RESEARCH ARTICLE Asian Journal of Dairy and Food Research, Volume 44 Issue 1: 134-139 (February 2025)

Performance Evaluation of Crossbred Cattle Fed Treated Leftover Feed

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ABSTRACT

Background: Left over feed is still an unnoticed problem at organized dairy farms which often leads to considerable economic losses. This study was done to assess the feasibility of treated left over feed and performance of crossbred dairy cattle for a period of 150 days during winter and spring seasons.

Methods: 24 healthy crossbred (Vrindavani) animals (8-12 months of age) were randomly selected to four different groups *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. Each feed was offered for a period of one month to each group and animals were rearranged after every trial. Adjustment period of one week was given after every treatment.

Result: The palatability score was found significantly ($P<0.05$) higher in Gr-1 than other treatment groups. The Gr-3 animals had equivalent palatability and weight gain in compared with control group. The average feeding cost per animal at farm was 80Rs. under normal circumstances. Analyzed data revealed that feeding cost was reduced significantly in Gr-1, Gr-2 and Gr-3 respectively. It can be concluded that the leftover feed can efficiently and economically be utilized for feeding to various classes of dairy animals under farm conditions and provide a better option during the scarcity period.

Key words: Cattle cost, Leftover feed, Palatability, Treatments.

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 11.24% green fodder, 23.4% dry crop residues and 28.9% concentrate feed ingredients (IGFRI-2020). This gap can be filled either by increasing crop 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). 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; Singh *et al.*, 2020a). 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 variety 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). It has been reported that if molasses and urea mixture is supplied to the animals with straw then intake, digestibility and palatability of feed increases (Sahoo *et al.*, 2004; Verma *et al.*, 2006). 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) 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). From the perusal of literature, it is found that the most of earlier research works have been targeted on treatment of dry crop 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

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How to cite this article: Yadav, D.K., Bharti, P.K., Singh, A.K., Sandeep, Gaur, G.K. and Singh, P. (2025). Performance Evaluation of Crossbred Cattle Fed Treated Leftover Feed. Asian Journal of Dairy and Food Research. 44(1): 134-139. doi: 10.18805/ajdfr.DR-1726.

Submitted: 19-05-2021 **Accepted:** 01-02-2022 **Online:** 20-05-2022

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. It is also expected that feeding of these treated feed may reduce the feeding cost without affecting the performance of animals.

MATERIALS AND METHODS

Place of study

The study was conducted at Cattle and Buffalo Farm, ICAR-Indian Veterinary Research Institute, Izatnagar, India during 2018-19 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.

Design of experiment

The experiment was conducted in two phase's *viz.* 1) Feasibility assessment of treated leftover feed and 2) Palatability and performance evaluation of dairy cattle using different combinations of treated leftover feed with fresh fodder. 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.

Selection of experimental animals

A total of 24 crossbred cattle (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 by providing each feed for one week subsequent to each other and one week was given between each treatment as adjustment period (Table 2).

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.

Chemical analysis of feed

Leftover feed was analysed before and after treatment to find out changes in the the chemical composition. The presence of fungal toxins *viz.* mycotoxin and ochratoxin were also tested in the treated feed. Testing was done using automatic chromatographic technique and methanol was used as solvent.

Feasibility testing

Leftover feed was mixed with urea, molasses and salt and packed in polybag of 25 kg capacity in airtight condition for incubation period of 21 days, thereafter polybags were opened and feed were valuated physically for smell, colour and texture. Moisture content was sufficient in the leftover feed so there was no requirement of water sprinkling.

Palatability testing

Palatability scores were given based on acceptance and time taken by animals to start feeding as mentioned in Table 3.

Performance of the animals

Performance of the animals was evaluated based on weight gain before and after each feeding trail.

Statistical analysis

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

RESULTS AND DISCUSSION

The chemical composition of leftover feed before and after treatment with urea, molasses and salt has been presented in Table 4.

The treatment of leftover feed was feasible during the winter and spring months of the year. The nutritional quality of the leftover feed increased after each treatment and there were no traces of mycotoxin and ochratoxin in any of the treated feed. Crude protein content increased due to

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

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).			

Table 3: Palatability score based on time to start feed intake.

Palatability score	Criteria
1	If feed intake starts within 10 minutes
2	If feed intake starts in 10-20 minutes
3	If feed intake takes more than 20 minutes
4	No feed intake

increased nitrogen content following urea treatment where as crude fibre content increased which might be due to break down of ester bonds between the lignin, hemi-cellulose and cellulose. Ash content increased because of addition of salt and other impurities.

Palatability of the feed

Palatability of the treated feed in different groups were measured by using palatability scored as mentioned in Table 5.

