ID: 333

Utilisation of Roughages (Rice Strauw) Treated with Mineral Feed to Cattle in Tandjilé Province, Chad

Keiba Dar[1], Moumouni Ousseini[2], A. Nasiru[3]

[1]Higher National Institute of Agronomic Sciences and Agro-Food Technologies of Laï-Chad. Department of Agronomic Sciences, Niamey-Niger
[2]Direction of Statistics Ministry of Agriculture and Animal Husbandry, Niamey-Niger
[3]Bayero University Kano Department of Animal Science, Niamey-Niger

Abstract

The study was conducted in Tandjilé Province Chad (GPS coordinates: 9° 39' 45° 25" N latitude and 16° 43' 24° 46" E longitude). The aim of the study was to determine the effect of treating roughages with minerals feed to cattle in dry season in Tandjilé. Thirty six Arab Zebu bulls weighing between 254-255 kg and aged 5- 6 years were assigned into three (3) treatments (T1, T2 and T3) with 12 replication per treatment in completely randomize design. The bulls were fed the experimental diets after returning from natural free grazing pasture and water provided *ad-libitum.* Data generated were subjected to analysis of variance. The results of the experimental feed indicated that the total weight gain (22.00kg), average daily weight gain (244g/head/day) were observing in T2. Daily dry matter intake and total dry matter intake were significantly higher ($P<0.05$) in group of bulls receiving rice straw treated with urea mixed with groundnut haulm plus cowpea haulm and cotton seedcake (T2). Lower values were obtained on group (T3) of bulls fed untreated rice straw mixed with groundnut haulm plus cowpea haulm and cotton seed cake (T3). However, the final weight gain were significant different among all treatments. The treated of rice straw with organic and inorganic mineral supplemented with groundnut haulm and cowpea haulm and cotton seedcake increased the weight gain and dry matter intake of bulls. It is recommended that grazing bull diets be supplemented with treated rice straw containing Doom fruit salt, poultry manure or urea mixed with cotton seedcake, groundnut and cowpea haulm during dry season for an improved performance.

Key Words:

Introduction

Livestock in Africa accounts for one-third of the global population (AU-IBAR, 2016) and about 40% of agricultural GDP, ranging from 10 to 80% (Panel, 2020). In the Sahel, livestock is the main activity of the pastoral populations. The feeding of domestic animals has always been based on natural pastures. These pastures of very good quality during the rainy season are abundant and consist mainly of annual plants (Diatta *et al.*, 2007). Transhumant pastoralism (70-90 %) remains the mode of production adapted to the Sahelo-saharian ecosystems (OCDE/CSAO, 2008). African livestocks also have significant impacts on the environment (Gerber *et al.,* 2013). Land area for grazing and feed availability in high livestock producing areas are progressively becoming a serious threat to livestock production (Muhammad, 2004). Degradation of above ground biomass combined with climate change has strongly contributed to the reduction of forage supply (Diarra & Breman, 1998). Livestock will be increasingly important in the future in sub-Saharan Africa because the demand for animal-source food is projected to increase due to population growth, increased income and urbanization. By 2050, consumers in low and middle income countries will demand 107 million tons of meat and 5.5 million tons more milk than they did in 2005/2007 (Alexandratos & Bruinsma, 2012). One of the important innovations is that the Sahel has experienced in recent decades the expansion of agro-pastoralism, that is to say the combination of crop and livestock production within the same farm. This new form of resource exploitation was born from the strategy of farmers and pastoralists to limit risks to face climate uncertainty (OCDE/CSAO, 2008). However, the savannahs, steppes, fallows and agricultural residues constitute the basis of livestock feed, even in sedentary farms or in the process of intensification (César, 2005).

Many Sahelian countries, such as Mali, Niger, Burkina Faso and Chad, have heterogeneous production systems, depending on their geographical location: the arid or semi-arid northern regions are mainly known by the practice of transhumant livestock farming (ECOWAS, 2008). The southern regions, which had more fertile land for agriculture is confronted by land pressure management. In most of these countries, the professions of transhumant herder and farmer have long been linked to "ethnic" affiliations and caste systems. Historically, this professional specialization structured exchanges between social groups sharing the same stock of resources (Banoin & Jouve, 2000). Chad is a large landlocked country spanning north-central Africa. It covers an area of 1,284,000 km^2.

