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Effects of feeding urea molasses treated straw based total mixed ration on growth performance in cross bred Calves

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Abstract
A growth trial for a period of 90 days was undertaken with main objectives to study the effects of feeding urea-molasses treated paddy straw based total mixed ration on nutrient utilization and growth performance. For this, a total of 15 no. of animals were selected and divided in to 3 groups (T_0, T_1, T_2, n=5)) basing their body weight. The animals in control group (T_0) were fed rations containing untreated paddy straw, green fodder and concentrate mixture. In T_1 group, urea-molasses treated paddy straw was provide instead of untreated paddy straw of T_0. Total Mixed Ration (TMR) prepared with same ratio and composition as in T_1 group was fed to the calves in T_2 group. Significantly ($p \leq 0.001$) higher DMI, CPI were observed in treatment groups as compared to control groups during the growth trial. The average daily body weight gain (g/d/animal) was significantly ($p \leq 0.001$) higher in the treatment groups (T_2 and T_1) than the control group (T_0), values being 578.89, 545.56 and 378.89 for T_2, T_1 and T_0, respectively. Highest feed conversion efficiency for growth (kg live weight gain/100 kg DMI) was observed in treatment groups (T_1 and T_2) over control group (T_0). As digestibility is concerned, digestibility coefficient of most of the nutrients like dry matter, crude protein, ether extract, organic matter, NDF, ADF, calcium and phosphorus were higher in the treatment groups (T_1 and T_2) as compared to that of control group. Therefore, from the present study, it may be concluded that feeding of urea-molasses straw based TMR resulted in higher feed intake, weight gain.

Keywords: urea, molasses, total mixed ration, paddy straw, growth

Introduction
Productivity enhancement in Indian cattle is a real challenge to production scientists/ nutritionists. Several measures have been initiated by the Government to increase the productivity of livestock in term of milk and meat. 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). Livestock population is expected to grow at the rate of 0.55% in the coming years, and the population is likely to be around 781 million by 2050.Though India is among the leading producers of milk, meat and eggs; productivity of our animals is 20-60% lower than the global average due to improper nutrition, inadequate health-care and management. Half of the total losses in livestock productivity are contributed by the inadequacy in supply of feeds and fodder (19th Livestock census, 2012). 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).

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) [12]. Crop residues are low in nutritive values with low level of crude protein content (2–5%DM), high fiber and lignin content (NDF≥50%) and low DM digestibility≤65%); thus, resulting in low level of feed intake (1.5–2.0%) (Wanapat *et al*., 1985) [19]. Urea (~46% N) is a common fertilizer and local farmers have become accustomed to its handling. Crude protein content of urea treated straw was increased from 2.8 to 6.5 % (Sethy *et al*., 2016) [13]. Treating the straw with urea were one of the most appropriate and friendly method which can be used for fattening of animals in field condition (Simegnew *et al*., 2014) [15]. Total mixed ration (TMR) is a complete mixture of all feed ingredients like forages, grains, by-products, protein feed, feed additives, minerals and vitamins. Feeding of TMR increases milk production, decreases feed costs, improves cow health, non-palatable feed can be fed in the form of TMR.

Waje *et al*. (2010) [18] reported that TMR (using concentrate and mixed forest grass) supplementation to crossbred calves improved DM, protein and energy intake. So based on these principle study was designed to carried out with the main objectives to study the effects of feeding urea-molasses treated paddy straw based total mixed ration on nutrient utilization and growth performance.

