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Economic feasibility of milk production of cows and buffalo milch animals in rural areas in Bikaner district of Rajasthan

## Dropati Saran, Madhu Sharma, Priyanka Lal and Hemant Sharma

Abstract
Livestock rearing is one of the most important economic activities in the rural areas providing stable and supplementary income round the year. Milch animals are kept as farming household from very long time in India. The Bikaner district of Rajasthan is selected for the study purposively as it is having largest cattle population and another reason for selecting the district is that if has higher Indigenous Cattle population in the area is second largest enterprise after crop production. Predetermined samples of 180 farmers, selected farmers were categorized into small, medium and large herd-size categories using cumulative square root frequency method. To estimate economic feasibility of milk production in the area, the cost and returns were worked out for different species of milch animals based on per day milk production budgeting technique was used and concluded that the productivity of milk was highest in case of crossbred cows. The net return realized by overall average of crossbred cows was found to be highest (Rs 93.96) followed by buffalo (Rs 60.27) and local cows (Rs 50.05) per animal per day. Net return per milch animal from milk was found to increase with increase in herd size category in case of crossbred cows and buffaloes but in case of indigenous cows net return was highest for medium herd size category. It was observed through the productivity of buffaloes that it was not very high, it gave higher return because of the fact that buffalo milk fetches a better price due to high fat content as compared to cow milk.

Keywords: maintenance cost, capital recovery cost, productivity, cost and returns

Introduction
Animal husbandry is an integral component of agriculture supporting livelihood of more than two-thirds of the rural population. Livestock rearing is one of the most important economic activities in the rural areas providing stable and supplementary income round the year. Dairying has become an important secondary source of income for millions of poor and rural families and has assumed the most important role in providing employment and income generating opportunities particularly for marginal and women farmers (Patel, 2003) [5]. Most of the milk is produced by animals reared by small, marginal farmers and landless labourers. India continues to be the largest producer of milk in the world. Several measures have been initiated by the Government to increase the productivity of livestock, which has resulted in increasing the milk production significantly from the level of 102.6 million tonnes at the end of the Tenth Plan (2006-07) to 187.75 million tonnes in 2018-19 showing an annual growth of 6.50 per cent per annual. The per capita availability of milk was around 394 grams per day in 2017-18. Projected milk production by 2021-22 is 254.5 million tones as per the vision 2022 document. (Govt. of India, 2019) [4].

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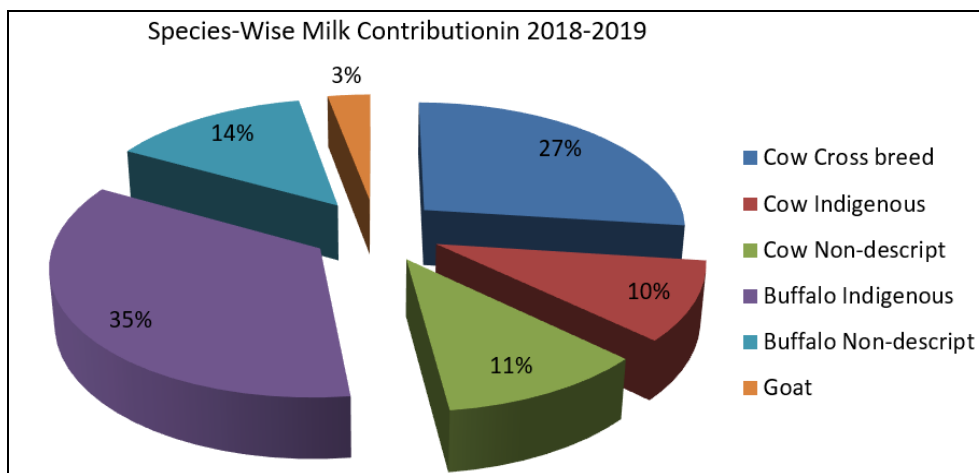
Fig 1: Contribution of milch animals in total production in India in the year 2018-19

