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Role of Livestock in enhancing farm income and sustainability in rice–wheat cropping system of Punjab, India

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Abstract

Agriculture in Punjab is predominantly characterized by the rice–wheat cropping system, which has contributed significantly to food security but has raised concerns regarding long-term sustainability and resource degradation. In this context, integration of livestock into farming systems has emerged as a potential strategy for enhancing farm income and improving resource-use efficiency. The present study was undertaken to examine the role of livestock in strengthening farm income and sustainability among farmers in eastern Punjab. The study was based on primary data collected from approximately 60 farmers across ten villages in Sahibzada Ajit Singh Nagar, Fatehgarh Sahib, and Rupnagar districts using a structured interview schedule. The survey encompassed key parameters including socio-economic characteristics, cropping patterns, nutrient management, mechanization, pest and disease management, and livestock practices. The findings revealed a predominant rice–wheat cropping system, with most of farmers cultivating wheat (83.33%) and rice (66.67%), while livestock rearing was practiced by about 66.7% of respondents, primarily for milk production. Integration of livestock facilitated efficient utilization of crop residues as feed and application of farmyard manure, contributing to improved nutrient recycling. Although 83.33% of farmers adopted integrated nutrient management, chemical-based pest and weed control practices remained dominant. Despite the evident economic and ecological benefits, significant gaps were observed, particularly in terms of low awareness of government livestock schemes (25%) and absence of livestock insurance coverage. The study concludes that while livestock plays a crucial role in income diversification and sustainability, targeted extension interventions, improved awareness, and scientific livestock management practices are essential to fully realize its potential in the rice–wheat production system.

Keywords: Livestock integration, farm income diversification, sustainability, rice–wheat cropping system, Punjab agriculture

1. Introduction

Agriculture continues to play a pivotal role in the Indian economy, contributing significantly to food security, employment, and rural livelihoods. Among various states, Punjab has been at the forefront of agricultural transformation since the Green Revolution, largely due to the widespread adoption of high-yielding varieties, irrigation infrastructure, and farm mechanization. The state is predominantly characterized by the rice–wheat cropping system, which has ensured stable production and economic returns for farmers (Pradhan & Meena, 2022) ^[5]. However, the long-term sustainability of this system has come under increasing scrutiny due to issues such as groundwater depletion, declining soil fertility, excessive reliance on chemical inputs, and reduced biodiversity (Kaur *et al.*, 2023; Singh *et al.*, 2021) ^[1, 7].

In recent years, there has been growing emphasis on integrated farming approaches to address these challenges and enhance farm resilience. Livestock, as an integral component of farming systems, plays a crucial role in supplementing farm income and improving resource-use efficiency (Lemaire, 2023) ^[4]. It provides regular cash flow through milk production while facilitating nutrient recycling through the application of farmyard manure (FYM) and efficient utilization of crop residues as feed (Tufail *et al.*, 2025) ^[8]. Such integration reduces dependency

on external inputs and contributes to ecological sustainability (Shyam *et al.*, 2023) [6]. Evidence from field-level observations indicates that a substantial proportion of farmers in Punjab practice livestock rearing alongside crop cultivation, highlighting its importance in diversified farming systems.

Despite its recognized benefits, the integration of livestock within the rice–wheat system remains suboptimal. Farmers continue to rely heavily on chemical fertilizers and pesticides, and institutional support mechanisms such as extension services, government schemes, and livestock insurance are inadequately utilized (Leharwan *et al.*, 2023) [3]. Limited awareness and access to scientific management practices further constrain the effective contribution of livestock to farm sustainability and income enhancement (Kashyap *et al.*, 2022) [2]. These gaps indicate a disconnect between recommended integrated farming practices and their actual adoption at the field level.

The present study was conducted in ten villages across Sahibzada Ajit Singh Nagar, Fatehgarh Sahib, and Rupnagar districts of Punjab to analyse the role of livestock in enhancing farm income and sustainability within the rice–wheat cropping system. By examining socio-economic characteristics, cropping patterns, resource management practices, and livestock integration, the study aims to provide empirical insights into the contribution of livestock to economic stability and sustainable agriculture, while identifying key constraints that limit its full potential.

