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An economic analysis of milk production in Rangareddy District of Telangana

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Abstract
Dairy farming is a vital supplementary business that improves farmers' quality of life, making it important to examine its profitability. The present study was undertaken to find out the cost and returns from milk production in the Rangareddy district of Telangana. Simple random sampling technique was adopted to identify the study area. Rangareddy district was selected based on the highest milk production and highest number of milk processing units. A sample of 120 milk producing households consisting where 60 producers from public enterprise (Vijaya Dairy) and remaining 60 producers from private enterprise (Masqati Dairy) were drawn randomly. A tabular analysis was carried to work out the cost and returns from milk production. The results of the study showed that maintenance cost of a cow and buffalo were 463 and 397.98 respectively. Out of total maintenance cost, was 78 per cent of variable cost and 21 per cent was as the fixed cost for cow and 75 per cent of variable cost and 25 per cent for buffalo. With respect to various categories, the maintenance cost of buffalo and cow was found a little lower in private category than public category for cow whereas for buffalo gross maintenance cost is lower in public category. The average net returns per cow and buffalo were observed ₹ 488.84 and ₹ 446.63 respectively, which is much higher than in case of cow. The higher returns in public category were mainly due to higher number of cows and better feeding of feeds and fodders than the other category.

Keywords: Capital recovery cost, net return, average cost, milk production, private and public dairy units

1. Introduction
The livestock industry is regarded as a crucial component of Indian agriculture. Keeping livestock is one of the many agricultural enterprises that the average household engages in to supplement their income and meet their family's nutritional needs. Dairy farming is becoming a significant source of income and employment due to the whims of the monsoon and its detrimental impact on crop production. It also has a wider social and economic scope. Since more than two decades, India is the largest milk producer in the world. The innovative Operation Flood programme, which was started in the 1970s, made it possible to accomplish the feat. Due to the extremely impressive performance of the dairy sector and the steadily rising contribution of the livestock sector to the agricultural gross domestic product over the past three and a half decades, India's agrarian economy has undergone the most significant changes. India with an annual milk production of 209.96 million tonnes and a per capita availability of 427 grams / day and maintained its position as the top milk producer in the world (NDDB, 2021–22). India shares about 22 per cent in global milk production. As per 20th Livestock Census, total cow population in India is 192.52 million and total buffalo population is 109.85 million (Livestock Census, Ministry of Fisheries, Animal Husbandry & Dairying 2019). Milk is the ultimate output having economic significance which brings returns to the milk producers. Hence, estimation of the cost and returns of milk production acts as an important economic indicator for assessing the level of profit of dairy enterprise at the producers' level. The objective of the present study is to analyse the costs and returns of milk production.

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2. Materials and Methods

2.1 Selection of study area

Telangana contributes 2.2 per cent of cattle and 3.85 per cent of buffalo to Indian cattle and buffalo population. (Department of Animal Husbandry and Fishery, 2019). Telangana ranks 13th position in milk production in the country with the annual milk production of 5765 tonnes in 2020-21. The per capita availability of milk is 422 grams/day against the national average of 444 grams (NDDB, 2021-22). Rangareddy district was selected based on the highest milk production and highest number of milk processing units in the state (Telangana State Statistical Abstract 2021).

2.1.2 Collection of data

Simple random sampling was employed for the selection of farmers. A sample of 120 milk producers where 60 producers from public enterprise (Vijaya Dairy) and remaining 60 producers from private enterprise (Masqati Dairy). Primary data pertaining to were collected from sample farmers using well-structured and pretested schedule by personal interview method.

2.1.3 Analytical framework

The information gathered from the milk producers was carefully examined, collated, and evaluated using a variety of analytical tools in order to meet the study's objectives. The costs and returns of producing milk were calculated using tabular analysis.

2.1.4 Cost of milk production

The costs and returns of milk production are crucial signs of a dairy farm's profitability. Both fixed costs and variable costs are included in the total costs associated with milk production. In order to estimate various costs and returns, the methodology below was used.