The Chadian livestock population is composed of 93.8 million cattle and 34.6 million heads of poultry. These groups represents 73% of the total number of livestock (FAO, 2018). It is essentially made up of ruminants such as goats (32.5%), sheep (28.2%), cattle (26.5%) and camels (6.8%). Poultry is dominated by chicken farming with

26.6 million heads (FAO, 2018). These figures place Chad in 3rd place in Africa in terms of livestock population (FAO, 2018). Livestock farming in Chad is the second largest source of income after petroleum (Marty, Pabamé, Djatto & Nabia., 2010). Chad is a country with agro-pastoral vocation (80%), contributing 28.3% to the national GDP (INSEED, 2014).

However, the successive stages in the evolution of a savannah subjected by a pastoral exploitation is marked by the modification of the structure of the grasses, quantitative changes in the composition of grasses, floristic composition, and disappearance of the herbaceous layer and to some extent degradation of rangelands (Hiernaux, 1996).

Most of ruminants in Africa depend on natural pasture and crop residues during the long dry season during which the quality and availability of the pastures decreases leading to an imbalance of essential nutrients resulting in poor performance (Tendonkeng *et al.,* 2018). Cereals in general, and especially rice, are not only the staple food for people in sub-Saharan Africa (Sohl, 2005), but they also produce large quantity of crop residues that are abandoned or burnt in the fields (Yaning *et al.,* 2012). Rational exploitation of these crop residues can be a promising way to overcome the quantitative and qualitative forage deficit especially during the long dry periods. The low quality of the residues does not provide enough nutrients to the small ruminants to maintain high production levels. The high level of lignification and limited ruminal degradation of the carbohydrates and the low content of nitrogen are the main deficiencies of the rice straw affecting its value as feed for ruminants (Tendonkeng *et al.,* 2016). Treating rice straw with urea or by supplementing with protein sources improve, intake, digestibility and ruminant performance when compared to untreated rice straw feeding alone (Wanapat *et al.,* 2009). However, the use of rice straw in animal nutrition remains limited by its low ingestion and digestibility due to its low crude protein content, available energy and high fiber and silica content (16%) (Van Soest, 2006; Huyen *et al.,* 2012). Several studies have shown that the treatment of 5% urea roughages improves their dietary values (Fawzy *et al.,* 2014). Supplementation is therefore necessary in addition to treatment to achieve significant production (Upreti & Orden, 2008). The objective of the research was to determine the effect of treating rice straw with mineral in cattle performance.

Materials And Methods

The study was conducted to investigate the effects of treated rice straw with two minerals to improve the nutritive value of rice straws and untreated rice straw both combined with concentrates supplements on the performance of bulls. The trial was conducted in Tandjilé Province (GPS coordinates: 9° 39’ 45° 25” N latitude and 16° 43’ 24° 46” E longitude) part of the Soudan zone which receives between 900 to 1200 mm of rainfall annually. It has an herbaceous vegetation of tropical savannahs which provides between 75 to 90 % of total biomass of the ecosystems (Garnier & Dajoz, 2001). It is characterized by a Sudanese tropical climate with a long dry season (7 months) and a short rainy season (5 months). The thermal regime is marked by a relatively cold period from December to February (from 11° to 22° C) and a hot period from March to June (from 39 to 45° C) (INSEED, 2014). Three local farms were chosen for the demonstration based on accessibility and availability of large number of animals. The treatment combinations and quantity formulated are shown in Table 1.

Table 1: Quantity of Organic and Inorganic Mineral Treatments Use treating Rice Straw for Animal feed.

Variables	Treatment	Quantity (g)
Doum fruit salt (T1)	T2+W+R	2+100+250
Urea (T2)	T3+W+RS	4+100+250
Rice straw only (T3)	T7=W+RS	250+125

T= Treatment; W= Water; RS= Rice Straw; T1= Doom fruit salt; T2= Urea; T3= Control; W= Water; RS= Rice Straw.

Two minerals Doom fruit salt as organic and urea as inorganic mineral were used to treat the rice straw for 28 days and fed to the animals. The rice straw (*Oryza sativa* L.) was obtained after harvesting rice in the fields at ITRAD-Farm Mala, Tandjilé Province of Chad.

Before treatment the rice straws were air dried for two days. The selected mineral were used to treat rice straw for a period of 28 days and fed to bulls with farmer practices as control. After treatment, the rice straw was opened for 72 hours on free air and mixed with cottonseed cake, groundnut and cowpea haulms and then feed to the animals.

