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Effect of Urea Nitrogen Treatment on Growth Performance and Rumen Parameters of Indigenous Buffalo *(Bubalus bubalis)* Heifers

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ABSTRACT. *Experiments were conducted to investigate the growth performance and rumen parameters of local buffalo heifers in response to urea nitrogen used in treated straw. Ten buffalo heifers were alloted to two groups balanced by body weight (89.0 kg) and age (12 months). All the animals were offered "Guinea A" grass (Panicum maximum) ad libitum during day time. At night, the treatment group (n=5) was given 4% urea treated straw, while the control group (n=5) was given untreated straw. Daily group feed intake of Guinea grass and straw was recorded. Individual body weights were obtained monthly. Representative samples of Guinea grass, straw and refusals were obtained periodically, for proximate analysis. Rumen samples were obtained to determine rumen pH, and rumen NH_3-N. Urea treated rice straw had a higher ($P \leq 0.05$) crude protein content than untreated straw. Straw dry matter intake ($P \leq 0.01$), total dry matter intake ($P \leq 0.01$), nitrogen intake ($P \leq 0.01$) and rumen NH_4-N ($P \leq 0.05$), were greater in the treatment group. This group achieved a higher final body weight due to the greater body weight gain, suggesting long-term beneficial effects of urea nitrogen used in treated straw.*

INTRODUCTION

A majority of the 0.9 million buffalo population in Sri Lanka are of indigenous type and are reared by small holder farmers. Generally, these animals are maintained under a natural grazing management system, the main source of feed being natural grazing lands. As a result, the nutritional requirement of buffaloes is not satisfied either qualitatively or quantitatively.

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Therefore, supplementation of feed to bridge the nutritional gap becomes vital to ensure enhanced growth and production.

Amongst numerous available feed stuff, the feeding value of rice straw has long been recognized by the traditional farmers in Sri Lanka. Rice straw is available in abundance during harvesting season as a by-product of rice production. In general, the quality of rice straw is inferior to that of green grass. Numerous research have been conducted in the past with the objective of improving the quality of rice straw as an animal feed (Doyle and Pearce, 1985). Urea treatment of rice straw has been shown to improve dry matter intake (Gadre and Jackson, 1980), dry matter digestibility (Deschard, 1983), enhanced rumen function and improved protein supply to the animal. Urea treatment is a simple processing method, which can easily be practiced by farmers. The present study was conducted to investigate the effects of the supplementary feeding of urea treated rice straw on rumen parameters and growth performance of indigenous buffalo heifers.

MATERIALS AND METHODS

The study was conducted in the Department of Animal Science, Faculty of Agriculture, University of Peradeniya using 10 buffaloe heifers. The animals were divided into two groups (n=5/group), balanced by age (12.0 $\pm$ 0.52 months) and body weight (89.0 $\pm$ 8.9 kg). All the animals were offered medium quality Guinea A grass (*Panicum maximum) ad libitum* during the day. During the night, one group of heifers was (treatment) offered urea treated straw (4% urea treated straw, ensiled for 7 days prior to feeding), while the other group (control) was offered untreated straw (moisture content of untreated straw was brought similar to urea treated straw). Except for this, the other management practices were similar for both groups during the 22 weeks experimental period. Group feed intake and refusals of both grass and straw were recorded daily. Representative samples of grass, straw, urea treated straw and refusals were collected weekly to determine dry matter (DM), organic matter (OM) and nitrogen content (Kejltec Autoanalyzer) using standard methods (AOAC 1980). Rumen samples were obtained from individual animals 3 hours after feeding using a mouth tube at every 8th week, to determine rumen ammonia nitrogen [NH_4-N] (Markham steam distillation method by Markham, 1942) and rumen pH (electrometric method using pH meter). Individual body weight measurements were obtained weekly using an electronic weighing balance (RUDDWEIGH Model: KM-2 S) beginning from Day 0 of the experiment.

Data were subjected to regression analysis and analysis of variance procedure (Snedecor and Cochran, 1979).

RESULTS AND DISCUSSION

Proximate compositions of the diets

The mean proximate compositions of the grass, untreated straw and urea treated straw are presented in Table 1. These values are comparable to those reported by Ravindran *et al.*, (1987) for *Panicum maximum* Eco type A (Guinea A) harvested at 4 weeks, and by Masaaki *et al.*, (1991) for untreated and urea treated straw. Based on the proximate composition, the guinea grass fed to the heifers can be considered as a medium quality base feed (Perera and Madawala, 1990). Since, the CP content of all three base feeds were < 12%, a high intake of dry matter could be expected to satisfy the requirement of the animals.

Table 1. Proximate compositions of the grass, untreated straw and urea treated straw fed to heifers (with SE).

	Grass	Untreated straw	Urea treated straw
Dry matter(%)	28.62±0.52	67.81±0.46	67.75±0.62
Other Components:(% DM)			
Organic matter	88.46±0.40	89.99±0.18	89.34±0.26
Crude protein (CP%)	7.89±0.04	5.58±0.03	9.10±0.02
Phosphorus	0.33±0.02	0.15±0.01	0.28±0.02
Potassium	0.61±0.02	0.12±0.01	0.26±0.02
Magnesium	0.26±0.06	0.13±0.04	0.26±0.03

Dry matter intake (DMI)

The DMI on the basis of animal body weight and metabolic weight are given in Table 2. The mean total dry matter intake (DMI) of the treatment

group (4.29 kg/d/animal) was greater ($P \leq 0.01$) than that of the control group (Table 2). This was mainly attributed to the greater ($P \leq 0.01$) straw DMI by this group as the grass DMI was similar in both groups (Table 2).

