Effect of urea treatment on the nutritive value of local sorghum and millet straw: a comparative study on growing performance of Djallonke rams

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ABSTRACT: Two tons of and chopped millet and sorghum straws have been treated with an urea solution at 5% (100 kg of straw, sprinkled with 50 lt. of solution). Treated straws were used as basic diet (900 g day) associated to 100 g of cotton cake for 24 growing Djallonke rams in comparison to non treated straws. Four groups of animals were fed for 98 days with: urea treated sorghum (UTSS), not treated sorghum straw (NTSS), treated millet (UTMS), non treated millet straw (NTMS). Treated straws presented an increase of NDF of about 9%, of total nitrogen from 2 to 3 times while digestibility of dry matter increased respectively by 8,8% and 23,0% respectively in treated sorghum and millet. Also dry matter intake increased by 4,5% and 15,5% for treated sorghum and millet respectively compared to non treated. Mean weekly weight gain were significantly higher ($P<0.05$) for UTSS e UTMS compared to NTSS e NTMS. While the weekly weight gain, did not differed between UTSS vs. UTMS and NTSS vs. NTMS. At the end of the trial the UTSS and UTMS group presented a weight gain of about 40% and 38.7%, of their initial weight; while the gain for both NTSS and NTMS was respectively of 31.1% and 29.5%.

Key words: Africa, Sheep, Straw, Urea.

INTRODUCTION – The climate of the sub-humid zone of west Africa is characterized by a rainy season of 4 months and a long dry one of 8. During the dry season livestock feeding becomes a major issue although, cereal crops, grown for human consumption, produces a lots of crop residues which are largely available throughout the dry period of the year. Burkina Faso the Ministry of Agriculture indicate an availability of cereal crops residues of about 10 millions tons per year. However, these straws are characterized by a low nutritional value due to a poor nitrogen content and low digestibility. Many treatments: such as the use of ammonia or sodium hydroxide have been proposed to enhance their nutritional value (Chaudhry, 1998), however, in tropical countries, these techniques remain scarcely applied at farmers due to various technical, economic and environmental reasons (Nguyen, 2001). Nevertheless, by applying a simple chemical treatment with urea (Jackson, 1978), which is largely available at a reasonable cost in many developing countries, the nutritional value of straws and other crop residues could be improved. Urea in presence of water and ureases, naturally present on straws and soils, and temperature around 20°C, is completely hydrolysed into ammonia and carbon dioxide As result of the treatment, straws should be more digestible, have a higher nitrogen content, and voluntary ingestion of dry matter should increase (Chenost, 1977). Based on this we have carried out a nutritional trial on Djallonke rams to verify to which extent millet and sorghum straws treated with urea can help to overcome the feeding problems for ruminants during the dry season in the sub-humid zone of west Africa.

MATERIAL AND METHODS – Two tons of crop residues (sorghum and millet straw) were treated following a 100/50/5 sprinkling scheme (100 kg of straw, 50 litres of water solution at 5% of urea) and offered as diet to 24 Djallonké growing rams for a 14 weeks period. Straw was hand chopped, distributed in successive well pressed layers, then placed in two silos of 10.2 m^3, each built with "laterite" bricks. Then, each layer was watered with the urea solution before spreading and pressing the following one which was watered in turn. The silos were therefore covered with a plastic film, and kept sealed for 3 weeks. The whole process was accomplished in two days by two workers. Both sorghum and millet straw were tested prior and after the treatment to define dry matter (DM), organic matter (OM), neutral detergent fiber (NDF) and total nitrogen (TN) contents. Dry matter digestibility (DMd) and dry matter ingestion (DMi) were also measured through feces collection for a period of 7 days for all groups starting 5 weeks after the beginning of the trial. DMi was calculated as g of ingested dry matter on the metabolic weight (gDM/kg$P^{0.75}$). Twenty-four Djallonké rams of 12±2 months of age, 18.7±2.2 kg average weight, were penned in individual cages and allotted to 4 groups of 6 animals each. Animals were allowed a 7 days adjustment period to cage and feeding scheme. During the adaptation period animals were progressively offered an increasing amount of treated straws to reach 100% of the respective feeding regime at day 7. Starting from day 0 groups were respectively fed with Urea Treated Sorghum Straw (UTSS), Non Treated Sorghum Straw (NTSS), Urea Treated Millet Straw (UTMS) and Non Treated Millet Straw (NTMS). All rams were also complemented daily with 100 gr. of cotton cake, while water and mineral blocks were available *ad libitum*. Each group was offered daily 900 gr. of either UTSS, NTSS, UTMS or NTMS. Feed stuff was distributed twice a day and what left over before the following forage distribution was weighed. To measure weight changes rams were weighed once a week. Data on gDM/kg$P^{0.75}$, weight changes, mean weekly gain were analyzed by one way ANOVA.