The supplementation trial was conducted for 90 days and involved a total of thirty six bulls. The on-farm experiment was conducted in a randomized complete block design. The supplementation was offered at 2% body weight per head per day.The bulls were separated in three treatments. In each treatment batches of 12 animals were divided into three (3) replicate groups of four (4) animals.

-Treatment one: 12 cattle divided into three replication groups of 4 animals each and were supplemented with a livestock feed composed of dry rice straw treated with lye (extracts from ash of burnt doum fruits) mixed with cottonseed cake, cowpeas haulms and groundnuts haulms every evening after the animals return from the pasture. The supplementation was offered at 2% body weight per head per day.

-Treatment two: 12 cattle divided into three replication groups of 4 animals each and were supplemented with a livestock feed formulation composed of dry rice straw treated with urea mixed with cottonseed cake, cowpeas haulms and groundnuts haulms offered every evening after the animals return from the pasture.
-Treatment three: 12 cattle divided into three replication groups of 4 animals which were supplemented with a livestock feed formulation composed of untreated dry rice straw mixed with cottonseed cake, cowpeas haulms and groundnuts haulms every evening after the animals return from the pasture.
The bulls were dewormed with Ivermectin 1 ml for 50 kilogram live weight a week to the commencement of the trial.
The treated straw was given as feed supplement in the evening after animals returned from grazing.
An adaptation period was observed for 14 days during which, 5 kilogram of treated straw + 5 kilograms of untreated straw + water was given to each group (group I and II) of animal per day every afternoon.
After the adaptation period, the supplement was giving to groups of four animal. Each group received a quantity of mixed supplementation of 40% of rice straws, 20% of cottonseed cake, 20% of groundnut haulm and 20% of cowpea haulm at the rate of 2kg/100kg live weight per day throughout the 3 months of experimentation.

Table 2. Proportion (%) of Mixed Feed Stuff

Treatments	Rice straw	Cotton seed cake	Groundnut haulms	Cowpea haulms	Total
T1 (Doum fruit salt)	40	20	20	20	100
T2 (Urea)	40	20	20	20	100
T3 (Untreated straw)	40	20	20	20	100

The data records were collected on baseline body weight (kg) at monthly intervals. Feed intake is determined by providing the animals with a known quantity of feed. The leftover is collected the next day in the morning. The difference between feed given the previous and leftover (ort) is the amount of feed taken by the animal .The animals were weighed at beginning of the experiment and every month. The weight gained by each animal is determined by subtracting the initial weight from the animal's final weight.
The data collected were saved in Microsoft Excel (2016) and analysed using Statistix 10, and JMPPRO/16 software. The means were separated using LSD at 0.05.

Results

Chemical composition of the experimental diet

The results revealed that there was a significant difference among the experimental diets for the parameters evaluated with exception of CP. The DM content values ranged from 89.29 to 92.9%. The highest value was recorded in T3 (92.9%) having untreated straw whereas, the least value was recorded in T2 (89.29%) having rice straw treated with urea. The Crude Protein ranged from 11.20%-18.16%, CF24.15%-27.43%, EE 4.41%-4.59%, Ash 5.47%-6.41%, NFE 51.72%-58.03%, ADF 27.13%-29.68%, and NDF 40.41%-43.41%.
Rice straw treated with urea treatment had the highest CP in absolute term among the treatments and the lowest was noticed in untreated rice straw treatment or control treatment. Rice straw treated with Doum fruit salt had the highest CF (27.43%) values and the lowest (24.15 %) value was obtained in rice straw treated with urea. EE value was higher in rice straw treated with Doum fruit salt and the lowest values is obtained in rice straw treated with urea and untreated rice straw treatment. Values for Ash were significant ($P>0.05$) among the treatments with T1 (Rice straw treated with Doom fruit salt) having the highest value and T2 (rice straw treated with urea) the lowest. Values for CP were similar ($P>0.05$) among the treatments, however in absolute term Crude protein was observed to be higher in the treatment T2. ADF, NDF, Nitrogen Free Extract values were significantly greater ($P<0.05$) in untreated rice straw. However the CF was significantly greater ($P<0.05$) in T1 (27.43%) containing rice straw treated with Doum fruit salt whereas T2 or rice straw treated with urea registered the lowest value.

