Full Length Article

COST ECONOMICS OF BREWERY WASTE IN JERSEY CROSSBRED DAIRY CATTLE UNDER FARMERS' FIELD CONDITIONS

B. Rajesh Kumar*

Livestock Farm Complex

Tamil Nadu Veterinary and Animal Sciences University

Madhavaram Milk Colony, Chennai – 600 051

ABSTRACT

A study was conducted to assess the cost economics of brewery waste in twenty four Jersey crossbred dairy cattle for one year with three treatments viz., control (T0), brewery waste (T1) and balanced ration (T2) in farmer's field conditions with eight animals in each group. The control, brewery and balanced ration animals were fed as per traditional and standard feeding practices. Statistical analysis revealed a significant (P<0.01) increase in the cost of concentrates (Rs. 15401.59/-) and total feed cost (Rs. 33278.93/-) for brewery waste fed dairy cattle than control animals. Also significant (P<0.05) increase in average gain of milk yield (0.73 Kgs /animal/day) was noticed for brewery waste fed animals than control. It is imperative to note that the total returns (Rs. 54653.18/-) were significantly (P<0.05) higher for brewery waste treated than control (Rs. 45393.15/-) animals. No significant (P>0.05) difference was evident in lactation days, cost and net returns per Kg of milk production using brewery waste. It can be concluded that farmers can utilize brewery waste to increase milk yield and total returns for augmenting income generation.

Keywords: Brewery waste, cost economics, feed cost, milk yield, net returns

Received : 29.11.2023 Revised : 19.01.2024 Accepted : 24.01.2024

INTRODUCTION

Livestock are an integral component of agriculture in India and make multifaceted contributions to the growth and development of the agricultural sector. Livestock is a source of subsidiary income for many families in India, especially the resource poor who maintain few heads of animals. Milch animals provide a regular source of income to livestock farmers through milk sales and value addition.

* Associate Professor and corresponding author Email id:drrajeshvet2008@gmail.com

The economic feeding of cows is a major component of successful dairy farming practices. Feed typically accounts for 60-80 per cent of the variable cost of milk production. Without good feeding programmes, the benefits of good breeding and management programmes could not be realized (Chakeredza *et al*., 2008).

Due to a shortage of raw feed ingredients, the cost of feed is increased day by day continuously. Further, a major gap exists between the demand and supply of conventional feed resources for feeding livestock in the world. The scarcity of raw feed ingredients has compelled to utilization of newer or non-conventional feed resources for feeding livestock. Appropriate use of relatively inexpensive agricultural and industrial by-products is of paramount importance for profitable livestock production. Brewery waste is a by-product of the brewery industry which is a rich source of protein, especially rumen un-degradable protein, which possesses high concentrations of methionine and lysine (Belibasakis and Tsirgogianni, 1996). Wet brewer's grain has been used in lactating cows ration as such or in compounded cattle feed formulations after drying (Dhiman *et al*., 2003). Currently, the interest in feeding wet brewer's grains to dairy cattle has increased among dairy farmers, because of the comparatively cheaper price. Hence, the experiment was carried out to study the cost economics of brewery waste with traditional feeding practices and balanced ration under field conditions in lactating Jersey crossbred dairy cattle.

MATERIALS AND METHODS

The present work was carried out at Melvenkatapuram village, Ranipet District of Tamil Nadu in twenty four Jersey crossbred dairy animals divided into three groups with eight animals each possessing uniform body weight and milk yield. The study was initiated in a farmer's field wherein the first farmer possessed 16 animals and the second had 8 animals. The selected dairy animals were in 1st lactation of 3 – 4 years of age, calved around 45 – 60 days with an average milk yield of 5.10 Kgs/day and mean body weight of 250.02 Kgs. All the selected dairy animals were given an adaptation period of two weeks before the experimental study which continued from October 2019 to September 2020. The study was carried out with three treatments *viz*., control (T0), brewery waste (T1) and balanced ration (T2). The control (T0) and brewery waste (T1) were carried out in the first farmer's field and balanced ration (T2) was carried out in the second farmer's field. The control (T0) animals were fed with rice bran/ wheat bran and oil cakes as per their traditional feeding practices being followed in the field. The brewery waste (T1) and balanced ration (T2) were given to the dairy cattle based on the dry matter requirement and milk production during the feeding trial. During this period, green fodder @ 9 Kg/ animal/day and dry fodder (paddy straw) @ 5 Kg/animal/day were fed to all the dairy cattle. The brewery waste was fed @ 1 Kg/ Kg of milk production in the T1 group and the concentrate feed was provided @ 400 gms/ Kg of milk production in the T2 group dairy

