

Economic Analysis of Cost and Returns from Milk Production in Maharashtra-A Regional Study

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Abstract

The regional variation in per litre cost of milk production of cross bred cow, was found to be varied from Rs.19.69 to Rs.16.92, with highest in Konkan region and lowest in WM region. Per litre returns from milk production ranged from Rs.4.27 to Rs.2.35, with the highest in WM region and lowest in Marathwada region. Per litre cost of milk production of local cow varied from Rs.42.45 to Rs.38.55, highest in Vidarbha region and lowest in WM region, whereas, returns per litre were negative in all the regions of the state. The cost of producing buffalo milk per litre was found to be ranged from Rs.36.15 to Rs.34.40 with the highest in Vidarbha and lowest in Western Maharashtra. All the regions earned positive returns, ranged from Rs.2.75 to Rs.0.54 per litre with Konkan and Marathwada region showed the highest and lowest returns respectively. Herd-size and type of milch animal significantly influenced cost of milk production. The gross returns were found to be highest in case of crossbreed animals as compared to local cow and buffalo.

Key words: Region, cross bred cow, local cow, buffalo, cost of milk production, returns from milk production

Introduction

The cost and returns in dairy enterprise are important concern for milk producers, consumers and policy makers to provide an effective linkage among them and to make rational economic decisions (Kumar and Pandian, 2003). The factors underlying regional imbalances in the growth of milk production could be many. Imbalances in general are associated with difference in the breeds of various species of milch animals, differences in the distribution of breedable bovine population in different regions, differences in resource base with respect to feed and fodder and animal health cover, difference in production environment such as temperate or tropical, differences in terms of number of inseminations in the field areas for breed improvement and thereby causing differences in genetic architecture of milch animals, and differences in the productivity of animals. Therefore, the need was felt to study the regional variation in the cost and returns in milk production across different regions.

Data

Primary Data was collected from five regions of the state namely, Konkan, Western Maharashtra, Khandesh, Marathwada and Vidarbha. From each region one district selected, from each district two block and from each block one village, thus total ten villages were selected randomly for the study. A complete enumeration of selected villages was out to ascertain the herd size of milch animals three herd size categories based on number of milch

animals was formed using cumulative square root frequency method. The total 346 households were selected as per the probability proportion to number of household in each category.

Research Methodology

Cost and Return Concept: The overall cost of milk production is an aggregate of expenditure incurred on the fixed and variable items of expenditure.

Fixed Cost

The fixed cost is the expenditure, which is incurred whether or not the production is carried out. It includes interest and depreciation on cattle shed, building and machinery. The animals in the shed are jointly housed and the assets are also used jointly for all the animals. Therefore, the fixed cost was apportioned on the basis of Standard Animal Units (SAU). The conversion coefficients use for apportioning the fixed cost in western region is as follows:

Table 1: Standard Animal Units (SAU) for Western Maharashtra Region of India

Animal Type	Crossbred Cow	Local Cow	Buffalo
Adult Male	0.87	0.72	0.82
Adult Female	1.18	1.00	1.22
Young Stock M<1	0.39	0.36	0.40
Young Stock F<1	0.37	0.35	0.38
Young Stock M>1	0.55	0.40	0.46
Young Stock F>1	0.42	0.38	0.42
Heifers	0.51	0.40	0.48

(Source: Sirohi et.al, 2015)

The components of fixed cost: The fixed items are durable assets with a productive life of more than a year, eg. animal sheds, store for feed and fodder, manger, machinery and equipment used in dairy operation and the animal itself.

i. Interest on Fixed Capital Investment

The interest on fixed capital was worked out at the prevailing rate, i.e. at 9 per cent per annum.

ii. Depreciation on Fixed Capital

It is the loss in the value of an asset as a result of its use, wear and tear, accidental damage and time obsolescence. It was worked out separately for milch animals, cattle shed, machinery and equipments keeping in view the present value and useful economic life.

iii. Depreciation on Milch Animals

For calculating depreciation on animals, economic life was considered and taken as:

Table 2: Depreciation Rate of Milch Animals

CB Cows	8 per cent (productive life 12.5 years),
Local cows	10 per cent (productive life 10 years),
Buffalos	10 per cent (productive life 10 years)

iv. Depreciation on Cattle Shed and Dairy Equipments

Depreciation on cattle shed, stores and dairy equipments was calculated by using the straight - line method.