Table 3: Chemical composition of the experimental diet

a, b, c means are significantly different from one another. SEM= Standard Error of Mean; T1=Treatment 1(Rice straw treated with doum fruit salt + Cotton seed cake +groundnut haulms + cowpea haulms); T2= Treatment 2(Rice straw treated with urea + Cotton seed cake +groundnut haulms + cowpea haulms); T3= Treatment 3(untreated rice straw + Cotton seed cake +groundnut haulms + cowpea haulms). DM= Dry Matter, CP= Crude Protein, CF= Crude Fiber, EE= Ether Extract, NFE= Nitrogen Free Extract.

Treatments	Parameters							
	DM	Ash	CP	CF	EE	ADF	NDF	NFE
T1	89.23^{c}	6.41^{a}	13.62^{b}	27.43^{a}	4.59^{a}	27.33^{b}	40.41^{c}	52.91^{b}
T2	91.02^{b}	5.47^{c}	18.16^{a}	24.15^{c}	4.40^{b}	27.13^{b}	42.39^{b}	51.72^{b}
T3	92.90^{a}	6.02^{b}	11.20^{c}	24.63^{b}	4.41^{b}	29.68^{a}	43.41^{a}	58.03a
SEM	0.033	0.023	1.655	0.009	0.007	0.043	0.043	0.139
P-value	0.001	0.007	0.964	0.001	0.013	0.003	0.001	0.005

The trial involved thirty six (36) bulls weighing averagely between 254-255.kg. The experiment was conducted on-farm in a randomized complete block design. The bulls consisted of three groups of 12 animals each. Three type of supplementations were given to three groups of animals. The final weight gain recorded varied from 267.46-275.86 kg and the DWG ranged from 136 to 244g. The TWG recorded varied from 12.26 to 22.0 kg and the average daily weight gain per group was shown in table 20.

The average daily weight gain was statistically significant ($p<0.05$) among the three treatments. However, the initial and final weight gain were at par or similar among treatments. The group fed rice straw supplemented with urea (T2) recorded the highest (244g/day) result while T3 recorded the lowest daily weight gain (136g/day).

The group of animals fed rice straw treated with urea plus residues and concentrate was significantly higher compare to others groups. The analysis shows that there was a significant difference in the mean daily body weight gain of bulls used in the experiment. The bulls fed the treated rice straw supplement had the highest mean daily body weight gain which was significantly higher than the other those which received untreated rice straw treatments. All the groups of bulls fed recorded the significant difference ($P<0.05$).

The total weight gain and daily weight gain obtained were all significant.

Animals fed with urea-treated straws had remarkable results in terms of ADWG. The ration composed of 40% treated rice straw in combination with 20% cowpea haulm, 20% groundnut haulm and 20% cottonseed gave an ADWG of 244 g, compared to an ADWG of 181 g for T2 and 136 g for the control T3 ration. This resulted in an average increase of 16.36 kg for the group receiving the T1 treatment, 22 kg for the group receiving T2 compared to 12.26 kg for the control receiving T3.

Results of feeding treated rice given to cattle showed a significant increase in weight in 90 days. On the other hand, cattle fed during the same period with untreated straw did not obtain enough increasing body weight. The comparison of the effect of supplementation of T1 and T2 with control T3 (untreated rice straw) showed a difference of 4.10 kg for T1 and 9.74 for T2 compared to the control. It has also been noted and improved feed intake in T1.

The highest mean total dry matter forage intake was recorded in T3 for the bulls fed by untreated rice straw supplement. There was significant difference ($P<0.05$) in the mean forage intake by group. The highest mean total feed intake was recorded by the bulls group fed the untreated rice straw supplement (T3), this was followed by the bulls group fed by rice straw treated with urea (T2) and the group received the treated rice straw treated with doum fruit salt (T1) recorded the least mean total feed intake.

There was significant difference ($P<0.05$) in the final body weight of the bulls. The highest feed conversion ratio was recorded for the bulls fed the untreated rice straw supplement.

