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RESEARCH ARTICLE

Economic analysis of costs and returns of milk production in Andhra Pradesh

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Abstract: The present study was conducted in the Chittoor and East Godavari districts in the state of Andhra Pradesh to estimate the costs and returns of milk production to know the status of milk profitability among the farmer-producer households. The milk productivity in the study area was higher in crossbreed cows than the buffalo and indigenous cattle. The overall gross cost of milk production estimated at ₹ 264.40 per animal per day, which was higher in the crossbreed cows than the Buffaloes and Indigenous cattle. The variable costs account for the major proportion of the cost of milk production (88.87%) than the fixed cost. Within variable costs, feed and fodder expenses represent the largest portion, accounting for 71.89 percent of milk production costs, exceeding labour, veterinary as well as miscellaneous costs. The average milk production per animal was 7.23 litres per day, was highest in the crossbreed cows with 10.37 litres per day than in buffalo (6.12 litres per day) and indigenous cattle (5.21 litres per day). The overall net returns per animal were highest in crossbreed cows with ₹ 83.14 per day than the buffalo (₹ 51.66 per day) and the indigenous cattle (15.66 per day). The cost of milk production and net returns per litre was highest in the buffalo with ₹ 44.89 per litre and ₹ 8.37 per litre than the crossbreed cows and the indigenous cattle. Even though the overall returns from milk production were positive among all the farmer-producer households in the study area rearing of crossbreed cows and buffalo was found to be profitable when compared with the indigenous cattle.

Keywords: Milk production; Economic analysis, Labour; Feed; Indigenous cattle

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Introduction

Dairying is essential to transforming Indian farmers' lifestyles. Farmers living in drought-prone regions where agriculture is only practiced for a brief period, depend heavily on livestock, making it their primary source of income. Both livestock and dairy employ more than one-third of the country's population (DAHD,2021). Dairy plays a crucial role in the income generation and employment of the rural population, which provides employment for more than 8 crore farmers directly and solely contributes around 5 percent of the National Economy (Economic Survey, 2021-22). It also observed that dairying helped people overcome poverty and enhance rural welfare (Yadav et al. 2017).

The economics of milk production plays a crucial role in dairy farming. It indicates the profitability of the enterprise. A farmer producer can run the enterprise successfully when they geta sufficient amount of income from that, otherwise, they may incur losses, which affects the farmer as well as the family and also the income of the country. If the farmer makes a huge investment in the dairy enterprise from the borrowings from the banks, if he is not able to pay debt properly, he will become a wilful defaulter. So, the economics of the enterprise gives the idea to the farmer producer about profit or loss and also helps the public agencies in making the policy decisions in order to ensure the minimum price to the producer. So, cost and returns are important in estimating the profitability of the dairy enterprise. It also suggests the producer where to increase and decrease in order to run the farm sound. Costs incurred in dairy farm includes fixed (buildings, machinery, *etc*.) and variable cost (feed and fodder, labour charges, *etc*.). The returns are from the sale of the milk and milk products. To run the farm successfully the returns must be more than the costs, otherwise farmers suffer from losses. The variable costs had a keen role in the production of milk. Feed and fodder costs are most crucial in the production of milk as they influence the

returns. Milk production depends on feed and fodder which increases production and productivity. So, the proper maintenance of feeding throughout the year is important. It is estimated that green fodder and dry fodder had shortages of 11.24 percent and 23.4 percent in the country (IGFRI, 2021). To overcome the problem of shortage, a proper fodder plan should be prepared and implemented throughout the year as it will enhance the productivity of the animal. The price of the milk is the most important incentive for the farmers to increase milk production (Chand et al.2017) and also helps in decision-making in the allocation of resources (Dwivedi and Naik, 2017). Other factors like quality of breed, artificial insemination, and veterinary care also a play key role in milk production even though they cost very little in the total costs.

Andhra Pradesh state stands fifth in the country in milk production with 14.7 million metric tons (MT) of milk production (contributing 7 percent to the total country's milk production). Very few studies were conducted on the costs and returns of milk in the state. So, there is a need to study investment patterns, feed costs, and other costs along with the price of the milk for developing the proper policies in the study in order to enhance the welfare of the farmers.