cattle. During the dry period, T1 and T2 were fed @ 4 Kgs of brewery waste and 1.5 Kgs per day per animal was provided as a maintenance requirement. The milk production of the three treatments was recorded daily from the start till the end of the experiment. Also, the number of days in lactation was assessed. Initially the experimental diet on control (T0), brewery waste (T1) and balanced ration (T2) were analysed for proximate principles at Animal Feed Analytical and Quality Assurance Laboratory, Namakkal (AOAC, 1990) and are presented in Table 1.

The data collected on the cost of feed and fodder, gain in milk yield, lactation days, total returns and net returns during the feeding trial were subjected to one way Analysis of Variance (ANOVA) using statistical software, IBM SPSS version 20.0. This analysis was performed to find out the significant difference between treatments and the final interpretation was done as per the procedure of Gomez and Gomez (1984).

RESULTS AND DISCUSSION

The mean values of cost economics of brewery waste in Jersey crossbred cattle under different treatment regimens were presented in Table 2.

Table 2 illustrates the cost for green fodder (in Rs) as 6370.21, 6565.99, 6540.80 and for dry fodder (in Rs) as 11045.08, 11311.35, 11439.15 for the control (T0), brewery waste (T1) and balanced ration (T2) animals during the study period. Similarly, the cost of concentrates (in Rs) were 7465.20, 15401.59 and 22886.33 for the T0, T1 and T2 animals. It could be observed that the cost of dry fodder and concentrates was significantly ($P<0.05$) higher for balanced ration (T2) followed by brewery waste (T1) and control (T0) animals in the descending order of magnitude. Also, the total feed costs (in Rs.) were 24880.49, 33278.93 and 40866.29 for T0, T1 and T2 animals during the experimental study period. A highly significant difference ($P<0.01$) was noticed in total feed cost between treatments, which was higher for balanced ration (T2) followed by brewery (T1) and control (T0) in the decreasing order of magnitude. The increased feed cost (total) for balanced ration animals (T2: Rs.40866.29) could be due to the higher cost of raw feed ingredients (Maize, soybean meal, deoiled rice bran, mineral mixture and salt) for concentrate feed preparation as per standard which was purchased @ Rs. 24.50/Kg followed by brewery waste (T1: 33278.93) which was purchased @ Rs. 6.50/Kg and least for control (T0: 24880.49) containing imbalanced feed ingredients which was purchased @ Rs. 16/ Kg.

It could be observed from the table that the average gain in milk yield (Kgs/ animal/day) for T0, T1 and T2 were 0.13, 0.73 and 1.56 respectively and significant ($P<0.05$) gain could be observed between treatments during the experimentation period. In control (T0) animals, there was a marginal increase in milk yield which was fed with wheat/ rice bran, rice gruel and ground nut oil cake (GNC) in an imbalanced proportion without meeting the dietary requirement of the animal.

Table 1. Proximate Principles (in %)

S. No.	Particulars	Control (T0)	Brewery waste (T1)	Balanced ration (T2)
1.	Moisture	9.15	73.17	12.22
2.	Crude protein	7.36	13.90	19.18
3.	Crude Fibre	5.95	6.40	9.02
4.	Ether Extract	4.95	5.13	6.09
5.	Total Ash	5.02	5.76	7.19
6.	Gross Energy (K.Cal/Kg)	1323	1931	3708

The concentrates fed to the control animals contained 1323 K.cal/kg energy, 7.36 % protein and 5.95 % crude fibre. This could be the probable reason for the comparative lower milk yield than brewery (T1) and balanced ration (T2) fed groups. Any animal if underfed or fed an imbalanced ration without meeting the requirement, there will be a definite decline in milk production. This corroborated with the findings of Garg *et al.* (2016) who observed 10.36 Kgs/day milk production before experimentation and after the ration balancing program, the milk yield significantly increased ($P<0.01$) to 11.67 Kgs/day implying the importance of balanced feeding on milk production. In the case of brewery waste fed dairy cattle (T1), the gain in milk yield (0.73 Kgs/animal/day) at the end of experimentation was higher than the control (T0) animals, but marginally lower than the balanced ration (T2) fed animals. The higher milk yield for brewery treated animals could be attributed to the fact that the brewery wastes had a larger degradable fraction of protein, which is converted into microbial cell protein, digested and absorbed in the duodenum and increased the milk yield. This is following the findings of Senthil Murugan *et al.* (2015). The gain in milk yield (1.56 Kgs/animal/day) was higher in balanced ration fed animals than in other treatments. This could be due to the supply of balanced nutrition which increased the rumen microbial protein synthesis to make more optimal rumen function for increased milk production (Garg *et al.,* 2014).

