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Assessment of livestock feeding practices and their impact on dairy productivity

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Abstract

The global agricultural system is based on livestock production, which provides food security and livelihoods to rural populations in India, the largest milk producer in the world. Dairy farming is an important sector of the Punjab economy, with a high propensity towards buffalo production in the production because of high milk fat content and market price. Amid its significance, there is still suboptimal dairy productivity as there is a major gap between scientifically recommended feeding and traditional management practices. The research was done in ten villages in the SAS Nagar (Mohali), Fatehgarh Sahib, and Rupnagar districts of Punjab to evaluate the current feeding methods and their influence on productivity.

The data was gathered as primary data through the use of 120 livestock farmers through structured questionnaires and personal interviews during the Rural Agricultural Work Experience (RAWE) programme. The results indicate that there is high dependency on the conventional Rice-Wheat cropping rotation (90% and 96.7% respectively), which provides the much-desired wheat straw (turi) by 100 percent of the respondents as a primary roughage. Although 93.3 percent of farmers own buffaloes and 86.7 percent own cows, most (63.3) have only a partial knowledge of the balanced ration, with one-fourth completely ignorant of the scientific standards of feeding. Therefore, there is a wide range of milk production with 41.7 per cent of farmers indicating that they have achieved over 10 liters per day with the crossbred cattle and balanced feeding, and 15 per cent have obtained less than 5 liters per day using the traditional, non-scientific production techniques.

The research mentions a few crucial limitations, the most important of which is a high expenditure on inputs (46.7%), the absence of insurance (18.3%), and the low prices of milk purchases (15.0%). The research indicates that Ration Balancing Programs (RBP), area-specific mineral supplementation and the increase of maize silage conservation should be implemented to alleviate seasonal fodder deficits and to increase productivity. The gap in knowledge and the need to shift the farming community towards sustainable, data-driven dairy management require strengthening the so-called last-mile extension services and veterinary support.

Keywords: Dairy productivity, livestock feeding, Punjab agriculture, balanced ration, smallholder farmers, fodder conservation

1. Introduction

Production of livestock is a part and parcel of the world agricultural system which plays a vital role in the food security, nutrition and livelihoods of rural communities. Livestock industry contributes to almost forty percent of the world agricultural production and sustains the livelihood of more than one billion individuals across the world (FAO, 2011; FAO, 2022) ^[1, 2]. Particularly, dairy farming is instrumental in offering quality protein and other key nutrients as well as act as a consistent source of income to farming communities.

The largest milk producer in the world is India, which produces over 23 percent of the world milk, and the dairy industry is turning out to be a key source of agricultural growth and rural development (NDDB, 2023) ^[3]. The livestock industry is a major contributor to agricultural GDP and a source of livelihood to a massive proportion of the rural population especially small and marginal farmers. Smallholder production systems are a major feature of dairy farming in India, with livestock being closely and intricately linked with crop production and being a significant source of income diversification and risk mitigation.

Punjab is one of the top milk producers in the country and has a well-established dairy industry and per capita milk production is high in the state. Rearing of livestock in Punjab is a key element of the agriculture system with preference towards buffalo dairy production because of better market value and higher milk fat content. The productivity of dairy animals is still less than optimum in most regions despite better technologies and management practices being available.

One of the most important aspects that affect the livestock productivity is feeding management because it has a direct impact on the milk yield, health of the animals, and their reproductive performance. Balanced ration, green fodder, concentrates, and mineral mixture supplementation are all scientific feeding methods that are necessary to realize maximum productivity (Deen *et al*; 2019) [5]. Nevertheless, some studies have indicated that a big percentage of farmers still use the traditional feeding methods that are usually not sufficient to support the nutritional needs of the dairy animals. This plays out as reduced productivity and economic inefficiencies.

Moreover, there is a huge disparity between the suggested and actual feeding practices because of absence of awareness, high feed cost, inadequate access to extension services, and seasonal fodder shortages (Yadav *et al*; 2026) [4]. These limitations should be addressed to facilitate livestock production and increase the income of farmers.

In this regard, the current research seeks to evaluate the current feeding traditions practised by farmers on livestock as well as to examine its effects on the productivity of dairy. The paper is also aimed at determining the limitations of the farmers and proposing appropriate actions that can be used to advance the use of science in feeding and developing livestock in a sustainable manner.

2. Materials and Methodology

The current research was done in selected villages of SAS Nagar (Mohali), Fatehgarh Sahib and Rupnagar districts of Punjab. Ten villages, Bajheri, Deh Kalan, Mehmoodpur, Mandlan, Karimpura, Kalaundi, Dugri, Kotli, Dholan Majra and Dumna were chosen according to their proximity to the university and accessibility during the RAW (Rural Agricultural Work Experience) programme. Such villages can be considered as the common rural farming systems where livestock is a part of the life of the farmers.

