Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2020; 8(1): 1182-1185

Received: 21-11-2019
Accepted: 25-12-2019

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Performance assessment of animals fed treated feed with certain ingredients in crossbred dairy cattle under sub-tropical conditions

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Abstract
A experiment was conducted to evaluate the performance of 24 crossbred animals (8-12 months of age) animals were randomly allocated to four different groups(6 animals per group) *viz*. Group-1 (Gr-1): 100% treated leftover feed; Group-2(Gr-2): 75% treated feed; Group-3 (Gr-3): 50% treated feed and Group-4(Gr-4) or Control: 100% green fodder. The leftover feed F-1, F-2, F-3, F-4, F-5 and F-6 were treated with combination of 1% urea+5% molasses+0.5% salt, 1% urea+5% molasses+1% salt, 1% urea+10% molasses+0.5% salt, 1% urea+10% molasses+1% salt, 5% molasses+0.5% salt and 10% molasses+0.5% salt, respectively. The average weight gain for F1 treatment group for the 1st, 2nd, 3rd and 4th group of animals was 1.66±1.60, 3.50±1.56, 2.66±0.0.66 and 3.33±0.61 respectively. Weight gains for F2 group of animals were 0.33±0.61, 4.00±1.84, 2.33±0.67, 3.66±0.67 respectively. For F3 group it was 0.50±0. 56^{a}, 3.33±0.55^{b}, 2.83±0.70^{ab}, 3.66±0.80^{b} respectively for all the four groups. Weight gains for F4 group were 1.66±1.49, 6.66±1.60, 6.16±0.49, 6.5±0.70 respectively for all the four groups. Weight gains for F5 treatment group were 1.50±0.67^{a}, 7.00±0.70^{b}, 6.00±1.12^{ab}, 5.5±0.62^{b} respectively. Weight gains for 6th group of animals were 1.66±0.98, 5.55±1.52, 4.83±0.83, 5.33±0.49 respectively for all the groups. It was evident from the weight gains that complete feeding of treated feed with urea and molasses is however not good but feeding in half proportions to the animals with fresh green fodder nowhere diminished the performance and in fact reduced the feeding cost as well as utilized the waste.

Keywords: Performance, leftover feed, molasses, palatability, urea, vrindavani

1. Introduction
India being a tropical south Asian developing nation has a large deficit of cereal grains, dry and green fodder. At present there is a shortage of 35.6% green fodder, 10.95% dry crop residues and 44% concentrate feed ingredients. This gap can be filled either by increasing productivity, utilizing untapped feed resources, increasing land area, or through imports. The bovine are the largest dairy animals which mainly subsist on green fodder followed by dry roughage and concentrate mixture. The feeding cost in dairy animals accounts for the highest input factor of the total cost of rearing and production (60-70%). The net cultivated area is around 142 million hectare in addition to forests and their associated grasslands and fodder sources (Singh *et al.*, 2014) [20]. There is high pressure on land for crop production in order to meet the growing demands of food grains for human consumption and hence farmers cannot spare land for fodder production to feed the cattle (Singh *et al*., 2014) [20]. At many organized farm in India, leftover feed constitute bulk roughage which is generally considered as waste material and discarded in crop-fields. The composition of leftover varies depending upon the fodder availability however by and large the leftover consist mainly of maize, jowar, bajra, berseem and napier grass in northern plain region of India (Birthal and Jha, 2005) [2]. It has been reported that if molasses and urea mixture is supplied to the animals with straw then feed intake, digestibility and palatability of rice straw increases (Sahoo *et al*., 2004; Verma *et al*., 2006) [16, 21]. Various studies have been conducted for this purpose by treating the inferior quality feed with urea, ammonia and molasses with different inclusion levels which provided positive results. It was observed that urea treatment could increase nutritive value of straw by 46% (Wanapat *et al*., 2009) [22] due to breakage of bonds between the lignin, hemi-cellulose and cellulose. The feeding practices using these feed have also improved the productivity of dairy animals (Singh *et al.*, 2014) [20]. From the perusal of literature, it is found that the most of earlier research works have been targeted on treatment of dry residues (wheat straw or rice

straw) using supplementation of urea as nitrogen or molasses as energy sources but no study has been conducted on treatment of the fresh leftover feed having high moisture contents (more than 50 per cent). The treatment of leftover feed using different combinations of urea, molasses and salt may enhance its nutritive value as well as its palatability. The treated leftover feed can also serve as better feed during the scarcity or lean period of fodder availability. It is also expected that feeding of these treated feed may reduce the feeding cost without affecting the performance of animals.

