

RESEARCH ARTICLE

Economic analysis of milk production in Southern and North coastal regions of Andhra Pradesh

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Abstract: A study on economic analysis of milk production was carried out in Chittoor and Vishakhapatnam districts of Andhra Pradesh. Using the cumulative square root frequency method, farms were divided into small, medium, and large groups based on the number of milch animals. A sample of 80 dairy farmers as drawn randomly from selected four villages of Chittoor and Vishakhapatnam districts of Andhra Pradesh during 2019-20. The cost and return calculation was computed using the budgeting technique. Fixed costs and variable costs were considered for estimation using the capital recovery cost technique. The overall maintenance cost per day per animal was highest for buffalo, followed by crossbred and indigenous cows. The overall cost of milk production was highest in the case of indigenous (₹ 32.45/litre) cow followed by buffalo (₹ 30.31/litre) and crossbred (₹ 22.64/litre). Study revealed that buffaloes were found to be more profitable than crossbred and indigenous cows. Milk productivity was highest for crossbred cows as compared to indigenous cows and buffaloes. Because of higher market price of milk for buffalo and comparative lower maintenance cost, overall net returns of buffalo were higher than crossbred and indigenous cows.

Keywords: Milk Production, Capital Recovery Cost, Standard Animal Unit

Introduction

In India, dairying plays a vital role in providing income and employment to masses. Coupled with crop production, dairy farming is practiced in rural households from ancient time. Indian

dairy industry witnessed a great transformation from the milk scarcity to the largest global milk producer. With 221.1 million tonnes of milk production and per capita milk availability of 444 g/day, India is world's largest producer and consumer of milk (GOI 2022). Milk production has increased significantly as a result of extensive dairy development programs and increased consumer demand for value-added products. The cost of milk production is an important tool for assessing the economics of dairy businesses at the producer level and determining procurement prices at dairy cooperative society (Sunil, et al. 2016). Andhra Pradesh is primarily an agricultural state with bright milk production potential (Government of Andhra Pradesh, 2017-18). Andhra Pradesh has well-known cattle breeds such as Ongole and Punganur, as well as the Buffalo (Godavari). In 2018-19, it ranked fifth in buffalo population (10.6 million) and fourth in buffalo milk production (7.4 million tonnes). Milk production in Andhra Pradesh increased to 150.44 lakh tonnes (LT) in the last decade. (NDDDB, 2018-19). On average, dairy production (with 1 or 2 dairy animals) adds net monthly household income of ₹ 1070 in Andhra Pradesh, which is roughly one third of the monthly wage of an agricultural wage labourer (Squicciarini and Vandeplas, 2011). In the light of importance of dairy sector for rural upliftment, an attempt has been made to analyse the economics of milk production in Andhra Pradesh.

Materials and Methods

Selection of study area

Andhra Pradesh was selected for the study, as the state ranked among top five milk producer states and contributed to the tune of 7.69% in country milk production (Animal Husbandry Statistics, 2020). The market size reached 608.1 billion in 2022 and expected to touch 1,014.3 billion by 2028, exhibiting a growth rate (CAGR) of 8.8% during 2023-2028. The livestock industry accounts for roughly 26% of the state's agricultural GDP. The state has a large network of dairy co-operatives to help support the dairy industry. There are over 7000 milk co-operative societies in the state, with an estimated membership of 8 lakh people. Four blocks were chosen at random, two each from Chittoor and Vishakhapatnam districts. They were chosen based on the districts with highest and lowest milk procurement per day respectively. One village

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was chosen at random from each selected block.

Collection of data

A complete enumeration of the selected villages was conducted, and a sample of 20 milk producer households was drawn from each village. The primary data was collected from a sample of 80 households by using well-structured schedule through personal interview. The data pertaining to socio-economic and demographic particulars of households like age, education, family composition, occupation, operational land holding, type of livestock, investment on livestock, machinery and equipment, value of feed, fodder and other miscellaneous expenses, milk production level and prices etc. were collected from respective farmers.