The milch animals have a significant contribution in the economy of country for the poor people of rainfed agro-ecosystem for their sustainable living because of severe risk involved in the crop production due to uncertainty of rain and drought (Misra and Ramakrishna, 2007). This is due to difference in production potential of bovine population, status of dairy farming practices, agro-climatic conditions, agricultural preferences and socio-economic importance of milk production (Sharma *et. al.* 2007). The livestock population of the state was 567.75 lakh (2012). Rajasthan is considered as 'Denmark of India'. The total milk production in Rajasthan was 23.68 million tonnes in 2018-19, and ranked second in India. Animal Husbandry in Rajasthan is a major economic activity contributing approximately 10.21% to the total GDP of the state. The livestock population of the state as per 2019 livestock census is 568 lacs. The total milk production in Rajasthan in 2018-19 was 23.67 million tones. it ranked second in India after U.P. (30.51 MT.). https://www.nddb.coop/information/stats. Thus, the milch animal rearing activity provides source of livelihood and supplementary occupation to majority of farmer living in the drought prone rainfed areas where crop production on its own way not be very productive and engaging them fully or partially (Samra *et al.*, 2006) [6].

In any commercial enterprise, profit is the major motive of an entrepreneur and to achieve maximum profit the limited resources should be allocated optimally. Thus, success of an enterprise is based on its profitability and productivity (Chand *et al.*, 2018) [1] An analysis of cost of milk production guides the decision making bodies and the policy makers to understand whether or not farmers are getting remunerative prices required for dairy development and to meet the future demand. The income flowing from the dairy enterprises is well spread over the entire year. There is desirability as well as scope for developing the dairy sector both as a specialized or a supplementary enterprise. Keeping this in view, an effort was made using the appropriate methodology to estimate costs and returns of different types of milch animals in this section.

In the study, only cows and buffaloes were considered as milch animals as their milk is largely produced for the purpose of selling or for business.

Data and Methodology
The Bikaner district of Rajasthan is selected for the study purposively. There are three distinct types of agricultural situations in the region *viz.*, canal irrigated (Lunkaransar

Tahsil), tubewell (Kolayat *Tahsil*) irrigated and unirrigated (Nokha) were selected. The primary data were collected from 180 milk producer households of selected three region of Bikaner district. The data collected have been analyzed using different statistical measures and interpreted across herd-size categories of milk producers as well as overall. In order to have an appropriate comparison, herd size maintained by different categories of households were converted into standard animal units using the conversion factors suggested by Sirohi *et al.,* (2015) [9]. Thus, the sample was comprised of 88 small herd size milk producers category (2-7 SAUs), 61 medium herd size (more than 7-12 SAUs) and 31 large herd size milk producers category (more than 12 SAUs). The primary data were collected from the sample farmers for the year 2019-20.

Survey tool
Various components of costs and returns in milk production were analysed by the conventional analysis in the form of averages and percentages.

Method of computation of costs and returns in milch animal
Cost components: The cost components were classified into fixed cost and variable cost.

a. Fixed cost: The fixed cost items are durable assets with productive life of more than a year. It includes interest on fixed capital, depreciation on buildings, depreciation on equipment and machinery and insurance cost, land rent, land revenue, animals sheds and store for feed and fodder etc. Cost of durable assets can be accounted for by charging depreciation based on the purchase cost (or current value of the asset when purchase cost is not available) or using the Capital Recovery Cost (CRC) Method.

Capital recovery cost of civil structures, machinery and equipment: The formula for estimation of CRC is:

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

Where, R, Z, r and n are the capital recovery cost (₹ per annum), initial/ current value of the capital asset (₹), interest rate (per cent) and useful life of assets (years).

Capital Recovery Cost of Milch Animals

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

Where, R, Z, r and n are the capital recovery cost (₹ per annum), initial/ current value of the capital asset (₹), interest rate (per cent) and useful life of assets (years). Local cow: 10 years, 6 calvings; Crossbred cow: 8 years, 5 calvings; Buffalo: 10 years, 6 calvings

b. Variable cost: Variable cost included cost of feed (green fodder, dry fodder, and concentrate), labour cost and cost of veterinary and medicine charges (breeding, vaccination, deforming),labour expenses, expenditure on veterinary and healthcare, other recurring expenditure such as repairing of shed, equipments, machinery, electricity and water charges, cost of artificial insemination (A.I.), natural service etc

Feed and Fodder cost
The cost of feed and fodder is one of the most important cost components. This included the cost of feeding dry fodder, green fodder and concentrates.