Table 3 : Depreciation Rate of Cattle Shed and Dairy Equipments

Particulars	Percent
Semi-pucca building	5
Pucca building	2
Bullock cart	10
Milk can	20
Chaff cutter	10
Buckets	20

Variable Cost

Variable costs are those costs, which are incurred on the variable factors of production and can be altered in the short run. Variable cost includes feed and fodder cost, labour cost, veterinary cost and miscellaneous expenditure.

i. Feed and Fodder Cost:

The cost of green fodder, dry fodder and concentrate was worked out by multiplying quantities of feeds and fodders consumed by animals with their respective prevailing prices in the study area.

ii. Labour Cost:

It included family as well as paid labour (hired labour). The hired labour was calculated considering the type of work allotted and wages paid. In case of family labour, the imputed value obtained depends upon the time spend in dairying and prevailing wage rate of casual labour in the study area.

iii. Miscellaneous Cost:

It includes the cost incurred on natural service, Artificial Insemination (A.I.), vaccination, medicines and as fees of veterinary doctor. It also includes cost of repairs, electricity, water charges, purchase of milk can, bucket, rope, etc. It was calculated on the per day per milch cow basis for different species.

Gross Cost:

It was obtained by adding all the cost components, including fixed and variable costs, i.e.

$$\text{Gross Cost (Rs.)} = \text{Total Variable Cost} + \text{Total Fixed Cost}$$

Net Cost:

The net cost was calculated by deducting the imputed value of dung, from the gross cost, i.e.

$$\text{Net Cost (Rs.)} = \text{Gross Cost} - \text{Imputed value of dung}$$

Quantity of dung excreted by bovine was calculated by using the formula given by i.e.

$$\begin{aligned} \text{Quantity of dung excreted by bovine} = & 0.52 \times \text{Quantity of Green Fodder} + \\ & 2.25 \times \text{Quantity of Dry Fodder} + \\ & 1.5 \times \text{Quantity of Concentrates} \end{aligned}$$

(Source: NPCS Board of Consultants and Engineers)

The dung excretion formula was calculated by taking the digestibility coefficient of 65 per cent for green fodder, 55 for DF and 70 per cent for Concentrate. The moisture content of the dung has been taken as 80 per cent

Gross Returns:

Gross return was calculated by multiplying milk yield of an individual animal with respective prevailing prices in the study area, i.e.

$$\text{Gross Returns (Rs.)} = \text{Quantity of the milk} \times \text{Market price of milk}$$

The Price of Milk: The price of milk differs in different seasons as well as for the type of milk, like crossbred cow milk, buffalo milk, local cow milk. The weighted average price of milk was calculated for each farmer household.

$$\text{Weighted average price (Rs.)} = \frac{\sum P_i \cdot W_i}{\sum W_i}$$

Where,

P_i is the price per litre of i^{th} type of milk, and W_i is the total quantity in volume of i^{th} type of milk sold by the farm.

Net Returns:

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

$$\text{Net Returns (Rs.)} = \text{Gross Returns} - \text{Net Cost}$$

Cost per litre

Cost per litre of milk was calculated by dividing net cost to total milk production (litres)

$$\text{Cost per litre (Rs.)} = \frac{\text{Net Cost}}{\text{Total Milk production}}$$

Returns per litre

Returns per litre of milk was calculated by dividing net returns to total milk production

$$\text{Returns per litre (Rs.)} = \frac{\text{Net Returns}}{\text{Total Milk production}}$$

Result and Discussion

While calculating the cost of milk production, we mainly considered total fixed cost and total variable cost. Fixed cost includes interest and depreciation on fixed capital while the variable cost includes feed and fodder cost, labour cost and miscellaneous cost. The maintenance cost of a milch animal includes cost on feeds and fodder, human labour, interest and depreciation on fixed assets and miscellaneous recurring expenses minus income from dung. A detailed component wise cost of milk production is presented in Table 4 to 6. The analysis is done separately for different species of milch animals across five regions of the state to have a better insight of species wise economics of milk production.

Maintenance Cost and Returns from Milk Production for Crossbred Cow

Table 4, shows the cost of maintenance and milk production of crossbred cow under overall category considering all the three categories, i.e. small, medium and large.