Materials and methods

Study area

The study was conducted in Andhra Pradesh, focusing on Chittoor and East Godavari districts due to their high milk production. A multistage random sampling method was employed to select 80 farmer-producer households from four villages, with 20 households from each village.

Data collection and methodology

The primary data was collected from the farmer-producer households through the pre-structured interview schedules on different aspects of dairy farming during 2023. The 80 farmer-producer households were post-stratified into small (1-3 milch animals), medium (4-5 milch animals), and large farmers (6-14 milch animals) based on milch animals by using the cumulative square root frequency method. The data collected from the farmer respondents were subjected to tabular analysis. The methodology used for the study was presented in detail as follows:

1. Cost of milk production: The costs of milk production include the fixed and variable expenditures incurred by farmers on different items

A. Fixed costs: It consists of the rental value of the land, depreciation on fixed assets like buildings, machinery, chaff cutter, *etc*. The capital cost recovery cost method was used for accounting for the assets.

Capital Recovery Cost (CRC) of civil structures, machinery, and equipment

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

R = Capital recovery cost, Z = Initial value of the capital asset, r = Current interest rate, n = Useful life of the assets/animals

The formula for CRC estimation of milch animals is the same as above but the important aspect is ascertaining 'n' *i.e*., the useful life of the animal or its productive life. As per the subject matter specialists at the field level, the useful productive life of milch animals, defined in terms of age (year) and order of lactation, viz., the average number of calving per animal is: a) Local cow: 10 years with 6 calving's; b) Crossbred cow: 8 years with 5 calving's and c) Buffalo: 10 years with 6 calving's.

B. Variable costs: These include feed and fodder costs, labour costs, and veterinary and miscellaneous costs.

Feed and fodder cost: Feed and fodder costs include dry fodder, green fodder, and concentrates. If the feed and fodder are purchased, the cost is worked as the product quantity of feed fed to the animal and the purchase price of feed. In the case of feed and fodder produced at the home, the prices are farm harvest prices.

Labour cost: These costs considers both family and hired labour, with hired labour costs based on work type and wages, while family labour costs align with prevailing permanent farm labour rates. Various labour types (adult male, female, and child) were used, later standardized to male equivalent units using Patel et al.'s 1980 wage rate recommendations.

Veterinary and miscellaneous costs: The veterinary expenses encompass artificial insemination, natural service, vaccinations, medications, and other costs. On the other hand, miscellaneous expenditures cover fixed asset repairs, petroleum, oil, lubricants, insurance premiums, and other charges.

There are different types and ages of animals in the herd (indigenous cattle, crossbreed cows, and buffaloes). These different categories of animals are converted into homogenous units for the easy estimation of costs and returns. For the present study, the standard animal units developed by Sirohi et al. (2015) were used. As the study region falls in the southern region, SAUs for the southern region are presented in Table 1.

2. Returns from milk production: To calculate the gross returns from the animals the milk production and animal dung returns are taken. The sale value of animals is not taken into consideration while calculating the returns from milk production.

3. Other costs and return concepts:

- Gross cost = Total fixed cost + total variable cost
- Net cost = Gross cost – value of dung

Net cost per animal

- Cost of milk production (₹ / litre) =

Average milk yield of animal

- Gross returns = Quantity of milk × price of milk
- Net returns = Gross returns – net cost

Net returns per animal per day

- Net returns per litre of milk =

Average milk yield of animal

Results and Discussion

Costs and returns of milk production for Indigenous cow

The cost and returns of milk production of indigenous cattle across different herd size categories in farmer-producer households. Table-2 shows that the overall gross cost of milk production was ₹ 203.04 with 86.59 percent variable cost and 13.14 percent fixed cost. Similar results were found in Sunil et al. 2017, Kumar et al. 2015 and and Mohapatra et al. 2021. Among the variables, the total feed and fodder account for 68.34 percent of gross cost followed by labour cost (16.86 percent) and miscellaneous cost (1.39 per cent). In the feed and fodder costs, green fodder cost, ₹ 75.35 was more than the concentrates, ₹ 44.90 and dry fodder ₹ 18.51.