Objectives of the Study

The present study was undertaken with the following specific objectives:

- To assess the extent and pattern of livestock integration in the rice–wheat cropping system among farmers in selected districts of Punjab.
- To evaluate the contribution of livestock to farm income and resource-use efficiency, particularly through income diversification, crop residue utilization, and nutrient recycling practices.
- To identify existing gaps and constraints in livestock-based farming systems, including institutional support, awareness of government schemes, and adoption of scientific management practices.

2. Materials and Methods

A field-based investigation was conducted in ten villages—Bajheri, Deh Kalan, Mehmoodpur, Mandlan, Karimpura, Kalaundi, Dugri, Kotli, Dholan Majra, and Dumna—across Sahibzada Ajit Singh Nagar, Fatehgarh Sahib, and Rupnagar districts of Punjab to evaluate the role of livestock in enhancing farm income and sustainability within the rice–wheat cropping

system. These villages were selected as they represent typical agricultural conditions of central Punjab characterized by intensive cultivation and mixed farming practices.

Primary data were collected from approximately 60 farmers using a structured and pre-tested interview schedule. Respondents were selected through random sampling to ensure adequate representation across different socio-economic groups and landholding categories. The survey collected detailed information on socio-economic characteristics, cropping patterns, input utilization, mechanization, pest and disease management, and livestock practices, with particular emphasis on livestock integration, income contribution, and resource recycling through crop residues and farmyard manure.

The data were systematically compiled, tabulated, and analysed using descriptive statistical tools, including frequency distribution and percentage analysis. A comparative assessment between livestock and non-livestock farmers was also carried out to evaluate differences in income generation, input use, and sustainability-related practices.

3. Results and Discussion

3.1 Socio-Economic Profile of Farmers

The socio-economic characteristics of farmers significantly influence integrated farming systems under the rice–wheat cropping system in Punjab (Table 1). Most respondents belonged to the middle age group (40–60 years), indicating that farm management is largely driven by experienced individuals, while lower youth participation raises concerns about long-term sustainability. Nuclear family systems were predominant, suggesting limited labour availability and a preference for enterprises such as dairy farming that provide regular income with manageable labour requirements.

Medium landholdings dominated the sample, reflecting the typical agrarian structure of the region. Farm size influenced the extent of integration, with medium farmers more actively combining crop and livestock enterprises, whereas smallholders relied on livestock for supplementary income. Farmers primarily depended on informal information sources, indicating limited access to formal extension services and scientific management practices.

Livestock rearing, mainly dairy-based, was widely integrated with cropping systems through residue utilization and manure recycling, enhancing resource-use efficiency and income stability. Overall, livestock remains a key component of integrated farming systems, though its potential is constrained by limited institutional support. These characteristics indicate that socio-economic factors directly influence the adoption and effectiveness of livestock integration.

Table 1: Socio-Economic Characteristics of Sample Farmers under Rice–Wheat System in Punjab

S. No.	Variable	Category	Number of Farmers (N=60)	Percentage (%)
1	Age Group (years)	< 40	12	20.00
		40–60	40	66.67
		> 60	8	13.33
2	Family Type	Nuclear	41	68.33
		Joint	19	31.67
3	Education Level	Up to Primary	20	33.33
		Secondary	26	43.33
		Graduate & above	14	23.33
4	Information Sources	Informal (farmers, dealers)	37	61.67
		Formal (KVKs, extension)	23	38.33

