**Dairy Enterprise: Source of livelihood security in Tal region of Bihar**

**ABSTRACT**

Dairy enterprise significantly contributing to the livelihood security in the Tal area of Bihar. Serving as a major source of income, particularly due to flood during monsoon season and the undulating low-lying area with the stagnant water, that leave the farmers with no other choice than to adopt alternative means of livelihood. Hence, this study investigates the profitability and reasons for practicing dairy farming as an alternate source of livelihood sustainability. Primary data were collected using Simple Random Sampling without Replacement technique (SRSWoR) making a sample size of 90 farmers practicing dairy. The data were analyzed using cost and return concept alongside Garrette ranking technique to identify the factors influencing for dairy farming practices in Tal region, Bihar. The research found that majority of the farmers were practicing cattle rearing, relying heavily on dairy farming for their livelihood with over 50 per cent of income derived from it. The return to cost ratio obtained from crossbred cow milk and buffalo milk were 1.39 and 1.34, respectively indicating a return of 0.39 paisa and 0.34 paisa per rupee of the investment. The outcome suggested that the primary motivation for engaging in dairy farming was the prolonged waterlogged condition in the Tal region, which was not conducive to crop yield throughout the year (Garrett score 77). Additionally, dairy farming allow for the absorption of disguised family labour and represents a tradional livelihood for the people of Tal.

**Key words:** Dairy farming, Economics, Profitability, milk, Tal area, livestocks

**HIGHLIGHTS:**

* Dairy enterprise serving as major source of livelihood in Tal region of Bihar with return of 0.39 paisa (crossbred cow milk) and 0.34 paisa (buffalo milk) per rupee of the investment.
* Waterlogged condition in Tal region, unfavourable for crop production was identified as main reason for practicing Dairy.

Almost fifty percent of the state of Bihar is left unirrigated, and the state suffers from both drought and floods frequently. The Tal and Diara areas are among those that experience drought and flooding each year. The backwaters of the inundated basin, located south of the Ganga in the districts of Bhagalpur, Munger, Patna, and Nalanda, are known as the tal land. During the kharif season, a lot of water stays there. Rabi crops are grown in rainfed conditions when the water diminishes, which is typically between September and October. It consists of seven consecutive "tal" and is intermittent in nature. Fatuha, Bakhtiarpur, Barh, Mor, Mokama, Barhiya, and Singhaul are the seven Tal. The tal land is quite fertile and has a significant potential yield, but it does not produce as much as it should because of stagnated water. As a result, land submerged in 4–6 meters of deep water makes it impossible to cultivate kharif season crops, and even throughout the winter, crops suffer from water retention and inadequate drainage. Floods results in signifacane human losses, disrupt access to essential supply, heighten the risk of epidepic diseases. Livestock-reapers of the largest flood-prone district (88.33%) thought that agricultural yield was completely damaged by the downpour (Jha *et al.,* 2020). Agriculture is directly influenced by floods, as excessive water can destroy crops and render land uncultivable, severely impacting food production and farmers' incomes. In flood-prone areas, these challenges make traditional crop cultivation difficult and unreliable (Nandy, 2005). Floods and heavy rains cut paddy and maize crop yields by 50%, while shortfall or delayed rainfall resulted in yield declines of 26% in paddy and 24% in maize. As a result, annual revenue (from overall sources) fell from INR 1.46 lakhs to INR 1.0 lakhs per year (Monobrullah, et al., 2024). Livestock is an essential component of Indian agriculture and will continue to play an important role in the farming system into the future (Gautam and Jha, 2022). Dairy farming, however, can serve as an alternative source of livelihood in these regions. Unlike crop cultivation, dairy farming is less affected by floods, as livestock can often be relocated to safer areas, and dairy production can continue with adequate planning and infrastructure.