Primary data was used to conduct the study, where 120 livestock farmers were surveyed through the questionnaire method. The main data collection tool was a structured questionnaire that contained questions pertaining to livestock composition, feeding habits, fodder supply and milk production. Each respondent was surveyed separately to have accuracy and reliability of the information.

Face-to-face personal interviews (in the local language (Punjabi)) were used to collect data, which served to understand the questions better by the respondents and achieve better quality of responses.

Data gathered were tabulated, categorized and analysed through simple statistical methods of frequency and percentage. The following formula was used to calculate the percentage of respondents with each parameter:

$$\text{Percentage (\%)} = \frac{\text{Number of respondents}}{\text{Total number of respondents}} \times 100$$

The data analysed were in a tabular form to enable easy interpretation and meaningful analysis of livestock feeding

habits and how they influence dairy production.

3. Results and Discussion

3.1 Cropping Pattern of Farmers (N=120)

The data indicate that there is a strong dependency on the traditional Rice-Wheat rotation with 90% and 96.7 percent of the farmers planting the crops respectively because of the need to have stable grain and straw production. About 35 percent of the farmers include Maize, which is a dual-purpose crop that will deliver both grain and green fodder to the dairy animals that are reported in the study. A smaller proportion of 18.3% of farmers are involved in Potato cultivation suggesting localized intensification and increased market-oriented spending in particular groups of S.A.S Nagar and Fatehgarh Sahib.

Table 1: Cropping pattern followed by farmers

Crop	No. of farmers	Percentage
Rice	108	90%
Wheat	116	96.7%
Maize	42	35%
Potato	22	18.3%



Fig 1: Wheat field



Fig 2: Harvested potato bags ready for transport

3.2 Type of Livestock Owned by Farmers (N = 120)

Most farmers (more than 80 percent) have a mixed herd of cows and buffaloes. This is done to counter the milk fat content

(greater in buffaloes) and milk volume (greater in crossbred cows) to suit the market needs. The livestock species that is common in these Punjab clusters is buffaloes; which is an effective source of backbone to the rural dairy economy since it is adaptable and the milk produced by buffaloes is in high demand in the market.

Table 2: Type of Livestock Owned by Farmers

Type of animal	No. of farmers	Percentage
Cow	104	86.7%
Buffalo	112	93.3%
Non-Milch (Draft/Young stock)	45	37.5%

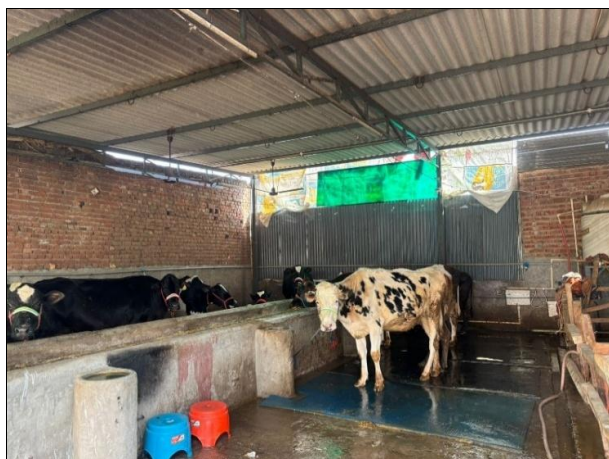


Fig 3: Livestock shed

3.3 Source of Fodder (n = 120)

In these clusters, where the highest production cost is avoided through growing their own green fodder (Berseem in winter and Maize/Sorghum in summer), the farmers, who are about 95 percent of the farmers in these clusters, focus on producing their own green fodder. All farmers surveyed use wheat straw (turi) as the main dry roughage that is usually stored throughout the year to provide bulk feed. The use of Maize Silage (Makki ka achar) is an increasing trend in Rupnagar and SAS Nagar. Other forward-looking farmers even have silage factories (e.g. in Dugri village) to feed the local community at the lean times.

Table 3: Source of Fodder

Source of Fodder	No. of farmers	Percentage
Self-Cultivated (Own Land)	114	95.00%
Crop Residues (Wheat/Rice Straw)	120	100.00%
Purchased Fodder (Green/Dry)	22	18.30%



Fig 4: Fresh green fodder provided for dairy cattle feeding.

