

METHODS OF UREA INCORPORATION IN STRAW AND THEIR EFFECTS ON PERFORMANCE OF BUFFALO HEIFERS

M. A. Akbar¹

Dept. of Animal Nutrition, Bangladesh Agricultural University
Mymensingh 2202, Bangladesh

Summary

Twelve indigenous buffalo heifers were grouped into 3 and were supplied with following diets - urea-ensiled rice straw + wheat bran + green grass (A); rice straw soaked in urea-water + wheat bran + green grass (B); and untreated straw + wheat bran + green grass (C); so that each group received any one diet. Total dry matter intake was highest in animals on diet C and lowest on B. However, straw DM intake was highest in animals on silage diet and lowest on untreated straw diet. Organic matter and crude fibre digestibility of silage and soaked straw diets were significantly higher ($p < 0.01$) than those of untreated straw diet. Although the values were lower with soaked straw diet than those with silage diet, the differences were not statistically significant. Body weight gain of animals on silage diet and soaked straw diet were significantly ($p < 0.01$) higher, however, the value for silage diet was not significantly different from that of soaked straw diet.

(Key Words: Straw Treatment, Different Methods, Growth, Buffalo Heifers)

Introduction

Simple and easily adoptable technique to improve digestibility of rice straw is essential if it is to be accepted by the village level farmers of Bangladesh. Urea treatment of straw has been found, in many instances, to improve digestibility of straw (Zafren, 1980; Saadullah et al., 1981; Jaiswal et al., 1983). Most common methods of urea incorporation in straw is the treatment with urea solution and subsequently ensiling. But the village people did not yet accept it (Rahman et al., 1988; Islam, 1989) although numerous efforts have been made to disseminate the technology to the farmers of rural area. The reason might be that the method is tedious and involve extra time and labour (Doyle et al., 1986). However, urea can also be incorporated in straw by soaking the latter in urea solution for sometimes before feeding which may be easily adopted by the village level farmers of Bangladesh, as it requires no extra labour or time. Moreover, the farmers in many areas of the country already practice chopping and soaking straw in plain water before

feeding. It was reported that chopping and subsequently soaking of straw in plain water prior to feeding resulted in increased dry matter consumption (Chaturvedi et al., 1973; Mathur et al., 1985). The present work was undertaken to study the effects of incorporation of urea in rice straw either by ensiling or soaking with urea solution on intake and digestibility of feeds and also on growth rate of buffalo heifers.

Materials and Methods

Preparation of silage

Rice straw was chopped into pieces (5-8 cm length) and spread on concrete floor. Four percent urea solution was prepared by dissolving 40 g urea in a liter of water/1.5 kg fresh straw. Urea solution was sprinkled over the straw with simultaneous mixing. Then the whole lot was ensiled by placing them in concrete silo pit. The top of the pit was covered with polyethylene sheet on which a thick layer of mud was put. The pit was covered with corrugated tin sheet to save it from rain water. The silage was opened after 2 weeks.

Preparation of soaked straw

Rice straw was chopped into pieces (5-8 cm length) and placed in a concrete chari (big bowl).

¹Address reprint requests to Dr. M. A. Akbar
Biochemistry Division, School of Agriculture, 581/King
Street, Aberdeen AB9 1UD, U.K.

Received August 13, 1991

Accepted April 29, 1992

Urea solution was prepared by dissolving 20 g of urea in a liter of water for each 1.05 kg of fresh straw. The solution was sprayed on the chopped straw slowly and was mixed thoroughly. The straw was left for 2 hours for soaking. Two batches of soaked straw was prepared daily and offered to the animals. At the time of feeding, there was no liquid effluent left.

Animals and diets

Twelve indigenous buffalo heifers of almost 3 years of age were grouped into 3, each having 4 animals. They were supplied with 3 different diets - straw silage + wheat bran + green grass (A); soaked straw + wheat bran + green grass (B) and untreated straw + wheat bran + green grass (C), so that each group received any one diet. Silage, soaked or untreated straw was fed *ad libitum*. The detailed composition of the diets are shown in table 1.

The animals were weighed at the beginning and then once in a week thereafter throughout the experimental period of 80 days. After a pre-experimental period of 3 weeks, the digestibility of diets were determined by a conventional digestibility trial with total collection of faeces over 7 days.

Analytical methods and design of experiment

Representative samples of feed and faeces were analysed for proximate components (AOAC, 1970). The design of experiment followed was Completely Randomised Design (CRD).

Results

Chemical composition of feed ingredients used in the experiment is presented in table 2. Table shows that soaked straw contained little more nitrogen than ensiled straw.