Table 4: Live Weight Changes (Kg) of Bulls Supplemented with Organic and inorganic mineral and Feed Intake as Affected by Dietary Treatment

Parameters						
Treatments	IWG	FWG	TWG	ADWG	DFI	TDMI
T1	254.30	270.66	16.36^{b}	0.181^{b}	17.9c	1611^{c}
T2	253.86	275.86	22.00^{a}	0.244^{a}	18.17b	1636^{b}
T3	255.20	267.46	12.26^{c}	0.136^{c}	18.47a	1663^{a}
SEM	0.55	0.73	0.72	0.008	0.00	0.00
P-value	0.222	0.001	0.001	0.001	0.001	0.001

a, b, c means are significantly different from one another. SEM= Standard Error of Mean; T1=Treatment 1(Rice straw treated with doum fruit salt + Cotton seed cake +groundnut haulms + cowpea haulms); T2= Treatment 2(Rice straw treated with urea + Cotton seed cake +groundnut haulms + cowpea haulms); T3= Treatment 3(untreated rice straw + Cotton seed cake +groundnut haulms + cowpea haulms). IWG= Initial Weight Gain, FWG= Final Weight Gain, TWG= Total Weight Gain, ADWG= Average Daily Weight Gain. DFI= Daily Feed Intake, TDMI= Total Dry Matter Intake.

Discussion

The valorization of straw by treatment with traditional salt extracts from Doom fruits after burning and distillation and urea could thus constitute an alternative mean to increase its fodder value. The use of rice straw in feeding ruminants is justified in the Province of Tandjilé especially by its appreciable production, the large availability, the cost and above all the possibility of improving their value food using those different fertilizers.

The experimental by treated rice straw positively influenced ($P < 0.05$) average final weight gain and average daily weight gain. The corresponding increases in weight gains were greater for treatment T2 and treatment T1 compared to control (T3). The total weight gain ranged from 12.26 to 22.00. However, the Maximum weight per animal head was observed in T2 compared to T1. Average daily weight gain (ADWG) demonstrated that there was a response to taking treated rice straw supplement, as the highest total body weight gain correspond to taking quality supplement (T2 and T1). This shows that feed utilization was better with bulls fed treated rice straw supplements (T2 and T1). These ADWG values in this study were lower than the work of Wuanor *et al.,* (2015) who reported ADWG values of 0.81 to 1.34 kg/day for feedlot Bunaji bulls supplemented at different levels of a diet at basis of industrial agricultural by-products and the conclusions of Norris *et al*., (2002), on foreign cattle breeds and their

crosses in feedlots in Botswana and also those of Madziga (2013), who reported ADWG values of 0.96 Kg/day for zebu Azawak in feedlots in Botswana. Kardaya, (2018) reported ADWG ranged from 0.60 to 0.65 kg/day for zebu Bali however, Ortiz *et al.,* (2002) for the same species found the result ranged from 0. 37 to 0.41kg.

The total average weight gain obtained in this study was almost similar to the finding of Galloway *et al.,* (2011) who got the value ranged from 0.19kg to 0.36kg respectively for 86 days of supplementation.

The average TDMI supplement, particularly by groups of bulls having received the treated rice straw treatment, shows the weight gain. The average weight gain resulting from the proposed supplement intake can be explained by the quality for treated rice straw over untreated rice straw. Food intake shows that the treatment had an effect on it.

Total food consumption differed between treatments due to differences in minerals used in the treatments. The animals receiving the diet containing urea and Doum fruit salt tended to leave some residues of uneaten straw unlike those of the untreated rice straw diet (control). Golombeski *et al.,* (2006) previously reported that a decrease in food intake during urea treatment was caused by the bitter taste of urea.

The study by Ortiz *et al.* 2002, Golombeski *et al.* 2006 and Galloway *et al.,* (2011), reported that a slow-setting urea supplement increased ($P < 0.05$) the body weight of zebu cattle.

The present findings are in line with other authors (Ortiz *et al.,* 2002), who also noted during their experience that higher final weight of bulls fed urea straw was related to their initial weight. Feeding bulls with an improved ration based on rice straw treated with organic mineral (Doom fruit salt) and inorganic, mineral (urea) increases feed efficiency and ADWG.

Conclusion

The study showed that there is a great potential to improve rice straw with organic and inorganic mineral for feeding ruminants. The possibility of feeding bulls with supplements after their return to free grazing in the evening with ad libitum fodder based on rice straw treated with fertilizer Doom fruit salt (T1) and urea (T2) were been well demonstrated. The result of this study will provide useful information to cattle breeders in the Tandjilé province in southern Chad. The treated of rice straw with organic and inorganic mineral supplemented with GH and Cowpea Haulm and cotton seedcake increased the weight gain and dry matter intake of bulls. It is recommended that grazing bull diets be supplemented with treated rice straw containing Doom fruit salt, poultry manure or urea mixed with cotton seedcake, groundnut and cowpea haulm during dry season.