Grazing Cost: One important aspect in feed and fodder cost relates to the valuation of the grazing cost. Only labour cost of grazing the animals is included in the study.

Labour costs: In case of family labour, the time spent on dairy activity is recorded and family labour cost is imputed on the basis of average wages paid to the agricultural labour in the area. Some studies use labour units worked out according to the sex of labour (3 women = 2 men)

Veterinary and miscellaneous costs: The expenditure on breeding and health care of the animals is covered under the veterinary expense. Specifically it includes, cost of artificial insemination (AI), natural service, vaccination, medicines, fee of veterinary doctor and other related expenses.

c. Gross cost: It was calculated by adding all the cost components of 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 - Imputed value of dung

d. Gross Returns
The returns from milk production and animal were taken into consideration for computing the gross returns. The returns from the sale of animals (except for salvage value) are not accounted for while estimating the returns from milk production.

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

Cost of Milk Production: All the costs were calculated for per animal per day which indicates the cost of maintaining an animal per day.

Cost per litre of milk production = Net cost per animal per day/milk produced per animal per day

Results and Discussion
In any commercial enterprise, profit is the major motive of an entrepreneur and to achieve maximum profit the limited resources should be allocated optimally. Thus, success of an enterprise is based on its profitability and productivity. An analysis of cost of milk production guides the decision making bodies and the policy makers to understand whether or not farmers are getting remunerative prices required for dairy development and to meet the future demand. The income flowing from the dairy enterprises is well spread over the entire year. There is desirability as well as scope for developing the dairy sector both as a specialized or a supplementary enterprise. Keeping this in view, an effort was made using the appropriate methodology to estimate costs and returns of different types of milch animals in this section.
From milch animals farmers can increase their family income in two ways i.e., by increasing milk production or by reducing cost of milk production. The first alternative is limited as productivity enhancement of the individual milch animal is influenced by certain biological as well as climatic factors such as genetic potential of the animal, climatic parameters like temperature, rainfall, relative humidity, etc. These externalities by no means are subjected to be controlled by the farmers and therefore, an economic sense can only be applied on reducing cost. The second alternative can be achieved through judicious use of various factors of production. The cost and returns were worked out for different species of milch animals based on per day milk production.

Cost and returns of milk production from Indigenes cows
Table 1 shows that the overall gross maintenance cost for Indigenes cow was worked out to be ₹ 139.93 per day was ₹ 141.61 per day per cow for small herd size category to ₹ 140.49 for large her size category. The average gross maintenance cost per day per cow was found to be leaste in medium herd size category. Fixed cost accounted about 12.83 per cent share of gross cost and variable cost for ₹121.97. Feed cost constituted major share in variable cost varying from 68.83 per cent for large category to 64.20 per cent for small category increasing with herd size categotry. Overall labour cost was ₹ 26.27 per day. It was found that labour cost declined from small (₹30.83) to large category (₹22.86).The share of feed cost in terms of percentage increased with the increase in herd size categories while the share of labour cost marginally decreased with increase in herd size categories. Per litre cost of milk production was found to be ₹ 24.42 for small category, ₹ 21.02 for medium category and ₹ 23.47 for large herd size category. On an averagel cost of milk production per litre of milk was worked out to be ₹ 22.90 per day. Net return per milch animal of milk was found to be positive for all the categories. It was highest for medium category (₹58.97) and lowest for small category (₹40.26).