TABLE 1. COMPOSITION OF EXPERIMENTAL DIETS (kg)

Ingredients	Diets		
	A	B	C
Untreated straw	—	—	<i>Ad lib.</i> (3.88)
Soaked straw	—	<i>Ad lib.</i> (6.96)	—
Urea ensiled straw	<i>Ad lib.</i> (7.32)	—	—
Wheat bran	0.50	0.50	1.8
Green grass	1.0	1.0	1.0

One percent (of concentrate) of each of steamed bone meal and common salt were supplied to the individual animal.

TABLE 2. NUTRIENT COMPOSITION OF FEEDS USED IN THE EXPERIMENTAL DIETS (g/100 g)

Feeds	DM	On DM basis				
		Crude protein	Crude fibre	Ether extract	Ash	Organic matter
Silage	53.2	7.9	33.9	2.3	14.4	85.6
Soaked straw	50.1	8.2	34.0	3.3	14.8	85.2
Wheat bran	86.0	17.8	10.1	4.7	5.7	94.3
Green grass	17.3	9.3	31.8	3.8	10.4	89.6
Rice straw	86.1	3.4	33.1	2.1	13.5	86.5

Dry matter (DM) intake of the experimental animals are shown in table 3. It can be seen from the table that total DM intake was highest in animals on untreated straw group and lowest in soaked straw group. However, straw DM intake was highest in silage group and lowest in un-

treated group. Digestible DM intake was also highest with silage diet and lowest with diet containing untreated straw.

Apparent digestibility of different diets are shown in table 3. It is evident from the table that organic matter (OM) digestibility of the diet

EFFECTS OF INCORPORATION OF UREA IN RICE STRAW

TABLE 3. FEED INTAKE, DIGESTIBILITY AND GROWTH OF BUFFALO HEIFERS ON DIFFERENT EXPERIMENTAL DIETS

	Animal groups		
	A	B	C
Average initial body wt. (kg)	159.8 ± 11.42	169.8 ± 8.86	164.1 ± 10.14
Average final body wt. (kg)	183.5 ± 10.10	192.3 ± 9.16	181.0 ± 11.32
Live weight gain (g/d)	296 ^a ± 15	281 ^a ± 17	211 ^b ± 13
Total DM intake (kg/d)	4.4 ± 0.21	4.0 ± 0.23	4.8 ± 0.15
Straw DM intake (kg/d)	3.8 ^a	3.4 ^a	3.1 ^b
Digestible DM intake (kg/d)	2.6	2.3	2.5
OM digestibility (%)	62.6 ^a ± 1.03	60.5 ^a ± 0.82	52.2 ^b ± 0.98
CF digestibility (%)	64.0 ^a ± 0.97	60.2 ^b ± 0.94	54.0 ^c ± 0.86
CP digestibility (%)	66.0 ^a ± 1.40	67.9 ^a ± 0.88	62.9 ^b ± 1.08

* The values are the average of 3 animals and expressed with ± SEM.

The means bearing different superscripts differ significantly ($p < 0.01$).

containing silage was highest and that containing untreated straw was lowest. The values of silage and soaked straw diets were closer. However, statistical analysis showed that OM digestibility of untreated straw diet was significantly lower ($p < 0.01$) than that of diets containing either silage or soaked straw. There was no significant differences between the values of silage and soaked straw diets. Crude fibre (CF) digestibility of silage diet was highest and that of untreated straw diet was lowest. Statistical analysis showed that CF digestibility of ensiled straw was significantly higher than those of soaked straw ($p < 0.05$) or untreated straw ($p < 0.01$) diets. However, crude protein (CP) digestibility of soaked straw diet was slightly higher than that of silage diet but was significantly higher ($p < 0.01$) than untreated straw diet (table 3).

Data for weight gain of the animals during the experimental period are shown in table 3. The average daily body weight gain in animals on silage diet was highest and that of animals on untreated straw diet was lowest. Statistical analysis showed that gain in animals on silage or soaked straw diet was significantly higher ($p < 0.01$) than that of the diet containing untreated straw.

Discussion

Although total DM intake of the animals on untreated straw was highest, straw DM intake on this diet was lowest. The reason for higher

total DM intake on untreated straw diet might be due to its higher wheat bran content than the other two diets. Since silage and soaked straw contained higher crude protein than untreated straw, higher amount of wheat bran was added to the later in order to make the three diets isonitrogenous. Treatment of straw with urea in either method resulted in increased straw DM intake over that of untreated straw. Urea-ensiling of straw and soaking of straw in urea-water increased straw DM intake by 25% and 13% respectively which presumably resulted in increased intake of digestible energy (Jayasuriya, 1981). Straw DM intake of silage diet was higher than that of soaked straw diet which might be due to more palatability and softness of straw as a result of ensiling (Islam, 1989).