References

Alexandratos, N., and Bruinsma, J. (2012). World Agriculture Towards 2030/2050: the 2012 Revision. ESA Working Paper No. 12-03. Rome (Italy): FAO.

AU-IBAR. (2016). Livestock Policy Landscape in Africa: a Review [accessed February 20, 2021] http://www.au-ibar.org/component/jdownloads/finish/ 36-vet-gov/2712-livestock-policy-landscape-in-africa-a-review.

Banoin, M., and Jouve, P. (2000). Déterminants des Pratiques de Transhumance en Zone Agro-pastorale Sahélienne. Cas de l'Arrondissement de Mayahi, au Niger, Actes du congrès Options Méditerranéennes, Série. Annuelle / n°39, Rupture… Nouvelle Image de l'Elevage sur Parcours. Montpellier, CIHEAM-IAMM, 2000, p. 91.

César, J. (2005). Evaluation des Ressources Fourragères Naturelles. Productions Fourragères en Zone Tropicale. Cirdes/Cirad, 2 p.

Diarra, L. and Breman, H. (1998). Supplementing Cattle in the Sudano-Sahelian Zone: a Necessity During the Dry Season, 88p.

Diatta, S., Houmey V.K., Akpo L.E., Kaboré-Zoungrana C.Y. and Banoin M. (2007). Possibilités de Bouturage chez *Maerua crassifolia* Forssk., Capparaceae, un Ligneux Fourrager Sahélien. Afrique Science 03(2) (2007) 271 – 283.

ECOWAS. (2008). Livestock and Regional Market in the Sahel and West Africa Potentials and Challenges 177 p.

Fawzy, M., Abo-DoniaSafa, N., Abdel-Azim, M., Elghandour, M.Y., Abdelfattah, Z.M., Salem, G.B. and Soliman, N.A.M. (2014). Feed Intake, Nutrient Digestibility and Ruminal Fermentation Activities in Sheep-fed Peanut Hulls Treated with *Trichoderma viride* or Urea. *Tropical Animal Health Production,* 46:221–228 DOI 10.1007/s11250-013-0479-z

FAO, (2018). https://www.fao.org/africa/news/detail-news/en/c/1128900

Galloway D.L Sr., Goetsch, A.L., Sun, W., Forster, L.A., Murphy, Jr, G.E., Grant E.W. and Johnson, Z.B. (2011). Digestion, Feed Intake, and Live Weight Gain by Cattle Consuming Bermuda grass Hay Supplemented with Whey. American Society of Animal Science. *Journal of Animal Sciences 1992, 70:2533-2541.* http://jas.fass.org/content/70/8/2533

Garnier, L.K.M., and Dajoz, I. (2001). The Influence of Fire on the Demography of a Dominant Grass Species of West African Savannahs, *Hyparrhenia diplandra*. *Journal of Ecology. Oxford*, 89(2): 200–208.l

Gerber, P.J., Steinfeld, H., Henderson, B., Mottet, N., Opio, C., Dijkman, J., Falcucci, A. and Tempio, G. (2013). Tackling Climate Change Through Livestock: a Global Assessment of Emissions and Mitigation Opportunities. Food and Agriculture Organization of the United Nations (FAO). https://www.cabdirect.org /cabdirect/ abstract/20133417883.

Golombeski, G.L., Kalscheur, K.F., Hippen, A.R. & Schingoethe, (2006). Slow-release urea and highly fermentable sugars in diets fed to lactating dairy cows. *Journal of Dairy Science. 89, 4395-4403.*

Hiernaux, P. (1996). Spatial Heterogeneity in Sahelian Rangelands and Resilience to Drought and Grazing. In N.E. West (ed.) Rangelands in a Sustainable Biosphere. Proc. of the 5th *International Rangeland Congress, Salt Lake City, 23-28 July 95, Society of Range Management, Denver, USA, vol1: 232-233.*

INSEED. (2014). Institut National de la Statistique et des Etudes Economiques et de Développement. Deuxième Recensement Général de la Population et de l'Habitat. 121 p.