Analytical Framework

In order to achieve the objectives of the study, the data gathered from 80 dairy farmers have been screened, tabulated and analysed using different techniques, which have been discussed in the following sections.

Cost and returns of milk production

Milk production costs and returns are important indicators of profitable dairy farming. Fixed and variable costs combine to constitute the total cost of milk production. To estimate the cost and returns, a budgeting technique was used.

Fixed cost

Fixed costs are costs that do not fluctuate with the level of output and remain constant in the short run. Depreciation of assets and the interest rate on fixed capital are two components of fixed cost. The fixed cost was calculated using the capital recovery cost (CRC) method. The CRC method was used to calculate depreciation cost, which is the annual payment that repays the cost of fixed assets over the asset's useful life, resulting in an economic rate of return on investment.

The formula for the estimation of CRC is:

Where, R is the capital recovery cost, Z is the initial value of the capital asset, r is the interest rate, n is the useful life of the assets. The duration of assets' usefulness were estimated to be 50 years for the pucca cattle shed, ten years for the kutcha shed, six years for the manual chaff cutter, and ten years for the powered chaff cutter. Milch animals' useful lives were estimated to be 10, 8, and 10 years for local cows, crossbred cows, and buffalo, respectively. The total CRC was then allocated to each individual animal using the Standard Animal Units (SAUs). When an asset was purchased with borrowed capital, the actual interest charged by the bank was used as 'r,' whereas when own

funds were used, the interest rate on a 1-5year term deposit was used.

Variable cost

Variable costs are the costs incurred on different production factors and which can be modified in the short term. Three items, include feed cost, labour, veterinary and miscellaneous costs.

Feed and fodder cost

It includes cost of feeding dry fodder, green fodder and concentrate feed. The costs were calculated as a product of the quantity fed to animals and the price of each feed. The prices of farm harvest in the study region were considered for home grown feed and fodder. The imputed value of the crop was adopted at the village price of a certain type of forage, in particular green feed where agricultural harvest prices are not available. The cost of concentrate (made at home) was determined by taking into account the composition and the market prices of each ingredient.

Labour cost

During the personal interviews with the farmers, information about labour requirements for various farm operations and labour costs was gathered. The cost of labour comprised both family labour and hired labour. Hired labour costs were calculated based on the type of work assigned and wages paid, whereas family labour costs were calculated based on the existing wage rate of permanent farm labour.

Veterinary and Miscellaneous expenses

The costs of breeding and healthcare were covered by the veterinary costs. The costs of insemination by artificial means (AI), natural service, vaccination, medicines, veterinary fees and other related expenses were included. Various expenses included repair expenses for fixed assets, water, electricity, insurance and other incidental charges. These were joint costs, and the distribution was therefore carried out on the basis of the standard animal units (SAU).

Standard animal units (SAUs):

The dairy animals were converted into SAUs using the factors suggested by Sirohi et al. (2015) for the southern region.

Other cost concepts used

Gross cost: It was obtained by adding all the cost components including fixed cost and variable cost.

Gross cost = Total variable cost + Total fixed cost

Net cost: The net cost was worked out 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

Price of milk: The price of milk differs among different categories of animals. Therefore, weighted average price of milk was taken as an explanatory variable in the marketed surplus function and calculated for each household as follows:

Weighted average price= “PiWi / “Wi Where,

Pi is price per litre of the ith type of milk

Wi is total quantity of ith type of milk sold by the household

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

Net returns = Gross returns – Net cost

All the costs were calculated for per SAU per day. This also indicates the cost of maintaining an animal per day.

Results and Discussion

The cost and return analysis is regarded as a vital aspect of milk production since it indicates the profitability of enterprise besides enabling better decision-making process.