Fixed costs

Fixed Costs (FC) are the expenditure incurred by the producer irrespective of the level of production. They don't vary with the output and remain unchanged in the short-run. Various components of fixed costs include depreciation and interest on fixed capital. Capital Recovery Cost (CRC) method was used for estimation of fixed cost. Another fixed cost item i.e., interest on fixed capital was not estimated separately as CRC approach was followed.

Depreciation costs

It is the loss in the value of an asset due to normal wear and tear, time and technological obsolescence. It can be accounted for by using the Capital Recovery Cost (CRC) Method. The CRC method is defined as the annual payment that will repay the cost of fixed input over the useful life of input and provide an economic rate of return on investment.

The formula for estimation of CRC

$$R = Z\left[\frac{(1+r)^n r}{(1+r)^n - 1}\right]$$

Where, R is capital recovery cost, Z is initial value of capital cost, r is interest rate and n are useful life of asset (in case of animals it is remaining productive life).
When the asset was purchased from borrowed capital the actual interest rate charged by the bank was taken as 'r' while in case of owned funds, the interest on term deposit of 1-5 years was taken.

The useful life of assets was assumed to be 50 years for pucca cattle shed, 10 years for katcha shed, 20 years for semi pucca, 6 years for manual chaff cutter, 10 years for power operated chaff cutter. The useful life of milch animals also varied with the type of animal and was taken as 10 and 10 years for cow and buffalo, respectively.

Variable Costs

Variable costs are those costs which are incurred on the variable factors of production. Variable cost items include feed and fodder cost, labour cost, veterinary and miscellaneous expenses. Data on variable expenses were collected from the farmers and annual expenditures were converted to daily expenses.

Feed and fodder cost

This included the cost of feeding dry fodder, green fodder and concentrates to animals. In case of purchased feed and fodder, the cost was worked out as product of quantity fed to animal and purchase price of respective feed. In case of home-grown feed and fodder, the relevant prices were the farm-harvest prices. For certain types of fodder, especially cultivated green fodder, where farm-harvest prices were not available, the imputed value of crop is worked was taken as the prevailing price of standing crop in the village. In case the animal was fed with collected grass and tree leaves from the common property resources, its imputed value was their expected sale price and was accounted for while estimating the cost. When the concentrate feed was prepared at home, its cost was computed by taking the weighted prices of ingredients used in the concentrate, the weights being the share of each ingredient in the concentrate composition.

Labour cost

The information regarding labour requirements for various farm operations and labour cost were collected during the personal interview from the farmers. Labour cost comprises both family labour and hired labour. The cost of hired labour was calculated considering type of work allotted and wages paid, whereas, family labour costs were arrived based on existing wage rate of permanent farm labour.

Veterinary and miscellaneous costs

Veterinary costs included cost of artificial insemination (AI), natural service, vaccination, medicines, fee of veterinary doctor and other related expenses.
Miscellaneous costs included expenses on repair of fixed assets, water and electricity charges, insurance premium and any other incidental charges.

2.1.5 Other Cost Concepts

Gross Cost

It is the total cost incurred by the producer which was estimated by adding all the cost components including fixed and variable costs.

Gross Cost = Total Fixed Cost + Total Variable Cost

Net Cost

The net cost was estimated by deducting the imputed income earned through dung, from the gross cost.

Net cost = Gross cost – Value of dung

Gross returns

Gross returns were obtained by multiplying milk yield of an individual milch animal with respective prevailing prices in the study area.

Gross returns = Quantity of milk × Market price of milk

Net returns

Net return was calculated by subtracting net cost from gross returns.

Net returns = Gross returns – Net cost

3 Results and Discussion

The productivity and profitability of the dairy business are reflected in the analysis of the costs and returns of milk production from various categories of milch animals. The results of the study are presented and discussed as follows.

