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Economic viability analysis of dairy farming in Muzaffarnagar district of Uttar Pradesh

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Abstract

Dairy farming plays an important role in sustaining rural livelihoods and generating regular income for farm households in India. The present study analysed the cost structure, milk production and profitability of cow and buffalo farming across different categories of dairy farmers in Muzaffarnagar district of Uttar Pradesh. Primary data were collected from 80 dairy farmers selected from four villages of Khatauli and Jansath blocks. Farmers were classified into small (1-3 animals), medium (4-6) and large (>6) categories. The study employed cost and return analysis to estimate production costs and profitability. The results revealed that feed constituted the major component of dairy expenditure, particularly green fodder, concentrate and dry fodder. In cow milk production, large farmers recorded the highest milk output (315.70 litres/day), the lowest production cost (Rs. 34.55/litre) and the highest profit (Rs. 10.45/litre). Similarly, large buffalo farmers had the lowest production cost (Rs. 47.52/litre) and highest profit (Rs. 12.48/litre). The findings indicate that larger dairy farms achieved relatively lower unit costs and higher margins, suggesting economics of scale in milk production. Improving access to quality feed, veterinary services, insurance and dairy development schemes could further enhance the profitability and sustainability of dairy farming.

Keywords: Cost of milk production, dairy economics, economics of scale, comparative net returns, Muzaffarnagar

Introduction

Dairy farming has emerged as one of the most critical allied sectors of agriculture in India, contributing significantly to food security, sustainable rural livelihoods, and the overall macroeconomic trajectory. Approximately 25 percent of global milk production, India reinforces its status as the world's leading producer, where animal husbandry functions as an essential livelihood buffer for over 80 million rural households (DAHD, 2024) ^[2]. The sector is uniquely inclusive, providing regular cash flows and vital protein nutrition to smallholder, landless, and marginal farmers who manage a majority of the national livestock inventory (NDDDB, 2020) ^[11]. Beyond economic insulation, women assume a leading role in livestock management, rendering dairy a central instrument for gender equality and financial inclusion in rural communities. (Kumar *et al.*, 2020) ^[8].

Despite its structural magnitude, the Indian dairy industry presents a paradox of aggregate dominance coupled with relatively low animal-level productivity. The average annual milk yield per cow in India remains at approximately 1,770 kg, significantly below the global average benchmark of 3,000 kg and drastically trailing highly industrialized, mechanized systems like the United States at 10,500 kg (FAO, 2023) ^[3]. This productivity gap is exacerbated by feed

price inflation, inadequate formalized cold-chain infrastructures, veterinary constraints, and high ambient temperatures causing severe climatic heat stress. Given these micro-level challenges, regional and district-specific cost-return analyses are crucial to formulate effective agricultural policies. (Garg and Singh, 2020; Joshi *et al.*, 2022) ^[5, 6].

The state of Uttar Pradesh represents India's primary 'Dairy Powerhouse,' consistently leading nationwide production by contributing over 15 percent of the country's aggregate output, which translated into 36.54 million metric tonnes during 2022-23 (DAHD, 2023) ^[1]. Within this state landscape, Muzaffarnagar district in Western Uttar Pradesh a highly vibrant agro-dairy framework. Strategically positioned within the Indo-Gangetic plain, the district has an economy where sugarcane by-products (molasses, tops, bagasse) are recycled directly as cattle feed, reducing overall costs by up to 25 percent during the crushing season (Kumar and Sharma, 2021) ^[7]. The local producers face immense pressures from concentrate feed price volatility and market price fluctuations. Grounded in this context, the primary objective of this paper is to rigorously evaluate the cost structure and net returns of milk production for independent cow and buffalo sub- enterprises across different farm sizes in Muzaffarnagar district.

Materials and Methods

A multistage purposive and random sampling technique was utilized to execute a systematic primary socio-economic field survey. In the first stage, Muzaffarnagar district was purposively selected. In the second stage, two blocks as Khatauli and Jansath were purposively selected based on elevated animal populations and intensive rural participation. In the third stage, two villages from each block (Thisang and Ahemadgarh in Jansath; Sikandarpur and Tighai in Khatauli) were randomly selected.