Over 70 per cent of farming households, most with less than one hectare of land, produce milk, demonstrating the significance of dairy farming (FAO, 2003; GoI, 2005). In Bihar, where landless, marginal and small farmers owned the majority of livestock (Swain et al., 2018), livestock sector significantly contribute in increasing the agricultural productivity, nutrition, and financial stability, provide social and economic stability (Thornton, 2010). The findings found that livestock was the primary source of income for more than 55% of households, accounting for more than 50% of total revenue (Gautam and Jha, 2022). Tremendous increase in milk production from 84.4 million tonnes in 2001–02 to 230.6 million tonnes in 2022–23, India has become the world’s leading producer of milk, while Bihar has seen its total milk output rise from 2.66 million tonnes in 2001–02 to 12.50 million tonnes in 2022–23, ranking ninth among states (DAHD, GoI) [Milk Production in India | nddb.coop](https://www.nddb.coop/information/stats/milkprodindia). In the year 2019–20 India produced 198.4 million tonnes of milk, with 10.4 million tonnes coming from Bihar. Agriculture and allied enterprises made about 20% of Bihar's GDP in 2019–20 (Bihar Economic Survey, 2022). The state of Bihar had approximately 77.197 million buffaloes and 15.397 million cattle in 2019. There were 1.001 million livestock in the Patna district in 2019 (GoI, 2022). The state government prioritised farming diversification in order to meet the Indian government's goal of doubling farmers' income by 2022.

Beyond the food and income generation livestock specifically dairy farming is a valuable in developing the flood prone region and stabalise the agricultural production (Randolph *et al.,* 2007). Dairy farming is considered as the most important source of subsidiary income of the majority of farm families in India (Garai et al., 2022). Evaluation of revenue created from multiple sources revealed that dairy contributed, on average, roughly 22.39 percent of all household earnings in study areas, second only to crop output (Kumar *et al.,*2012).Given the socio-economic volnarability caused by the floods, it is need of the hours to explore the how the dairy framing can mitigate these impacts and support the farming communities in flood prone areas of Bihar. (Mishra, 2017). Considering the importance of dairy farming in the Tal region, this study examines its profitability, focusing on milk production economics and reasons for its adoption in flood-prone areas. The study analyzes production costs, market prices, and milk sales income to develop strategies enhancing dairy farming viability. Understanding community preferences for dairy farming reveals benefits like lower flood vulnerability and stable income. By evaluating milk production economics and sustainability, the study aims to improve living standards and economic resilience through better infrastructure, market access, and veterinary care, highlighting dairy farming's role in supporting livelihoods in the Tal region.

**DATA AND METHODOLOGY**

Patna district was purposively selected to study dairy enterprise. Two blocks and three villages from each block were specifically selected- namely 1) Mokama Block: i) Hathidha ii) Ramtola and iii) Aunta and 2) Ghoswari Block: i) Gosaygaon ii) Goshwari and iii) Paijana representing tal areas. Further a sample of 90 farmers, 15 from each village were randomly selected using the Simple Random Sampling without Replacement (SRSWoR) Technique. Primary data on various aspects of milk production were collected from farmers by personal interview method. The collected data were summarized, tabulated and analyzed using statistical tools such as frequency, percentage and measures of central tendency.

**Economics of dairy enterprise**:

 The cost structure of milk production was analysed by catagorising the cost into fixed costs and variable costs. The fixed costs include depreciation on capital assets, livestock depreciation and interest on fixed capital. Variable costs include cost on various feeds, fodder, veterinary services etc. used as well as, labour costs and other recurring costs.

**Costs and returns of milk production**

**Fixed Cost:** These includes interest on fixed capital and depreciation on animals, cattle sheds and machinery. The interest on fixed capital was worked out at the then prevailing rate of interest i.e. at 7.50 per cent per annum. The depreciation rate calculated on different items are presented in table 1 as follows:

**Table 1:** Depreciation rates on cattle shed, stores and dairy equipments were applied as under

|  |  |
| --- | --- |
| **Particulars** | **Depreciation rate per annum (%)** |
| Pucca houseSemi-pucca houseChaff cutterMilk cans and petty itemsCross- bred cows Local cows and Buffaloes  | 2510208 (productivelife 12.5 years)10 (productive life 10 years) |

The depreciation rates for consumables like rope and gunny bags were assumed to be 100%. The annual depreciation expense has been allocated on a per Standard Animal Units (SAUs) basis.

