Journal of Applied Scienes Research, 5(8): 1002-1006, 2009

Effects of *Albizia Lebbeck* or Wheat Bran Supplementation on Intake, Digestibility and Rumen Fermentation of Ammoniated Bagasse

Balgees, A, Atta Elmnan, A.M.A Fadal Elseed and A. M. Salih

Faculty of Animal Production, University of Khartoum, Postal code 13314, Khartoum North, Sudan.

Abstract: The performance of nine goat kids maintained on basal diet of ammoniated baggase supplemented with *Albizia lebbeck* and/or wheat bran was examined in a completely randomized design experiment. The supplements were: 100 g of wheat bran, 100 g of *A. lebbeck* leaves, and 50 g of *A. lebbeck* leaves plus 50 g of wheat bran. The results showed that the intake of bagasse, total dry matter intake (TDM) and crude protein intake (CPI) differs significantly (P< 0.05) among supplements, the highest value recorded for *A. lebbeck* leaves followed by *A. lebbeck* leaves plus wheat bran and the lowest value recorded for wheat bran. DM, NDF and CP digestibility and N-retention were increased significantly (P< 0.05) for animals supplemented with *A. lebbeck* leaves and *A. lebbeck* leaves plus wheat bran than wheat bran. Moreover, animals supplemented with *A. lebbeck* leaves and *A. lebbeck* leaves plus wheat bran showed higher VFA and NH_3-N concentrations. The results demonstrated that *Albizia lebbeck* could be used to improve the utilization of ammonia treated on small holder farms during dry season.

Key words: ammoniated bagasse, supplementation, wheat bran, *Albizia lebbeck*.

INTRODUCTION

Bagasse is the main byproduct of sugarcane industry. It contains 60 to 70% carbohydrate, mostly in the form of polysaccharides and is a potential source of dietary energy for animals. The major limitation of bagasse as feed is its low digestibility which is due to association of lignin with cellulose and hemicelluloses [21]. It has been recognized that in order to improve the nutritive value of lignocellulosic materials for livestock, some form of pre-treatment is required [9,11,19 and 21]. Also evidence suggests that low quality roughages utilization could be improved by supplying deficient nutrients like nitrogen, minerals and vitamins to ruminant animal [6,8,17,16]. In this context, the role of fodder trees and shrubs in the diet of animals is should be considered particularly in developing countries like Sudan which has severe problem of feeding availability and costly animal feeds from more conventional sources like cakes and bran especially during dry season.

A wide variety of multipurpose trees (MPT) grown at the farmers' field can be used as nitrogen source in supplementary feeds. These trees foliage not only provide a cheap source of nitrogen, energy, minerals and vitamins but also have many other advantages like their wide spread on-farm availability and easy accessibility to farmers, their laxative influence on the alimentary system, low degradability of nitrogen in the rumen and scope of variety in the diet [16]. The replacement of conventional ingredients by tree leaves will make such supplements cheaper than the commercial concentrates. Hence, long term studies are required on production responses and animal performance to test different potential sources of tree leaves to broaden the base of alternative quality feed resources for the feeding of livestock.

The experiment was undertaken to probe the balance reaction and regulating potential of different supplement combinations with treated bagasse in order to determine better supplement formulas and to provide supplementation and feeding recommendations for local condition and resources available.

MATERIALS AND METHODS

Feeds and Feed Preparation:

Bagasse: About two hundred and fifty kg of bagasse were weighed and filled in airtight container in layers then 36 liters of ammonia solution were added insuring that all of the quantities were covered. After 4 weeks the container was opened for a few days to allow all excess ammonia gas to evaporate to reduce the strong odor of ammonia for animals to consume the feed.

Leaves: Mature leaves from 5 trees were collected during the dry season from different areas of Khartoum North city picked up by hand from randomly selected trees which were taken at three highest (top, middle and bottom of the trees), polled, air dried in a shaded place and stored.

Corresponding Author: Balgees, A, Atta Elmnan, Faculty of Animal Production, University of Khartoum, Postal code 13314, Khartoum North, Sudan.

