensiled with Cassava Peel. *Agricultura tropica et subtropica*, 46(4): 123-128.
60. Osafo, K. (1993). Sorghum Stover as forage; cultural effect on yield and straw chopping, | amount offered, supplementation and variety on intake and live -weight gain in | Ethiopian sheep and cattle. Ph.D. Thesis, Reading, U K. 19PP.
61. Osasanya.T.O. (2010). Effect of varying levels of broiler litter on growth performance and Nutrient digestibility of West African dwarf lambs. *Nigerian journal of Animal Science*; (12) :123-128.
62. Oumarou A., 2004. Production laitière et croissance du zébu Azawak en milieu réel: suivi et évaluation technique à mi-parcours du projet d'appui à l'élevage des bovins de. Thèse de Doctorat, École Inter-États de sciences et médecine vétérinaire, 82 p.
63. Ousmane, B., Ibrahim, B., Lawali, S.and Rabe, M. M. (2019). Groundnut Production and Storage in the Sahel : Challenges and Opportunities in the Maradi and Zinder Regions of Niger Groundnut Production and Storage in the Sahel : Challenges and Opportunities in the Maradi and Zinder Regions of Niger. February 2021. https://doi.org/10.5539/jas.v11n4p25
64. Pailanl, G. H., Mahanta, S. K. and Verma, N.C. (2007). Evaluation of sorghum stover based diets in cattle, sheep and goats. *Indian Journal of Animal Sciences*, 78 (2): 225-227.
65. Petty T. W. and M. J. Cecava, Beef cattle feeding and nutrition. 1995. 2nd ed. San Diego, New York, Boston, London, Sydney, Tokyo, Toronto: Academic Press.
66. Rasby R. J., A. Stalker, and R. N. Funston. 2014. Body Condition Scoring Beef Cows: A Tool form Managing the Nutrition Program for Beef Herds. Neb Guid., no. June, pp. 1–7. [Online]. Available: http://extensionpublications.unl.edu/assets/pdf/ec281.pdf.
67. RENALOC. (2012). Répertoire National des Localités. Institut National de la Statistique.734.
68. Recensement General de l'Agriculture et du Cheptel RGAC. (2008). Productivité du cheptel et enclaves pastorales et Transect. vol5.
69. Samireddypalle, A., Ayantunde, A., Okike, A., Babayemi, O. J., Sosina, A. O. and Duncan, A. 2014. Assessment of Livestock feed value chain in Ayedire and Atakumosa East local government areas of Osun state. CGIAR Research program on Integrated Systems for the Humid Tropics. ILRI Technical Report December 2014 www. cgspace.cgiar.org.
70. Saidou O., 2004. Influence de la production laitière sur l'évolution pondérale des vaches et des veaux chez le zébu Azawak à la Station Sahélienne Expérimentale de Toukounous (Niger).
71. Sere, C., Ayantunde, A., Duncan, A., Freeman, A., Herrero, M., Tarawali, S.and Wright, I. (2008). Livestock production and poverty alleviationchallenges and opportunities in arid and semi-arid tropical rangelandbased systems. In: The proceedings of multi-functional grasslands in a changing world (XXI International Grassland Congress and VII International Rangeland Congress, China, pp. 19–29). International Rangeland Congress.
72. Silva, A. T. and Orskov, E. R. 1988. Fibre degradation in the rumens of animals receiving ay, untreated

or ammonia-treated straw. *Animal Feed Science and Technology*, 19: 277-287
73. Tesfaye M, Mengistu, Urgie, Getachew, A. (2016). Effects of Different Proportions of Pennisetum Purpureum Silage and natural grass hay on feed utilization, milk yield and Composition of Crossbred dairy cows supplemented with concentrate diet. *Journal of Biology, Agriculture and Healthcare,* 6(11):59-71.
74. Underwood EJ (1981). The mineral nutrition of livestock, (CAB International: Farnham Royal, UK).
75. Wu, Z., and L. D. Satter. 2000. Milk production and reproductive performance of dairy cows fed two concentrations of phosphorus for two years. *Journal of Dairy Science*, (83:1052– 1063.
76. Wu, Z., L. D. Satter, and R. Sojo. 2000. Milk production, reproductive performance, and fecal excretion of phosphorus by dairy cows fed three amounts of phosphorus. *Journal of Dairy Science.* 83:1028–1041.