

Economics of Feeding Rice DDGS and Mixture of Wheat Straw and Groundnut Straw to Growing Crossbred Heifers

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ABSTRACT

Feeding of growing heifers is generally ignored by the farmers as they do not want to spend their limited resources during their non-productive growing phase. This deprives heifers of essential nutrients. Present study was planned on twenty-four HF×Kankrej heifers (avg. BW=116.13±4.74kg) and conducted for 168 days to note the effect of feeding rice DDGS and mixture of wheat straw and groundnut straw on feeding cost and feed efficiency. Three different concentrates containing 0%, 20% and 40% rice DDGS (RDDGS) were offered to T1, T2 and T3 group heifers, respectively. Under each group half of the heifers were offered wheat straw and another half a mixture of wheat straw (50%) and groundnut straw (50%). The protein requirement of heifers was fulfilled as per ICAR (2013) feeding standards. Cost of feeding under different treatments was calculated from the records of daily feed consumption and by considering the procurement cost of feeds and fodders. The recorded data was analyzed by RBD factorial design. Daily feed cost (₹/head/d) reduced linearly and significantly ($p<0.05$) on replacing soyaDOC with RDDGS. Feed cost (₹/kg BW gain) also reduced linearly but there was significant ($p<0.05$) reduction only when 40% soyaDOC in concentrate was replaced with RDDGS. There was net saving of ₹ 11.91 and ₹ 23.83/kg BW gain on replacing half and full soyaDOC with RDDGS. Daily feed cost (₹/head/d) increased significantly on feeding mixture of groundnut straw and wheat straw but the feed efficiency improved as feed cost (₹/kg BW gain) reduced by 4.74 % in heifers.

Key words: RDDGS, Groundnut straw, Feed cost, Feed efficiency, Growing heifers

A significant population of livestock in India is owned by small and marginal farmers⁶. Feeding of growing heifers is generally ignored or given less importance by the farmers as they do not want to spend their resources/money in the non-productive growing phase. This deprives heifers of essential nutrients required for proper growth. A good quality concentrate provides high

digestible nutrients but costs more. Whereas, roughage provides ample fibre but has low digestible nutrients although, is relatively cheap¹². Proper nutrition is extremely important in the diet of growing heifers to ensure adequate frame size, height at wither and growth¹. Inadequate and unbalanced feeding at the growing phase affects the development of the mammary gland and can decrease subsequent milk yield⁵. Using cheap alternate feed resources and efficient utilization of available feed resources can optimize the growth and feed efficiency during the growing phase. Distillers dried grains with soluble (DDGS) is one of the residual coproduced from the production of ethanol from the grain after fermentation of starch¹⁷ and rich in protein, fat, fibre, vitamins

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and minerals. DDGS product obtained from rice distillery is called Rice Distillers Dried Grains with soluble (RDDGS). RDDGS contains more than 40% protein and can replace highly prized soybean meal^{2,4,16}. The availability of DDGS will increase in future as government of India has already made it mandatory to add 10% ethanol to gasoline and ethanol requirement will be about 12.7 billion litres by 2030 to achieve E20 (20% ethanol-blended fuel) target¹³. Molasses alone will not be sufficient to meet future ethanol demands of the country, especially for use as a biofuel. India is one of the main rice-producing countries and stands second after China in the world; the rice production was 118.43 MT in 2019-20³. Hence, to increase production of fuel grade ethanol, Govt. is encouraging distilleries to produce ethanol from maize & rice available with Food Corporation of India. The significant amount of grains is being diverted to distilleries. Seasonally available legume/pulse straws viz. groundnut straw, moong straw and pigeon pea straw are nutritionally superior to cereal straws. Feeding a mixture of cereal and non-leguminous straw improves feed and nutrient intake¹⁰. This study was planned to study the effect of feeding rice DDGS and mixture of wheat straw and groundnut straw on feeding cost and feed efficiency of growing heifers.