Table 1: Costs and returns of milk production from Indigenous cows (₹ /SAU/day)

S. No.	Cost / Return	Small	Medium	Large	Average
1.	Total fixed cost	17.69 (12.49)	17.09 (12.41)	19.10 (13.59)	17.96 (12.83)
2.	Dry fodder	24.81(17.51)	23.88 (17.34)	24.54 (17.46)	24.41 (17.44)
3.	Green fodder	5.34 (03.77)	6.23 (04.52)	9.44 (06.71)	7.00 (05.00)
4.	Concentrates	51.78 (36.56)	53.42 (38.79)	52.87 (37.63)	52.69 (37.65)
5.	Grazing	2.50 (01.76)	2.59 (01.88)	2.81 (02.00)	2.63 (01.88)
6.	Supplements	6.49 (04.58)	7.01 (05.09)	7.04 (05.01)	6.84 (04.89)
7.	Total feed cost (1+6)	90.92 (64.20)	93.13 (67.63)	96.7 (68.83)	93.58 (66.87)
8.	Family labour	30.83 (21.77)	25.12 (18.24)	22.86 (16.27)	26.27 (18.77)
9.	Veterinary & miscellaneous	2.17 (01.53)	2.36 (01.71)	1.83 (01.30)	2.12 (01.51)
10.	Total variable cost (7+8+9)	123.92 (87.50)	120.61 (87.58)	121.39 (86.40)	121.97 (87.16)
11.	Gross cost(1+10)	141.61	137.7	140.49	139.93
12.	Value of dung	6.05	5.64	5.95	5.88
13.	Net cost(11-12)	135.56	132.06	134.54	134.05
14.	Sale price of milk	31.68	30.42	32.26	31.45
15.	Milk production (l/day)	5.55	6.28	5.73	5.85
16.	Cost of milk production (*Rs*/l)(13/15)	24.42	21.02	23.47	22.90
17.	Gross return(14*15)	175.82	191.03	184.84	184.10
18.	Net return (17-13)	40.26	58.97	50.30	50.05

Cost and returns of milk production from crossbred cows
The evaluation of table 2 indicates that the per day per animal cost of maintaining a cross bred cow for small, medium and herd size was ₹ 161.81, 171.97 and 167.29, respectively with an average of 167.03 per day per cow. Keeping in mind the breakup of expenditure, the average variable cost accounted for about 86.02 percent of the total cost and fixed cost was only 13.97 percent. The feed and fodder cost was the major component accounting for 63.24 percent of the total cost. It was observed that more expenditure was made on feeding and concentrates to crossbred cows on all the categories of herd size but maximum in medium herd size category i.e., 63.23 per cent and least in small herd size category i.e., 61.64 per cent. Labour cost was found to other major component within

variable cost with an average cost of ₹ 32.22 per day. It was highest for small category ₹ 34.16 and lowest for large category ₹ 28.88 which is similar to the findings of Nagrale (2011) in Vidarbha region of Maharashtra, where the labour cost decreased with the increasein the herd size categories in all the regions.
The average per day milk production of per milch cow on small, medium and large herd sizes was 7.70, 8.28 and 8.28 litres, respectively. On an overall average, the gross income, net cost and net return per crossbred cow per day were estimated to be Rs. 254.30, 160.38 and 93.96, respectively. The net return was highest on large farms Rs. 106.42 followed by small Rs.88.60 and medium size Rs. 86.74 per day.

Table 2: Costs and returns of milk production from crossbred cows (₹ /SAU/day)

S. No.	Cost / Return	Small	Medium	Large	Overall
1.	Total fixed cost	21.23 (13.11)	23.01(13.38)	25.78 (15.41)	23.34 (13.97)
2.	Dry fodder	27.29 (16.86)	31.23 (18.16)	29.35 (17.54)	29.29 (17.53)
3.	Green fodder	6.78 (04.18)	6.11 (03.55)	9.3 (5.55)	7.39 (04.42)
4.	Concentrates	57.16 (35.32)	61.69 (35.87)	60.94 (36.42)	59.93 (35.88)
5.	Grazing	0.00	0.00	0.00	0.00
6.	Supplements	8.52 (5.26)	9.72 (5.65)	8.82 (5.27)	9.02 (5.40)
7.	Total feed cost (1+6)	99.75 (61.64)	108.75 (63.23)	108.41 (64.80)	105.64 (63.24)
8.	Family labour	34.16 (21.11)	33.63 (19.55)	28.88 (17.26)	32.22(19.29)
9.	Veterinary & miscellaneous	6.66(4.12)	6.57(3.82)	4.212975(2.51)	5.81(3.48)
10.	Total variable cost (7+8+9)	140.58(86.88)	148.96(86.61)	141.51(84.58)	143.68(86.02)
11.	Gross cost(1+10)	161.81	171.97	167.29	167.03
12.	Value of dung	6.48	6.84	6.60	6.64
13.	Net cost(11-12)	155.33	165.13	160.69	160.39
14.	Sale price of milk	31.68	30.42	32.26	31.45
15.	Milk production (l/day)	7.70	8.28	8.28	8.09
16.	Cost of milk production (*Rs*/l)(13/15)	20.17	19.94	19.41	19.83
17.	Gross return(14*15)	243.94	251.88	267.11	254.35
18.	Net return (17-13)	88.61	86.74	106.42	93.97