1.4 Awareness about Balanced Ration (n = 120)

The largest group of farmers (63.3%) have only partial awareness, which is usually related to the knowledge of the necessity to combine various types of feed, but does not involve the technical accuracy in balancing the ratio properly. A quarter of the surveyed population (25.0) is completely unfamiliar with the concepts of balanced feeding and uses more traditional, non-measured practices that in most cases increase the cost of input and reduce the output. Very few farmers (11.7 percent) are well informed on the scientific feeding standards, indicating that extensive extension campaigns are required to guide the rest of the farming population into more lucrative and fact-based dairy management.

Table 4: Awareness about Balanced Ration

Awareness level	No. of farmers	Percentage
Fully aware	14	11.7%
Partially aware	76	63.3%
Not aware	30	25.0%

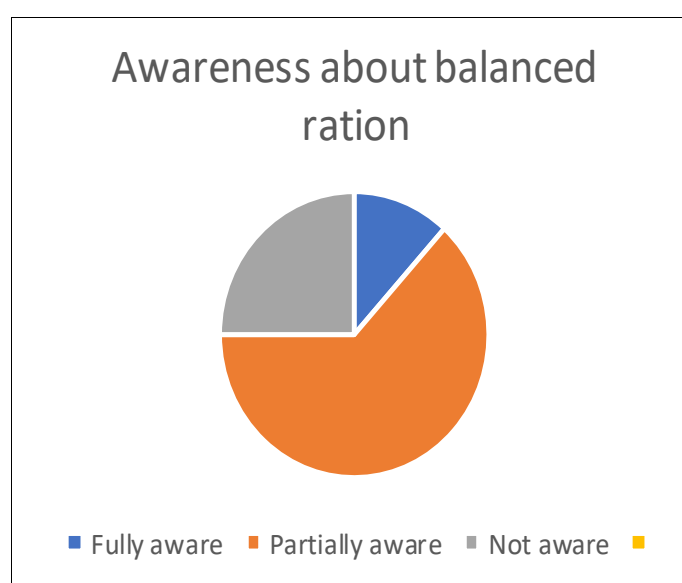


Fig 5: Depicts awareness about balanced ration

1.5 Average Milk Yield per Day (N = 120)

The highest percentage of farmers (43.3) attain 5-10 litres per animal yield, which is the average of the Murrah buffaloes and mid-potential crossbred cows in normal management. About 41.7 percent of the farmers are indicating over 10 litres per day and 15 percent over 15 litres most probably because of the introduction of high potential HF/Jersey crossbreds and balanced scientific feeding. On the other hand, 15 percent of the respondents are at the bottom of the ladder of lower than 5 litres, indicating a segment that may be focused on indigenous breeds or non-scientific methods of feeding that inhibit genetic possibilities. This distribution validates that, although the region is generally very productive, there is still a lot to be done to improve the bottom 15% by increasing their knowledge about balanced rations and mineral supplementation.

Table 5: Average Milk Yield per Day

Milk Yield (Litre/Animal/Day)	No. of farmers (N=120)	Percentage
Less than 5	18	15.0%
5- 10	52	43.3%
10- 15	32	26.7%
Above 15	18	15.0%

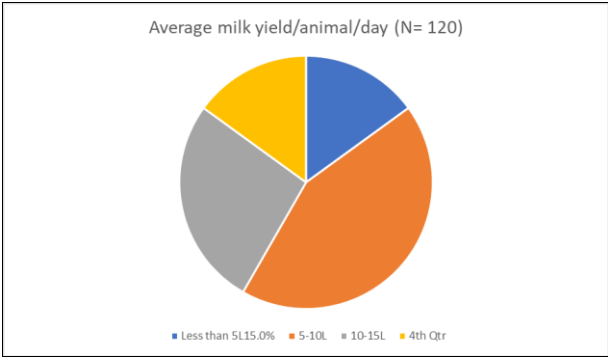


Fig 6: Depicts average milk yield

1.6 Constraints Faced by Farmers (n = 120)

Almost fifty per cent of the respondents saw increased input prices (feed and fodder) as their greatest challenge, which directly impacted the profit margins in the SAS Nagar and Rupnagar clusters. Almost one-fifth cited the absence of cattle insurance as their major issue, and the risk of losing high-priced high-yielding animals was high. The other farmers are mostly discouraged by the poor prices of milk (15%), scientific ignorance (11.7%), or late veterinary services (8.3) and they need to have improved last-mile extension services.