Costs and returns of milk production for indigenous cow

Table 1 indicates the total costs and returns of milk production for indigenous cow in the study area. The percent of fixed cost to the gross cost was found to be lowest (11.52%) for largest herd size category. The total variable cost accounted for 88.41 per cent of overall gross cost. overall feed and fodder constituted a major share of 67.76 percent of overall gross cost. The overall average price of indigenous milk was ₹ 30 per litre, although slightly varies with herd size category. Overall cost of milk production per litre was estimated to be ₹ 32.54, which ranged between ₹ 31.42 to ₹ 33.11 for large and small category, respectively. The overall negative net returns (₹ -2.55/ litre) of milk production indicating that indigenous cows are not economical. Nonetheless, farmers are rearing indigenous cow mainly for two reasons, i.e., first, own consumption of milk as they considered indigenous cow milk is better than crossbred and health benefits particularly to the children, secondly, ease of rearing– can be reared with locally available resources. Hence, scientists need to work on improvement in productivity of indigenous cows through breeding and farmers need to adopt better management practices. The result obtained with regards to the cost and returns of milk production in the case of indigenous cows were found to be in conformity with the earlier study conducted by Priya (2018) and Vanishree (2018)

Costs and returns of milk production for crossbred cows

Results provided in Table 2 indicates that the overall total fixed cost per day contributes about 12.07 per cent of overall gross cost. The total fixed cost was per animal was found vary with herd size categories. The share of total variable cost to the gross maintenance cost was 87.93 per cent. The overall feed and fodder

Table 1 Costs and returns of milk production for indigenous cow (₹/animal/day)

| Cost/ Returns Components | Herd size category | | | Overall |
|--|--------------------|----------------|----------------|----------------|
| | Small(1-5SAU) | Medium(6-9SAU) | Large(>9SAU) | |
| Total Fixed Cost (TFC) | 20.40(11.63) | 22.14(11.62) | 24.33(11.52) | 22.29(11.59) |
| Dry fodder (F1) | 13.99(7.98) | 15.21(7.99) | 17.15(8.12) | 15.45(8.03) |
| Green fodder (F2) | 53.45(30.48) | 57.21(30.04) | 63.79(30.20) | 58.15(30.24) |
| Concentrate (F3) | 50.87(29.01) | 56.36(29.59) | 63.10(29.88) | 56.78(29.49) |
| Feed and fodder cost (V1=F1+F2+F3) | 118.30(67.47) | 128.78(67.61) | 144.03(68.20) | 130.37(67.76) |
| labour cost (V2) | 19.96(11.38) | 21.45(11.26) | 22.88(10.83) | 21.43(11.16) |
| Miscellaneous (V3) | 16.69(9.52) | 18.10(9.50) | 19.96(9.45) | 18.25(9.49) |
| Total Variable Cost (TVC=V1+V2+V3) | 154.95(88.37) | 168.33(88.38) | 186.87(88.48) | 170.05(88.41) |
| Gross Cost (A=TFC+TVC) | 175.35(100.00) | 190.47(100.00) | 211.19(100.00) | 192.34(100.00) |
| Value of Dung (B) | 2.90 | 3.27 | 3.56 | 3.24 |
| Net Cost (C=A-B) | 172.45 | 187.20 | 207.63 | 189.09 |
| Price of milk (₹ /litre) | 29.27 | 30.03 | 30.39 | 29.90 |
| Average milk production (litre/animal/day) (E) | 5.21 | 5.70 | 6.61 | 5.84 |
| Gross Return (D) | 152.45 | 171.25 | 200.83 | 174.84 |
| Net Returns (D-C) | -19.99 | -15.95 | -6.80 | -14.25 |
| Cost of milk production (₹ /litre) (C/E) | 33.11 | 32.83 | 31.42 | 32.45 |
| Returns (₹ /litre) | -3.84 | -2.80 | -1.03 | -2.55 |

*Figures in parentheses indicate percentage of gross cost

cost constituted a major portion of about 75.64 per cent of the gross cost. Among the feed and fodder, the green fodder occupied a major share of 48.58 per cent in the gross cost, followed by concentrates (43.04%) and dry fodder (8.38%). The overall labour cost was estimated to be ₹ 29.35 per day with a share of 13.67 per cent to the gross cost and it was found to be highest for small herd size category (14.31%) and lowest in case of large herd size category (12.93%).