MATERIALS AND METHODS

Experimental location, animals and duration:

The present work was carried out at Livestock Research Station, College of Veterinary Science & Animal Husbandry, Anand Agricultural University, Anand, Gujarat on twenty-four HF×Kankrej (75:25) heifers with an average body weight of 116.13±4.74kg (Table 1). The experiment started on 24th June 2020 and ended on 9th December 2020, with a total duration of 168 days (a total of 12 fortnights).

Experimental treatments and feeding regime:

There were six experimental groups with four animals in each group. Animals were offered three different types of concentrates containing 0 % (T1), 20% (T2) and 40% (T3) RDDGS.

Within each concentrate type, half of the heifers were offered wheat straw (R1) and another half a mixture of wheat straw and groundnut straw (R2) as dry roughage (Table 2).

General Management: All the experimental crossbred heifers selected for the study were dewormed with Fenbendazole @ 7.5mg/kg BW before the start of the experiment. They were kept under iso-managerial condition in well-ventilated hygienic shed and were provided. Animals were tied individually with a neck chain in front of the pakka manger with partitions for individual feeding.

Feeding Management: The protein requirements of the heifers under different treatment were met as per ICAR feeding standard⁷. Concentrate and roughage were given to the experimental heifers in the form of total mixed ration (TMR). TMR was offered twice to experimental animals first after tying them at their respective place between 9:00 to 9:30 hours and then between 16:00 to 16:30 hours. In addition to TMR, heifers were offered fixed 2 kg/head/d and 4 kg/head/d green hybrid napier up to 100kg and above 100kg BW, respectively and with preset 35 gm/head/d mineral mixture throughout the experiment. Protein requirement of experimental heifers were adjusted at biweekly interval as per change in body weight. Feed leftover of individual heifer was weighed on the next day, when no leftover was observed, heifers were offered measured quantity of extra wheat straw so that they could complete their bulk requirement for rumen fill at 17:30 hours.

Feed intake: A measured quantity of TMR and green fodder were offered to the experimental heifers as per the treatment and leftover was weighed on next day morning between 7:00 to 7.30 hours. Moisture % of offered TMR, green and leftover feed was measured on biweekly basis so that actual DM consumption can be calculated. Utmost care was taken while feeding animals to get actual feed intake. Mangers were partitioned with bricks and mud keeping sufficient space for individual animals. In general, there

Table 1: Details of experimental animals

Group		Number of heifers	Body Weight at the start of Experiment (kg)
T1	R1	4	115.85±15.55
	R2	4	116.35±12.50
T2	R1	4	116.00±12.29
	R2	4	116.55±12.07
T3	R1	4	116.00±12.53
	R2	4	116.00±13.55
Total		24	116.13±4.74
Mean ± SE			

Table 2: Concentrate type and dry roughage offered to experimental heifers

Group	Number of heifers	Ingredients in Total Mixed Ration			
		Concentrate type 50%	Dry Roughage (50%)		
			Wheat Straw	Groundnut Straw	
T1	R1	4	Concentrate -I (0% RDDGS)	50%	0%
	R2	4		25%	25%
T2	R1	4	Concentrate -II (20% RDDGS)	50%	0%
	R2	4		25%	25%
T3	R1	4	Concentrate -III (40% RDDGS)	50%	0%
	R2	4		25%	25%



Plate 1: Rice DDGS



Plate 2: Groundnut straw

was no leftover of green as it was provided in limited quantity.

Cost of feeding: Cost of feeding under different treatments was calculated from the records of daily feed consumption and by considering the procurement cost of feed and fodder used for feeding experimental heifers (**Table 3**). The feed cost per kg BW gain was also worked out from recorded body weights of different group heifers at fortnightly interval.

Analysis of data: The experimental data was analysed at Department of Agricultural Statistics, B. A. College of Agriculture, Anand Agricultural University, Anand (Gujarat) using in house tested software. Design of the experiment was RBD (factorial) and analysed as per the statistical method¹⁴.