3.1 Costs and returns of milk production from cow

The overall gross maintenance cost of indigenous cows was estimated to be ₹ 463 per day per cow which varied from ₹ 433.93 per day for private dairy (Masqati) to ₹ 492.07 per day for public dairy (Vijaya) (Table 1). The overall total fixed cost was estimated to be ₹ 100.06 per day which contributed for about 21.61 per cent of overall gross cost. The overall total variable cost was found to be ₹ 362.94 per animal per day which estimated to be ₹ 333.93 and ₹ 391.95 for private and public dairy category, respectively and it accounted for about 78.38 per cent of overall gross cost. From the above table, the labour cost constituted a major share for about 49.40 per cent of gross cost, followed by feed and fodder cost which accounts for 28.79 per cent. The contribution of to the gross maintenance cost was highest as compared to other cost components attributed to the higher price of labour in the study region. The labourers were paid on monthly basis which varied from 9000 to 15,000 per month i.e., around 300 to 500 rupees per day. The contribution of both fixed and variable costs to the gross cost are found to be in conformity with the earlier studies conducted by Mohapatra et al. (2021) [3].

Overall cost of milk production per litre was estimated at ₹ 15.01. The per litre cost of milk production was found to

decrease in public dairy category (Vijaya), (11.34 per cent). The net return obtained from per litre milk in case of categories was found to be positive. The overall net return per litre of milk was worked out to be ₹ 55.73 and it varied from ₹ 65 for private dairy category and ₹ 46.46 for public dairy category. The net return from milk production was found to be positively with the different category households.

The result obtained regarding the cost and returns of milk production in case of cows was found to be in conformity with the earlier study conducted by Athare et al. (2019) [2] and Sunil et al. (2016) [4].

3.2 Costs and returns of milk production from buffalo

The cost and return of milk production of buffalo is presented in Table 2. The overall gross cost for buffalo milk production was estimated at ₹ 397.98 per day which varied from ₹ 404.81 in case of private dairy category to ₹ 391.15 for public dairy category. The overall total fixed cost and total variable cost for milch buffalo was computed at ₹ 99.5 and ₹ 298.48 per day, respectively. The share of total fixed cost and total variable cost to the overall gross maintenance cost was found to be 25 per cent and 74.99 per cent, respectively. The result obtained was in conformity with earlier studies conducted by Vanishree et al. (2018) [1]. The contribution of overall labour cost to the gross cost was found to be 52.34 per cent, followed by overall feed and fodder cost (22.04 per cent). Among the feed and fodder, the contribution of overall green fodder, dry fodder and concentrates to the gross cost was worked out to be 9.50 per cent, 3.72 per cent and 8.81 per cent, respectively. Highest cost share of green fodder was attributed to their high cost and lowest share of dry fodder in the study area.

The overall cost of production per litre of milk was estimated to be ₹ 16.84. The net return per litre of milk production was positive for all the categories. The net return was found to be ₹ 65 and ₹ 30.97 per litre of milk for private and public dairy categories, respectively. The overall net return per litre of milk was worked out to be ₹ 47.98. The result obtained regarding the cost and returns of milk production in case of cows was found to be in conformity with the earlier study conducted by Kumar et al. (2016) and Vanishree et al. (2018) [6, 1].

Table 1: Average cost and returns from milk production for Cow (₹/Animal/Day)