The average price of milk was estimated as ₹ 25.33, ₹ 26.07 and ₹ 26.45 for small, medium and large herd size category respectively. It is worth mentioning that market prices of crossbred milk are lower than indigenous cow and buffalo milk. This is because of the fact that crossbred cow milk has comparatively lower fat content. The milk of indigenous cow is being preferred by the consumers particularly children and old age persons because of health properties. There is a nudging effect on the customers that indigenous milk is A2 which is better than A1 milk (crossbred).

The overall cost of production was estimated to be ₹ 22.64 per litre of milk. Overall net return was estimated to be ₹ 3.19 per litre

of milk and also found to be positive for all the categories of dairy households. Interestingly, despite the lower per liter price of crossbred milk, rearing of crossbred is an economically viable enterprise. This is because of higher productivity. The result obtained regarding the cost of production and net return per litre of milk for crossbred were similar with the previous studies conducted by Priya (2018) and Vanishree (2018).

Costs and returns of milk production for buffalo

Table 3 shows that, the share of variable cost to the overall gross maintenance cost was found to the tune of 89.74 per cent. It is clear from the Table 3 the contribution of overall feed and fodder cost to the gross cost was found to be 67.40 per cent which varied from 66.15 per cent in small herd size to 68.74 per cent in case of large herd size category. Among the feed and fodder, the contribution of overall green fodder, dry fodder and concentrates to the gross cost was worked out to be 34.43 per cent, 5.83 per cent and 27.14 per cent, respectively. The overall labour cost was estimated to be ₹ 42.11 per day with a contribution of 15.86 per cent to the gross maintenance cost. It can be interpreted that the

Table 2 Costs and returns of milk production for crossbred (₹ /animal/day)

| Cost/ Returns components | Herd size category | | | Overall |
|--|--------------------|---------------------|--------------------|--------------------|
| | Small (1-5 SAU) | Medium (6-9 SAU) | Large (>9SAU) | |
| Total fixed cost (TFC) | 28.53 (12.37) | 29.53 (11.80) | 31.33 (11.91) | 29.46 (12.07) |
| Dry fodder (F1) | 12.97 (8.58) | 13.65 (8.15) | 14.85 (8.36) | 13.60 (8.38) |
| Green fodder (F2) | 76.61 (50.67) | 78.66 (46.93) | 84.02 (47.27) | 78.88 (48.58) |
| Concentrate (F3) | 61.61 (40.75) | 75.29 (44.92) | 78.87 (44.37) | 69.89 (43.04) |
| Feed and fodder cost (V1=F1+F2+F3) | 153.19 (74.81) | 167.60 (75.93) | 177.75 (76.72) | 162.37 (75.64) |
| Labour cost (V2) | 28.92 (14.31) | 29.53 (13.39) | 29.96 (12.93) | 29.35 (13.67) |
| Miscellaneous (V3) | 21.99 (10.88) | 23.61 (10.69) | 23.96 (10.34) | 22.95 (10.69) |
| Total variable cost (TVC=V1+V2+V3) | 202.09 (87.63) | 220.74 (88.20) | 231.67 (88.09) | 214.67 (87.93) |
| Gross cost (A=TFC+TVC) | 230.62 (100.00) | 250.26 (100.00) | 263.00 (100.00) | 244.13 (100.00) |
| Value of dung (B) | 2.78 | 3.27 | 3.56 | 3.11 |
| Net cost (C=A-B) | 227.84 | 246.99 | 259.54 | 241.02 |
| Price of milk (₹ /litre) | 25.33 | 26.07 | 26.45 | 25.82 |
| Average milk production (litre/animal/day) (E) | 10.35 | 10.63 | 11.31 | 10.76 |
| Gross return (D) | 262.17 | 276.96 | 299.09 | 275.01 |
| Net returns (D-C) | 34.33 | 29.97 | 39.65 | 33.99 |
| Cost of milk production (₹ /litre)(C/E) | 22.01 | 23.25 | 22.94 | 22.64 |
| Returns (₹ /litre) | 3.32 | 2.82 | 3.51 | 3.19 |

