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Evaluation of nutritive value of urea treated paddy straw added with different levels of molasses

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Abstract
The present study was carried out with the primary objective to evaluate nutrients content and keeping quality of urea treated straw added with different levels of molasses. Paddy straw was treated with 4% urea and molasses levels were 0.0, 2.5, 5.0, 7.5 and 10.0% for treatments A, B, C, D and E, respectively. Total carbohydrate content and ether extract content of straw improved from treatment A to treatment E. However, reverse pattern was observed in case of NDF, ADF, Cellulose, hemicellulose, lignin, ash. Treatment E was also a good source of calcium (3.17%), phosphorus (2.17%), copper (7.73 mg/kg) and Iron (243.33 mg/kg). Therefore, treatment E was selected as best combination of urea- molasses treatment based on physical character and chemical composition.

Keywords: Molasses, paddy straw, proximate, urea, Van-soest, AAS

Introduction
Productivity enhancement in Indian cattle is a real challenge for nutritionists. Several measures have been initiated by the Government to increase the productivity of livestock in term of milk and meat. The milk production significantly increased from the level of 102.6 million tonnes at the end of the Tenth Plan (2006-07) to 127.9 million tonnes at the end of the Eleventh Plan (2011-12). Milk production in India for the year 2016-17 was 165.4 million tonnes with per capita availability of 355 g/day/person (Annual Report 2016-17, Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, GOI). However, the expected growth in the production is seen. Deficiency of good amount of good quality fodder for the animals is one of the major reasons behind this. At present, the country faces a net deficit of 35.6% of green fodder, 26% of dry-crop residues and 41% of concentrate feed ingredients (DARE-ICAR Annual Report, 2013-14). Therefore, nutritionists have found several ways to improve the quality of fodder, which can meet the fodder deficit in India. One of them is treatment of straw with urea. Urea (~46% N) is a common fertilizer and local farmers have become accustomed to its handling. Urea is most extensively used for treatment of paddy straw. Schiere and Ibrahim (1989) [5] reported that urea content high nitrogen, crude protein content of urea treated straw was increased from 2.8 to 6.5 % (Sethy *et al*., 2016) [7]. Urea treatment of crop residues increases the nitrogen content as well as intake (Tuen *et al.*, 1991) [10] and rate of digestion (Ibrahim *et al.*, 1989) [5]. Alkali agents such as urea can be absorbed into the cell wall and chemically break down the ester bonds among lignin, hemicellulose and cellulose and physically make the structural fibres swollen (Lam *et al*., 2001). CP content of rice straw increased from 2.9% to 5.9% and 6.7% by treatment with 3% and 5% urea in an earthen pit for 20 days. The CP,NDF and ADF% of the feed were 2.5, 7.8 and 5.8; 84.9,72.0 and 74.6; and 61.3,53.5 and 55.1 percent in untreated, 5.5% urea treated and 2.2%+2.2% calcium hydroxide treated paddy straw (Wanapat *et al*., 2009) [12]. Sheikh *et al*., (2017) [8] reported that improvement of crude protein and reduction in ADF and NDF contents of rice straw treated with 2% urea and 5% molasses in 40 litres of water and fibrolytic enzyme mixture (@ 9 g/kg DM). Ruminants have unique capacity to transform relatively low-quality dietary nitrogen (N) into high-quality animal proteins (i.e., meat and milk) (Schroeder and Titgemeyer, 2008) [6].