Table 4: Maintenance Cost and Returns from Milk Production of Crossbred Cow-Overall Category

(Rs./animal/day)

Cost Components	Regions of Maharashtra state					Maharashtra State
	Konkan	Western Maharashtra	Khandesh	Marathwada	Vidarbha	
Green Fodder	31.28	46.60	46.08	30.97	29.73	42.43
Dry Fodder	27.34	28.00	32.03	37.18	39.73	31.65
Concentrates	60.08	77.49	74.64	73.37	67.30	74.38
Total Feed Cost	118.70 (69.75)	152.10 (73.12)	152.75 (73.35)	141.51 (73.03)	136.76 (71.89)	148.47 (72.97)
Labour Cost	24.14 (14.19)	19.94 (9.59)	21.54 (10.34)	20.62 (10.64)	23.05 (12.11)	21.05 (10.35)
Misc. Cost	1.73 (1.02)	3.06 (1.47)	2.46 (1.18)	2.19 (1.13)	2.22 (1.17)	2.62 (1.29)
Total Variable Cost	144.57 (84.95)	175.10 (84.18)	176.74 (84.87)	164.31 (84.80)	162.02 (85.17)	172.14 (84.61)
Depreciation on Fixed Cost	11.03	13.60	12.95	12.54	12.02	13.01
Interest on Fixed Cost	14.58	19.31	18.56	16.92	16.19	18.30
Total Fixed Cost	25.61 (15.05)	32.91 (15.82)	31.51 (15.13)	29.46 (15.20)	28.21 (14.83)	31.31 (15.39)
Gross Cost	170.18 (100)	208.00 (100)	208.26 (100)	193.77 (100)	190.24 (100)	203.45 (100)
Value of Dung	5.19	5.88	5.67	5.52	5.31	5.68
Net Cost	164.99	202.13	202.59	188.26	184.93	197.77
Price of	23.61	21.18	21.50	20.40	22.27	21.41

Milk (Rs./litre)							
Milk Production (litres)	7.60	12.02	11.25	10.46	9.55	11.17	
Gross Returns	179.30	255.21	242.50	213.43	212.93	239.38	
Net Returns	14.31	53.08	39.91	25.18	28.00	41.61	
Cost per Litre (Rs./litre)	21.70	16.92	18.10	18.05	19.46	17.88	
Net Returns per Litre (Rs./litre)	1.90	4.27	3.40	2.35	2.81	3.53	

. Contribution of fixed cost and variable cost varied from 15 to 16 per cent and 84 to 85 per cent respectively to the gross cost across region and was 15.36 and 84.61 per cent respectively, at the state level. It was found that feed and fodder cost was the major component in gross cost which varied from 70 to 73 per cent across regions and the state. Highest percentage contribution of feed and fodder was in Khadesh (73.35) followed by Western Maharashtra (73.12), Marathwada (73.03), Vidarbha (71.89) and lowest in Konkan (69.75) region. Past studies on economics of milk production revealed that feed cost alone accounted for the largest component which ranges between 60-70 per cent of the total cost of production (Rajadurai,2002; Kumar.*et.al.*, 2003; Das,2004 and Singh *et al.*, 2007). The total maintenance cost ranged from Rs.170.18 to Rs.208.26 across five regions and Rs.203.45 at the state level. It was highest in Khandesh (Rs.208.26) followed by Western Maharashtra(Rs.208.00), Marathwada (Rs.193.77), Vidarbha (Rs.190.24) and lowest in Konkan (Rs.170.18) region. Per liter cost was estimated to be highest in Konkan region (Rs.21.70) followed by Vidarbha (Rs.19.46), Khandesh (Rs.18.10), Marathwada (Rs.18.05) and lowest Western Maharashtra (Rs.16.92) while at state level it was Rs.17.88. All the regions earned positive returns, but was highest Rs.4.27 in Western Maharashtra followed by Rs.3.40, Rs.2.81, Rs.2.35 and Rs.1.90 in Khandesh, Vidarbha, Marathwada and Konkan region respectively.

Similar finding from Kumar and Rai (2008), feeds and fodders was the most important inputs for milk production. About 2/3 rd of the total cost of milk production was covered by the cost of feed and fodder alone.

Maintenance Cost and Returns from Milk Production of Local Cow

Table 5, shows the cost of local cow milk production and returns from milk production under overall category considering all the categories, i.e. small, medium and large.