Cost and returns of milk production from buffaloes
Table 3 shows the cost and returns of milk production from buffaloes in Bikaner district. On an average, the gross maintenance cost for buffalo was worked out to be ₹ 166.64 per day which varies from ₹ 176.53 for small category to ₹ 155.13 for large herd size category. The average gross maintenance cost per day per milch buffalo was found to be decreasing with increase in herd size category. Baweja (2004) also reported similar finding. The average total fixed cost was

found to be ₹ 21.73 per buffalo per day which accounted for about 13.04 per cent share of gross cost which were in conformity with earlier studies (Prasad, 2010; Nagrale, 2011). On an average, the total variable cost per buffalo per day accounted for ₹ 143.94. Feed cost constituted major share in cost varying from 68.65 per cent for large category to 64.07 per cent for small category. Overall labour cost was ₹ 29.39 per day and it was found that per buffalo paer day labour cost declined from small (₹ 34.18) to large category (₹ 23.50). The

share of feed cost in terms of percentage increased with the increase in herd size categories while the share of labour cost got marginally decreased with increase in herd size. Per litre cost of milk production was found to be ₹ 30.69 for small category, ₹ 28.02 for medium category and ₹ 27.38 for large herd size category. Overall cost of milk production per litre of milk was worked out to be ₹ 29.36 per day. Per litre cost of milk production was decreased with increase in the herd size.

Nagrale (2011) and Venkatesh and Sangeeta (2011) reported similar finding which is in agreement with our findings. Net return per litre of milk was found to be positive for all the categories. It was highest for large category (₹ 72.14) and lowest for small category (₹ 52.23). It was observed that though the productivity of buffalo was not very high, it gave higher returns because of the fact that buffalo milk fetches a better price due to high fat content as compared to cow milk.

Table 3: Costs and returns of milk production from Buffaloes (₹ /SAU/day)

S. No.	Cost / Return	Small	Medium	Large	Overall
1.	Total fixed cost	21.40(12.12)	24.80(14.21)	22.07(14.22)	21.73(13.04)
2.	Dry fodder	35.59(20.16)	34.84(19.96)	31.90(20.56)	33.54(20.12)
3.	Green fodder	9.03(5.11)	13.40(7.68)	8.58(5.53)	8.85(5.31)
4.	Concentrates	66.00(37.38)	66.01(37.82)	63.69(41.05)	65.86(39.52)
5.	Grazing	1.17(0.66)	0.59(0.33)	0.44(0.28)	0.73(0.44)
6.	Supplements	7.57(4.28)	9.09(5.21)	8.37(5.39)	8.33(4.99)
7.	Total feed cost (2+6)	113.11(64.07)	114.35(65.52)	106.50(68.65)	110.56(66.35)
8.	Family labour	34.18(19.36)	31.17(17.86)	23.50(15.15)	29.39(17.63)
9.	Veterinary & miscellaneous	4.92(2.79)	4.16(2.38)	3.04(1.96)	3.96 (2.38)
10.	Total variable cost (7+8+9)	152.24(86.23)	149.69(85.78)	133.05(85.77)	143.94(86.37)
11.	Gross cost(1+10)	176.53(100)	174.50(100)	155.13(100)	166.64(100)
12.	Value of dung	6.68	6.57	7.02	6.80
13.	Net cost(11-12)	169.84	167.93	148.10	159.83
14.	Sale price of milk	39.4	39.81	39.87	39.71
15.	Milk production (l/day)	5.63	6.00	5.526	5.53
16.	Cost of milk production (₹/l)(13/15)	30.69	28.02	27.38	29.36
17.	Gross return(14*15)	222.08	239.21	220.52	220.11
18.	Net return (17-13)	52.23	71.28	72.41	60.27