2. Material and Methods

2.1 Place of study: The study was conducted at Cattle and Buffalo Farm, ICAR-Indian Veterinary Research Institute, Izatnagar, India, which is located at latitude of 28° 22' north, longitude of 79° 24' East and altitude of 169.2 meter above the mean sea level. The location comes under upper gangetic plain region and has sub-tropical climatic condition with high humidity, especially during the winter season. Weather turns colder during winter stretching from November to February whereas summer ranges from May to August months annually. The annual rainfall ranges from 90 to 120cm and most of which are received during the months of July and August.

2.2 Design of experiment

Palatability and performance evaluation of dairy cattle using different combinations of treated leftover feed with fresh fodder was taken out. The leftover feed consisted of chaffed fodder sorghum, millets, maize, Napier grass and berseem (clover) as raw material. Six combinations of urea, molasses and salt were used for treating the leftover feed (table 1) to increase its nutritive value and palatability. The feasibility of the treatment during the months of December to April was tested and weight gain of animals in different treatment groups was compared.

Table 1: Six different combinations of urea, molasses and salt used for treatment of leftover feed

Basal feed material (on fresh matter basis)	Chemical substance (on dry matter basis of basal feed)			Treated feed (end product)
	Urea	Molasses	Salt	
Leftover feed	1%	5%	0.5%	F1
	1%	5%	1%	F2
	1%	10%	0.5%	F3
	1%	10%	1%	F4
	Nil	5%	0.5%	F5
	Nil	10%	0.5%	F6

2.3 Selection of experimental animals

A total of 24 crossbred animals (8-12 months of age) were selected and randomly allocated to four different groups (6 animals per group) *viz*. Group-1 (Gr-1): 100% treated leftover feed; Group-2(Gr-2): 75% treated feed; Group-3 (Gr-3): 50% treated feed and Group-4(Gr-4) or Control: 100% green fodder, without use of treated feed. Feeding was done for 7 days in four different proportions (table-2) of treated and fresh green fodder to test palatability of each combination.

Table 2: Feeding trial using different combination treated leftover feed and green fodder

Feeds	T1 group	T2 group	T3 group	T4 Control
Green: Treated leftover feed	0: 100	25:75	50:50	100:0
Concentrate feed	Provided equally in all groups (As per institute feeding protocol)			

Palatability score was used to test the palatability of the treatment; all the 24 animals were weighed before and after each feeding trail and their weight gains were compared after the end of each trial.

2.4 Chemical analysis of feed

Leftover feed was analysed before and after treatment by proximate analysis to find out changes in the nutritive values (crude protein, crude fibre, moisture, dry matter and ash content). The presence of fungal toxins *viz*. mycotoxin and ochratoxin were also tested in the treated feed.

2.8 Statistical analysis

The data obtained from the experiments were analysed using the SPSS 20.0 software package.

3. Results

3.1 Performance of the animals

Performance of the experimental animals was measured by weighing them before and after starting the experiment and the results are shown in Table-3.

Table 3: Change in body weight of animals upon feeding on different leftover feed

Feed	Parameter	Gr- 1 Treated: fresh feed (100:0)	Gr-2 Treated: fresh feed (75:25)	Gr-3 Treated: fresh feed (50:50)	Control Treated: fresh feed (0:100)
F1	IW (Kg.)	227.33±9.05	237.83±11.81	230.16±11.37	234.33±15.80
	FW (Kg.)	229.00±9.54	241.33±11.89	232.83±11.89	237.66±15.52
	WG(Kg.)	1.66±1.60	3.50±1.56	2.66±0.0.66	3.33±0.61
F2	IW (Kg.)	226.83±11.41	240.16±10.47	228.55±13.57	233.83±16.68
	FW (Kg.)	227.66±11.41	244.16±9.22	230.83±13.83	237.54±16.50
	WG(Kg.)	0.33±0.61	4.00±1.84	2.33±0.67	3.66±0.67
F3	IW (Kg.)	237.00±10.06	242.66±8.81	237.5±12.56	243.55±18.65
	FW (Kg.)	237.50±9.83	246.00±8.69	240.33±13.04	247.16±18.45
	WG(Kg.)	0.50 ± 0.56^{a}	3.33 ± 0.55^{b}	2.83 ± 0.70^{ab}	3.66 ± 0.80^{b}
F4	IW (Kg.)	246.66±9.54	258.83±8.23	250.00±10.58	253.33±14.70
	FW (Kg.)	248.33±8.54	265.00±7.83	256.46±10.93	261.50±15.34
	WG(Kg.)	1.66±1.49	6.66±1.60	6.16±0.49	6.5±0.70