Experimental Animals and Feed Intake: Nine male goats with pre-experimental body weight of 11.5 + 0.5 kg were allocated to three treatments in completely randomized design. The diets used in experiment were:

1. Ad libutum treated bagasse + 100 g Alibiza leaves (A)
2. Ad libutum treated bagasse + 100 g wheat bran (WB)
3. Ad libutum treated bagasse + 100 g (50% WB + 50% AL) (WA)

Chemical composition of the diet ingredients were presented in Table 1.

The individually housed goats were randomly allotted to three dietary treatments with free access to water and mineral blocks. The feeds were offered once a day at 8:30 hr. The treated bagasse was offered after the consumption of the supplements. The experiment lasted for 60 days with 15 days adaptation period. During experimental period, animals were weighed weekly. Residual amounts from the previous day were measured so that the amount consumed is determined.

Rumen Environment Study: Rumen liquor was collected by stomach tube and sampled every 2 hr up to 6 hr post the morning meal. Immediately the pH was measured using standard laboratory pH meter. Then the fluid strained through two layers of cheese cloth and stored at -20^{o}C for further analysis. Rumen ammonia nitrogen (NH_3-N) and volatile fatty acid were determined according to Abdulrazak and Fujihara[1].

Chemical Analysis: Samples of feed examined and residues were analyzed for their proximate components, DM, ash and CP according to AOAC methods [2]. NDF, ADF and ADL were determined according to Georing and Van Soest [7]. All the analysis was run in triplicate.

Statistical Analysis: Data were analyzed by analysis of variance for a completely randomize design [20] .where the F test was significant, the treatment means were compared using least significant difference (LSD).

RESULTS AND DISCUSSION

As shown in Table (2), there were remarkable differences in feed intake in response to supplement. The average daily bagasse, total dry matter (TDM) intake were significantly increased by 41.0 g, 30.56, 43.60 and 31.80 g for *A. lebbeck* leaves and *A. lebbeck* leaves plus wheat bran respectively as compared to wheat bran. Total CP intake was significantly different among treatments, the highest value 30.94 g/day was recorded by *A. lebbeck* leaves followed by *A. lebbeck* leaves plus wheat bran 28.82 g/day and the lowest value was obtained by wheat bran 25.21 g/day. Digestibility of NDF and CP significantly differ, *A. lebbeck* leaves recorded 69, 68% and wheat bran recorded 60.33 and 57.67% respectively. Digestibility of dry matters was 66% and 62.67% for *A. lebbeck* leaves and *A. lebbeck* leaves plus wheat bran respectively which were significantly higher than wheat bran 57.67%. N-retention was significantly higher for *A. lebbeck* leaves plus wheat bran 1.31 g/d and and *A. lebbeck* leaves 1.23 g/d compared to 0.22 for wheat bran as shown in Table (3).

The mean values for the concentration of VFA, ammonia-N and pH are summaried in Table (4) and were plotted graphically in Figure (1) and (2) respectively. The lowest concentration of VFA was obtained by animal fed *A. lebbeck* leaves plus wheat bran 10.07 mmol/dl while the highest values were recorded by animal fed wheat bran 10.76 mmol/dl. Ammonia-N concentration and pH were significantly higher for *A. lebbeck* leaves and *A. lebbeck* leaves plus wheat bran than wheat bran.

Table 1: Chemical composition (%) of *Albizia lebbeck*, treated baggase and wheat bran

	DM	CP	EE	NDF	ADF	Ash
Albizia lebbeck	95.01	17.50	3.65	48.54	36.87	9.34
Treated bagasse	90.5	10.01	-	69.40	36.87	-
Wheat bran	92.5	16.8	3.23	46.70	12.70	5.44

Table 2: Feed intake and digestibility of ammoniated bagasse supplemnted with *Albizia lebbeck* and/or wheat bran in goats

		A	WA	WB	SEM
Feed intake (g DM/day)	Bagasse	130.58^{a}	120.14^{a}	89.58^{b}	5.13
	TDM	225.68^{a}	213.88^{a}	182.08^{b}	5.13
	CP	30.94^{a}	28.22^{b}	25.21^{c}	0.55
Digestibility (%)	DM	66.00^{a}	62.67^{ab}	57.67^{b}	0.01
	CP	68.00^{a}	63.67^{ab}	57.67^{b}	0.02
	NDF	69.00^{a}	64.00^{ab}	60.33^{b}	0.02

(A) treated bagasse supplemented with 100 g *Albizia lebbeck* (WA) treated bagasse supplemented with 50% *Albizia lebbeck* + 50% wheat bran;(WB) treated bagasse supplemented with 100g wheat bran; (TDM) total dry matter; (CP) Crude protein; (NDF) nutrient detergent fiber; (N) nitrogen SEM standard error of means: $^{a-c}$ means with different superscripts in the same raw were significantly different (P< 0.05).