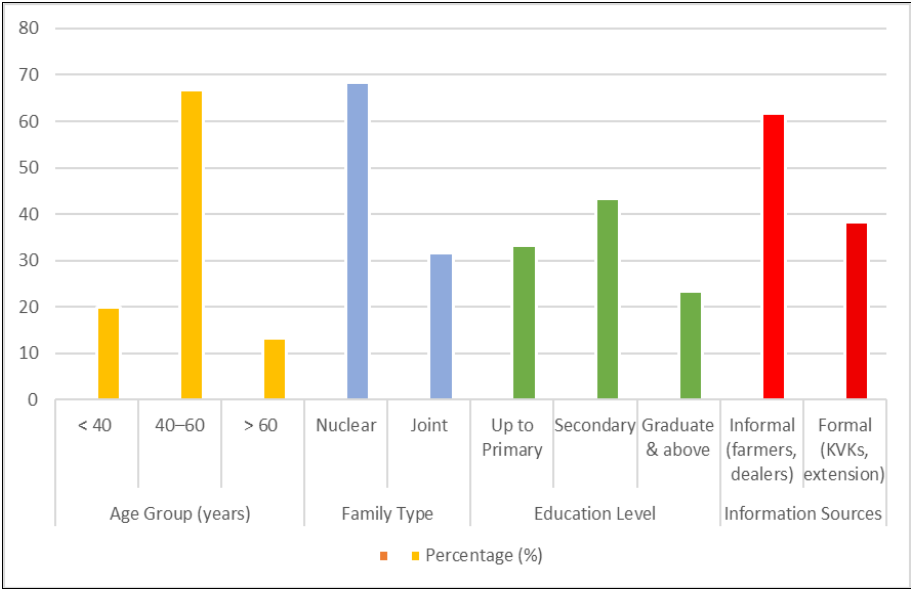


Fig 1: Socio-economic profile of farmers

3.2 Farming System Characteristics

The farming systems were predominantly based on the rice–wheat cropping pattern, typical of Punjab (Table 2). Many farmers practiced crop–livestock integration, with dairy animals as the central component, reflecting strong complementarities between crop and livestock enterprises. The dominance of crop–livestock systems (63.33%) further support this observation. Fodder cultivation, along with the use of crop residues as feed and manure recycling, indicates effective resource utilization

within the system. In contrast, crop-only systems were less prevalent, suggesting a shift toward diversification for income stability. The dominance of dairy-based integration highlights livestock as a reliable source of regular income, complementing seasonal crop production. Overall, integrated systems enhance resource-use efficiency and resilience, although limited diversification beyond dairy indicates scope for further improvement.

Table 2: Farming System Typology and Integration Pattern

Variable	Category	Number (N=60)	Percentage (%)
Farming System Type	Crop only (rice–wheat)	15	25.00
	Crop + livestock (dairy-based)	38	63.33
	Mixed farming (incl. small ruminants/poultry)	7	11.67
Integration Practices	Fodder cultivation	32	53.33
	Crop residue use as feed	46	76.67
	Manure recycling (FYM)	42	70.00

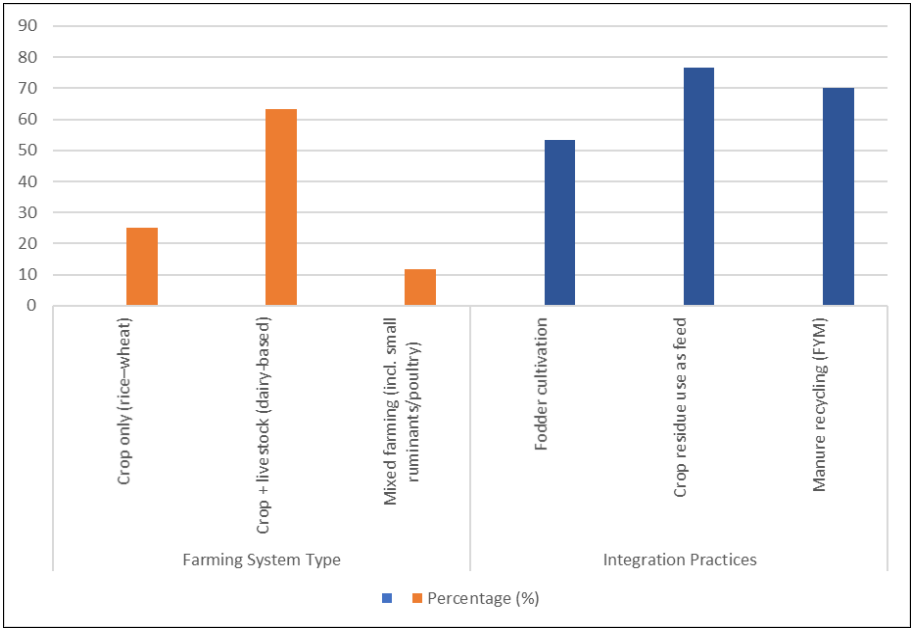


Fig 2: Farming system typology and integration practices

3.3 Cropping Pattern as a Basis for Crop–Livestock Integration

The cropping pattern of the surveyed farmers (Table 3) highlights the dominance of the rice–wheat system, with wheat cultivated by 83.33% and rice by 66.67% of respondents. While this reflects the prevailing monocropping structure of Punjab’s agriculture, the relevance of the cropping system to livestock integration becomes evident through the presence of fodder crops. Approximately 41.67% of farmers cultivated fodder crops such as berseem, which serve as a critical input for livestock rearing.

