

Economic viability of milk production in seasonal pasture-based production system in temperate region of India

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Abstract

The present study was carried out to assess the economic viability of milk production in a seasonal pasture-based production system in temperate region of India. For this study, six years data related to economic viability of milk production was collected from dairy unit of Division Livestock Production Management. It was observed that when crossbred Jersey cows were reared under a seasonal pasture-based production system, the average total expenditure cost per animal per annum was Rs. 94447.86/- and among this, total feed cost contributed around 60.49%. In total feed cost incurred per annum per animal, concentrate contributes around 68.70% and fodder cost contributes 31.29% of the total feed cost, which was incurred only during the winter season. Average net returns per annum per animal, per day, per litres of milk production and cost of production under seasonal pasture-based production system were Rs. 20458.53/-, Rs. 56.05/-, Rs. 6.71/- and Rs. 29.96/-, respectively. After the deduction of labour cost, the average total expenditure cost per annum per animal was reduced to 34.30%, and the average net returns per annum per animal was increased by 61.29%. The cost of milk production was also decreased by 33.64% as a result of a decrease in average total expenditure cost per animal per year (34.30%).

Keywords: Cost of milk production, Crossbred Jersey cattle, Pasture, Temperate region

Highlights

- When crossbred Jersey cows were reared under a seasonal pasture-based production system, total feed cost contributed around 60.49% of the total expenditure cost, and in total feed cost, concentrate contributed around 68.70%.
- Fodder cost incurred was 31.29% of the total feed cost and was mostly spent during winter, late autumn and early spring seasons.
- An average gross return per annum per animal was Rs. 114906.40/- among this contribution of returns from milk was around 93.27%.
- The average net returns per annum per animal was Rs. 20458.53/- and the cost of production for each litre of milk was Rs. 29.96/- under a seasonal pasture-based production system.
- An average net return per annum per animal was increased by 61.29%, and the cost of production decreased by 33.64% after the deduction of labour costs.

Owing to highland pastures and meadows, the livestock sector has emerged as an important sector in the economy of Jammu and Kashmir. Among the livestock, dairying is a source of supplementary income and a means for the upliftment of rural farmers. It provides employment opportunities and contributes to the welfare of the local population. The total bovine population of Jammu and Kashmir is 32.56 lakh; among this, cattle population is 25.32 lakh, and the buffalo population is 6.90 lakh. Total milk production in the UT is 2726.79 thousand tonnes, and per capita availability of milk is 597 g for the year 2021-22 (Anonymous, 2023). Revenue generated from dairy

farming in Jammu and Kashmir union territory for 2020-21 is around Rs. 9080 crore which contributes significantly to UT's agricultural economy (Anonymous, 2022). Milk production in India is dominated by smallholder farmers including landless agricultural workers. The cost of milk production depends upon a number of factors: the system of rearing of dairy animals, season, feed and fodder, labour, herd size, farming experiences and knowledge level of farmers regarding animal husbandry practices etc (Feroze *et al.* 2019). In Jammu and Kashmir, most rural dairy farmers keep 2 to 3 dairy animals which are reared under the pasture-based rearing system of management.

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In pasture-based dairy production systems, grazing pastures like meadows, highland pastures (alpine and sub-alpine) and common property resources are utilized to meet the roughage requirement of dairy animals (Farooq, 2016). Dairy production systems based on pasture are seen to be more favourable to the environment and animal welfare (Spigarelli *et al.*, 2020). This type of dairy production system is also referred to as a low-input and low-output system, with emphasis on the minimum use of concentrates and fertilizers for fodder production and maximum utilization of pasture (Delaby *et al.*, 2020; Joubran *et al.*, 2021). Further, dairy animals are exclusively reared under an intensive system during the winter season in Kashmir Valley, which further affects the economics of dairy production. Keeping in view the benefits of a seasonal pasture-based dairy production system, the present study was carried out to work out the economic viability of milk production from small holding dairy cow units reared under this production system in the temperate region of India.