**Variable Costs:** These cost varied with the levels of milk production including expenses on green fodder, dry fodder, concentrates, labour, veterinary cost and miscellaneous expenses.

**Gross Cost:** It was obtained by adding all the cost components included in the fixed and variable costs, i.e.

Gross Cost = Total Fixed Cost + Total Variable Cost

**Net Cost:** The net cost was reckoned by deducting the imputed value of dung, from the gross cost, i.e.

Net Cost = Gross Cost - Imputed value of dung

**Cost per litre of Milk Production:** Average net maintenance cost per animal per day divided by average milk production per animal per day.

**Gross Returns:** Gross returns were obtained by multiplying milk yield of an individual animal with respective to prevailing price of milk in the study area, i.e.

Gross Returns = Quantity of milk x Market price of milk

**Price of Milk:** The weighted average price of milk and calculated as

$$Weighted average price=\frac{∑P\_{i}W\_{i}}{∑W\_{i}}$$

Where,

Pi is the price per litre of ith type of milk, and Wi is the total quantity in volume of ith type of milk sold by the farm.

**Net Returns:** Net returns were calculated by subtracting net cost from gross returns, i.e.

Net Returns = Gross Returns - Net Cost

**Profitability:** Worked out on the basis of selling of milk, selling of dung, milk retained at home and net returns over cost per litre of milk produced.

**Garrett’s Ranking Technique:**

In this method, respondent farmers were asked to rank the specific reason for practicing dairy enterprise. The assigned ranks were converted into percentage position which is subsequently transformed into Garrett Score using Garrett and Woodworth’s table (1969). For each reason, score of individual respondent was added together and then divided by total number of respondents. Thus, mean score for each was ranked by arranging them in descending order.

**Percentage Position = 100(Rij-0.05)/ Nj**

Where,

**Rij=** Rank given for the ith item by the jth individual and

**Nj**= Number of items ranked by jth individual.

**RESULTS AND DISCUSSION**

The socio-economic characteristics of the sample farmers including age, education and land holdings patterns are presented in the table 2.The sample included 58 marginal farmers (64.44 %), 22 small farmers (24.44 %) and 10 semi-medium farmers (11.11 %) out of 90 sample farmers. The average age of head of household was 41 years, ranging from 38 years to 42 years across different categories of farmers. This result demonstrate that the majority of the sample underlies in elderly farmers groups with maximum experience. The family size varied from 4 to 7 members in the household. Marginal farmers had low literacy rate as compared to small and semi-medium farmers. This disparity is attributed to unavailability of adequate finance to afford education among the marginal and small farmers while semi-medium farmers who were resource efficient could afford better education. The overall average land holding size was 0.96 ha, while the land holding size of the marginal, small and semi-medium farmers was 0.42 ha, 1.23 ha, and 3.49 ha, respectively. As land holding size increases, so did the resoucerses availability with the farmers, which enahance farmers ability to adopt modern scientific methods for agricultural practices and ultimately in managing the risks during droughts and floods in the Tal region.