Village-level analysis reveals a strong association between

fodder cultivation and livestock ownership. Villages such as Mandlan, Karimpura, and Dugri, where fodder cultivation reached 100%, also exhibited complete livestock integration. In contrast, villages lacking fodder cultivation, such as Mehmoodpur and Kotli, showed no livestock adoption. This demonstrates that the cropping pattern is not merely a production system but also a structural determinant of crop–livestock integration, facilitating the internal flow of resources within integrated farming systems. This structural linkage between cropping patterns and livestock forms the foundation of integrated farming systems in the study area.

Table 3: Cropping Pattern and Fodder Integration (% of Farmers)

Crop	Bajheri	Deh Kalan	Mehmoodpur	Mandlan	Karimpura	Kalaundi	Dugri	Kotli	Dholan Majra	Dumna	Overall (%)
Rice/Paddy	100	100	0	0	100	100	100	0	100	100	66.67
Wheat	100	100	100	100	100	100	100	100	100	100	83.33
Maize	100	100	0	100	0	100	100	0	0	0	50.00
Sugarcane	33.33	0	100	0	0	0	0	0	0	0	16.67
Fodder (Berseem)	33.33	0	0	100	100	0	100	0	0	0	41.67

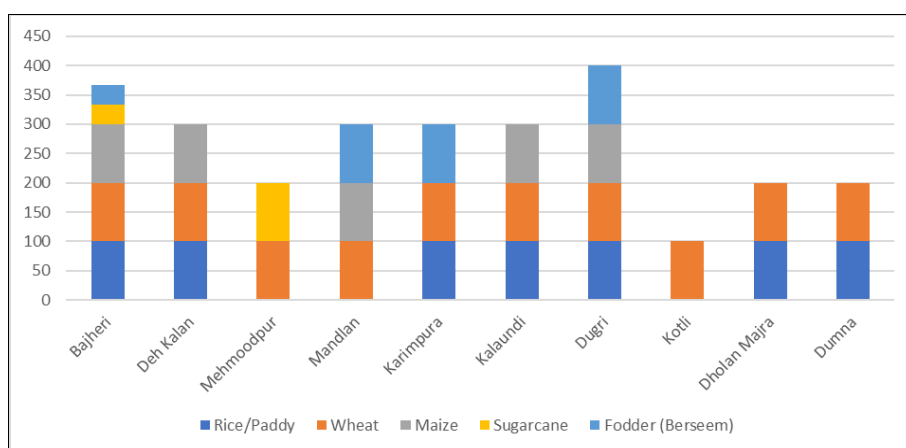


Fig 3: Village-wise cropping pattern and fodder distribution

3.4 Livestock Rearing and Degree of System Integration

Livestock rearing was practiced by 66.7% of the surveyed farmers (Table 4), indicating a moderate level of integration within the rice–wheat system. However, the distribution of livestock ownership was uneven across villages. Fully integrated villages such as Karimpura, Dugri, Mandlan, and Dumna recorded 100% livestock ownership, whereas Mehmoodpur, Kotli, and Dholan Majra reported no livestock rearing, reflecting the coexistence of integrated and non-integrated farming systems within the study area.

Among livestock-owning farmers, 66.7% were engaged in milk sale, suggesting that livestock serves primarily as a commercial

enterprise rather than a subsistence activity. This highlights the economic significance of livestock in enhancing farm income. Despite its widespread adoption, livestock integration remains largely informal and farmer-driven. Institutional support is limited, as only 25% of farmers were aware of government livestock schemes, and none reported having livestock insurance. This lack of institutional linkage restricts the potential of livestock as a risk-buffering and income-enhancing component of farming systems. This indicates that livestock integration, though economically important, remains insufficiently supported by institutional mechanisms.