In the final sampling stage, 20 dairy farmers were randomly drawn from each village in probability proportion to their size, for a total sample size of 80 respondents. Sample households were stratified into three functional production tiers based on their milch animal herd size as small farmers (1-3 milch animals; n=47), Medium farmers (4-6 milch animals; n=21), and large farmers (more than 6 milch animals; n=12). Primary data encompassing capital assets, daily variable feed allocations, veterinary costs, hired and family labour inputs, milk yields, and disposal parameters were gathered through a pre-tested structured interview schedule.

Analytical tools involved comprehensive accounting frameworks. (Meena *et al.*, 2011) ^[9] Total expenditure was decomposed into fixed costs (depreciation on buildings, implements, and milch stock; interest on fixed capital) and variable costs (green fodder, dry fodder, concentrate feeds, mineral supplements, medicine, and human labour values). Hired labour was accrued at prevailing market wage rates, while family labour was imputed. (Mkuna, 2026) ^[10].

Total cost = Depreciation on all fixed investments + interest on fixed capital + variable cost of different items + interest

on working capital

Gross Returns

Gross returns were calculated from the value of milk, dung, calves, and appreciation in the value of cattle.

Gross Returns = Value of milk + Value of dung + Value of calves + Cattle appreciation

Net Returns

Net returns were calculated by deducting total cultivation costs from gross returns.

Net Income = Gross returns – Total cost

Results and Discussion

Livestock structure of sample dairy farmers

In Table-1 small dairy farmers, 87.32 percent of cows and 74.42 percent of buffaloes were in milk, with female calves accounting for 8.45 percent and 18.60 percent, respectively. No heifers were reported. In the medium category, 74.24 percent of cows and 65.22 percent of buffaloes were in milk. The livestock also included 2 non-pregnant heifers, 1 male calf and 12 female calves. In large farmers, 64.71 percent of cows and 61.54 percent of buffaloes were in milk. Heifers accounted for 9.41 percent, while female calves formed 18.82 percent of the cow population. Three female buffalo calves were also reported. Overall, milch animals formed the major share of livestock across all categories. The proportion of cows and buffaloes in milk declined with increasing farm size, while female calves were more numerous than male calves.

Table 1: Livestock strength in the study area

Type of Animal	Category	Small – Cow	Small – Buffalo	Medium – Cow	Medium – Buffalo	Large – Cow	Large – Buffalo
Adults	In Milk	62(87.32)	32(74.42)	49(74.24)	15(65.22)	55(64.71)	8(61.54)
	In Dry	2(2.82)	3(6.98)	2(3.03)	2(8.70)	2(2.35)	2(15.38)
	Total Milch Animal	64(90.14)	35(81.40)	51(77.27)	17(73.91)	57(67.06)	10(76.92)
Heifers	Pregnant	0(0.00)	0(0.00)	0(0.00)	0(0.00)	4(4.71)	0(0.00)
	Non-Pregnant	0(0.00)	0(0.00)	2(3.03)	0(0.00)	4(4.71)	0(0.00)
	Total Heifers	0(0.00)	0(0.00)	2(3.03)	0(0.00)	8(9.41)	0(0.00)
Calves	Male	1(1.41)	0(0.00)	1(1.52)	0(0.00)	4(4.71)	0(0.00)
	Female	6(8.45)	8(18.60)	12(18.18)	6(26.09)	16(18.82)	3(23.08)
Total		71100.00	43100.00	66100.00	23100.00	85100.00	13100.00

Expenditure pattern of dairy farm (cow + buffalo)

Table-2 shows overall daily expenditure on dairy farms was Rs. 11,467.30, with the major share spent on green fodder (41.49%), concentrate (30.91%) and dry fodder (13.24%). Total expenditure was highest among small farmers (Rs. 16,679.53), followed by large (Rs. 9,479.00) and medium farmers (Rs. 8,243.38). Fodder expenses dominated across all

categories, while veterinary and other expenses accounted for less than 1 percent. No expenditure on insurance was reported due to lack of awareness about dairy schemes. Per-animal expenditure was highest for small farmers (Rs. 141.86/day), followed by large (Rs. 94.23) and medium farmers (Rs. 90.17).