Data for this study was from two crossbred Jersey cows for the first three years and for the last three years from three milch animals reared collected from a small holding dairy unit of the Division of Livestock Production and Management, Faculty of Veterinary Sciences and Animal Husbandry, Shuhama. Data was recorded from different registers maintained at dairy unit related to fixed cost, labour, feeding and veterinary medicine cost, milk production and revenue output etc for a period of six years from 2016 to 2021. Crossbred Jersey cows along with their followers were maintained under a seasonal pasture-based production system in different seasons. Under this production

system, animals were allowed for 5 to 6 hours of grazing during late spring, summer and early autumn (April to October), while in the winter season (November to March), an intensive system of feeding was followed as per ICAR feeding standard (hay, succulent fodder and compound cattle pellet type II concentrate). Moreover, compound cattle pellet type II concentrate was fed to dairy animals as per their production level (i.e. 1 kg of concentrate for every 2.5 litres of milk produced) in all the seasons.

The economics of small-holding dairy farms reared under seasonal pasture-based production was calculated on a per annum basis per animal in different seasons for a period of six years.

Total expenditure cost per year = Total fixed cost + Total variable costs

Fixed costs = Depreciation charges on cow shed @ 2.5% per year + depreciation charges on milch animals @ 5.5% after 3rd lactation (Hussain *et al.*, 2014); Variable costs = Feeding cost + hired labour cost + veterinary medicine cost including feed supplements; Gross returns per year = Returns from sale of raw milk + farmyard manure + surplus male calf.

Net return per year = Gross return – Total expenditure cost

$$\text{Cost of milk production} = \frac{\text{Total expenditure cost per year}}{\text{Total milk yield}}$$

$$\text{Benefit cost ratio} = \frac{\text{Net returns}}{\text{Total expenditure cost per year}}$$

Data were tabulated, analysed and averages were worked out.

Table 1. Economics of milk production in seasonal pasture-based production system in different years

Parameters	Economics of dairy farm in different years							
	Year	2016	2017	2018	2019	2020	2021	Average /Animal
Total expenditure cost/year (Rs.)		176340	209124	220045	281771.5	277776	251661.5	236119.67
Total feed cost (Rs.)		84162	121024	125345	186648.5	185476	154361.5	142836.17
Concentrate cost (Rs.)		59122	80955	84700	122152.5	124591	117335.5	98142.67
Fodder cost (Rs.)		25040	40069	40645	64496	60885	37026	43160.17
Labour cost (Rs.)		81000	81000	81000	81000	81000	81000	81000
Fixed cost (Rs.)		5000	5000	8300	8300	8300	8300	7200
Total milk produced/year L)		8024.5	6860.5	7417	8020	9645	8754.5	8120.25
Returns from milk (Rs.)		224443	207615	242184.5	269915.5	341932	324280	268395
Gross returns (Rs.)		224443	229677	270004.5	305349.5	360197	333925	287266
Net returns per year (Rs.)		48103	20553	49959.5	23578	82421	82263.5	51146.33
Net returns per day (Rs.)		131.79	56.31	136.88	64.60	225.81	225.38	140.13
Net returns per litres (Rs.)		6.38	3.17	7.20	3.16	9.08	10.15	6.52
Benefit - cost ratio		0.27	0.10	0.23	0.08	0.30	0.33	0.22
Cost of production (Rs.)		21.98	30.48	29.67	35.13	28.80	28.75	29.13

Total expenditure includes fixed cost, feed & fodder cost, labour cost, medicine cost

Table 2. Economics of milk production in seasonal pasture-based production system in different years without including labour cost