**Table 2:** **Socio-economic characteristics of sample farmers**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Category** | **Average age of head of household** | **Family Size** | **years of schooling** | **Land holding (ha.)** |
| Marginal farmer | 42.21 | 6.74 | 3.75 | 0.42 |
| Small farmer | 39.64 | 5.64 | 5.00 | 1.23 |
| Semi-medium farmer | 38.10 | 4.10 | 6.90 | 3.49 |
| Overall | 41.12 | 6.18 | 4.41 | 0.96 |

 Table 3 portrays the cost and return of milk production from crossbred cows and it was observed that the average amount of total feed given to the milch animal was 22 kg/animal/day. Out of the total feed, the amount of green fodder, dry fodder and concentrate given to them were 13 kg, 5 kg and 4 kg per animal per day, respectively. The average annual cost in rearing crossbred cow was Rs. 62414 including the total variable cost of Rs. 55653 i.e. constituting 89.17 per cent of the total costs and total fixed cost of Rs. 6762 comprising 10.13 per cent of the total costs (Table 3).

The overall total return and net return obtained from the dairy enterprise by the sample farmers was Rs. 87275 and Rs. 24861 per household per annum, respectively. The farmers generated income of Rs. 85040 annually from sale of milk with return to cost ratio of 1.39. This ratio remained constant in the semi-medium and small farmer’s category while it was least for marginal farmers (1.33). This discrepancy has significant impact on the farmer’s choice of opting dairy as source of livelihood in Tal region of Bihar where crops cultivation is not viable, making dairy farming a more attractive alternative.

**Table 3: Cost and returns of milk production from cross-breed cow** (Rs./lt day)

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl.****No.** | **Particulars** | **Category of sample farmers** | **Overall (N=90)** |
| **Marginal farmer****(n1=58)** | **Small farmer****(n2=22)** | **Semi-medium farmer****(n3=10)** |
| 1 | Green Fodder | 10899 | 11410  | 11987 | 11145  |
| 2 | Dry Fodder | 7530  | 7837 | 8687 | 7733  |
| 3 | Concentrate | 12947  | 13775 | 14775 | 13352 |
| 4 | Veterinary Charges | 7110  | 7260 | 7523 | 7298 |
| 5 | Labour Cost | 8994 | 9767 | 10490 | 9750  |
| 6 | Interest on working capital@12% | 6179  | 6334 | 6696 | 6374 |
| A | Total Variable Cost(TVC) | 53659  | 56383 | 60157 | 55653  |
| 1 | Depreciation of shed | 1459 | 1433 | 1584 | 1492  |
| 2 | Depreciation of crossbred cow | 4553 | 4770 | 4994 | 4655  |
| 3 | Interest on fixed capital @10% | 601 | 620 | 658 | 615  |
| B | Total fixed cost | 6613  | 6824 | 7235 | 6762  |
|  | **Total cost** | **60271** | **63207** | **67392** | **62414**  |
| 1 | Milk yield/day | 6.62  | 6.81  | 7.14  | 6.75  |
| 2 | Milk yield/lactation | 1854 | 2043 | 2178 | 2025 |
| 3 | Sale of milk | 77851 | 85806 | 91463 | 85040 |
| 4 | Value of dung | 2099 | 2278 | 2329 | 2235 |
| 5 | Total return | 79950 | 88084 | 93792 | 87275 |
| 6 | Total Cost | 60271 | 63207 | 67392 | 62414 |
| 7 | Net return | 19679 | 24876 | 26400 | 24861 |
| 8 | Cost /litre of milk | 33 | 31 | 31 | 31 |
| 9 | Price/litre of milk | 42 | 42 | 42 | 42 |
| 10 | Net return/litre of milk | 9 | 11 | 11 | 11 |
| **Returnto cost ratio** | **1.33** | **1.39** | **1.39** | **1.39** |

Table 4 indicates the cost and return of buffalo milk production among sample farmers. The overall annual average cost incurred in buffalo rearing was Rs. 59602 This includes a total variable cost of Rs. 55,628, constituting 93.33 per cent of the total costs, and a total fixed cost of Rs. 3,974, accounting for 6.67per cent of the total cost. It was also observed that majority of expenditure was incurred on concentrates (25.52 %), green fodder (17.65 %) and dry fodder (11.86 %). Furthermore, the overall total return and net return from buffalo milk production was Rs. 79855 and Rs. 20252 per household per annum, respectively. It was also observed that the average cost per litre of milk production was Rs. 38 while the price prevailing for sale per litre of milk was Rs. 50. The average annual revenue generated from milk was Rs. 77687, and it was highest for the semi-medium category of the farmers and lowest among the marginal farmers with the return to cost ratio ranging from 1.30 to 1.35 indicating a consistent profitability across different categories of farmers.