Inter-category analysis shows that the feed fodder cost was highest in the large herd size category (₹ 147.50) followed by medium (₹ 138.79) and small (₹ 130.00). while in the case of labour cost, it was highest for large herd size (₹ 35.16) followed by medium (₹ 33.13) and small herd size (₹ 34.38). In the case of miscellaneous charges, it was highest for large herd size (₹3.16) followed by medium (₹ 2.83) and small herd size (₹ 2.46).

The overall net cost of production was obtained by subtracting the dung value from the gross cost. The overall net cost of indigenous cattle has been estimated of ₹ 200.75, which was highest in large herd size ₹ 216.02, followed by medium ₹ 200.40 and small herd size ₹ 185.83. The overall average price of the milk was ₹ 41.55, was highest in the case of large herd size (₹ 42.00) followed by medium (₹ 41.64) and small herd size (₹ 41.00). The overall average production of milk per day was found to be of 5.21 litres per day, was highest in case of large herd size category 5.58 litres per day followed by medium herd size, 5.21 litres per day and small,4.82 litres/day.

The gross returns were highest in the case of large herd size (₹ 234.50 per animal per day) followed by medium (₹ 217.12 per animal per day) and small (₹ 197.62 per animal per day) with an average of ₹ 216.41 per animal per day. It was found that the average net returns per day were ₹ 15.66 per day per animal, which was highest in large herd size (₹ 18.48 per day per animal) followed by medium (₹ 16.72 per day per animal) and small (₹ 11.79 per day per animal).

The overall cost of milk production per litre was ₹ 38.56, which was highest in large herd size (₹ 38.69), followed by medium (₹ 38.43 per litre) and small herd size (₹38.55per litre). The overall net returns per litre were ₹ 2.99, which was highest in large herd size (₹ 3.31) followed by medium (₹ 3.21) and small herd size (₹ 2.45). The table revealed that with an increase in milk production, the net returns were also increasing. While in the case of indigenous cattle, milk yield was low when compared with other crossbreed cows and buffalo. The net returns were found positive

Table 1: Standard animal units for the Southern region

Animals	Indigenous cattle	Crossbreed cows	Buffalo
Adult male	0.97	1.12	1.04
Adult female	1.00	1.62	1.24
Young stock male (<1 year)	0.22	0.24	0.24
Young stock female (<1 year)	0.27	0.30	0.28
Young stock male (≥ 1 year)	0.54	0.63	0.60
Young stock female(≥ 1 year)	0.47	0.52	0.51
Heifer	0.82	0.86	0.77

among all the categories of farmers. similar findings were also obtained by other studies in Madhya Pradesh by Chand et al.2017 and Agrawal and Raju, 2021. Some studies also showed that the net returns from the indigenous cattle were negative (Singh et al. 2012, Sunil et al.2017 and Jaiswal and Singh, 2015).

Cost and returns of milk production of crossbreed cows

The cost and returns of milk production of crossbreed cows across different herd size categories in the study area are shown in Table-3. The overall average gross cost of milk production was ₹ 313.05, which accounts for 91.27 per cent variable cost and 8.73 per cent fixed cost similar results were observed in the study of Kumar et al. 2022.

The Feed and fodder cost accounts for 77.33 per cent of the total cost of milk production followed by labour costs at of 13.53 per cent and miscellaneous costs of 1.00 per cent. Among the feed and fodder cost, green fodder accounts for about 35.28 per cent of the total cost of production, followed by concentrate cost, 30.99 per cent and dry fodder cost, 10.79 per cent. Inter-category analysis revealed that feed and fodder cost was highest in the large herd size category [1] 258.22, followed by medium, [1] 245.90 and small, ₹ 216.55. while in the case of green fodder, it was highest in large herd size (₹ 118.53) followed by medium (₹ 115.64) and large (₹ 97.15) with an overall average of ₹ 110.45. In the case of dry fodder, it was highest for large (₹ 36.96) followed by medium (₹ 34.63) and small (₹ 28.92). while in concentrate cost also follows a similar pattern *i.e.*, large (₹ 102.69), medium (₹ 95.63) and small herd size (₹ 90.48). The large herd size (₹ 44.11) had the highest labour charges followed by medium ([1] 41.92) and small (₹ 41.07). while in the case of miscellaneous cost, it was highest in large (₹ 3.22) followed by medium (₹ 3.16) and large (₹ 3.00) with an average of ₹ 3.13.