Table 5: Maintenance Cost and Returns from Milk Production of Local Cow-Overall Category

(Rs./animal/day)

Cost Components	Regions of Maharashtra state					Maharashtra State
	Konkan	Western Maharashtra	Khandesh	Marathwada	Vidarbha	
Green Fodder	24.11	31.34	30.53	30.55	29.05	29.78
Dry Fodder	17.27	19.91	23.45	25.59	27.50	23.97
Concentrates	15.60	28.86	22.37	19.07	16.98	20.72
Total Feed Cost	56.97 (57.46)	80.11 (63.50)	76.35 (62.49)	75.20 (64.34)	73.53 (63.22)	74.46 (63.10)
Labour Cost	20.92 (21.09)	18.45 (14.63)	20.23 (16.56)	19.35 (16.55)	21.47 (18.46)	20.01 (16.96)
Misc. Cost	1.23 (1.24)	2.01 (1.60)	1.87 (1.53)	1.49 (1.27)	1.28 (1.10)	1.58 (1.34)
Total Variable Cost	79.12 (79.79)	100.57 (79.73)	98.45 (80.57)	96.04 (82.16)	96.29 (82.79)	96.05 (81.39)
Depreciation on Fixed Cot	8.85	11.68	11.09	10.27	9.54	10.37
Interest on Fixed Cost	11.19	13.89	12.64	10.58	10.47	11.59
Total Fixed Cost	20.04 (20.21)	25.57 (20.27)	23.74 (19.43)	20.85 (17.84)	20.02 (17.21)	21.96 (18.61)
Gross Cost	99.16 (100)	126.14 (100)	122.19 (100)	116.89 (100)	116.31 (100)	118.00 (100)
Value of Dung	3.98	5.30	5.20	4.15	4.04	4.50
Net Cost	95.18	120.84	116.99	112.75	112.27	113.50
Price of Milk (Rs./litre)	24.72	23.54	24.15	24.49	25.38	24.51
Milk Production	2.33	3.14	2.97	2.80	2.65	2.81

(litres)						
Gross Returns	57.46	73.83	71.71	68.69	67.15	68.88
Net Returns	-37.72	-47.01	-45.28	-44.06	-45.11	-44.63
Cost per Litre (Rs./litre)	40.95	38.55	39.43	40.35	42.45	40.47
Net Returns per Litre (Rs./litre)	-16.23	-15.01	-15.27	-15.86	-17.07	-15.96

It was found that percentage contribution of fixed cost was 17 to 20 per cent while variable cost was 80 to 83 per cent to the gross cost. Under variable cost, feed and fodder cost was the major component whose contribution varied from 57 to 64 per cent, while the labour cost from 14 to 20 per cent and miscellaneous cost contribute 1 to 2 per cent of the gross cost in all regions and the state. Earlier studies had also observed that feed and fodder accounted for 55-70 per cent of gross cost, depending upon the breed and species of milch animals (Aitawade *et al.* 2005). Per day average productivity varied from 2.33 to 3.14 litres across regions and at state level it was observed 2.81 litres. The total maintenance cost ranged from Rs.126.12 to Rs.99.16 across regions and at state level it was Rs.118.00. It was found to be highest in Western Maharashtra (Rs.126.14) followed by Khandesh (Rs.122.19), Marathwada (Rs.116.89), Vidarbha (Rs.116.31) and lowest in Konkan (Rs.99.16) region. Per liter cost was estimated to be ranged from Rs.42.45 to Rs.40.95; highest in Vidarbha region (Rs.42.45) followed by Konkan (Rs.40.95), Marathwada (Rs.40.35), Khandesh (Rs.39.43) and Western Maharashtra (Rs.38.55) while at state level it was Rs.40.47. It was observed that all the regions and also at the state level, local milk production incurred negative returns.

Maintenance Cost and Returns from Milk Production of Buffalo

Table 6 shows the cost of maintenance and returns from milk production under overall category considering all the the categories, i.e. small, medium and large.