Table 4: Livestock Ownership and Utilization Pattern (%)

Parameter	Bajheri	Deh Kalan	Mehmoodpur	Mandlan	Karimpura	Kalaundi	Dugri	Kotli	Dholan Majra	Dumna	Overall (%)
Keep Livestock	66.7	100	0	100	100	100	100	0	0	100	66.7
No Livestock	33.3	0	100	0	0	0	0	100	100	0	33.3
Sell Milk	66.7	100	0	100	100	100	100	0	0	100	66.7
Home Use Only	0	0	0	0	0	0	0	100	0	0	8.3
Aware of Schemes	66.7	0	0	100	0	0	0	0	0	100	25.0
Livestock Insurance	0	0	0	0	0	0	0	0	0	0	0

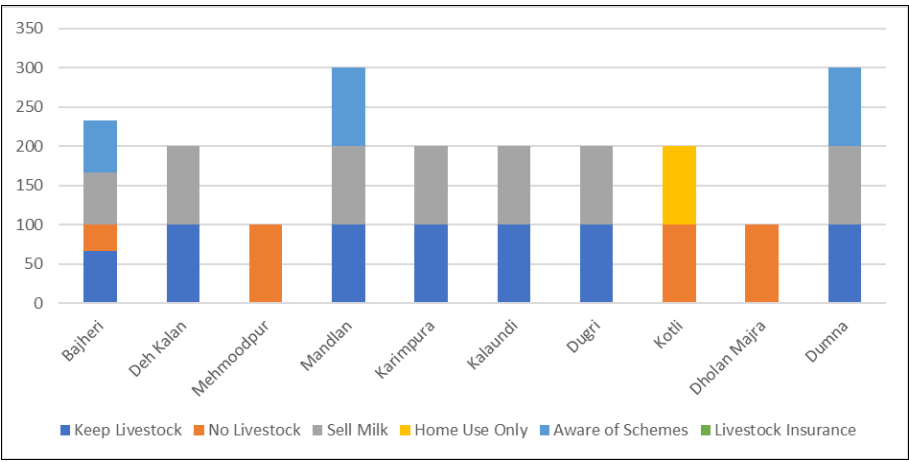


Fig 4: Livestock dynamics and institutional awareness across villages

3.5 Contribution of Livestock to Farm Income

Livestock contributes significantly to farm income under the rice–wheat system, accounting for about one-fourth of total income (Table 5). Similar findings have been reported in integrated farming systems where livestock acts as a stabilizing source of income and reduces economic risk for farmers (BIRTHAL *et al.*, n.d.) [9]. While crop production remains dominant, livestock provides a stable and continuous income source. Livestock contributed approximately 24.10% of total farm income, emphasizing its economic significance. Its contribution varies across farm categories, with marginal and small farmers showing higher dependence on livestock, whereas medium and large farmers rely more on crop income. Despite this, livestock remains economically important across all groups by reducing income variability and enhancing financial stability. The dominance of dairy-based systems further strengthens this role through regular cash flow from milk production. Overall, livestock serves as a key component of integrated farming systems, supporting income stability and resilience, particularly for smaller farmers.

Table 5: Relative Contribution of Livestock to Total Farm Income

Farm Category	Crop Income (%)	Livestock Income (%)
Marginal	64.00	36.00
Small	68.18	31.82
Medium	76.19	23.81
Large	80.00	20.00
Overall	75.90	24.10

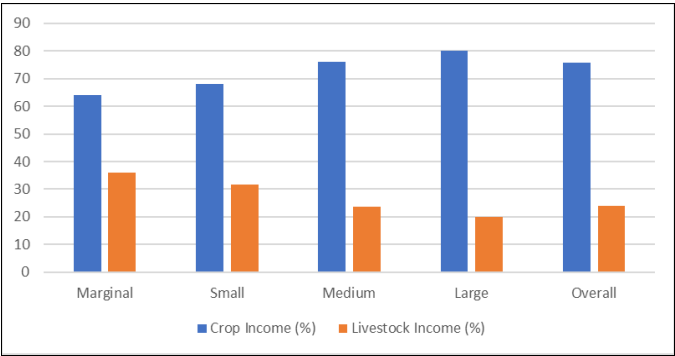


Fig 5: Income composition by farm category

3.6 Resource Use Efficiency and Recycling

Resource-use efficiency is a key advantage of integrated farming systems under the rice–wheat cropping system in Punjab (Table 6). Previous studies have also highlighted that crop–livestock