It was evident to note that the number of days in lactation for control (T0), brewery (T1) and balanced ration (T2) fed animals was 295.20, 299.99 and 302.39 respectively during the study period. Due to the imbalanced feeding, the lactation length decreased in control animals than other treatment groups. Further the concentrate feed of control animals contained lower levels of nutrients (1323 K.cal/kg energy, 7.36 % protein and 5.95 % crude fibre) to meet the dietary requirement of the

Table 2. Cost economics of brewery waste in Jersey crossbred cattle under different treatment regimens (Mean ± SE)

Parameters	Treatments			F value
	Control (T0)	Brewery waste (T1)	Balanced ration (T2)	
a. Cost of green fodder @Rs.3/Kg (in Rs)	6370.21 ± 16.69[a]	6565.99 ± 7.49[a]	6540.80 ± 9.24[a]	2.95[NS]
b. Cost of dry fodder @Rs.6/Kg (in Rs)	11045.08 ± 17.83[b]	11311.35 ± 16.73[ab]	11439.15 ± 30.26[a]	3.78[*]
c. Cost of concentrate (in Rs)				
i. Cost of control feed (imbalanced) @Rs .16/Kg				
ii. Cost of brewery waste @Rs.6.50/ Kg on a fresh basis				
iii. Cost of balanced ration @ Rs.24.50/Kg	7465.20 ± 95.11[c]	15401.59 ± 372.52[b]	22886.33 ± 174.25 [a]	44.93[**]
d. Total feed cost (a + b + c)	24880.49 ± 108.22[c]	33278.93 ± 373.89[b]	40866.29 ± 171.52 [a]	44.52[**]
e. Average gain in milk yield (Kgs/ animal/day)	0.13 ± 0.02 [b]	0.73 ± 0.07 [ab]	1.56 ± 0.15 [a]	3.63[*]
f. Number of days in lactation	295.20 ± 6.48[a]	299.99 ± 12.96[a]	302.39 ± 4.14 [a]	0.18 [NS]
g. Total milk production (in Kgs)	1488.30 ± 36.28[b]	1722.45 ± 62.67[ab]	2099.09 ± 74.92 [a]	3.15 [NS]
h. Cost per Kg of milk production (in Rs)	18.60 ± 2.50[a]	19.42 ± 0.58[a]	19.77 ± 0.72 [a]	0.15 [NS]
i. Total returns (in Rs) (Based on fat & SNF %)				
□ Milk sale @Rs.30.50/Kg for control, Rs.31.73/Kg for the brewery and Rs.34.80/Kg for a balanced ration	45393.15 ±126.43[b]	54653.18 ± 198.48[b]	73048.33 ± 187.34 [a]	6.40*
j. Net returns (in Rs)	20512.66 ± 128.42[a]	21374.25 ± 175.05[a]	32182.05 ± 168.12 [a]	2.12 [NS]
k. Net returns/Kg of milk production (in Rs)	11.90 ± 2.50[a]	12.31 ± 0.58[a]	15.03 ±0.72 [a]	1.22 [NS]

Means bearing the same superscripts within rows do not differ significantly

[**] - *Highly Significant (P<0.01)* [*] - *Significant (P<0.05)* *NS – Non Significant (P>0.05)*

animals which was below the recommended level and hence the number of days in lactation was reduced. In the case of the brewery (T1), the feed contained 1931 K.cal/kg energy, 13.90 % protein, 5.13 % ether extract and 6.40 % crude fibre which would also not have met the dietary requirement of the animals as like control and hence the lactation length was reduced. On the other hand, the balanced ration (T2) contained 3708 K.cal/Kg energy, 19.18 % protein and 9.02 % crude fibre which would have a synergistic effect on increasing the number of the lactation days under this experimental group.