Table 3: Effects of *Albizia lebbeck* or Wheat bran Supplementation on Nitrogen retention.

	A	AB	WB	SEM
N intake (g/day)	4.92[a]	4.51[a]	3.95[b]	0.15
Faeces-N	2.19[a]	1.79[ab]	1.57[b]	0.17
Urine-N	2.16	2.11	1.64	0.20
N-retention	1.23[a]	1.31[a]	0.22[b]	0.16

(A) treated bagasse supplemented with 100 g *Albizia lebbeck;* (WA) treated bagasse supplemented with 50% *Albizia lebbeck* + 50% wheat bran; (WB) treated bagasse supplemented with 100g wheat bran; N nitrogen; SEM standard error of means: [a-b] means with different superscripts in the same raw were significantly different (P< 0.05).

Table 4: Average ruminal pH, total VFA and ammonia-N concentration

	A	WA	WB	SEM
pH	6.78[a]	6.73[a]	6.13[b]	0.06
NH3-N mg/dl	14.57[a]	14.29[a]	12.68[b]	0.28
VFA mmol/dl	10.50[a]	10.09[b]	10.76[a]	0.05

(A) treated bagasse supplemented with 100 g *Albizia lebbeck;* (WA) treated bagasse supplemented with 50% *Albizia lebbeck* + 50% wheat bran; (WB) treated bagasse supplemented with 100g wheat bran; VFA volatile fatty acid: SEM standard error of means: [a-b] means with different superscripts in the same raw were significantly different (P< 0.05).

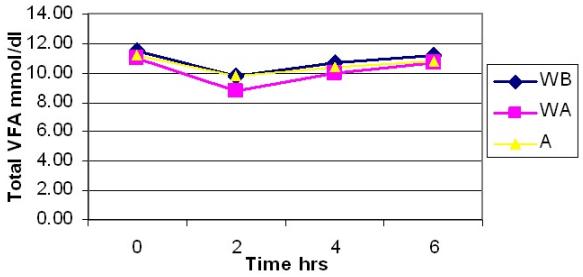

Fig. 1: Diurnal change in rumen total VFA conentration of goat offered (A) treated bagasse supplement with 100 g *Albizia lebbeck;* (WA) treated bagasse supplement with 50% *Albizia lebbeck* + 50% wheat bran (WB) treated bagasse supplement with 100g wheat bran.

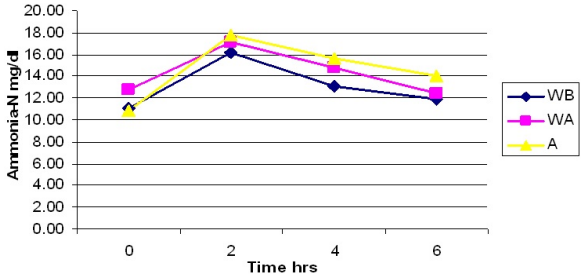

Fig. 2: Diurnal change in rumen ammonia-N conentration of goat offered (A) treated bagasse supplement with 100 g *Albizia lebbeck;* (WA) treated bagasse supplement with 50% *Albizia lebbeck* + 50% wheat bran (WB) treated bagasse supplement with 100g wheat bran.

Discussion: The experiment showed that the digestibility of CP and NDF were greatly increased to more than 60% when *Albizia lebbeck* whole or partial was added to treated bagasse that fed to the goats than wheat bran supplement. Increased digestibility, especially NDF, stimulates intake of basal diet (bagasse). The increases of total DM intake has been associated with improve N supply to cellulolytic bacteria leading to an increase in the degradation rate of poor quality roughages and to a higher digest passage rate. Patara *et al.* [16] suggested that agricultural by- products utilization can be improved by supplying deficient nutrients like protein, minerals and vitamins. However, with wheat bran supplement the digestibility of nutrients was less than 55% which agrees with Patara *et al.* [16]. The digestibility value of DM and NDF were highly responded to *A. lebbck* leaves than wheat bran may be because of availability of soluble carbohydrate in wheat bran lead to reduce rumen pH that may be affected rumen bacteria activity[6]. The