Table 6: Constraints Faced by Farmers

Constraints	No. of farmers	Percentage
High Cost of Inputs	56	46.7%
Lack of Insurance & Credit	22	18.3%
Inadequate Milk Procurement Price	18	15.0%
Lack of Awareness	14	11.7%
Lack of Veterinary & Extension Services	10	8.3%

3.7 Vaccination status of livestock among farmers (n = 120)

The network of local and personal veterinarians that have close ties with farmers has been the main factor in the high percentage of vaccination at 88.3. The farmers in the SAS Nagar and Fatehgarh Sahib clusters tend to have personal vets as they are readily available whenever needed and because of the trust that has been established through frequent visits to their farms. The few non-vaccinating farmers usually explained the temporary reduction in milk production following the vaccination, or they did not have information on timing, or they were absent when the mobile veterinary clinic came to their farm.

Table 7: Vaccination status of livestock among farmers

Vaccination status	No. of farmers	Percentage
Vaccinated	106	88.3%
Not vaccinated	14	11.7%

4. Recommendations and Suggestions

4.1 Adoption of Ration Balancing Programs (RBP)

The survey found out that only 63.3 percent of the farmers possess partial knowledge about balanced rations. Technical interventions like Ration Balancing Programs (RBP) are suggested to fill this gap. Milk production can be enhanced by 2-14 percent and milk fat level can be enhanced by 0.15-0.2 percent through scientific balancing of local feed resources, which is usually crop residues such as wheat straw combined with green fodder (Singh *et al.*, 2024) [9]. This shift towards the unmeasured feeding as traditional to the data-driven nutrition is necessary to achieve the genetic potential of high-yielding breeds.

4.2 Strategic Supplementation of Area-Specific Mineral Mixtures

As a lot of farmers in the SAS Nagar and Rupnagar clusters are using traditional feeding, mineral deficiencies tend to be neglected. High-impact, low-cost strategy is implementation of area-specific mineral mixtures. In other Punjab areas (like the Kandi region of Hoshiarpur), daily mineral supplementation was linked with an increase in milk yield (by 15 percent) and fat percentage (by 12.5 percent) (Kour *et al.*, 2025) [6]. The practice has also been shown to increase yields alongside the conception rate by up to 75 percent, which is in response to the reproductive limitations that have been observed in regional dairy systems (Singh, 2020) [8].

4.3 Fodder Conservation and Silage Promotion

Seasonal scarcity is a bottleneck with 95% of farmers self-cultivating fodder. The increasing tendency of using Maize Silage in Rupnagar and SAS Nagar ought to be scaled. The studies show that maize silage supplements in lean periods (e.g., November-December) substantially enhance fat-corrected milk (4% FCM) and the benefit-cost ratio to 1.28 in comparison with conventional diets based on wheat straws (Kour *et al.*, 2022) [6]. By setting up community-related silage banks, the smallholders will be insured against the seasonal shortage of fodder and the increase in the prices of inputs.

4.4 Strengthening Extension Services and Market Linkages

Scientific illiteracy (11.7%) and poor milk purchase prices (15%) are severe institutional challenges. Institutions such as GADVASU (Guru Angad Dev Veterinary and Animal Sciences University) should work towards extending their work in terms of training feed millers and farmers on quality assurance. High economic risk of losing high-yielding, expensive animals can be reduced by enhancing "last-mile" veterinary care, and access to affordable cattle insurance.

5. Conclusion

In Punjab, the livestock industry has continued to be the backbone of rural livelihoods, especially in the SAS Nagar, Fatehgarh Sahib and Rupnagar districts where dairy farming is closely associated with the conventional rice-wheat agriculture. This study substantiates that though the area has a good abundance of buffaloes and crossbred cows, dairy productivity is grossly affected by an endemic knowledge-practice gap. The result shows that although Punjab is the largest milk producer in India, 63.3 per cent of farmers have partial knowledge of balanced rations and 25 per cent of farmers were found to be totally ignorant of the scientific principles of feeding. Such imprecision in the technical side causes the use of traditional and unmeasured procedures that tend to be inadequate in satisfying the nutritional needs of the animals, hence less than optimal yields, as shown by the 15% of respondents, who reported less than 5 liters per animal per day. Economic barriers also make the shift to modernization difficult. Increased feed and fodder prices (mentioned by 46.7% of the respondents) and uninsured livestock (18.3%) put smallholder farmers in a high-risk situation. The research presents a perfect example of this correlation in that balanced feeding translates into increased yields, whereas traditional practices translate into reduced productivity and inefficiencies in economies. To conclude, the shift between the traditional and experience-based dairy management (scientific and data-driven) is a key to the sustainable development of the industry in Punjab. The need

to manage constraints by engaging in intensive extension programs, area based mineral supplementation, and fodder conservation, i.e. by using maize silage will be vital in closing the productivity gap. Through a combination of these scientific methods and improved market prices and veterinary services, farmers will be able to realize the full genetic potential of their animals and therefore with assurance of their livelihoods and an improved overall agricultural GDP of the area.

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