Urea treatment, both ensiling and soaking significantly ($p < 0.01$) increased organic matter (OM), crude fibre (CF) and crude protein (CP) digestibility of straw based diets over untreated straw which has also been reported by Saadullah and Haque (1981). Ensiling of straw with urea gave higher digestibility values than those of soaked straw, however, the differences were not statistically significant. The higher digestibility values of urea-ensiled straw might be due to more pronounced interaction between gaseous ammonia and straw cell wall during ensiling process (Jayasuriya, 1981) than soaking, resulting in more available fermentable carbohydrate for microbial attack.

The average daily live weight gain of the

animals receiving either silage or soaked straw diet were significantly higher ($p < 0.01$) than that of animals receiving untreated straw diet. This indicates that treatment of straw with urea following either of the methods has positive effect on live weight gain of animals. However, when treatment methods were compared, it was found that ensiling resulted in higher weight gain in animals than that of soaked straw. The reason for higher weight gain on silage diet than soaked straw diet might be the higher DM intake and hence digestible energy intake (Jayasuriya, 1981) as well as higher CF digestibility of former diet.

Conclusion

It may be concluded that treatment of straw with urea following either ensiling or soaking in urea-water results in increased intake of straw, increased feed digestibility and weight gain in buffalo heifers when compared to untreated straw. Although soaked straw gave lower values of nutrient digestibility and growth rate than urea-ensiled straw, the differences were not statistically significant. Therefore, soaking of straw in urea-water may be suggested to village level farmers of Bangladesh as the easily adoptable method of urea incorporation in straw based ration for buffaloes.

Literature Cited

- A.O.A.C. 1970. *Official Methods of Analysis* (11th edn.). Association of Official Agricultural Chemists, Washington, D.C.
- Chaturvedi, M. L., U. B. Singh and S. K. Ranjhan. 1973. Effect of feeding water soaked and dry straw on feed intake, digestibility of nutrients and VFA production in growing Zebu and buffalo calves. *J. Agric. Sci. Camb.* 80:393-397.
- Doyle, P. T., C. Devendra and G. R. Pearce. 1986. Rice straw as feed for ruminants. In "International Development Programme of Australian Universities and Colleges Ltd. (IDP)", Canberra, Australia.
- Islam, S. M. A. 1989. Effect of different methods of urea incorporation in straw based diets on intake, feed digestibility and growth rate of buffalo heifers. M. Sc. Thesis, Bangladesh Agricultural University, Mymensingh, Bangladesh.
- Jaiswal, R. S., M. L. Verma and I. S. Agrawal 1983. Effect of urea and protein supplements added to untreated and ammonia treated rice straw on digestibility, intake and growth of crossbred heifers. In "Proceedings of 4th seminar on Maximum Livestock Production from Minimum Land" May 24, pp. 26-31, Mymensingh, Bangladesh.
- Jayasuriya, M. C. N. 1981. Effect of urea-ensiling of rice straw on digestibility, voluntary intake and VFA production in growing buffalo calves. In "Proceedings of Co-ordination Meeting of the Regional co-operative agreement of the use of nuclear techniques to improve domestic buffalo production in Asia. March 2-6, pp. 45-46, Bangkok, Thailand.
- Mathur, M. C. and V. V. Sharma. 1985. Feed intake, digestibility and nitrogen retention in crossbred heifers fed water soaked straw rations. *Indian J. Anim. Sci.* 55(3):218-220.
- Rahman, M. M., M. R. Islam and M. M. Rahman. 1988. Study on livestock feeds, fodder and feeding practices in Bangladesh and their nutritive evaluation. Unpubl. reports.
- Saadullah, M., M. Haque and F. Dolberg. 1981. Effectiveness of ammonification through urea in improving the feeding value of rice straw in ruminants. *Tropical Anim. Prod.* 6:30-36.
- Saadullah, M. and M. M. Haque. 1981. Treated and untreated paddy straw for growing cattle. In "Proceedings of 1st seminar on Maximum Livestock Production from Minimum Land". May 25, pp. 136-155, Mymensingh, Bangladesh.
- Zafar, S. Y. 1980. Treatment of straw with ammonia. *Nutr. Abstr. and Rev. series B.* 50:510.