### Table 4: Cost and returns of milk production from buffaloes (Rs./ltr./day)

|  |  |  |  |
| --- | --- | --- | --- |
| Sl.No. | **Particulars** | **Category of sample farmers** | **Overall****(N=90)** |
| **Marginal****farmer****(n1=58)** | **Small****farmer****(n2=22)** | **Semi-mediumfarmer****(n3=10)** |
| 1 | Green Fodder | 10304 | 10716 | 11344 | 10520 |
| 2 | Dry Fodder | 6982 | 7088 | 7541 | 7070 |
| 3 | Concentrate | 14717 | 15848 | 16662 | 15210 |
| 4 | Veterinary Charges | 7512 | 8264 | 8399 | 7794 |
| 5 | Labour Cost | 8559 | 8983 | 10165 | 8841 |
| 6 | Interest on working capital@12% | 6099 | 6249 | 6614 | 6193 |
| A | Total Variable Cost(TVC) | 54173 | 57148 | 60725 | 55628 |
| 1 | Depreciation of shed | 1239 | 1280 | 1339 | 1286 |
| 2 | Depreciation of buffalo | 2276 | 2385 | 2497 | 2328 |
| 3 | Interest on fixed capital @10% | 352 | 366 | 384 | 361 |
| B | Total fixedcost | 3867 | 4031 | 4219 | 3974 |
| **Total(A+B)** | **58039** | **61179** | **64944** | **59602** |
| 1 | Milk yield/day | 5.25 | 5.61 | 6.11 | 5.55 |
| 2 | Milk yield/lactation | 1470 | 1571 | 1711 | 1554 |
| 3 | Sale of milk | 73500 | 78540 | 85540 | 77687 |
| 4 | Value of dung | 2099 | 2278 | 2329 | 2168 |
| 5 | Total return | 75599 | 80818 | 87869 | 79855 |
| 6 | Total Cost | 58039 | 61179 | 64944 | 59602 |
| 7 | Net return | 17559 | 19639 | 22924 | 20252 |
| 8 | Cost /litre of milk | 39 | 39 | 38 | 38 |
| 9 | Price/litre of milk | 50 | 50 | 50 | 50 |
| 10 | Net return/litre of milk | 11 | 11 | 12 | 12 |
| **Returnto cost ratio** | **1.30** | **1.32** | **1.35** | **1.34** |

**Fig.1: Per cent cost incurred in milk production per household per annum**

Fig.1 indicates the percent cost incurred in milk production per household per annum on crossbred cow and buffalo, whereby it was observed that about 80 to 90 per cent of the total cost expenditure incurred in total variable cost that includes feed cost, veterinary charges and labour cost. The remaining cost expenditure accounts for 10 to 20 per cent that includes depreciation on sheds as well as animals and interest on fixed capitals. This clearly indicates that the farmers make majority of expense on variable cost as compared to fixed costs in dairy enterprise as the expenses on fixed capital incurs one time and after that the expenditure is made on maintainence purpose only.

The combined costs and returns of milk production from crossbred cows and buffaloes among different categories of farmers is presented in table 5. The average total return from milk sales was Rs. 445,274 per household per annum, with an incurred production cost of Rs. 333,497, resulting in a return-to-cost ratio of 1.37.