Cost Components	Category		Overall
	Private (Masqati)	Public (Vijaya)	
Total Fixed Costs (TFC)	100 (23.04)	100.12 (20.34)	100.06 (21.61)
Green Fodder (F1)	48.59 (11.19)	52.65 (10.69)	50.62 (10.93)
Dry Fodder (F2)	18.71 (4.31)	18.62 (3.78)	18.66 (4.03)
Concentrate (F3)	74.35 (17.13)	50.74 (10.31)	62.54 (13.50)
Feed & Fodder costs (V1=F1+F2+F3)	141.66 (33.33)	122.02 (24.79)	133.34 (28.79)
Labour Cost (V2)	190.85 (43.98)	266.66 (54.19)	228.75 (49.40)
Veterinary & Miscellaneous Costs (V3)	1.41 (0.32)	3.26 (0.66)	2.33 (0.50)
Total Variable Costs (TVC = V1+V2+V3)	333.93 (76.95)	391.95 (79.65)	362.94 (78.38)
Gross Cost (A = TFC+TVC)	433.93 (100)	492.07 (100)	463 (100)
Value of Dung (B)	125.13	175.80	150.46
Net Cost (C = A-B)	308.8	316.27	312.53
Price of milk (₹/litre)	45	40	42.5
Average milk production /animal/day (E)	16.52	27.87	22.19
Gross Return (D)	700.52	902.23	801.37
Net Return (D-C)	391.72	585.96	488.84
Cost of milk production (₹ / Litre) (C/E)	18.69	11.34	15.01
Returns (₹ / Litre) (D/E)	42.40	32.37	37.38

Figures in parentheses indicate the percentage of gross cost

Table 2: Average cost and returns from milk production for buffalo (₹/Animal/Day)

Cost Components	Category		Overall
	Private (Masqati)	Public (Vijaya)	
Total Fixed Costs (TFC)	101.0 (24.94)	98 (25.05)	99.5 (25)
Green Fodder (F1)	42.66 (10.53)	32.97 (8.42)	37.81 (9.50)
Dry Fodder (F2)	13.20 (3.26)	16.43 (4.20)	14.81 (3.72)
Concentrate (F3)	62.85 (15.52)	7.36 (1.88)	35.10 (8.81)
Feed & Fodder costs (V1=F1+F2+F3)	118.72 (29.32)	56.76 (14.51)	87.74 (22.04)
Labour Cost (V2)	183.33 (45.28)	233.33 (59.65)	208.33 (52.34)
Veterinary & Miscellaneous Costs (V3)	1.76 (0.43)	3.05 (0.77)	2.40 (0.60)
Total Variable Costs (TVC = V1+V2+V3)	303.81 (75.05)	293.15 (74.94)	298.48 (74.99)
Gross Cost (A = TFC+TVC)	404.81 (100)	391.15 (100)	397.98 (100)
Value of Dung (B)	164.72	162.6	163.66
Net Cost (C = A-B)	240.09	228.55	236.32
Price of milk (₹/litre)	65	60	62.5
Average milk production /animal/day (E)	10.18	22.6	16.39
Gross Return (D)	661.81	700.11	680.96
Net Return (D-C)	421.72	471.55	446.63
Cost of milk production (₹ / Litre) (C/E)	23.58	10.11	16.84
Returns (₹ / Litre) (D/E)	65	30.97	47.98

Figures in parentheses indicate the percentage of gross cost

4. Conclusions
The study concluded that the variable cost was the most important item of the total maintenance cost accounting for 78.38 per cent in case of cow and 74.99 per cent in case of buffalo of the total cost in the study area. The fixed cost was accounted 21.61 per cent and 25 per cent for cow and buffalo respectively on the total cost. In the variable cost most important item of the total maintenance costs were labour cost accounting for 49.40 per cent for cow and 52.34 per cent for buffalo on the total cost. The overall gross and net returns per cow and buffalo were ₹ 801.37, ₹ 488.84, ₹ 680.96and ₹ 446.63respectively, in the private and public dairy category. Gross and net returns was higher in public dairy category due to higher number of milch cows and buffaloes and better feeding of feeds and fodders than the other category. The overall net returns were found to be high in case of buffalo (₹ 47.98) when compared to cow (₹ 37.38) because of higher marker price of the buffalo milk due to high fat content. The overall cost of milk production was found to be higher in case of buffalo (₹ 16.84) when compared to cow (₹ 15.01) which shows that there were higher expenses on gross maintenance of the buffalo compared to cow.

5. Future scope
This research article gives a brief idea about the various researches who have work under the economics of milk production in different areas in India using tabular analysis.

6. Conflict of interest
The authors do not have any conflict of interest.

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