Kardaya, D., Wiryawan, K.G. Parakkasi., A. and Winugroho, H.M. (2018). Effects of three slow-release urea inclusions in rice straw-based diets on yearling Bali bull performances. *South African Journal of Animal Science 2018, 48 (No. 4)*

Madziga, I.I., Alawa, C.B.I., Lamidi, O.S., Goska, D.Y. and Adesote. A.A. (2013). Feedlot assessment of four indigenous breeds of cattle in Nigerian. *International Journal of Life Sciences and Medical research 2013, 3(1):35-38.*

Marty, A., Pabamé, S., Djatto, D., and Nabia, A. (2010). Causes des Conflits Liés à la Mobilité Pastorale et Mesures D'atténuation » Rapport D'étude Juin-Septembre 2010. 123 p.

Muhammad, I. R. (2004). Production and Utilization of Colombus Grass (*Sorghum almum Parodi*) in the Savannas of Nigeria. (Unpublished Doctoral thesis). Ahmadu Bello University, Zaria, Nigeria.

Norris, W.D., Macala, J., Makore, J. and Masominyana, B. (2002). Feedlot performance of various breed groups of cattle fed low to high levels of roughage. *Livestock Research for Rural Development 14(6)* 2002 retrieved at http://www.lrrd.org/lrrd14/6/norr146.htm. On 10/25/2023

OCDE/CSAO, (2008). Elevage et Marché Régional au Sahel et en Afrique de l'Ouest 54p.

Ortiz, R.M.A., Galina, M.A. and Carmona, M.M.A., (2002). Effect of a slow non-protein nitrogen ruminal supplementation on improvement of Cynodon nlemfuensis or Brachiaria brizanta utilization by Zebu steers. *Livestock Production Science 78, 125-131.*

Panel, M.M. (2020). Meat, milk and more: policy innovations to shepherd inclusive and sustainable livestock systems in Africa. International Food Policy Research Institute. Retrieved from https://www.ifpri.org/cdmref/p15738coll2/id/133855/filename/134065.pdf

Sohl, M. (2005). Rice is life in 2004 and Beyond. International Rice Commission Newsletter, 54:1-10.

Tendonkeng, F., Matumuini, N.E.F., Mboko, A.V., Lemoufouet, J., Miégoué, E., Fogang, Z.B., Mekuiko, W.H., Chounna, A., Boukila, B. and Pamo, T.E. (2016). Effet du Niveau d'Incorporation de Mélasse et de la Source du Liquide Ruminal sur la Digestibilité In Vitro de la Paille de Riz Traitée à l'Urée. *Livestock Research for Rural Development. Volume* 28, Numéro 2. 34-40.

Tendonkeng, F., Miegoue, E., Lemoufouet, J., Fogang, Z.B. and Pamo, T.E. (2018). Rice Straw Production and Potential Uses in Cameroon. In: Rice and Rice Straw: Production, Cultivation and Uses (Editors, Asma Timayer and Gada Kadyrov). 2018 *Nova Science Publishers*, Inc. Pp: 1-53.ISBN: 978-1-53612-911-3.

Upreti, C.R. and Orden, E.A. (2008). Effect of Rice Bran and Leucaena Supplementation on the Growth Performance of Goats Fed with Urea Treated Rice Straw. *Nepal Journal of Science and Technology,* 9:29-36.

Van Soest, P.J. (2006). Review. Rice Straw, the Role of Silica and Treatments to Improve Quality. *Animal feed Science and Technology*, 130:137-171.

Wanapat, M., Polyrach, S., Boonnop, K., Mapato, C. and Cherdthong. A. (2009). Effect of Treating Rice Straw with Urea and Calcium Hydroxide upon Intake, Digestibility, Rumen Fermentation and Milk Yield of Dcows. *Livestock Science* 125:238-243.

Wuanor, A.A., Ayoade, J.A. and Ani, F.O. (2015). Performance of feedlot Bunaji bulls supplemented varying levels of an agricultural industrial by- products based diet. *Journal of Agriculture and Veterinary Science* (IOSR-JAVS). Volume 8, Issue 7 Ver. I (July. 2015).

Yaning, Z., Ghaly, A.E. and Bingxi, L. (2012). Physical Properties of Rice Residues as Affected by Variety and Climatic and Cultivation Conditions in Three Continents. *American Journal of Applied Sciences*, 2012, 9 (11):1757-1768.