Parameters	Economics of dairy farm in different years							
	2016	2017	2018	2019	2020	2021	Average	Average /Animal
Total expenditure cost/year (Rs.)	95340	128124	139045	200771.5	196776	170661.50	155119.66	62047.86
Net returns per year (Rs.)	129103	101553	130959.50	104578	163421	163263.50	132146.33	52858.53
Net returns per day (Rs.)	353.71	278.23	358.79	286.52	447.73	447.30	362.04	144.82
Net returns per litres (Rs.)	17.12	15.67	18.88	14.00	17.99	20.14	17.30	17.32
Benefit - cost ratio	1.35	0.79	0.94	0.52	0.83	0.96	0.90	0.87

Detail of economic viability of milk production under seasonal grass-based production system is given in Tables 1 and 2. It was observed that when crossbred Jersey cows were reared under seasonal grass production system, average total expenditure cost per annum per animal was Rs. 94447.86/-. Total feed cost contributes around 60.49% of the total expenditure cost, amount Rs. 57134.48/- and in total feed cost, concentrate contributes around 68.70%, which amounts to around Rs. 39257.06/- per annum per animal. Fodder cost incurred was 31.29% of the total feed cost, amounting to Rs. 17877.39/- per annum per animal, which was spent during periods when there was no grass available on the pasture, i.e. winter, late autumn and early spring seasons. The average gross returns per annum per animal was Rs. 114906.40/- among this contribution of returns, from milk was around 93.27%, which amounts to Rs. 107184.34/-. An average net return per annum per animal, per day and per litres was Rs. 20458.53, 56.05 and 6.71, respectively. Moreover, the cost of production and benefit-cost ratio under the seasonal pasture production system was Rs. 29.96 and 0.22, respectively. After the deduction of labour cost, the average total expenditure cost was reduced to 34.30%, which amounts to Rs. 62047.86/- per annum per animal, and average net returns were increased by 61.29%, amounting to Rs. 52858.53/-per annum per animal. Similarly, average net returns per animal per day and per litre were increased to Rs. 144.82/- and Rs. 17.32/-, respectively. The cost of production was also decreased to Rs. 19.88/- indicating a decrease in average total expenditure cost per animal per year and an increase in dairy farm profitability.

Similar to the present study, positive net returns have been reported by Hamadani *et al.* (2020) in dairy farms from Srinagar city in various agro-climatic zones of Jammu and Kashmir. Feroze *et al.* (2019) reported that feed and labour costs were the major cost components in the total cost of maintenance of dairy animals. Within the feed cost, shares of concentrate and dry fodder were highest. Also, net maintenance cost was minimal in the summer season for both local

and crossbred cows, whereas the highest was found in winter in the case of local cows and in the rainy season in the case of crossbred cows. Similarly, different authors in their dairy economics studies in India reported that feed and labour costs were major cost components in the total cost of maintenance of dairy animals (Jaiswal and Singh, 2015; Baral and Bardhan, 2016; Kumawat *et al.*, 2016; Umamageswari *et al.*, 2017; Lone *et al.*, 2022). Hanrahan *et al.* (2018) reported that in pasture-based dairy production, an increased proportion of purchased feed in the diet of dairy animals resulted in a reduction in net profit per hectare. Kelly *et al.* (2020) reported that there is a strong inverse relationship between cost of milk production per liter and proportion of grazed grass in the dairy cow diet under pasture-based dairy production systems. Ramsbottom *et al.* (2015) reported that in a pasture-based dairy production system, increasing the proportion of grazed grass by dairy animals will reduce total costs and increase farm returns.

It can be concluded from the present study that when dairy animals (2 to 3 cows along with their followers) are raised under seasonal pasture production systems, using local pasture/common land resources for grazing and utilization of family labour are economically viable.

Conflict of interest: The authors declare that they have no conflict of interest.

Author's contribution: RAP: Involved in research work, preparing original draft; HMK: Engaged in conceptualization of the idea; HH: Helped in the supervision of trial and editing; IAB: Engaged in final editing; AAS: Helped in statistical analyses and methodology.

Data availability statement: This article includes all data generated or analyzed during this study. The corresponding author is willing to provide the raw data upon reasonable request.