RESULTS AND DISCUSSION

Feed cost (₹/head/d): Feed cost (₹/head/d) of crossbred heifers was calculated at fortnightly interval during the experiment. The average feed cost (₹/head/d) at first fortnight and last fortnight of the experiment, ignoring treatments was 56.79 ± 1.28 and 75.17 ± 0.89 , respectively. Feeding cost (₹/head/d) increased by 32.64% over an experimental period of 168 days. When roughage source was ignored, average feed cost (₹/head/d) was found to be 71.84 ± 0.77 , 68.30 ± 0.63 and 65.25 ± 0.63 in T1, T2 and T3 group, respectively. There was a linear and significant ($p < 0.05$) reduction in the cost of feeding when soyaDOC was replaced with RDDGS. On avoiding concentrate source, it was found that average feed cost (₹/head/d) in R1 and R2 group heifers was 66.89 ± 0.58 and 70.03 ± 0.59 , respectively. The cost of feeding heifers (₹/head/d) increased significantly ($p < 0.05$) when the mixture of wheat straw and groundnut straw was offered to heifers. Similar Interaction of concentrate and roughage (T×R) was also found to be significant ($p < 0.05$) over an experiment period. Average feed cost (₹/head/d) was lowest in T3R1 group heifers (63.88 ± 0.86) which were fed concentrate with 40% RDDGS

and wheat straw as dry roughage; whereas the highest feed cost (₹/head/d) was observed in T1R2 group heifers (74.04 ± 0.97). Half and full soyaDOC replacement with RDDGS reduced the daily cost of feeding by 4.93 and 9.17%, respectively in heifers. The previous worker¹⁵ in dairy cows reported a similar finding. He observed cost of feeding would reduce by 4% for every 10% inclusion of DDGS in the diet. Similar to present study previous workers⁹ also found higher feeding cost for feeding mixture of soybean straw or wheat straw against sole feeding of wheat straw.

Feed cost (₹/kg BW gain) or Feed Efficiency:

Feed cost (₹/kg BW gain) in crossbred heifers was calculated at fortnightly interval during the experiment. Average feed cost (₹/kg BW gain) in T1, T2 and T3 group heifer was observed to be 117.15 ± 7.98 , 105.24 ± 4.11 and 93.32 ± 3.97 , respectively when roughage source was ignored. The feed cost (₹/kg BW gain) reduced by 10.16% and 20.34% on replacing half and full soyaDOC, respectively with RDDGS in concentrate. There was a significant ($p < 0.05$) decrease in average feed cost (₹/kg BW gain) when all 40% soyaDOC in concentrate was replaced with RDDGS. Likewise, previous workers² in water buffaloes found a significant ($p < 0.05$) reduction in feed cost (₹/kg BW gain) by using DDGS in feed (2.24 vs. 2.46 \$/kg). Total feeding cost in T1, T2 and T3 group heifers for the observed change in body weight of 119.08, 122.83 & 128.13 kg was ₹13950.22, ₹12926.62 and ₹11957.09, respectively. Substitution of soyaDOC with RDDGS resulted in a net saving of ₹ 11.91 and ₹ 23.83/kg BW gain in T2 and T3 group, respectively. Average feed cost (₹/kg BW gain) in R1 and R2 group heifers on avoiding concentrate source, was found to be 107.79 ± 5.82 and 102.68 ± 3.17 , respectively. Feed cost (₹/kg BW gain) did not differ statistically but it reduced by 4.74 % when crossbred heifers were fed a combination of wheat straw and groundnut straw. Feeding a mixture of wheat straw and groundnut straw to crossbred heifers reduced feed cost (₹/kg BW

Table 3: Procurement cost of feed and fodder

S.No	Feed ingredients	Cost (₹)/ kg
1	RDDGS	26.90
2	SoyaDOC	36.10
3	Amul Dan	19.24
4	Groundnut Straw	8.50
5	Wheat Straw	4.00
6	Green Hybrid Napier	2.00
7	Mineral Mixture	90.00