The cost per Kg of milk production (in Rs.) for different treatments was 18.60, 19.42 and 19.77 for control (T0), brewery (T1) and balanced ration (T2) respectively during the trial period. The cost per Kg (in Rs) was higher for the balanced ration (T2:19.77) followed by brewery (T1:19.42) and control (T0:18.60) in the descending order of magnitude. This was in accordance with the findings of Garg *et al.* (2016) who studied the effect of balanced feeding in dairy cows and observed that the cost of feeding increased marginally from Rs.144.02/day to Rs.146.60/ day after the implementation of ration balancing programme. In this study the cost of feed/Kg of milk production was Rs.18.60 for control animals which could be due to higher consumption of dry matter intake with low level of milk production by the animals and returns from milk being marginal. In the case of balanced ration animals, the feed conversion efficiency would have increased in cows to produce more milk/ Kg of dry matter intake (Garg *et al*., 2016). Moreover, this could be useful to increase the profitability of milk producers and contribute to the efficient use of scarce feed resources in developing countries while achieving targeted milk production (Haldar and Rai, 2003).

Also the total returns (in Rs) for different treatments were 45393.15, 54653.18 and 73048.33 for control (T0), brewery (T1) and balanced ration (T2) fed animals during the study period. A significant ($P<0.05$) difference was noticed in total returns among the treatment group with the higher amount for balanced ration fed animals (T2: Rs. 73048) followed by brewery (T1: Rs. 54653.18) and control (T0: Rs.45393.15) animals based on milk fat and solids not fat composition of milk. It was observed after experimentation that an appreciable milk fat decrease of 0.05 % for control (T0) and 0.35 % for brewery waste (T1) was observed and on the other hand an increase of 0.47 % was evident for balanced ration treated animals. The net returns (in Rs) for different treatments were 20512.66, 21374.25 and 32182.05 for T0, T1 and T2 and no significant difference ($P>0.05$) was evident between them with numerically higher values for balanced ration treatment. Garg *et al*. (2016) stated that the returns through the sale of milk significantly ($P<0.05$) increased from Rs. 206.25 to Rs. 255.34 by implementing a ration balancing programme while studying the effect of balanced feeding on SNF content of milk and attributed the reason for increased feed conversion efficiency to produce more milk per Kg dry matter intake.

The net returns per Kg of milk production (in Rs) for different treatments were 11.90, 12.31 and 15.03 for T0, T1 and T2 fed animals during the experimental study period. The net return per Kg (in Rs) of milk production was higher for balanced ration (T2: Rs.15.03), followed by brewery (T1: Rs.12.31) and control (T0: Rs.11.90) in the decreasing order of magnitude. The increase in milk yield for balanced ration fed animals could be attributed to increased rumen microbial N synthesis due to more optimal rumen function because of the more balanced nutrient supply (Garg *et al*., 2014). They also stated that the feeding of a balanced ration increased ($P<0.05$) the daily average milk yield by 6.7 % due to the supply of deficient minerals through balanced feeding thereby increasing the net returns. Also, the higher net returns of balanced ration fed animals (T2) could be due to increased feed conversion efficiency for milk production per Kg dry matter intake (Garg *et al*., 2016).

CONCLUSION

Hence it can be concluded from the study that the total feed cost, average gain in milk yield and total returns were lower for brewery waste treated dairy cattle than balanced ration animals and higher than control (imbalanced fed) animals. Further, the cost incurred for brewery waste on fresh basis was lower than balanced ration treated dairy animal and no comparable difference was evident in cost per Kg of milk production between the treatments. The results also suggested that with significant decrease in total feed cost for brewery waste than balanced ration, net returns per Kg of milk production was comparable to that of the balanced ration. Thus farmers could utilize brewery waste as a non conventional feed resource for lactating dairy cattle thereby augmenting income generation. Awareness about the use of unconventional feed and its inclusion level for livestock should be advocated by providing training programmes for the farming community through extension centres so as to gain the knowledge on non conventional feed resources to meet the demand and supply of feed resources which could increase renewed income for the farmers towards their upliftment.

ACKNOWLEDGEMENT

The author expresses his sincere gratitude to the Director of Agriculture/ State Nodal Officer, Extension Reforms, Chennai and the Project Director/ Joint Director of Agriculture, Agricultural Technology Management Agency, Vellore for providing necessary financial assistance to this research project. Also, the facilities provided by the Vice-Chancellor, TANUVAS and Director of Research and Director of Extension Education, TANUVAS are sincerely acknowledged.

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