Palatability scores show identical trends in all the treatment groups. The high value of palatability score indicated that feed acceptability was poor in treatment than control. From the results as shown in Table 3, it is evident that animals fed on 100 percent fresh feed in Gr-4 had better acceptability whereas Gr-1 with 100 per cent treated leftover feed had the lowest acceptability. Among the treatments, the combinations of treated and fresh feed (in ratio of 50:50 and 75:25) gave better results in terms of feed acceptability without any adverse effect on performance of the growing animals (Table 2).

Performance of the animals

Performance of the experimental animals in terms of changes in their boy weights are shown in Table 6.

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 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 percent 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.

Economics of the feed

Economic feasibility of the treated feed in different groups were measured by using scorecards as mentioned in Table 7.

Feeding cost chart shows that there was reduction in feeding cost up to almost half in 1st and 2nd treatment groups feeding cost was somewhat higher in 3rd treatment group due to higher cost of molasses but even though it was lower than the control group. Among the treatments, the combinations of treated and fresh feed (in ratio of 50:50 and 75:25) gave better results in terms of feed acceptability without any adverse effect on performance of the growing animals.

Chemical composition of feed

The nutritive value of the feed increased 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 Hamad *et al.* (2010) and

Table 4: Nutritive values of leftover feed before and after treatment.

Leftover feed	Treatment status	Moisture	Dry matter	Crude protein	Crude fibre	Ash
F1	Pre-treatment	65.45	34.55	4.32	8.54	6.58
	Post-treatment	61.67	38.33	6.70	11.37	11.65
F2	Pre-treatment	74.46	25.54	3.78	9.76	7.80
	Post-treatment	71.75	28.25	6.30	10.70	12.56
F3	Pre-treatment	69.93	30.07	4.20	14.20	11.00
	Post-treatment	63.98	36.07	6.70	14.60	13.60
F4	Pre-treatment	74.78	25.22	3.78	9.76	8.00
	Post-treatment	70.89	29.11	5.40	12.90	11.89
F5	Pre-treatment	62.78	37.22	5.50	14.20	11.00
	Post-treatment	67.56	32.44	6.10	16.50	13.60
F6	Pre-treatment	65.78	34.22	4.90	17.20	10.78
	Post-treatment	62.23	37.77	5.20	17.50	12.06

Table 5: Average palatability scores of all the treatment groups.

Groups	F1 feed	F2 feed	F3 feed	F4 feed	F5 feed	F6 feed
Group 1	3.43	2.79	2.66	3.06	3.7	3.1
Group 2	1.56	1.52	1.43	2.36	1.76	1.96
Group 3	1.53	1.50	1.40	2.06	1.66	1.83
Group 4	1	1	1	1	1	1

Table 6: 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.

Table 7: Average daily feeding cost per animal (in Rupees) of all the treatment groups.

Groups	F1 feed	F2 feed	F3 feed	F4 feed	F5 feed	F6 feed
Group 1	36	37	70	70	35	69
Group 2	50	51	70	71	50	70
Group 3	60	61	75	75	60	75
Group 4	80	80	80	80	80	80

Sarwar *et al.* (2010) who found higher crude protein and total protein content of barley or wheat straw being treated with 4% urea. Reduction of energy intake during far off period provided positive results in crossbred animals (Singh *et al.*, 2020a; Singh *et al.*, 2020b). Results are also in line with Oji *et al.* (2007) who reported increase in crude protein content and crude fibre content of maize residues 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) reported high ruminal NH_3-N in bulls fed urea treated straw. Dutta *et al.* (2004) and Dass *et al.* (2000) 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) 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) 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 (Manyuchi *et al.,* 1992; Nisa *et al.,* 2004; Sarwar *et al.,* 2004; Jabbar *et al.*, 2008). Ramirez *et al.* (2007) reported decrease in acid detergent fibre on treatment of *Zea mays* with urea.

Performance of animals

Significant difference in weight gain of the animals in treatment groups for F3 and F5 feed where lower weight gain in Gr1 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 (Garg *et al.*, 2006). Kilic and Emre (2017) 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) 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 and lambs (Rath *et al.*, 2001).

CONCLUSION

Treatment of left over feed using different combinations of urea, molasses and salt was feasible and increased nutritive values in terms of crude protein without production

of fungal toxins. The animals fed on 50 per cent treated feed and 50 percent fresh green fodder had equivalent palatability and weight gain in comparison to 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. Body weight gains were not diminished when the treated feed is given even upto the levels of 75 per cent but it was not higher than the group fed with green fodder.

ACKNOWLEDGEMENT

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

Declarations of interest

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

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