integration improves nutrient cycling and reduces dependence on external inputs through effective recycling of residues and manure (Kashyap *et al.*, 2022) [2]. The findings indicate widespread adoption of internal resource recycling practices, particularly in crop–livestock systems. High adoption of residue utilization (76.67%) and manure recycling (70.00%) indicates strong internal resource cycling. A large proportion of farmers utilized crop residues as livestock feed, reducing feed costs and minimizing waste. Similarly, the application of farmyard manure in crop fields was commonly practiced, contributing to improved soil fertility and reduced dependence on chemical fertilizers. Fodder cultivation further supported livestock integration by ensuring a consistent feed supply within the farm. These practices reflect strong linkages between crop and livestock components, enhancing overall system efficiency. Resource recycling not only lowers input costs but also promotes environmental sustainability by reducing external inputs and improving nutrient cycling. Overall, integrated farming systems demonstrate higher resource-use efficiency through effective recycling mechanisms, reinforcing the role of livestock in sustaining productivity and farm resilience.

Table 6: Resource Recycling Practices in Integrated Farming Systems

Resource Recycling Practice	Number of Farmers (N=60)	Percentage (%)
Crop residue used as feed	46	76.67
Farmyard manure application	42	70.00
Fodder cultivation	32	53.33
Use of organic inputs (partial substitution)	28	46.67

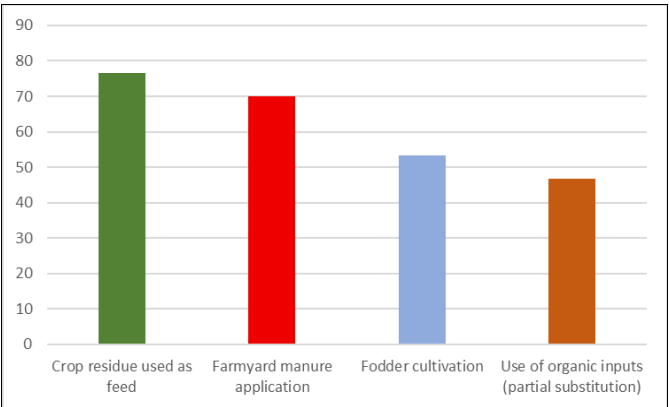


Fig 6: Adoption of resources recycling in IFS

3.7 Constraints in Livestock-Based Integrated Farming Systems

Farmers reported several constraints limiting the effectiveness of livestock-based systems (Table 7). High feed cost (73.33%) and fodder emerged as the most critical constraint, affecting overall profitability. Inadequate veterinary services and limited access to quality breeds further constrained productivity. A considerable proportion of farmers also lacked awareness of scientific livestock management practices, while market-related issues such as price fluctuations affected income stability. Labour shortages added to the operational difficulties. Overall, these constraints reduce the efficiency and economic viability of livestock enterprises, highlighting the need for improved extension services, veterinary support, and market infrastructure to strengthen integrated farming systems.

Table 7: Major Constraints Faced by Farmers in Livestock-Based Farming Systems

Constraint	Number of Farmers (N=60)	Percentage (%)
High feed and fodder cost	44	73.33
Inadequate veterinary services	38	63.33
Lack of quality breeds	35	58.33
Limited knowledge of scientific practices	32	53.33
Market price fluctuations	29	48.33
Labour shortage	26	43.33