The overall average net cost was ₹ 310.64, which was highest in large herd size ₹ 334.18, followed by medium ₹ 317.98 and small ₹ 279.77. The overall average sale price of milk was ₹ 37.91, with large herd size ₹ 38.50, medium ₹ 38.48 and small [1]₹ 36.75. The overall production of milk production per day was highest in

Table 2: Costs and returns of milk production of Indigenous cattle in farmer producer households (₹/ animal/ day)

Cost and Returns components	Small	Medium	Large	Overall
Green fodder	70.00 (37.09)	75.71 (37.37)	80.33 (36.89)	75.35 (37.11)
Dry fodder	18.00 (9.54)	18.29 (9.03)	19.25 (8.84)	18.51 (9.12)
Concentrate	42.00 (22.25)	44.79 (22.10)	47.92 (22.00)	44.90 (22.11)
Feed and fodder cost	130.00 (68.88)	138.79 (68.50)	147.50 (67.72)	138.76 (68.34)
labour cost	34.38 (18.21)	33.13 (16.35)	35.16 (16.35)	34.22 (16.86)
Veterinary & Miscellaneous cost	2.46 (1.30)	2.83 (1.40)	3.16 (1.40)	2.82 (1.39)
Total Variable Cost	166.84 (88.40)	174.75 (86.25)	185.83 (85.32)	175.81 (86.59)
Total Fixed Cost (TFC)	21.89 (11.60)	27.85 (13.75)	31.97 (14.68)	27.24 (13.41)
Gross Cost (TFC+TVC)	188.73 (100.00)	202.60 (100.00)	217.79 (100.00)	203.04 (100.00)
Value of Dung	2.90	2.20	1.77	2.29
Net Cost	185.83	200.40	216.02	200.75
Price of milk (₹/litre)	41.00	41.64	42.00	41.55
Milk production (litre/animal/day)	4.82	5.21	5.58	5.21
Gross Return	197.62	217.12	234.50	216.41
Net Returns	11.79	16.72	18.48	15.66
Cost of milk production (₹/litre)	38.55	38.43	38.69	38.56
Net Returns (₹/litre)	2.45	3.21	3.31	2.99

Note: Figures in the parenthesis indicate the percentage of the gross cost of milk production

large herd size (11.11 litres per animal per day) followed by medium (10.53 litres per animal per day) and small (9.48 litres per animal per day) with an average of 10.37 litres per animal per day. The gross returns were highest in large herd size (₹ 427.78), followed by medium (₹ 405.00) and small (₹ 348.57) with an average of ₹ 393.78. The net returns per animal were highest in large herd size (₹ 93.60) followed by medium (₹ 87.03) and small (₹ 68.79), with an average of ₹ 83.14 per animal per day. The overall average cost of milk production per litre was ₹ 29.93, was highest in medium herd size (₹ 30.21) than in large (₹ 30.08) and small (₹ 29.50). The net returns per litre were highest in large (¹ 8.42), medium (₹ 8.27) and small (₹7.25) with an average of ₹ 7.98 per litre. The overall returns found similar to that of studies conducted by Sunil et al.2017 in Karnataka and Agarwal and Raju, 2021 in Madhya Pradesh. The increased returns per litre in case of large herd size are due to the increase in milk production per animal.