Materials and Methods
The present study was carried out at Eastern Regional Station, National Dairy Research Institute (ERS-NDRI), cattle yard located in Kalyani, West Bengal. The institute is situated at an altitude of 9.75 meter above mean sea level, 22°58'30" N latitude and 88°26'04" E

longitude. Locally available paddy straw was collected for preparation of urea molasses treated paddy straw. Urea-molasses solution was prepared with 4%urea dissolved in 40 lit water and molasses at the rate of 0%, 2.5%, 5.0%, 7.5% and 10.0% in separate buckets. This solution of urea-molasses of respective treatment was sprinkled over 8kg of chopped paddy straw and mixed uniformly. Those treated paddy straws of respective groups were preserved at proper anaerobic condition in new polythene bags for the period of 3-4 week. The samples were analyzed as per procedure given by AOAC (2005) [1] in triplicates. The fraction of cell wall constituents such as NDF, ADF, cellulose, hemicellulose and lignin were estimated as per Van Soest *et al*.(1991) [11]. Minerals such as Mg, Cu, Zn, Mn, Fe, and Co in the feed and fodders were analyzed using atomic absorption spectrophotometer (Agilent 240 AA model) and Phosphorus was analyzed by volumetric method. Calcium in feed and fodder samples was estimated from the mineral extract following procedure of Talapatra *et al*. (1940) [9].

The statistical analysis of the data was done with using analysis of variance (with one way and two ways ANOVA) with randomized Block Design (RBD) in IBM SPSS statistics 20.

Results and discussion

Chemical composition of urea and urea-molasses treated paddy straw (on DM basis) was presented in Table 1. The proximate compositions of different feed resources *i.e.* urea and urea-molasses treated paddy straw were analyzed to determine organic matter, crude protein, ether extract, total ash, cell wall fractions which included neutral detergent fiber, acid detergent fiber, hemicelluloses, cellulose and acid detergent lignin content.

Dry matter percent was gradually increased with increasing the concentration of molasses *i.e*. from treatment A to E. Highest crude protein content (percent) was observed in treatment A (7.95±0.66) followed by B (7.51±0.05), C (7.30±0.32), D (6.95±0.09) and then E (6.56±0.28) which was mainly due to increasing percentage of molasses in the urea treated paddy straw. Due to higher nitrogen content of urea (Schiere and Ibrahim, 1989) [5], crude protein content of urea treated straw was increased from 2.8 to 6.5 % (Sethy *et al*., 2016) [7]. CP content of rice straw increased from 2.9% to 5.9% and 6.7% by treatment with 3% and 5% urea in an earthen pit for 20 days; increase of CP of treated straw with urea by a factor of 2 to 2.5 (Saaldullah *et al*., 1981). Due to incorporation of molasses total carbohydrates (percent) was increased gradually in treatment B to E and lowest was observed in treatment A (75.84±0.16).Total ash (percent) ranged from 14.69 in treatment A to 13.19 in treatment D. Highest percentage of NDF was estimated in treatment A (73.35±0.14) and lowest NDF was estimated in treatment E (67.32±0.16). ADF value (percent) was highest in treatment A (51. 35±0.48) group and lowest ADF in treatment E (45.87±0.93). Hemicellulose values are slightly variable among the treatment groups. Cellulose was estimated to highest in treatment A (41.81±0.45) and lowest in treatment E (37.41±0.03). Acid detergent lignin percent was estimated to be highest in A treatment (5.24±0.89) group and lowest in D (3.90±0.42) treatment group. The cell wall constituents varied due to addition of various levels of molasses in different treatment groups of urea treated paddy straw. Sarwar *et al*. (2006) observed increased DMI, OMI, CPI and fiber intake in buffalo calves when fed wheat straw treated with 4% urea and 4% molasses without affecting digestibility of nutrients.