F5	IW (Kg.)	255.33±8.81	271±6.96	260.00±9.12	267.5±15.47
	FW (Kg.)	256.83±9.19	278.16±7.07	266.00±9.68	273±15.40
	WG(Kg.)	1.50±0.67[a]	7.00±0.70[b]	6.00±1.12[ab]	5.5±0.62[b]
F6	IW (Kg.)	258.33±12.73	283.66±9.29	276.16±10.90	284.84±18.50
	FW (Kg.)	260±13.57	289.16±9.09	281±10.82	289.16±18.32
	WG(Kg.)	1.66±0.98	5.55±1.52	4.83±0.83	5.33±0.49

Where, IW- Initial weight, FW= Final Weight, WG= Weight gain

The difference of initial body weights (IW) was non-significant in all the groups. The final body (FW) and weight gain (WG) of animals for F3 and F5 were found significant in Gr-1 in compared with control, however Gr-3 and Gr-4 were non-significant with control. Among the proportion of treated and fresh feed, the weight gain in Gr-2 was found superior even than control, however the difference was non-significant. The equivalent performance in Gr-2 than control might be due increased nutritive values of feed and better acceptability than other groups. In 3rd and 5th group the initial body weight of animals in control, Gr.1, Gr.2 and Gr-3 was non- significant among each other. The final body of animals in different groups were also found non-significant. The weight gain was significantly (p<0.5) lower in Gr-1 where 100 per cent treated feed was offered to animals than control, Gr-2 but non-significant from Gr-3. The equivalent performance in Gr-2 might be due increased nutritive values of feed along with acceptability and better palatability in control group.

4. Discussion

4.1 Proximate analysis of feed

Proximate analysis of feed showed increase in nutritive value of the after every treatment which was due to urea ammoniation of leftover feed and increased content of carbohydrate, molasses, ash was due to minerals present in salt and other impurities present in premix. The increase in crude protein and crude fibre content is in agreement with Gordon and Chesson (1983) [5] and Sarwar *et al.*, (2010) [19] who found higher crude protein and total protein content of barley or wheat straw being treated with 4% urea. Results are also in line with Saadullah *et al.* (1980) [15] who reported increase in crude protein content of rice straw from 2.9 to 5.9% when treated with 3% urea and CP content increased to 6.7% when treated with 5% urea. Hassan *et al.* (2011) [6] reported high ruminal NH_3-N in bulls fed urea treated straw. Fike *et al* (1995) [3] and Dass *et al.*, (2000) [1] reported increase in crude protein by urea ammoniation of wheat straw whereas higher digestible protein and digestible nutrients were recorded by Prasad *et al*., (1998) [13] in rations containing either stacked or baled urea treated rice straw. Treatments fifth and sixth contained only molasses and salt and they had sweet smell and golden brown colour so their palatability was comparatively better. Sahoo *et al*. (2002) [17] reported that organic matter, neutral detergent fibre and hemicellulose digestibility were highest in urea treated wheat straw. Similarly, many reports say that urea treated wheat straw increased the ruminal NH_3 concentration in (Manyuchi *et al.*, 1992; Nisa *et al.*, 2004; Sarwar *et al.*, 2004; Jabbar *et al*, 2008) [9, 11, 7].

4.2 Performance evaluation of animals

Initial weights of the animals were non-significant, final weights were also non-significant but there was significant difference in weight gain of the animals in treatment groups for F3 and F5 feed in which lower weight gain than the other three groups were observed which might be due less palatability of treated feed than that of fresh green fodder. The equivalent performance in Gr-2 might be due increased nutritive values of feed along with acceptability and better palatability in control group (Garg *et al*, 2006) [4]. Kilic and Emre, 2017 [8] reported that digestibility of wheat and soybean straw could be improved upon some additives however in present study feed palatability was taken in account for performance evaluation along with weight gain. Mishra *et al.*, (2012) [10] found that supplementation of urea molasses block significantly increased the milk yield, live weight and body score of cows. Similarly, the enhanced acceptability of feed upon treatment with molasses was observed in crossbred heifers (Pathak *et al*, 2015) [12] and lambs (Rath *et al*., 2001) [14].

5. Conclusions

Treatment of left over feed using different combinations of urea, molasses and salt was feasible and increased nutritive values in terms of crude protein and fibre contents without production of fungal toxins like mycotoxins and ochratoxins. The animals fed on 50 per cent treated feed and 50 per cent fresh green fodder had equivalent palatability and weight gain in compared with control group. The leftover feed can efficiently be utilized for feeding to various classes of dairy animals under farm conditions to minimize the rearing cost and could also serve a better option during the scarcity period of fodder production.

Declarations of interest

The authors report no conflict of interest over the content of this paper.

6. Acknowledgements

The authors are thankful to the Director, ICAR-Indian Veterinary Research Institute (IVRI), Izatnagar for providing all the necessary facilities during the study.

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