Costs and returns of milk production for Buffalo

The costs and returns of milk production of buffalo across different herd size categories was shown in Table-4. The fixed and variable costs account for about 12.16 per cent and 87.84 per cent of the total cost of milk production. Similar findings were reported in Banekol et al. 2023. Among the variable cost, feed and fodder cost account for 69.00 per cent of the total cost of milk production, labour cost, 17.63 per cent and miscellaneous

Table 3: Costs and returns of milk production for crossbred cows in farmer-producer households (₹ / animal/ day)

Cost and Returns components	Herd size category			Overall
	Small	Medium	Large	
Green fodder	97.15 (34.44)	115.64 (36.10)	118.58 (35.22)	110.45 (35.28)
Dry fodder	28.92 (10.34)	34.63 (10.89)	36.96 (11.06)	33.50 (10.79)
Concentrate	90.48 (32.34)	95.63 (30.08)	102.69 (30.73)	96.27 (30.99)
Feed and fodder cost	216.55 (77.40)	245.90 (77.33)	258.22 (77.27)	240.23 (77.33)
labour cost	41.07 (14.56)	41.92 (13.08)	44.11 (13.10)	42.37 (13.53)
Veterinary and miscellaneous cost	3.00 (1.07)	3.16 (0.99)	3.22 (0.96)	3.13 (1.00)
Total Variable Cost	260.63 (92.39)	290.97 (90.83)	305.56 (90.76)	285.72 (91.27)
Total Fixed Cost (TFC)	21.48 (7.61)	29.38 (9.17)	31.12 (9.24)	27.33 (8.73)
Gross Cost (TFC+TVC)	282.11 (100.00)	320.35 (100.00)	336.68 (100.00)	313.05 (100.00)
Value of Dung	2.33	2.38	2.50	2.40
Net Cost	279.77	317.98	334.18	310.64
Price of milk (₹/litre)	36.75	38.48	38.50	37.91
Milk production (litre/animal/day)	9.48	10.53	11.11	10.37
Gross Return	348.57	405.00	427.78	393.78
Net Returns	68.79	87.03	93.60	83.14
Cost of milk production (₹/litre)	29.50	30.21	30.08	29.93
Net Returns (₹/litre)	7.25	8.27	8.42	7.98

Note: Figures in the parenthesis indicate the percentage of the gross cost of milk production

costs, 1.21 per cent of the total cost of production. The overall feed and fodder cost was highest in green fodder with ₹ 98.56, which was highest in large herd size (₹ 111.90), then in medium (₹ 92.74) and small (₹ 91.05). After greenfodder, concentrates had a high amount ₹ 72.01, in which large herd size (₹ 75.79) shares higher share followed by medium (₹ 74.19) and small (₹ 66.03). In the case of dry fodder, it follows a similar pattern of concentrates and green fodder *i.e.*, large (₹ 24.14), medium (₹ 19.76) and small (₹18.05) with an average of ₹ 20.65. After feed and fodder costs, the labour cost, ₹ 48.84 was the highest variable cost than the miscellaneous cost, ₹ 3.36. In the case of labour charges, a large herd size (₹ 51.31) had a higher cost than medium (₹ 49.92) and small (₹ 45.30).

The overall average net cost per animal was ₹ 274.57, which was highest in large, ₹ 302.57, medium, ₹ 268.58 and small, ₹ 252.54. The average price per litre of milk was ₹ 53.26, which was highest in large (₹ 54.88), medium (₹ 52.92) and small (₹ 51.98). the average milk production per animal was highest in large, 6.65 litres per animal per day followed by medium, 6.12 litres per animal per day and small, 5.58 litres per animal per day, with an average of 6.12 litres per animal per day. The overall average gross returns per animal were ₹ 326.22, was highest in large herd size (₹ 364.69), followed by medium (₹ 323.93) and small (₹ 290.05). The net

Table 4: Costs and returns of milk production for buffalo in farmer-producer households (₹ / animal/ day)