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 animal farm is situated at an altitude of 9.75 meter above mean sea level, 22°58'30" N latitude and 88°26'04" E longitude. The 15 Jersey crossbred calves were equally divided into three groups (T_0, T_1, T_2), five animals each depending on body weight and age. Animals were schedule vaccinated and dewormed and kept/sheltered in Pucca house and floors are made up of concrete. Three rations were prepared iso-nitrogenous by adjusting concentrate mixture and fodder level into the treatments. Growth trial was conducted for the period of 90 days from 22stJanuary to 6thMay, 2018; excluding initial 10 days adaptation period meet out maintenance and growth (600g average daily gain) requirement (NRC,2001). The experimental treatment were as follow: Control Group (To): untreated paddy straw (30%) + Concentrate mixture (50%) + Green Fodder (20%); Treatment Group 1 (T_1): Urea-molasses treated paddy straw (40%) + Concentrate mixture (40%) + Green Fodder (oat) (20%) which was fed separately; Treatment Group 2 (T_2): Total Mixed Ration (TMR) form of T1 ration. Urea molasses treated paddy straw was prepared with proportion of Straw (90%DM) 100kg, Urea 4kg, Molasses 10kg and Water 40 liters. Urea and molasses were mixed properly with water and sprinkled on paddy straw (air dried) and mixed properly, thereafter, covered properly with polythene sheet after manual pressing in concrete rectangular pits capacity of 400kg. The proximate composition of feeds an fodder were estimated as per AOAC (2005) [2] and cell wall constituents as per Van Soest analysis (1991) [17]. To study the growth rate, all the experimental animals were weighed fortnightly before offering feed and water on two consecutive days. Dry matter intake (DMI), Average daily gains (ADG), Feed efficiency of the ration, Feed Conversion Ratio were recorded during the trail.

The statistical analysis data of growth studies and digestibility studies were analysis using analysis of variance (with one way and two way (ANOVA) with randomized Block Design (RBD) in IBM SPSS statistics 20.

Results and Discussion

All the feeds offered to the growing crossbred calves during the growth and digestibility trial were analysed for their chemical composition Chemical composition of feeds and fodder is presented in Table 1. Proximate and Cell wall composition were in normal range.

Average total dry matter intake (TDMI) (kg/day/animal) as well as crude protein intake (CPI) (g/animal/day) during growth trial were presented in Table 2. The TDMI during the growth trial were 3.46±0.14, 4.23±020 and 4.26±0.20 for T_0, T_1 and T_2, respectively. The difference was statistically significant ($p\leq0.01$) higher in calves under T_2 and T_1 over T_0.

Rahman *et al*. (2009) [9], who supplemented urea-molasses straw in emaciated bull was found significantly ($p\leq0.05$) DMI *i.e.*3.41, 4.65, 4.79, and 5.14 for T0, T1, T2, and T3, respectively. Similarly, the voluntary dry matter intake per kg metabolic weight (DMI/kg $W^{0.75}$) was found to be significantly ($P<0.05$) higher in sheep fed diet containing 4% urea treated straw (Yulistiani *et al*., 2003) [20]. Macdearmid *et al*., (2001), Sethy *et al*., (2016) [13] and Sarwar *et al*. (2006) [11] were reported similar results in ruminant. Khan *et al*. (1999) [6] in cow, Mahr-un-Nisa *et al*., (2004) [8] in Nili- Ravi buffalo bulls and Akbar *et al*. (1990) in buffalo were observed similar results on supplementation molasses with urea treated straw.

Average CPI intake (g/d/animal) during the growth trial period was significantly ($p\leq0.001$) higher in T_2 (686.18±27.05) over T_1 (604.74± 30.09) and T_0 (518.84±20.99). Maximum value of CPI was observed after feeding the urea-molasses treated straw based TMR, in calves under T_2 due availability of total mixed ration on 24 hour x 7 days basis, which might have supplied balance nutrition for ruminal microbes. Similar result were also reported by (Saaldullah *et al*., 1981; Sethy *et al*., 2016; Sheikh *et al*., 2017) [10, 13, 14]. Sarwar *et al*. (2006) [11] 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. Similarly, improved feed intake, rumen fermentation and efficiency of microbial N synthesis in crossbred dairy steers were observed due to feeding of urea treated rice straw (Gunun *et al.*, 2013) [4].

Average body weight of growing crossbred calves during the trial has been shown in Table 2. The initial body weight 106.25±14.44, 104.05±14.06 and 105.55±12.22 kg for the control group (T_0) and treatment groups (T_1 and T_2), respectively; statistical non-significant ($p>0.05$). The corresponding final average body weight at the end of 90 days trial were 140.35±17.74, 153.15±17.27 and 157.65±19.23 kg in control T_0 and treatment groups (T_1 and T_2), respectively. Highest total body weight gain (kg) during 90days period was observed in urea-molasses treated straw based TMR fed group (T_0) (52.10±7.16), followed by treated straw fed separately group (T_1) (49.10±3.46) and control group (T_0) (34.10±3.57). The average daily body weight gain (g/d/animal) was significantly ($p\leq0.001$) higher in the (T_1 and T_2) than T_0, values being 578.89±31.15, 545.56±16.38 and 378.89±18.40 for T_2, T_1 and T_0, respectively. Trach. (2003) [16] in cattle, Hassoun *et al.* (2002) [5] in emaciated bull, Emmanuel *et al*. (2015) [3] in camel were corroborated with the study in body weight gain.