Table 2: Expenditure pattern of dairy farm (cow + buffalo) in the study area (Rs/Day)

Sr.No.	Particulars	Category of Dairy Farmers			Overall Average
		Small	Medium	Large	
1	Green Fodder	7325.64(45.30)	2952.74(36.79)	3590.95(38.89)	4623.11(41.49)
2	Dry Fodder	2230.98(13.80)	1007.44(12.55)	1186.92(12.85)	1475.11(13.24)
3	Concentrate	5330.64(32.96)	2387.28(29.75)	2615.82(28.33)	3444.58(30.91)
4	Veterinary Expenses	156.96(0.97)	78.35(0.98)	89.35(0.97)	108.22(0.97)
5	Insurance cost	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
6	Labour Expenses	563.83(3.49)	638.10(7.95)	720.83(7.81)	640.92(5.75)
7	Interest on milch animal	139.56(0.86)	162.15(2.02)	199.59(2.16)	167.10(1.50)
8	Depreciation on milch animal	265.93(1.64)	286.59(3.57)	305.98(3.31)	286.17(2.57)
9	Interest on building	84.95(0.53)	91.22(1.14)	92.16(1.00)	89.45(0.80)
10	Depreciation on Building	108.19(0.67)	125.53(1.56)	131.71(1.43)	121.81(1.09)
11	Interest on equipment's	173.93(1.08)	206.22(2.57)	216.97(2.35)	199.04(1.79)
12	Depreciation on equipment's	298.92 (1.85)	307.77 (3.83)	328.72 (3.56)	311.80 (2.80)
13	Total Expenditure	16679.53	8243.38	9479.00	11467.30
14	Value of Dung	507.30	218.05	244.75	323.37
15	Net Cost	16172.23(100.00)	8025.33(100.00)	9234.25(100.00)	11143.94(100.00)
16	Per animal Expenditure	141.86	90.17	94.23	108.75

Figures in the Parentheses indicates the percentage of the respective column total

Cost and returns of milch cow milk production

Table-3 presents the cost and profitability of milch cow production across different categories of dairy farmers. The overall daily expenditure per milch cow was Rs. 9,928.93, with green fodder (42.05%), concentrate (24.13%) and dry fodder (11.14%) constituting the major cost components. After deducting the value of dung, the net cost was Rs. 9,800.30 per day. Labour expenditure accounted for 8.05 percent, while veterinary, depreciation and interest expenses formed relatively smaller shares.

Category-wise, large farmers incurred the highest total

expenditure (Rs. 11,050.10) but also achieved the highest milk production of 315.70 litres/day. Their cost of milk production was lowest at Rs. 34.55/litre, compared with Rs. 36.37 for medium and Rs. 37.12 for small farmers. At a common selling price of Rs. 45/litre, the profit was highest among large farmers (Rs. 10.45/litre), followed by medium (Rs. 8.25/litre) and small farmers (Rs. 7.88/litre). Thus, higher herd size was associated with greater milk output, lower unit production cost and higher profitability, indicating the presence of economics of scale in dairy farming.

Table 3: Cost and returns of milch cow milk production

Sr.No.	Particulars	Category of Dairy Farmers			Overall Average
		Small	Medium	Large	
1	Green Fodder	4324.35(46.73)	3752.35(40.62)	4287.75(39.31)	4121.49(42.05)
2	Dry Fodder	1085.95(11.73)	1011.68(10.95)	1178.36(10.80)	1092.00(11.14)
3	Concentrate	1925.70(20.81)	2206.98(23.89)	2963.14(27.16)	2365.27(24.13)
4	Veterinary Expenses	113.65(1.23)	113.07(1.22)	117.18(1.07)	114.63(1.17)
5	Insurance cost	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
6	Labour Expenses	666.38(7.20)	797.01(8.63)	904.19(8.29)	789.19(8.05)
7	Interest on milch animal	164.94(1.78)	202.54(2.19)	250.36(2.30)	205.94(2.10)
8	Depreciation on milch animal	314.29(3.40)	357.96(3.87)	383.81(3.52)	352.02(3.59)
9	Interest on building	100.40(1.08)	113.94(1.23)	115.61(1.06)	109.98(1.12)
10	Depreciation on Building	127.87(1.38)	156.79(1.70)	165.21(1.51)	149.95(1.53)
11	Interest on equipment's	205.57(2.22)	257.57(2.79)	272.16(2.50)	245.10(2.50)
12	Depreciation on equipment's	353.28(3.82)	384.42(4.16)	412.33(3.78)	383.34(3.91)
13	Total Expenditure	9382.39	9354.30	11050.10	9928.93
14	Value of Dung	128.34	115.64	141.90	128.63
15	Net Cost	9254.05(100.00)	9238.66(100.00)	10908.20(100.00)	9800.30(100.00)
16	Milk Production per Day	249.32	251.37	315.70	272.13
17	Per liter cost of production	37.12	36.75	34.55	36.14
18	Sales price per liter	45.00	45.00	45.00	45.00
19	Profit	7.88	8.25	10.45	8.86