Cost/Returns components	Herd size category			Overall
	Small	Medium	Large	
Green fodder	91.05 (35.64)	92.74 (34.23)	111.90 (36.69)	98.56 (35.57)
Dry fodder	18.05 (7.07)	19.76 (7.29)	24.14 (7.92)	20.65 (7.45)
Concentrate	66.03 (25.85)	74.19 (27.38)	75.79 (24.85)	72.01 (25.98)
Feed and fodder cost	175.13 (68.56)	186.69 (68.90)	211.82 (69.46)	191.22 (69.00)
labour cost	45.30 (17.73)	49.92 (18.42)	51.31 (16.82)	48.84 (17.63)
Veterinary and miscellaneous cost	3.28 (1.28)	3.33 (1.23)	3.47 (1.14)	3.36 (1.21)
Total Variable Cost	223.71 (87.57)	239.94 (88.55)	266.60 (87.42)	243.42 (87.84)
Total Fixed Cost (TFC)	31.75 (12.43)	31.02 (11.45)	38.36 (12.58)	33.71 (12.16)
Gross Cost (TFC+TVC)	255.46 (100.00)	270.96 (100.00)	304.96 (100.00)	277.13 (100.00)
Value of Dung	2.92	2.38	2.39	2.56
Net Cost	252.54	268.58	302.57	274.57
Price of milk (₹/litre)	51.98	52.92	54.88	53.26
milk production (litre/animal/day)	5.58	6.12	6.65	6.12
Gross Return	290.05	323.93	364.69	326.22
Net Returns	37.50	55.35	62.12	51.66
Cost of milk production (₹/litre)	45.26	43.88	45.53	44.89
Net Returns (₹/litre)	6.72	9.04	9.35	8.37

Note: Figures in the parenthesis indicate the percentage of the gross cost of milk production

Table 5: Cost and returns of milk production in farmer-producer households (¹ / animal/ day)

Cost and Returns components	Indigenous cattle	Crossbred cows	Buffalo	Overall
Green fodder	75.35 (37.11)	110.45 (35.28)	98.56 (35.57)	94.79 (35.85)
Dry fodder	18.51 (9.12)	33.50 (10.70)	20.65 (7.45)	24.22 (9.16)
Concentrate	44.90 (22.11)	96.27 (30.75)	72.01 (25.98)	71.06 (26.87)
Feed and fodder cost	138.76 (68.34)	240.23 (76.74)	191.22 (69.00)	190.07 (71.89)
labour cost	34.22 (16.86)	42.37 (13.53)	48.84 (17.63)	41.81 (15.81)
Veterinary and miscellaneous cost	2.82 (1.39)	3.13 (1.00)	3.36 (1.21)	3.10 (1.17)
Total Variable Cost	175.81 (86.59)	285.72 (91.27)	243.42 (87.84)	234.98 (88.87)
Total Fixed Cost (TFC)	27.24 (13.41)	27.33 (8.73)	33.71 (12.16)	29.42 (11.13)
Gross Cost (TFC+TVC)	203.04 (100.00)	313.05 (100.00)	277.13 (100.00)	264.40 (100.00)
Value of Dung	2.29	2.40	2.56	2.42
Net Cost	200.75	310.64	274.57	261.99
Price of milk (₹/litre)	41.55	37.91	53.26	44.24
Milk production (litre/animal/day)	5.21	10.37	6.12	7.23
Gross Return	216.41	393.78	326.22	312.14
Net Returns	15.66	83.14	51.66	50.15
Cost of milk production (₹/litre)	38.56	29.93	44.89	37.79
Net Returns (₹/litre)	2.99	7.98	8.37	6.45

Note: Figures in the parenthesis indicate the percentage of the gross cost of milk product

returns per animal per day were highest in large (₹ 62.12) than in medium (₹ 55.35) and small (₹ 37.50) with an average of ₹ 51.66 per animal per day. The overall cost of milk production per litre was highest in large (₹ 45.53), followed by small (₹ 45.26) and medium (₹ 43.88) with an average of ₹ 44.89. The net returns per litre were highest in large (₹ 9.35), medium (₹ 9.04) and small (₹ 6.72) with an average of ₹8.37. The overall similar findings were found in the studies conducted by Sunil et al.2017 and Agrwal and Raju, 2021.