Table 4: Feeding cost and feed efficiency of experimental heifers

Particulars	Group						R1	R2
	T1		T2		T3			
	R1	R2	R1	R2	R1	R2		
Initial Weight (kg)	115.85 ±15.55	116.35 ±12.50	116.00 ±12.29	116.55 ±12.07	116.00 ±12.53	116.00 ±13.55	115.95 ±7.07	116.30 ±6.64
	116.1±9.2		116.3± 8.0		116.0±8.5			
Final Weight (kg)	229.95± 18.99	240.40± 17.46	233.75± 9.34	244.45 ±18.44	241.15 ±12.51	247.10 ±13.28	234.95±7 .54	243.98 ±8.68
	235.2±12.1		239.1±9.8		244.1±8.5			
Change in Body Weight (kg)	114.10	124.05	117.75	127.90	125.15	131.10	119.0	127.7
	119.08		122.83		128.13			
Feed cost (₹/head/d)	69.64 ±1.12	74.04 ±0.97	67.16 ±0.82	69.43 ±0.94	63.88 ±0.86	66.62 ±0.89	66.89^a ±0.58	70.03^b ±0.59
	71.84^c±0.77		68.30^b±0.63		65.25^A±0.63			
CD	0.583						0.476	
Feed cost (₹/kg BW gain)	124.50 ±15.13	109.80 ±5.13	106.08 ±6.14	104.39 ±5.53	92.79 ±5.67	93.85 ±5.63	107.79 ±5.82	102.68 ±3.17
	117.15^B±7.98		105.24^{AB}±4.11		93.32^A±3.97			
CD	14.273						NS	
Total Feeding Cost (₹)	14205.4 5	13620.6 9	12490.9 2	13351.4 81	11612.67	12303.73	12827.01	13112.24
	13950.22		12926.62		11957.09			

Means with different superscripts in a row (A, B) differ significantly for concentrate and (a, b) differ significantly for roughage source ($p < 0.05$). *CD Critical Difference at 5% significance level.