Table 2. Dry matter intake of buffalo heifers fed with untreated straw (control) or urea treated straw (treatment) as a supplement.

Attribute'	Untreated straw	Urea treated straw	
Mean			
Live weight (kg)	105.70	111.25	
Grass DMI			
kg/d/anim.	2.90	2.96	NS
kg/100 kg BW	2.74	2.66	NS
g/kg$^{0.75}$ BW	87.97	86.41	NS
Straw DMI			
kg/d/anim.	0.56	1.32	**
kg/100 kg BW	0.53	1.19	**
g/kg$^{0.75}$ BW	16.99	38.83	**
Total DMI			
kg/d/anim.	3.46	4.29	**
kg/100 kg BW	3.27	3.85	**
g/kg$^{0.75}$ BW	104.69	125.24	**

** ($P<0.01$)

Similar increases in DMI of straw, after urea treatment have been reported previously (Wongsrikeao and Wanapat, 1984). The improved DMI of urea treated straw could be due to increased microbial activity on straw dry matter, facilitated by breaking down of lignocellulose complex by Urea-ammonia (Saadullah *et al.*, 1981). This leads to the exposure of cellulose encapsulated in lignin matrix which is generally resistant to microbial degradation in the rumen. Improved activity of rumen microbes in the

presence of high nitrogen availability resulting from the urea treatment also increases digestibility. Therefore, it is evident that the amount of N in the diet has a significant effect on DMI and digestibility, specially in roughage feeds.

Nitrogen intake

The grass nitrogen intake based on the DMI and the N content of grass was not different between the two groups. However, the treatment group had a greater ($P \leq 0.05$) total nitrogen intake (72 *vs* 53 g/d/animal) primarily due to a greater straw nitrogen intake (23 *vs* 5 g/d/animal) by this group (Table 3). Since the total N intake is a product of the N content in the diet and total DMI, the feeds that are highly palatable and rich in N result in a higher intake of dietary N.

Table 3. Nitrogen intake and rumen parameters of buffalo heifers fed with untreated straw (control) or urea treated straw (treatment) as a supplement (with SE).

	Untreated straw	Urea treated straw	
Nitrogen Intake (g/d/animal)			
Grass	48.0	49.0	NS
Straw	5.4	22.8	**
Total	53.4	71.8	**
Rumen Parameters			
pH	7.48 ± 0.48	7.82 ± 0.37	NS
NH_3-N (mgN/L)	20.05 ± 0.52	36.49 ± 4.00	*

* ($P \leq 0.05$) ** ($P \leq 0.01$)

It is important to note that a higher intake of N does not necessarily guarantee favourable results, as most of the ammonia N disappearing from the rumen can be eliminated in the urine as urea in an attempt to prevent rumen NH_3-N toxicity. This is especially true, when urea treated or supplemented roughages are given under inadequate levels of available energy.

Rumen parameters

Rumen pH of the two groups were not significantly different ($P \leq 0.05$) although the treatment group had a slightly higher rumen pH (7.82 *vs* 7.48). This is a good indication of the buffering capacity of the rumen and greater utilization of NH_3-N by rumen microbes because, usually an elevated rumen pH is expected when urea treated straw is given (Masaaki *et al.*, 1991).

The rumen NH_3-N content was greater ($P \leq 0.05$) in heifers supplemented with urea treated straw compared to the control group (Table 3). However, the rumen NH_3-N contents of both the groups (36.49 and 20.05 mg N/L), were lower than required by the rumen microbes (80 mg N/L) for an optimal microbial protein synthesis (Hoover, 1986). As observed by Masaaki *et al.*, (1991), the low concentration of NH_3-N in the rumen may be due to the higher rate of elimination of ammonia N from the rumen and excreted in the urine as urea.

Body weight gain

During the 22 weeks, the mean body weight of the treatment group animals increased to 133 kg while that of the control group increased only to 122 kg (Table 4). The final body weight, the total gain and the daily gain were greater in the treatment group eventhough the weight gain was not significant. It appears that the treatment group would have gained greater body weight and reached a significantly higher final body weight if this treatment was extended for a longer period. The lower than expected gain in the weight of treatment animals over the control animals may be associated with the low nitrogen status of the rumen.

Table 4. Mean live weight gain of buffalo heifers fed with untreated (control) or urea treated straw (treatment) as a supplement.

	Untreated straw	Urea treated straw
Days on experiment	154	154
Number of buffaloes	05	05
Initial body weight (kg)	89.5 ± 5.1*	89.8 ± 3.9*
Final body weight (kg)	122.4 ± 5.8*	132.7 ± 4.2*
Total gain (kg)	33.0	43.0
Daily gain (g/day)	214.3	279.2

* ± SE

CONCLUSION

The results indicate that the urea treatment of rice straw improves its CP content, increases DMI, and rumen NH_4-N resulting in a greater body weight gain in the long run in buffalo heifers.

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