*Figures in parentheses indicate percentage of gross cost

Table 3 Cost and returns of milk production for buffalo (₹ /animal/day)

| Cost/ Returns components | Herd size category | | | Overall |
|--|--------------------|-----------------|----------------|----------------|
| | Small(1-5 SAU) | Medium(6-9 SAU) | Large(>9 SAU) | |
| Total Fixed Cost (TFC) | 26.93(10.82) | 26.66(10.07) | 28.15(9.93) | 27.25(10.27) |
| Dry fodder (F1) | 14.30(5.74) | 15.82(5.97) | 16.34(5.77) | 15.49(5.83) |
| Green fodder (F2) | 85.40(34.29) | 91.36(34.50) | 97.80(34.51) | 91.52(34.43) |
| Concentrate (F3) | 65.01(26.11) | 71.07(26.84) | 80.67(28.47) | 72.25(27.14) |
| Feed and fodder cost (V1=F1+F2+F3) | 164.71(66.15) | 178.25(67.31) | 194.81(68.74) | 179.25(67.40) |
| Labour cost (V2) | 39.90(16.02) | 42.55(16.07) | 43.89(15.49) | 42.11(15.86) |
| Miscellaneous (V3) | 17.47(7.02) | 17.36(6.56) | 16.55(5.84) | 17.13(6.47) |
| Total Variable Cost (TVC=V1+V2+V3) | 222.08(89.18) | 238.16(89.93) | 255.25(90.07) | 238.49(89.73) |
| Gross Cost (A=TFC+TVC) | 249.01(100.00) | 264.82(100.00) | 283.40(100.00) | 265.74(100.00) |
| Value of Dung (B) | 6.20 | 8.70 | 11.20 | 8.70 |
| Net Cost (C=A-B) | 242.81 | 256.12 | 272.20 | 257.04 |
| Price of milk (₹ /litre) | 37.23 | 38.40 | 39.02 | 38.22 |
| Average milk production (litre/animal/day) (E) | 7.71 | 8.49 | 9.29 | 8.50 |
| Gross Return (D) | 287.14 | 326.03 | 362.61 | 325.26 |
| Net Returns (D-C) | 44.33 | 69.91 | 90.41 | 68.22 |
| Cost of milk production (₹ /litre)(C/E) | 31.48 | 30.17 | 29.29 | 30.31 |
| Returns (₹/litre) | 5.75 | 8.23 | 9.73 | 7.90 |

*Figures in parentheses indicate percentage of gross cost

maintenance cost can be reduced by effective management of locally available feed, fodder and labour, etc. The average price of milk was estimated as ₹ 37.23, ₹ 38.40 and ₹ 39.02 for small, medium and large herd size category respectively (Table 3). The prices of buffalo milk are marginally higher than the indigenous milk and crossbred milk. Although buffalo milk has comparatively higher fat content but due to less developed market infrastructure, farmers could not realized better prices of milk in general and buffalo milk in particular. The per litre cost of milk production was found to be negatively related with the herd size due to the economics of scale. The net return was found to be ₹ 5.75, ₹ 8.23 and ₹ 9.73 per litre of milk for small, medium and large herd size categories, respectively. The overall net return per litre of milk was worked out to be ₹ 7.90. It could be concluded that buffalo rearing is more profitable in the study area.

Conclusion

A comparative economic analysis of indigenous cow, crossbred and buffalo inferred that buffalo rearing is more profitable in Southern and North Coastal regions of Andhra Pradesh. Despite negative returns of indigenous breed, farmers are rearing for mainly own consumption. However, net return in case of crossbred was found to be positive for all the categories dairy farm households. The return to scale effect was evident in buffalo and crossbred dairy farms. Buffalo milk fetches higher prices owing to higher fat content. The farmers still could not realized the full potential of dairying in the study area due to less developed organized market.

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