incremental digestion of nutrient in ruminant through supplementation of agricultural by-products (bagasse) with tree leaves generally agrees with other similar researches. Supplementation of crop residues with leaves of legumes has been reported to increase dry matter intake (DMI) [13] and DMI and digestibility [12]. Band and Ayoad [4] reported that *Leuceaena spp.* supplementation of goats fed a basal diet of maize stover increased organic matter (OM) and crude protein (CP) digestibility from 60 and 51 to 67 and 55% respectively. Patra *et al.*[16] reported that dry matter intake (DMI) was increased when low quality roughages were supplemented with leaves of tree legumes. Also Aregheore and Perera[3] stated that leaves of *Gliricid sepium* and *Leuceana leucocephala* can be used as protein supplements to improve the nutritive value of maize stover in the diet of goats. Hindrichsen *et al* [8] concluded that supplementation of basal diet of maize stover with *Leuceana diversifolia* results in an increase in total feed intake.

In another studys with different ratio of supplemented energy and protein with soya bean as protein source and cassava as energy source Bennison [5] found that increasing level of protein source appeared to be more appropriate than high energy supplement. In the present study, supplement *Albizia lebbeck* or partial *Albizia lebbeck* to treated bagasse also resulted in higher CP and NDF digestibility than wheat bran supplement. It can be concluded that supplementation with nitrogen source containing a defined amount of vitamins and minerals could be more appropriate to balancing the deficiency of bagasse and provide nutrient to rumen microbes leading to increase fiber digestion. Results of the feeding trial showed that supplementation with local nitrogen resources, not only had excellent effect on stimulated nutrient intake and digestibility, but also obviously decrease feed cost. However, with wheat bran had little effect on intake and digestibility. Similar results were obtained by Manyuchi *et al.* [10], when he supplemented steers and lambs grazing dry season pasture with combination of low protein-high energy, and high protein low energy and found that the combination of high protein low energy had better effect than combination of high energy low protein. It is commonly known when ruminants fed on low quality forage; nitrogen supplement is the first importance to balance nutrient deficiency [10].

Nitrogen retention as a proportion of digested nitrogen had a similar trend for CPD. In general nitrogen retention tend to be higher in *A. lebbeck* leaves than wheat bran due to higher nitrogen intake and digestibility in the trial.

Ammonia-nitrogen concentration in goat fed *A. lebbeck* leaves and (WA) tend to be higher in 2 hr post feeding, which may attribute to rapidly degradable CP in treated bagasse and *Albizia lebbeck*. Ammonia concentration of all diets were above the recommended minimal level of rumen ammonia-N concentration 5 mg/100 ml [18] to support efficient use of fermentable carbohydrates for microbial growth. This adversely affected pH that tend to be lower after 2 hr post feeding due to increase ammonia nitrogen level and decrease level of VFA. This result is in agreement with the results obtained by [6]. pH values of rumen liquor were within the range (6-7) of maximum rumen microbial fermentation was abolished [14].

Conclusion: Goats fed treated bagasse supplement with *Albizia lebbeck* leaves had increased intake and digestibility of nutrients. This study indicated that local nitrogen source like *Albizia lebbeck* could be used effectively and economically to improve utilization of fibrous material like bagasse on small holder farms during dry season.