Table 6: Maintenance Cost and Returns from Milk Production of Buffalo -Overall Category (Rs./animal/day)

Cost Components	Regions of Maharashtra state					Maharashtra State
	Konkan	Western Maharashtra	Khandesh	Marathwada	Vidarbha	
Green Fodder	45.81	62.52	60.70	49.29	49.70	51.32

Dry Fodder	24.22	23.76	28.85	33.41	39.34	31.28
Concentrates	48.10	57.43	51.09	49.59	46.31	49.52
Total Feed Cost	118.12 (70.01)	143.70 (71.25)	140.65 (71.83)	132.29 (70.83)	135.35 (71.13)	132.12 (70.87)
Labour Cost	22.44 (13.30)	21.09 (10.45)	21.53 (10.99)	21.02 (11.26)	22.27 (11.70)	21.82 (11.70)
Misc. Cost	1.54 (0.92)	2.16 (1.07)	2.08 (1.06)	1.97 (1.05)	1.92 (1.01)	1.88 (1.01)
Total Variable Cost	142.11 (84.23)	166.95 (82.77)	164.26 (83.88)	155.28 (83.14)	159.55 (83.85)	155.83 (83.59)
Depreciation on Fixed Cot	11.31	15.34	13.86	13.00	12.23	12.76
Interest on Fixed Cost	15.30	19.41	17.70	18.50	18.51	17.83
Total Fixed Cost	26.61 (15.77)	34.75 (17.23)	31.56 (16.12)	31.50 (16.86)	30.74 (16.15)	30.59 (16.41)
Gross Cost	168.71 (100)	201.70 (100)	195.82 (100)	186.77 (100)	190.29 (100)	186.42 (100)
Value of Dung	7.27	7.75	7.76	7.30	7.11	7.33
Net Cost	161.45	193.95	188.06	179.47	183.18	179.09
Price of Milk (Rs./litre)	37.20	36.20	37.05	36.52	36.99	36.82
Milk Production (litres)	3.77	5.65	5.37	4.99	5.07	4.85
Gross Returns	174.60	204.39	199.05	182.33	187.54	186.63
Net Returns	13.15	10.44	10.99	2.86	4.36	7.54
Cost per Litre	34.44	34.40	35.05	35.98	36.15	35.35

(Rs./litre)						
Net Returns per Litre (Rs./litre)	2.75	1.80	2.00	0.54	0.84	1.56

Contribution of concentrates to the total cost was more in case of buffaloes as compared to cows. This was due to better feeding of buffaloes (Kulkarni and Hembarde, 2010). The average maintenance cost ranged from Rs.201.70 to Rs.168.71 across five regions and Rs.186.42 at the state level; highest in Western Maharashtra region followed by Khandesh (Rs.195.82), Vidarbha (Rs.190.29), Marathwada (Rs.186.77) and lowest in Konkan (Rs.168.71) region. Average productivity of buffalo ranged from 3.77 to 5.65 litres per day; lowest in Konkan and highest in Western Maharashtra region. Per liter cost of milk production was estimated and it was found to be Rs.35.35 at state level; highest in Vidarbha region (Rs.36.15) followed by Marathwada (Rs.35.98), Khandesh (Rs.35.05), Konkan (Rs.34.44) and Western Maharashtra (Rs.34.40). All the regions earned positive returns, but highest in Konkan (Rs.2.75) followed by Khandesh (Rs.2.00), Western Maharashtra (Rs.1.80), Vidarbha (Rs.0.84) and lowest in Marathwada (Rs.0.54) region. It was found that variable cost contribute above 83 per cent to the gross cost, which includes feed and fodder cost (about 72-73 per cent), labour cost (about 9 to 12 per cent) and miscellaneous cost (about 1 per cent) of the gross cost across regions and the state. Percentage contribution of feed and fodder cost was found to highest in Khandesh (73.37) followed by Western Maharashtra (72.72), Vidarbha (72.08), Marathwada (72.00) and lowest in Konkan (71.55). Contribution of labour cost was worked out to highest in Konkan (12.66) followed by Vidarbha (10.81), Marathwada (10.35), Khandesh (10.05) and lowest in Western Maharashtra (9.77).

The results are in accordance with Kaware and Yadav (2014) who revealed that total cost of milk production of cow and buffalo was comprised of 85 per cent of working cost and 15 per cent fixed cost of the total cost.

Regional Difference in Cost and Return from Milk Production of Different Species

It can be seen from the Figure 1, that cost of milk production was highest for local cow followed by buffalo and lowest for crossbred cow across five regions and also at the state level.

