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An overview of integrated farming systems and their role in enhancing farm productivity

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Abstract
The present study was conducted to evaluate the adoption, performance, and sustainability of Integrated Farming Systems (IFS) among farmers across seven districts of Punjab. A total of 48 farmers were surveyed using a structured questionnaire covering socio-economic profile, landholding, IFS components, marketing, and challenges. The results revealed that 75% of the respondents practiced crop-livestock integration, making it the most common and profitable combination due to its contribution to nutrient recycling and regular income generation. A smaller proportion of farmers diversified into poultry (6.25%), horticulture (8%), and aquaculture (2%), indicating a gradual shift toward multi-enterprise farming. The findings also showed that larger and better-resourced farmers adopted more diversified systems, while smallholders remained crop-dependent due to limited resources and technical knowledge. Major constraints identified were high input costs, lack of training, and poor market linkages. Overall, the study highlights that IFS enhances farm productivity, income, and resource-use efficiency while maintaining ecological balance. Strengthening farmer capacity, infrastructure, and institutional support can promote wider adoption, ensuring sustainable and resilient agriculture in Punjab.

Keywords: Integrated farming system, farm productivity, crop-livestock integration, diversification

Introduction
Food security, livelihood security, environmental protection, and the preservation of natural resources have all become pressing global concerns in recent years. Developing nations are finding it difficult to cope with the combined effects of globalisation and climate change, resulting into failure of agricultural crops. According to estimations, over 410 million farms are less than 1 hectare, and more than 475 million farms are smaller than 2 hectares, constituting 72% and 84% of the total farms globally. In case of India, approximately 60% of total population relies on agriculture for their livelihood (Raghavendra *et al*., 2024), making the economy rural and agrarian in nature. We must produce 289 and 349 million tons of food grains throughout the corresponding periods to meet the demand for the future. According to Gill *et al*. (2005), the country's current situation suggests that the area under cultivation may continue to decline and that by 2030, over 20% of the cultivable land would be used for non-agricultural purposes. The problem is made more difficult in India by the declining average farm size and the financial barriers to increased agricultural investment because 80% of farm families fall into the small and marginal farmer groups [Gill *et al*., 2005)]. Increasing production could be a key strategy for ensuring food security and nutrition for a large population. This involves implementing scientific agronomic techniques and technology that increase the traditional agricultural systems' potential for production. Agronomic techniques like the 20th century's frequent use of inorganic fertilizers and pesticides greatly increased productivity, but unfavourable environmental damage and higher agricultural operating costs raised questions about the sustainability and viability of the industry [IAASTD, 2009 and FAO, 2010] [1, 3].

Concepts of Integrated Farming System
The Integrated Farming System (IFS) is a modern and scientific approach to agriculture that focuses on combining different farming activities such as crop production, livestock rearing,

fisheries, poultry, bee keeping, agroforestry, and other allied enterprises within a single farm. IFS as a mixed farming system that consists of at least two separate, but logically interdependent parts of a crop and livestock enterprises defined by.w`(Jitsanguan, 2001) defined the IFS as an aquaculture system that is integrated with animals and in which fresh animal waste is used to feed fish and also reported that there are synergies and complementarity between enterprises that comprise a crop and animal factor that form the basis of the concept of IFS.

In contrast to traditional farming, which typically depends on a single revenue stream (such growing crops), IFS places a strong significance on connecting and integrating different farm elements to make the farm self-sufficient, environmentally responsible, and financially stable. The fundamental idea is that waste or product from one system can be used as input for another, which reduces waste, lowers costs, and increases resource efficiency.

Materials and Methodology

The present study was conducted to understand the status and performance of Integrated Farming Systems (IFS) in Punjab. A purposive sampling technique was used to identify farmers from seven districts (Barauli, Fatehpur Jattan, Thablan, Nogawan, Kishanpura, Dholan Majra, Dhoom Cherri), representing different agro-climatic conditions of the state. In total, 48 farmers were surveyed, forming the primary data base for the study. A structured questionnaire was prepared to capture both qualitative and quantitative aspects of farming. Out of the 48 respondents, 36 were found to be practicing crop-livestock farming, 3 had integrated poultry units, 1 farmer was maintaining a fishpond along with crops, and the rest were engaged solely in crop cultivation. This distribution provided a comparative view of diverse IFS models across the districts.

The data was collected through face-to-face interviews and field observations, ensuring that responses were authentic and contextual. After collection, the data was systematically coded and tabulated. Descriptive statistics such as frequencies, percentages, and graphical representation (pie charts) were used to interpret the results in a simple and meaningful manner.