Figures in the Parentheses indicates the percentage of the respective column total

Cost and returns of milch buffalo milk production

Similarly, Table-4 presents the cost and profitability of milch buffaloes across different categories of dairy farmers. The overall daily expenditure was Rs. 5,000.60, mainly comprising green fodder (29.42%), concentrate (21.21%), dry fodder (8.81%) and labour (13.23%). After deducting the

value of dung, the net cost was Rs. 4,939.68 per day. Buffalo milk production averaged 102.39 litres/day, with a production cost of Rs. 48.06 per litre and a selling price of Rs.60.00 per litre.

Category-wise, expenditure was highest among small farmers (Rs. 7,927.39), followed by medium (Rs. 4,677.54)

and large farmers (Rs. 2,396.88). Small farmers recorded the highest milk production (161.25 litres/day), followed by medium (96.32 litres) and large farmers (49.61 litres). However, the cost of production per litre declined with farm size, from Rs. 48.78 for small farmers to Rs. 47.87 for

medium and Rs. 47.52 for large farmers. Consequently, profit per litre was highest among large farmers (Rs. 12.48), followed by medium (Rs. 12.13) and small farmers (Rs. 11.22), indicating economies of scale in buffalo milk production.

Table 4: Cost and returns of milch buffalo milk production

Sr.No.	Particulars	Small	Medium	Large	Overall Average
1	Green Fodder	2684.56(34.13)	1217.26(26.40)	462.46(19.62)	1454.76(29.42)
2	Dry Fodder	792.05(10.07)	367.46(7.97)	147.42(6.25)	435.64(8.81)
3	Concentrate	1935.36(24.60)	868.52(18.84)	341.93(14.50)	1048.60(21.21)
4	Veterinary Expenses	82.29(1.05)	83.08(1.80)	56.46(2.39)	73.94(1.50)
5	Insurance cost	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
6	Labour Expenses	1012.64(12.87)	684.14(14.84)	266.49(11.30)	654.42(13.23)
7	Interest on milch animal	185.02(2.35)	200.32(4.34)	175.64(7.45)	186.99(3.78)
8	Depreciation on milch animal	352.55(4.48)	354.04(7.68)	269.26(11.42)	325.28(6.58)
9	Interest on building	112.62(1.43)	112.69(2.44)	81.10(3.44)	102.14(2.07)
10	Depreciation on Building	143.43(1.82)	155.07(3.36)	115.90(4.92)	138.13(2.79)
11	Interest on equipment's	230.59(2.93)	254.75(5.52)	190.94(8.10)	225.43(4.56)
12	Depreciation on equipment's	396.29(5.04)	380.21(8.25)	289.27(12.27)	355.25(7.18)
13	Total Expenditure	7927.39	4677.54	2396.38	5000.60
14	Value of Dung	60.95	66.45	39.36	55.59
15	Net Cost	7866.44(100.00)	4611.09(100.00)	2357.52(100.00)	4945.01(100.00)
16	Milk Production per Day	161.25	96.32	49.61	102.39
17	Per liter cost of production	48.78	47.87	47.52	48.06
18	Sales price per liter	60.00	60.00	60.00	60.00
19	Profit	11.22	12.13	12.48	11.94

Figures in the Parentheses indicates the percentage of the respective column total

Conclusion

The study concludes that dairy farming is an economically viable component of farm livelihoods in Muzaffarnagar district, with feed costs constituting the major share of total expenditure. Large dairy farmers achieved higher milk productivity, lower per-litre production costs and greater profit margins for both cows and buffaloes compared with small and medium farmers. The results indicate the presence of economies of scale, as expansion in herd size was associated with improved cost efficiency and profitability. However, the absence of expenditure on livestock insurance and the relatively low veterinary expenditure indicate gaps in access to formal dairy services. Strengthening veterinary facilities, promoting livestock insurance, improving access to quality feed and increasing awareness of government dairy schemes can help enhance productivity and income, particularly among small and medium dairy farmers.

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