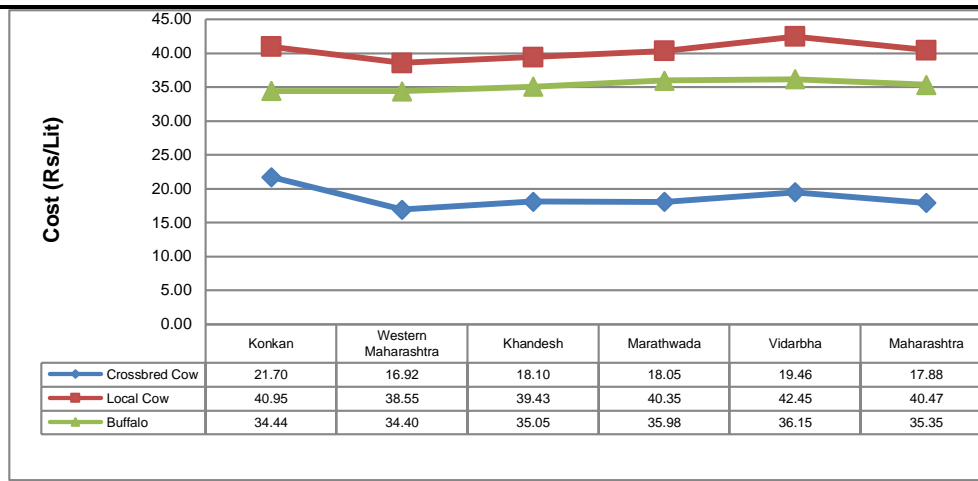


Figure 1: Cost of Milk Production for Different Species of Milch Animals in Different Regions of Maharashtra

It was also observed that the cost of milk production for crossbred cow ranged from Rs.16.92 to Rs.21.70 across five region, lowest in Western Maharashtra and highest in Konkan region. For local cow, cost of milk production ranged from Rs.38.55 to Rs.42.45, lowest in Western Maharashtra and highest in Vidarbha region. Cost of milk production for buffalo varied from Rs.34.40 to Rs.36.15, lowest in Western Maharashtra and highest in Vidarbha region. However, costs of milk production of local cows and buffalo do not differ significantly, though they are significantly higher from cost of milk production in crossbred cows (Singh et.al, 2012).



Figure 2: Returns from Milk Production from Different Species of Milch Animals in Different Regions of Maharashtra

The Figure 2, shows that returns from milk production across different species of milch animals does not follow the same pattern in all the regions. It was observed that in Konkan region returns were higher from buffalo milk production followed by crossbred cow and local cow while in all other regions (Western Maharashtra, Khandesh, Marathwada and Vidarbha) and at state level returns were comes out to be higher from crossbred cow milk production followed by buffalo and negative returns incurred from local cow milk production. These results are in close conformity with results of Kumar and Rai (2008) who reported that the net profit in case of buffaloes was higher as compared to cows because economic feasibility was more in case of buffaloes as compared to cows,

because of Cows were less economic due to their low and poor productivity. In another study by Basavarajappa, et.al, 2012 it was found that gross returns were found to be highest in case of crossbred animals as compared to local cow and buffalo since the later are genetically poor yielders.

Summary and Conclusion

The cost of milk production per litre of milk showed a varied pattern across the regions and also across the milch species. It was found that cost of milk production was highest for local cow followed by buffalo and crossbred. It was estimated that for crossbred it was Rs.17.88 at state level which varied from Rs.16.92 to Rs.21.70 across all five regions, lowest being in Western Maharashtra and highest in Konkan region. It was estimated that for local cow it was Rs.40.47 at state level varying from Rs.38.55 to Rs.42.45; highest in Vidarbha and lowest in Western Maharashtra while for buffalo it was Rs.35.35 at state level, it varied from Rs.34.40 to Rs.36.15; highest in Vidarbha and lowest in Western Maharashtra. In this part of the study, it was found that crossbred cow and buffalo milk production fetches positive returns while local cow milk production provided negative returns. Returns per litre of milk were estimated to be highest from crossbred cow followed by buffalo and local cow. It was estimated that returns per litre of milk were Rs.3.53 from crossbred cow at the state level and it ranged from Rs.1.90 to Rs.4.27 across all the regions; highest in Western Maharashtra and lowest in Konkan region. At state level and across regions, buffalo milk production provided positive returns. It was found to be highest in Konkan (Rs.2.75), lowest in Vidarbha (Rs.0.84) region and at state level (Rs.1.56) while local cow milk production was not a profitable proposition as it incurred negative returns both at regional as well as at state level.

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