**Table 5: Comparative analysis of costs and returns for crossbred and buffalo milk production**

|  |  |  |
| --- | --- | --- |
| **Particulars** | **Category of sample farmers** | **Overall****(N=90)** |
| **Marginal farmer****(n1=58)** | **Small** **farmer****(n2=22)** | **Semi-medium****farmer****(n3=10)** |
| **Cross-breed cow** |
| No.of milch | 3 | 2 | 4 | 3 |
| Sale of milk | 231217 | 171612 | 384145 | 244065 |
| Value of dung | 6234 | 4556 | 9782 | 6414 |
| Total cost | 179005 | 126414 | 283046 | 179128 |
| Gross Income | 237452 | 176168 | 393926 | 250479 |
| Return to Cost ratio | 1.33 | 1.39 | 1.39 | 1.39 |
| **Buffalo** |
| No. of milch | 2 | 3 | 4 | 3 |
| Sale of milk | 160965 | 235620 | 342160 | 201209 |
| Valueofdung | 4597 | 6834 | 9316 | 5615 |
| Totalcost | 127105 | 183537 | 259776 | 154369 |
| GrossIncome | 165562 | 242454 | 351476 | 206824 |
| Return to Costratio | 1.3 | 1.32 | 1.35 | 1.34 |
| **Overall** |
| Sale of milk | 392182 | 407232 | 726305 | 445274 |
| Valueof dung | 10831 | 11390 | 19098 | 12030 |
| Total cost | 306110 | 309951 | 542822 | 333497 |
| Gross Income | 403013 | 418622 | 745402 | 457304 |
| Return to Cost ratio | 1.32 | 1.35 | 1.37 | 1.37 |

Table 6 presents the cause for practicing dairy farming in the Tal area among the sample farmers. The foremost reason was waterlogged situation in tal region, which hindered crop production throughout the year, ranking first with Garrett score 77. It was followed by the absorption of disguised family labour in dairy farming with Garrett score 63, and dairy also being the traditional source of livelihood to the residents of Tal region ranked third with Garrett Score 54. The dairy farming was preffered by the sample farmers due to limited opportunities for agriculture activities particularly during kharif season water logging prevent crop production. In addition to this the families engaged in disguised farm labour found dairy as viable alternate. The ease of maintenance with family labor, easy availability of cattle loans compared to crop loans, and convenient marketing of milk and dairy products further contributed to the preference for dairy farming among sample farmers.

**Table 6: Reason for dairy farming in the tal region**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl. No.** | **Reasons** | **Garrett’s Score** | **Garrett’s Rank** |
| 1. | Prolonged flood / waterlogged circumstance at Tal region fails to promote cropping over the year | 77 | I |
| 2. | Dairy farming absorbs disguised household labour. | 63 | II |
| 3. | The Tal region's residents traditionally rely on dairy as a source of income. | 54 | III |
| 4. | It requires relatively little labour and is easy to maintain. | 46 | IV |
| 5. | Disbursement of crossbred cow loans are easy as compared to crop loans | 37 | V |
| 6. | Marketing of milk and milk products conveniently done through loans procurement agencies | 23 | VI |

**CONCLUSION**

The state encounters the frequent incidence of flood especially in the Tal region and the residents are left with no other option than to opt dairy as means of livelihood. The region is dominated by the marginal and small farmers with average land holding size of 0.96 ha. It was found that more than 50 per cent of the people derive their livelihood from dairy enterprise and remaining were dependent on the other source of income such as crop production (pulses), small shops, self-employment, services etc. The average net return obtained from sale of cross bred cow milk and buffalo milk was Rs. 11 and Rs. 12 per litre, respectively and the average return per rupee invested was 39 paise and 34 paise, respectively. Hence, the dairy farming offers them a sustainable source of income and livelihood generation. However, the production cost of cow's milk has been observed to be higher than that of buffalo milk.