Macro and micro mineral composition of urea and urea-molasses treated paddy straw **(**on DM basis) was presented in Table 2. Three macro minerals *i.e*. Calcium, Phosphorus and Magnesium and micro minerals like copper (Cu), zinc (Zn), manganese (Mn), Cobalt (Co) and Iron (Fe) were estimated. Calcium percent was estimated highest in treatment E (3.17±0.03) and lowest was recorded in treatment A (2.27±0.09). Phosphorus percent was highest in treatment E (2.17±0.07) and lowest in treatment A (1.40±0.04). Among other treatment groups, phosphorus percent were B (1.60±0.15), C (1.70±0.06) and D (2.13±0.03). Similar trend was recorded in respect of Mg content (%) in the treated paddy straw; which ranged from 0.143 in treatment C to 0.14 9in treatment E. The concentration of copper (mg/kg) was highest in treatment E (7.73±0.89), the values in other groups were 7.40±0.21, 6.67±0.38, 7.07±0.15 and 6.57±0.18 in A, B, C and D groups, respectively. Zinc (mg/kg) estimated in various groups were 14.70, 12.62, 12.74, 14.53 and 14.53 in A to E treatment groups, respectively. Manganese concentration (mg/kg) was estimated highest in treatment A (12.60±0.15) group and lowest in group C (11.02±0.39). Cobalt (mg/kg) also showed same trend of changes as in manganese. Cobalt (mg/kg) was highest in treatment A (3.62±0.12) group, although much variation was not recorded in other treatment groups. Iron concentration (mg/kg) estimated slightly higher in treatment C (247.67±60.92) than other treatments B and D.

No treatment combination of the paddy straw showed any visible growth of fungi/moulds after 25 days of treatment period in polythene bags.

Table 1: Chemical composition of urea and urea-molasses treated paddy straw (on % DM basis).

Sample	DM	OM	CP	EE	Total Carbohydrate	Total Ash	NDF	ADF	Hemicellulose	Cellulose	Lignin
A	59.99±0.13	85.31±0.62	7.95±0.66	1.58±0.01	75.84±0.16	14.69±0.50	73.35±0.14	51.4±0.48	21.95±0.54	41.81±0.45	5.24±0.89
B	60.82±1.06	85.77±0.38	7.51±0.05	1.67±0.27	76.08±0.13	14.23±1.0	72.22±0.03	50.82±0.54	21.40±0.39	40.37±0.95	4.37±0.06
C	61.01±0.29	85.55±0.43	7.30±0.32	1.58±0.00	76.95±0.13	14.45±0.0	71.32±2.03	48.36±1.01	22.96±0.92	39.24±0.12	4.85±0.47
D	62.28±0.00	86.81±0.37	6.95±0.09	1.84±0.26	78.18±0.35	13.19±0.35	69.91±0.56	47.72±0.65	22.19±0.88	38.77±0.38	3.90±0.42
E	62.13±0.03	85.63±0.45	6.56±0.28	1.84±0.26	79.85±0.02	14.37±0.92	67.32±0.16	45.87±0.93	21.45±0.95	37.41±0.03	4.44±1.02

Table 2: Macro and micro mineral composition of urea and urea-molasses treated paddy straw (on DM basis).

Minerals	A	B	C	D	E
Calcium (%)	2.27±0.09	2.40±0.06	2.80±0.06	3.10±0.06	3.17±0.03
Phosphorus (%)	1.40±0.06	1.60±0.15	1.70±0.06	2.13±0.03	2.17±0.07
Magnesium (%)	0.145±0.0006	0.146±0.0002	0.143±0.0003	0.145±0.0011	0.149±0.0006
Copper (mg/kg)	7.40±0.21	6.67±0.38	7.07±0.15	6.57±0.18	7.73±0.89

Zinc (mg/kg)	14.70±0.12	12.62±0.43	12.74±0.59	14.53±0.24	14.53±0.85
Manganese (mg/kg)	12.60±0.15	11.58±0.60	11.02±0.39	11.27±0.45	12.26±0.37
Cobalt (mg/kg)	3.62±0.12	3.33±0.19	3.56±0.07	3.33±0.09	3.87±0.07
Iron (mg/kg)	210.33±19.19	174.00±28.84	247.67±60.92	197.00±4.16	243.33±34.80

Conclusion

From the above experiment it can be concluded that, treatment of paddy straw with 4% urea improved the CP content of straw. However, treatment of urea and molasses on paddy straw had no significant effect on mineral composition of straw.

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