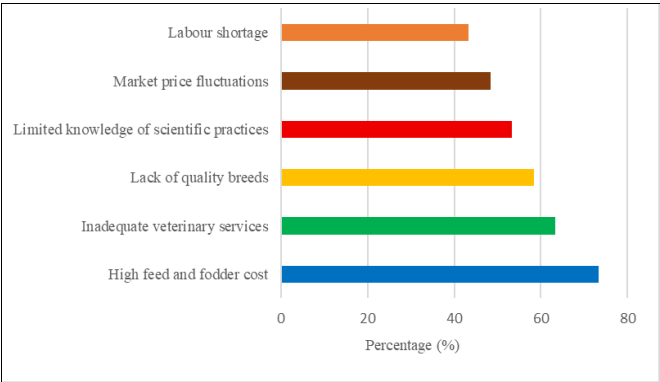


Fig 7: Constraints faced by farmers in livestock management

4. Conclusion

The present study provides a comprehensive assessment of the role of livestock in enhancing farm income and sustainability within the rice–wheat cropping system of Punjab. The findings clearly indicate that livestock serves as a crucial component of integrated farming systems, contributing to income diversification, risk reduction, and improved resource-use efficiency. A substantial proportion of farmers were engaged in livestock rearing, primarily for milk production, which ensured a regular and relatively stable source of income alongside crop cultivation. The integration of livestock with crop production facilitated effective recycling of agricultural resources, particularly through the utilization of crop residues as feed and the application of farmyard manure to maintain soil fertility. While a majority of farmers adopted integrated nutrient management practices, the continued dominance of chemical-based pest and weed control reflects an imbalance in sustainable agricultural practices. The persistence of the rice–wheat cropping system with limited diversification further highlights the structural constraints within the existing farming system.

Despite the evident benefits, the study identifies critical gaps that limit the full potential of livestock integration. Low awareness of government schemes, absence of livestock insurance, and limited access to extension services indicate weak institutional support. Additionally, dependence on informal sources of information restricts the adoption of scientific livestock management practices. These constraints underscore the need for strengthening knowledge dissemination and improving farmer engagement with formal agricultural institutions. Overall, the study concludes that livestock has significant potential to enhance both economic and ecological sustainability in the rice–wheat system; however, its effectiveness depends on improved policy support, targeted extension interventions, and increased farmer awareness. Promoting scientific livestock management, strengthening institutional linkages, and encouraging integrated farming approaches are essential for developing resilient and sustainable agricultural systems in Punjab.

References

1. Kaur R, *et al.* Increasing efficiency of rice–wheat cropping system. *Sustainability*. 2023;15(17):12694. <https://www.mdpi.com/2071-1050/15/17/12694>
2. Kashyap S, *et al.* Crop–livestock interactions and sustainability. *Sustainability*. 2022;14(11):6653. <https://www.mdpi.com/2071-1050/14/11/6653>
3. Leharwan P, *et al.* Conservation practices in rice–wheat systems. *Sustainability*. 2023;15(17):12736. <https://www.mdpi.com/2071-1050/15/17/12736>
4. Lemaire G, *et al.* Role of livestock in sustainable agriculture. *Agronomy*. 2023;13(4):982. <https://www.mdpi.com/2073-4395/13/4/982>
5. Pradhan P, *et al.* Rice–wheat system and food security. *Sustainability*. 2022;14(15):9334. <https://www.mdpi.com/2071-1050/14/15/9334>
6. Shyam M, *et al.* Integrated farming system model. *Agronomy*. 2023;13(4):955. <https://www.mdpi.com/2073-4395/13/4/955>
7. Singh R, *et al.* Sustainability issues in rice–wheat system. *IJPSS*. 2021. <https://journalijpss.com/index.php/IJPSS/article/download/1273/2550/2466>
8. Tufail M, *et al.* Crop–livestock integration for sustainability. *AgriEngineering*. 2025;4(3):40. <https://www.mdpi.com/2674-1024/4/3/40>
9. BIRTHAL PS, Jha AK, Negi DS, Singh D. Livestock and farm income diversification in India. *Agricultural Economics Research Review*. 2007;20:1-14. <https://ageconsearch.umn.edu/record/47437/files/2-PS-BIRTHAL.pdf>
10. Paramesh V, Dass A, Suresh A, Kumar B. Impact of integrated farming system on residue recycling and soil health. *Indian Journal of Agricultural Sciences*. 2021;91(3):363-368. <https://pdfs.semanticscholar.org/dfbb/a39ef5c4c87ce0bbfb2746fd040ee041f57f.pdf>