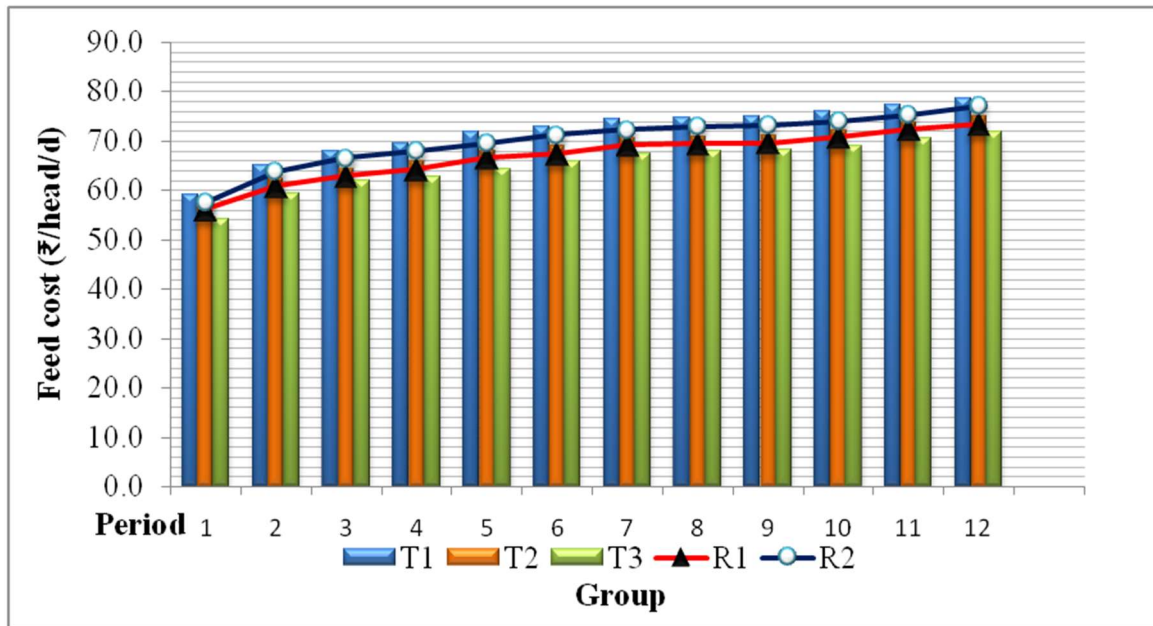


Fig 1: Average fortnightly feed cost (₹/head/d) of crossbred heifers

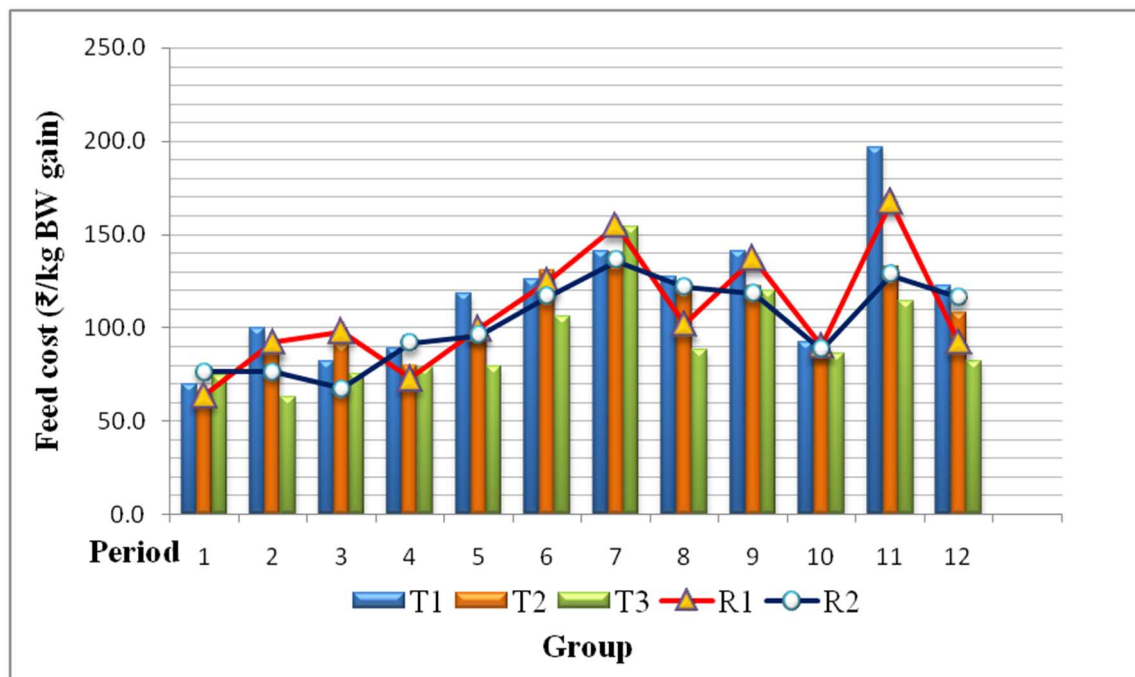


Fig 2: Average fortnightly feed cost (₹/kg BW gain) of crossbred heifers

gain) but the reduction was non-significant as the cost of mixture was more than wheat straw alone. Previous workers¹¹ reported reduction in feed cost for per kg body weight gain in Osmanabadi goat kids. Total expenditure on feeding R1 and R2 group heifers for observed change in body weight (kg) 119.0 and 127.7 were ₹12827.01 and ₹13112.24. The observed saving was ₹5.11/ kg BW gain on feeding mixture of groundnut straw and wheat straw. Improved feed efficiency on feeding mixture of cereal straw and legume straw in corresponding to present study was reported by previous workers^{8,9} in dairy cattle.

CONCLUSION

Daily feed cost (₹/head/d) and feed cost (₹/kg BW gain) reduced by (4.93 & 9.17%) and (10.16 & 20.34%) respectively in heifers on half and full soyaDOC replacement with RDDGS. There was net saving of ₹ 11.91 and ₹ 23.83/kg BW gain on replacing half and full soyaDOC with RDDGS. Daily feed cost (₹/head/d) increased significantly on feeding mixture of groundnut straw and wheat straw due to higher price of groundnut straw but feed cost (₹/kg BW gain) reduced by 4.74 % in heifers. Therefore, it can be concluded from the present study that feeding RDDGS in place soyaDOC in concentrate and feeding a mixture of legume straw and cereal straw (groundnut straw and wheat straw) are superior with respect to economic feeding and feed efficiency.

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