Farmers face a number of difficulties, including lower productivity, a lack of ideal breeds, a lack of organised dairy farms, and limited access to markets. Appropriate government initiatives and public-private partnerships are needed to address the high cost of feed and lower milk prices that farmers receive from retailers or dairy cooperatives. Appropriate extension services and research must be conducted to increase the profitability of the dairy industry for farmers in general and the Tal region in particular. Innovations in dairy farming must be promptly transferred to dairy farmers by livestock departments and consulting firms engaged in dairy development. This can be accomplished by planning demonstrations, trips, and exhibitions as well as by fostering closer ties with forward-thinking dairy producers. The government must make a special effort to set up visits to the agricultural, small-scale, and marginal workers in order to promote dairy centres. To boost milk production, the government has implemented a number of initiatives, including the National Dairy Plan (NDP) and the Rhastriya Gokul Mission. However, there hasn't been a rise in supply to match the rise in demand for milk. To tackle the problems ahead, more attention needs to be paid to milk production, distribution, marketing, and research facilities.

**REFERENCES**

Behera, J., Jha, S. K., Maiti, S., & Garai, S. (2020). Assessment of perceived economic impact of flood among the livestock-rearers of Odisha. *International Journal of Livestock Research*, **10**(11).

Bihar Economic Survey. (2022). Retrieved from: <https://prsindia.org/budget/states/bihar-budget>

FAO. (2003). Milk Production in India: Opportunities and Risks for Small Scale Producers. PPLPI Policy Brief. Food and Agricultural Organization, Rome.

Garai, S., Ghosh, M. K., Maiti, S., Garai, S., Meena, B. S., Dutta, T. K., & Kadian, K. S. (2022). Development and application of dairy-based sustainable livelihood security index in the districts of West Bengal, India: A tool for dairy development planning. *Journal of Rural Studies*, **93,** 187-195.

Gautam, P. K., & Jha, S. K. (2022). Status of Livelihood Security of Dairy Households in Bundelkhand: A Comparative Analysis. *Journal of Experimental Agriculture International*, **44**(10), 209-214.

Government of India. (2005). Some Aspects of Farming: Situation Assessment Survey of Farmers. NSS Report No. 496. National sample Survey Organization, Government of India.

Government of India. (2022). Department of Animal Husbandry & Dairying. Retrieved from: <https://dahd.nic.in/sites/default/filess/Districtwise%20cattle%20population%202019_1.pdf>.

Kumar, A., Singh, K. M., & Singh, R. (2012). Role of livestock sector in sustainable livelihood security in Bihar: Status and opportunities. *Available at SSRN 2062823*.

Mishra, P. K. (2017). Socio-economic impacts of climate change in Odisha: issues, challenges and policy options. *Journal of Climate Change*, **3**(1): 93-107.

Monobrullah, M., Raizada, A., Singh, D. K., Tamta, M., Kumar, U., Kumar, R., & Kumar, A. (2024). Estimation of Economic Losses in Farming due to Climatic Aberrations in East Champaran, Bihar. *Economic Affairs*, **69**(4), 1567-1572.

Nandy, S. (2005). Floods in India–disaster and management. *Convenar Moksha, Member Centre for Built Environment*, 1-19.

Randolph, T. F., Schelling, E., Grace, D., Nicholson, C. F., Leroy, J. L., Cole, D. C., & Ruel, M. (2007). Invited review: Role of livestock in human nutrition and health for poverty reduction in developing countries. *Journal of animal science*, **85**(11): 2788-2800.

Swain, D. P., Das, B. C., Swain, P., Chandraker, K., & Mohapatra, M. M. (2018). Gomitras Vis–A-Vis Veterinary Officials in Jagatsingpur District of Coastal Odisha in Regards to Compatibility, Cohesiveness and Co-ordination. International Journal of Current Microbiology and Applied Sciences, **7**(9): 2376-2382.

Thornton, P. K. (2010). Livestock production: recent trends, future prospects. *Philosophical Transactions of the Royal Society B: Biological Sciences*, **365**(1554): 2853-2867.

**Web reference:**

[Milk Production in India | nddb.coop](https://www.nddb.coop/information/stats/milkprodindia)