REFERENCES

- Anonymous, 2022. Basic Animal Husbandry Statistics. Animal Husbandry Statistics Division of Department of Animal Husbandry and Dairying. Ministry of Fisheries, Animal Husbandry and Dairying, Govt. of India, New Delhi
- Anonymous, 2023. Digest of Statistics 2021-22. Planning Development and Monitoring Directorate of Economics and Statistics, Jammu and Kashmir
- Baral S and Bardhan D, 2016. Multivariate typology of milk producing households in Uttarakhand hills. *Indian J Agri Econ*, 71(2): 160-175
- Delaby L, Finn J, Grange G and Horan B, 2020. Pasture-based dairy systems in temperate lowlands: challenges and opportunities for the future. *Front Sustain Food Syst*, doi: 10.3389/fsufs.2020.543587
- Farooq F, 2016. Economics of milk production in Pulwama district of Kashmir valley. MSc Thesis submitted to Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir
- Feroze SM, Singh R and Sirohi S, 2019. Economics of milk production and factors affecting milk yield in Meghalaya: estimating the seasonal effect. *Indian J Dairy Sci*, 72(3): 328-335
- George S, Saseendran PC, Anil KS, Gleeja VL, Benjamin ED *et al.*, 2021. Cost and returns of milk production under different types of dairy farms in Kerala. *J Anim Res*, 11(06): 1105-1109, doi: 10.30954/2277-940X.06.2021.23
- Hamadani H, Khan AA, Wani SA, Khan HM, Banday MT *et al.*, 2020. Economics of milk production and profitability of different cow unit sizes in Srinagar. *Indian J Anim Sci*, 90(7): 1065-1069, doi: 10.56093/ijans.v90i7.106683
- Hanrahan L, McHugh N, Hennessy T, Moran B, Kearney R *et al.*, 2018. Factors associated with profitability in pasture-based systems of milk production. *J Dairy Sci*, 101(6): 5474-5485, doi: 10.3168/jds.2017-13223
- Hussain A, Aujla KM and Hassan S, 2014. Economics of cow milk production in Sindh and Azad Jammu and Kashmir. *Pak J Agri Res*, 27(1): 21-29
- Jaiswal P and Singh KR, 2015. Economics of milk production and determinants of market participation for small holder dairy farmers in Raipur district of Chhattisgarh. *Indian J Dairy Sci*, 68(6): 619-628
- Joubran AM, Pierce KM, Garvey N, Shalloo L and O'Callaghan TF, 2021. Invited review: A 2020 perspective on pasture-based dairy systems and products. *J dairy Sci*, 104(7): 7364-7382
- Kelly P, Shalloo L, Wallace M and Dillon P, 2020. The Irish dairy industry- recent history and strategy, current state and future challenges. *Int J Dairy Technol*, 73(2020): 309-323, doi: 10.1111/1471-0307.12682
- Kumawat R, Pramendra and Singh NK, 2016. Analysis of cost and returns of milk production in Rajasthan. *Econ Affairs*, 61(1): 71-74, doi: 10.5958/0976-4666.2016.00010.3
- Lone TA, Singh H, Rather JA, Ali S and Nanda AM, 2022. Economic analysis of dairy farming in Pulwama district of Jammu and Kashmir (Union Territory). *J Himalayan Ecol Sustain Dev*, 17
- Ramsbottom G, Horan B, Berry DP, and Roche JR, 2015. Factors associated with the financial performance of spring-calving, pasture-based dairy farms. *J Dairy Sci*, 98: 3526-3540, doi: 10.3168/jds.2014-8516
- Spigarelli C, Zuliani A, Battini M, Mattiello S, Bovolenta S *et al.*, 2020. Welfare assessment on pasture: A review on animal-based measures for ruminants. *Animals*, 10: 609, doi: 10.3390/ani10040609
- Umamageswari M, Dixit PK and Sivaram M, 2017. Economics of milk production in Tamil Nadu- A comparative study. *Indian J Dairy Sci*, 70(2): 221-227