Conclusion
From the study it was concluded that the cost of milk production decreases with increase in herd size in case of crossbred and buffalo whether in case of indigenous cow, cost of milk production low in medium herd size category. The overall average milk yield per day of cross breed cows was found to be highest per litre per animal followed by Indigenous cow and least buffalo. To estimate economic feasibility of milk production in the area, the cost and returns were worked out for different species of milch animals based on per day milk production. It was concluded that, overall results of economic feasibility of milk production revealed that the highest returns from milk production per animal per day were in case crossbred cows followed by buffaloes and indigenous cows. The evaluation of net maintenance cost was highest in case of crossbred cows followed by buffalo and local cow. Feed and fodder cost accounted for about 66% of the total variable cost followed by labour cost 18%.The maintenance cost of milch buffalo per day was high and net return per day per milch buffalo was low due to low milk yield per day of milch buffalo. Cost of milk production was estimated Rs 22.90, Rs 19.83, Rs 29.36, respectively for local cow, cross breed cow and buffalo. The cost of milk production in case of buffalo decreased with increase in herd size. Cost per litre of milk was found to be less for large herd size category farmers. The share of feed cost in terms of percent of total cost increased with the increase in herd size category while the share of labour cost got marginally decreased with increase in herd size. Net return per milch animal from milk was found to increase with increase in herd size category in case of crossbred cows and buffaloes but in case of indigenous cows net return was highest for medium herd size category. The overall average milk yield per day of crossbred cows was found to be highest per animal per day followed by indigenous cows and least buffaloes. The net

return realized by overall average of crossbred cows was found to be highest (Rs 93.96) followed by buffalo (Rs 60.27) and local cows (Rs 50.05) per animal per day. It was observed through the productivity of buffaloes that it was not very high, it gave higher return because of the fact that buffalo milk fetches a better price due to high fat content as compared to cow milk.

References
1. Chand P, Sirohi S, Saxena R, Mishra A. How profitable is dairying in tribal Chhattisgarh?. Indian Journal of Animal Sciences. 2018;8(6):749-754.
2. Government of India. 19th livestock census 2012 All India Report, Ministry of Agriculture, Department of Animal Husbandry, Dairying and Fisheries, Government of India, New Delhi, 2014.
3. Government of India. Basic animal husbandry and fisheries statistics. Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture and Farmers Welfare, New Delhi, 2018.
4. Government of India. State wise and item wise estimates of value of output from agriculture and allied sectors, Central Statistics Office, Ministry of Statistics and Programme implementation, Government of India, 2019.
5. Patel, Amrita. Inaugural address delivered at the International Workshop on Livestock and Livelihoods: Challenges and Opportunities for Asia in the Emerging Market Environment, Anand, November, 2003, 10.
6. Samra JS, Singh G, Dagar JC. Drought management strategies in India. Drought management strategies in India, 2006.
7. National Dairy Development Board. Milk production by states (https://www.nddb.coop/information/stats) as assessed on 20 July 2019.
8. Sirohi S, Chand P, Sharma D, Saxena R. Estimation of

bovine equalizing units in India. Indian Journal of Animal Sciences. 2019;89(9):1009-1013.

9. Sirohi S, Saxena R, Chauhan AK, Dhaka JP, Sirohi SK, Kumar N, *et al*. Costs and Returns in Milk Production: Developing Standardized Methodology and Estimates for Various Dairy Production Systems. Project report submitted to Department of Animal Husbandry, Dairying and Fisheries, Krishi Bhawan, New Delhi, 2015.