REFERENCES

1. Abdulrazak, S.A. and T. Fujihara, 1999. Animal Nutrition, A laboratory Manual. Kashiwangi Printing Company Matsue-shi, Japan, pp: 16-22.
2. AOAC., 1990. Official Methods of Chemical Analysis. Association of Official Agricultural Chemists. Washington, DC. (16th edition).
3. Aregheore, E.M. and D. Perera, 2004. Effects of Erthrina variegata, Gliricidia sepium and Leucaena leucocephala on dry matter intake and nutrient digestibility of maize stover before and after sparing with molasses. Anim. Feed Sci. Tech., 11: 190 – 201.
4. Band, L.L. and J.A. Ayoad, 1986. Leucaena leucocephala leave hay as protein supplement for Malawian goats fed chopped maize stoven. In: Preston, T.R. Nuwanyak Pa. M.Y. (eds). Proceeding of workshop, University of Alexandria 1985) ILCA, Adisabab, pp: 134 –128.
5. Bennison, J.J., 1993. Supplementation of straw diets for growing lambs. In: Animal Production in Developing Countries. (Ed. M. Gill, E. Owen, G. E. Pollott and T. L. J. Lawrence). Br. Soc. Anim. Prod. Occasonal Publ., 16: 181-182.
6. Fadel Elseed, A.M.A., A.E. Amin, K.A. Abdel, Ati, J. Sekine, M. Hishinuma and K. Hamana, 2002. Nutritive evaluation of some Fodder tree species during the dry season in central Sudan. Asian-Ausi. J. Anim. Sci., 15: 844-850.
7. Goering, H.K. and P.J. Van Soest, 1970. Forage fiber analysis (Apparatus, Procedure and some Application) agricultural Hand Book No. 379. Agricultural Research Services. USDA, Washington, DC.

8. Hindrichsen, I.K., P.O. Osuji, A.A. Odenyo, J. Madsen and T. Hvelplund, 2002. Effects of supplementation of basal diet of maize stover with different amounts of Leucaena diferesifolia on intake, digestibility nitrogen metabolism and rumen parameters in sheep. Anim. Feed. Sci., Tech., 98: 131 – 142.
9. Klopfenstein, T.J., V.E. Krause, M.J. Jones and S.W. Wood, 1972. Chemical treatment of low quality roughages. J. Anim. Sci., 35:418.
10. Manyuchi, B., T. Smith and S. Mikayiri, 1993. Poultry litter and cotton meal as supplement for cattle grazing dry season pasture in Zimbawe. Anim. Prod. Occasional Publ., 16: 181-182.
11. McManus, R. and C.C. Cheung, 1976. Studies of forage cell walls 1, condition for alkali treatment of rice straw and rice hulls. J. Agric. Camb., 86:453.
12. Minson, R. and R. Milford, 1967. The voluntary intake and digestibility of diets containing different proportion of legumes and mature pangola grass. Aust. J. Exp. Agric. Anim. Husbandry, 7: 546–551.
13. Mosi, H.K. and M.H. Butterworth, 1985. The voluntary intake and digestibility of diet combination of cereal crop residues and legumes hay for sheep. Anim. Feed Sci. Tech., 12: 241 – 251.
14. Mould, F.L. and E.R. Ørskov, 1983. Manipulation of rumen fluid, pH and its fluencies on celluloysis *in sacco* dry matter, degradation and rumen microflora of sheep fed either hay or concentrate. Anim. Feed Sci. Tech., 10: 10 – 21.
15. O'rden, E.A., S.A. Abudlrazik, E.M. Cruz, M.E.M. Oden, T. Lchionhe and T. Fujihara, 2002. Leucaena leucocephala and Gliricida sepium supplementation in sheep fed ammoniated rice straws affected on intake, digestibility, microbial protein yielded and live weight changes. Asian Aust. J. anim. Sci., 13(12): 1659 – 1666.
16. Patra, A.K., K. Sharma, D. Narayan and A.K. Pattanik, 2003. Response of gravid dose to partial replacement of dietary protein by a leaf meal mixture of Leucaena leucocephala, Morus alba and Azadrichia indica. Anim. Feed. Sci. Tech., 100: 171 – 182.
17. Salem, A.Z.M., M.M. El Dawy and P.H. Robinson, 2006. Nutritive evaluation of some browses tree foliage during dry season: Secondary compounds, feed intake and *in vivo* digestibility in sheep and goats. Anim. Feed. Sci. Tech., 127: 25 – 267.
18. Satter. L.D. and L.L. Slyter, 1974. Effect of ammonia concentration on microbial protein production *in-vitro*. Bri. J. Nut., 32: 194-208.
19. Shah, F.H., T. Firdos and Z. Rehman, 1983. Improvement in the digestibility of best pulp by chemical treatment. Pak. J. Sci. and Res., 26: 328.
20. Steel, R.G.D. and J.H. Torrie, 1980. Principle and procedure of Statistical A Biometrical approach.2nd ed. McGraw- Hill, new York, USA.
21. Suksombat, W., 2004. Comparison of different alkali treatments on bagasse and rice straw. Asian – Aust. J. Anim. Sci., 17(10): 1430 – 1433.