Cost and returns of milk production

The cost and returns of milk production across different animals of farmer-producer households was shown in Table-5. The overall fixed and variable costs across different animals were 11.13 per cent and 88.87 per cent of the total cost of milk production.

Among the total variable costs, feed and fodder costs account for 71.89 per cent of the total cost of production, followed by labour, 15.81 per cent and miscellaneous costs,1.17 per cent. In the case of feed and fodder costs, crossbreed cows, ₹ 240.23 had the highest cost followed by buffalo, ₹ 191.22) and indigenous cattle, ₹ 138.76. In the case of feed and fodder, green fodder (35.85 per cent) shared a large amount than followed by concentrates (26.87 per cent) and dry fodder (9.61 per cent) of the total cost of production. while the green fodder cost was highest in crossbreed cows, ₹ 110.45, followed by buffalo ₹ 98.56 and indigenous cattle ₹ 75.35. Similar pattern is followed for concentrates and dry fodder *i.e.*, crossbreed (₹ 96.27, ₹ 33.50), buffalo (₹ 72.01, ₹ 20.65) and indigenous cattle (₹ 44.90, ₹ 18.51). while in the case of labour costs, it was highest for crossbreed cows, ₹ 42.37, followed by buffalo, ₹ 48.84 and indigenous cattle,

₹ 34.22 with an average of ₹ 41.81. In the case of miscellaneous costs also follow the same as that of labour charges *i.e.*, crossbreed cows (₹ 3.13), buffalo (₹ 3.36) and indigenous cattle (₹ 2.82) with an average of ₹ 3.10.

The overall net cost was ₹ 261.99, was highest in crossbreed cows (₹ 310.64) followed by buffalo (₹ 247.57) and indigenous cattle (₹ 200.75). The average price of the milk in the study area was ₹ 44.24, it was highest in buffalo (₹ 53.26) followed by indigenous cattle (₹ 41.55) and crossbreed cows (₹ 37.91). The highest price of buffalo milk was due to the high-fat content of both the indigenous cattle and crossbreed cows. The overall milk production per animal per day was 7.23 litres, with crossbreed cows (10.37 litres per day), buffalo (6.12 litres per day) and indigenous cattle (5.21 litres per day). The gross returns were highest in crossbreed cows (₹ 393.78) followed by buffalo (₹ 326.22) and indigenous cattle (₹ 216.41) with an average of ₹ 312.14. the lower returns in the case of buffalo and indigenous cattle are due to the lower productivity of the animal in the study area. The net returns were highest in crossbreed cows (₹ 83.14 per animal) followed by buffalo (₹ 51.66 per animal) and indigenous cattle (₹ 15.66 per animal) with an average of ₹ 50.15 per animal. The cost of production of milk per litre was highest in buffalo (₹ 44.89), followed by indigenous cattle (₹ 38.56) and crossbreed cows (₹ 29.93) with an average of ₹37.79 per litre. The net returns per litre were highest in buffalo (₹ 8.37), followed by crossbreed cows (₹ 7.98) and indigenous cattle (₹ 2.99) with an average of ₹ 6.45. The results are in line as found in the study by Dwivedi et al. 2024. The overall maintenance cost per litre as well as net returns per litre was highest in the case of buffalo than in crossbreed cows and indigenous cattle.

Conclusion

The study on the costs and returns on milk production concludes that the milk productivity of crossbreed cow was higher than the buffalo and indigenous cattle in the study area. The overall returns from the crossbreed cow were found more than the buffaloes and indigenous cattle . The feed and fodder costs were playing the major role in the total milk production and indirectly affects the profitability of the dairy. The dairy was main source and also improved the welfare of the farmers. Even though net returns per litre was higher in the buffaloes but the overall returns were low due to low milk productivity. The basic infrastructure like the improvement of hospitals, cattle sheds and subsidies for concentrates and mineral mixtures is to be provided for the betterment of the dairy industry in the state. Providing village-level training to dairy farmers on scientific management practices enhances milk production, meeting the demand of both domestic and global consumers. The overall study indicates that the rearing of dairy animals by the farmers was not only profitable but also an efficient source of income for the dairy producers.

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