RESULTS AND CONCLUSIONS – The effect of the treatment on sorghum and millet straw are outlined in Table 1. As can be noticed the treatment has increased NDF% by 9% in both treated sorghum and millet compared to the untreated straws.

Table 1. Effect of urea treatment at 5% on chemical composition of sorghum and millet straw.

Straws	Groups	DM %	OM %	NDF %	TN %	CP %	DMd%	DMi (gDM/kg$P^{0.75}$)
sorghum	treated	95.4	92.3	75.9	1.87	11.7	34.5	44.3±6.7a
	non treated	95.0	90.2	69.3	0.43	2.6	31.7	42.2±6.3a
Millet	treated	95.7	88.5	78.9	1.07	6.7	40.0	49.2±6.1b
	non treated	95.5	86.6	72.2	0.60	3.7	32.5	42.6±6.0a

*DM = Dry Matter, OM= organic Matter, NDF = Neutral Detergent Fibre, TN= Total Nitrogen, CP = Crude Protein, DMd%= Dry Matter digestibility, DMi= g*DM ingestion/kg of metabolic weight.*
Figures in the same column with different superscript statistically differ by P<0.05.

Also TN% on the DM increased, making CP% over 3 and almost 2 times higher respectively for treated sorghum and millet straws vs. non treated. In conclusion the effect of the treatment on the straws is similar to that obtained by Larwence (2000) and and Chenost (1997), although the treatment lasted only 3 weeks An increase of dry matter digestibility (DMd) and dry matter ingestion were also obtained. DMd of treated vs. non treated sorghum was enhanced of about 9% whereas for treated non treated millet the increase was of 23%. Dry matter ingestion was respectively 4.97% and 15.5% higher for treated sorghum and millet compared to the corresponding non treated straws. On average forage left over ranged between 25% and 30%. DMi of UTMS was respectively 11.0%, 16.5 % and 15.4 (P<0.05) higher compared UTSS and NTSS, or NTMS.
Both UTSS and UTMS groups had higher (P < 0.05) mean weekly weight gain and mean net gain compared to their control groups, NTSS and NTMS respectively (Table 2). No differences were observed between UTSS and UTMS or NTSS and NTMS. At the end of the trial the rams of the UTSS group increased on average by 40% their initial weight; similar, although with a lower magnitude to the gain of the UTMS group (38.7%). Both control groups (NTSS and NTMS) had a lower weight increase of 31.1% and 29.5% respectively. The fact that the UTMS group had higher DMi per kg of metabolic weight compared to UTSS group could be due to the fineness of millet straw com-

pared to that of sorghum. The similar weight gain of UTSS and UTMS groups thought DMi of the UTSS (44.3±6.7) was 11.06% lower in comparison with the UTMS (49.2±6.1) is likely due to the higher CP content of the treated sorghum (11.7%) compared to the treated millet (6.7%). A cost analysis shows that: with 50 kg of urea purchasable at about 19.00 on the rural markets , 1000 kg of straws (free of charge since available at farmers level) can be efficiently treated at an actual cost 0.019 € per kg of forage. Considering that animals intake was about 500 g of treated straw per day, the daily expense for forage was 0,0095 € which multiplied by the days of the trial (98) gives an overall expenditure of 0.931 € per animal. To define whether there is a cost effective benefit in the long run for both: weight gain and animal body condition, the treatment should be protracted throughout the dry season.

Table 2. Weight changes of Djallonké rams feed for 14 weeks with urea treated and non treated sorghum and millet straw.

Straws	Groups	Mean individual body weight at week 0 in kg	Mean individual body weight at week 14 in kg	Mean weekly weight gain in g	Mean net gain in kg
Sorghum	treated	18.5±2.1	26.1±2.1	540±240[a]	7.5±0.9[a]
	non treated	18.6±2.8	24.4±2.4	420±280b	5.8±0.5[b]
Millet	treated	18.6±2.2	25.8±1.3	510±330[a]	7.2±1.0[a]
	non treated	19.3±2.0	25.0±2.0	410±350b	5.7±0.7[b]

Figures in the same column with different superscript statistically differ by P<0.05.

This would permit to determine the effect on the animal appearance which is very important under African market situation where animals are sold by head and not by weight. In addition, in the region (Nianogo, 1992) over 50% of the sheep lamb from April to June, carrying out large part of the gestation during the during harsh period of the year. Treated straws might sustain pregnant ewes during the dry season. Supplementary research should be conducted to define the most effective urea concentration (3%, 5%, 10%) according to the available variety of straws.

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