Feed conversion efficiency for growth (kg live weight gain as % DMI) was 11.16±0.53, 13.54±0.57 and 13.59±0.37 for T_0, T_1 and T_2 respectively which differed significantly ($p\leq0.001$). Feed conversion efficiency for growth (as percent CP) was 74.13±3.20, 94.88±3.96 and 93.32 ±2.31 for T_0, T_1 and T_2 respectively and was significantly different ($p\leq0.001$). Both the parameters were higher for urea-molasses treated paddy straw compared to that of untreated straw. Feed conversion ratio (FCR) as DM intake in kg/kg gain and as CP intake in kg/kg gain was found maximum ($p\leq0.001$) in T_2 group (7.51±0.19, 1.09±0.03, respectively) followed by T_1 group (7.71±0.27, 1.10±0.04, respectively); however, lowest FCR in both forms (DM intake in kg/kg gain and CP intake in kg/kg gain) was observed in T_0 group (9.62±0.51, 1.43±0.07, respectively). Hue *et al*., (2006) in lamb, Rahman *et al*., (2009) [9] in emaciated bull observed similar results due to supplementation of urea treated straw and molasses.

Conclusions

From the present study, it may be concluded that TMR form of diet with urea-molasses treated paddy straw as basal component significantly increased voluntary intake in

crossbred calves resulting in higher DCPI and TDNI. The TMR form of the diet increased growth performance of crossbred calves with the highest values in ADG and FCE.

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Table 1: Chemical Compositions (%DM Basis) of paddy straw, concentrate mixture and urea-molasses treated strawduring digestibility trial.

Parameters	Green fodder	Urea-treated straw	Straw	Concentrate
DM	27.00	61.00	90.58	90.00
OM	91.46	87.43	86.51	88.53
CP	7.59	10.06	4.06	22.65
EE	1.73	1.33	1.29	4.16
TCHO	82.14	76.04	81.16	61.72
Total ash	8.54	12.57	13.49	11.47
NDF	72.38	65.72	76.77	52.20
ADF	45.30	43.52	48.75	16.40
Hemicellulose	27.08	22.20	28.02	35.80
Cellulose	34.27	29.81	32.78	10.86
ADL	7.66	6.74	7.47	5.94

Table 2: Growth rate, TDMI, CPI and feed conversion efficiency of crossbred calves of control and treatment groups.

Attributes	Groups			Significance	'F' Value
	T0	T1	T2		
Average Initial Body weight	106.25±14.44	104.05±14.06	105.55±12.22	p>0.05	0.373
Average Final body weight	140.35±17.74	153.15±17.27	157.65±19.23	p≤0.001	6.37
Total body weight gain (kg)	34.10^{a}±3.57	49.10^{b}±3.46	52.10^{b}±7.16	p≤0.001	7.46
Average daily body weight gain (g)	378.89^{a}±18.40	545.56^{b}±16.38	578.89^{b}±31.15	p≤0.001	19.45
Average TDMI (kg/d)	3.46^{a}±0.14	4.23^{b}±0.20	4.26^{b}±0.20	p≤0.01	6.39
Average CPI (g/d)	518.84^{a}±20.99	604.74^{b}±30.09	686.18^{c}±27.05	p≤0.001	10.43
Feed conversion efficiency (ADLG as % of DMI)	11.16^{a}±0.53	13.54^{b}±0.57	13.59^{b}±0.37	p≤0.001	11.32
FCR (DM intake kg/kg gain)	9.62^{b}±0.51	7.71^{a}±0.27	7.51^{a}±0.19	p≤0.001	19.74
FCE(growth as% CP)	74.13^{a}±3.20	94.88^{b}±3.96	93.32^{b}±2.31	p≤0.001	16.30
FCR(kg CP intake/kg gain)	1.43^{b}±0.07	1.10^{a}±0.04	1.09^{a}±0.03	p≤0.001	24.09

The values with different superscripts (a, b, c) among treatments differ significantly.

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