Results and Discussion

By considering social, ecological, and economic goals, integrated farming significantly advances sustainable development. The function of IFS in sustainability is illustrated by this flow diagram in figure1, which demonstrates how the outputs of one component are used as inputs in another:

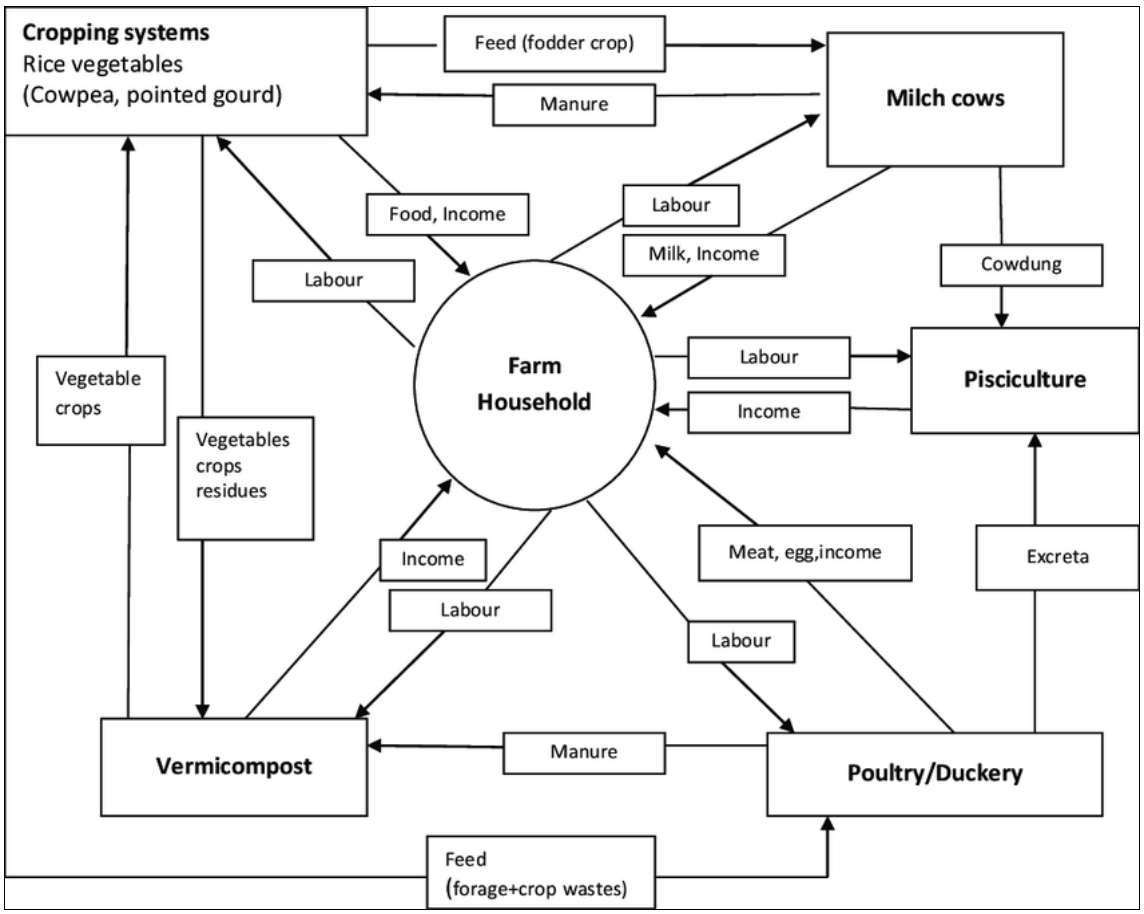

Fig 1: IFS flow chart showing how input of one component is used in another.

The distribution of farmers practicing Integrated Farming Systems (IFS) across the surveyed villages is illustrated in Figure 2. The chart highlights the variation in adoption levels among different districts of Punjab. It clearly depicts that some areas showed a higher concentration of IFS practitioners, likely due to better resource availability, awareness, and institutional support, while others had relatively fewer adopters.

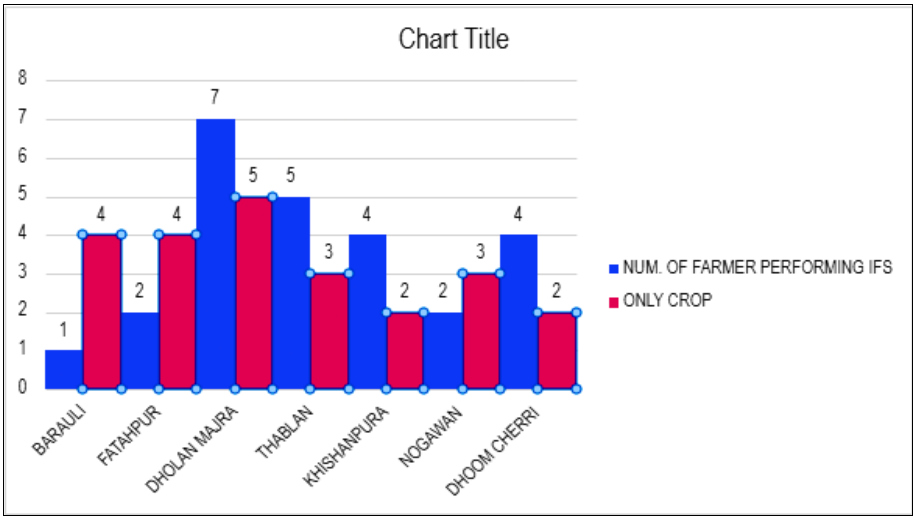

Fig 2: Number of farmers performing ifs from each village

The survey conducted across seven districts of Punjab provided useful insights into the adoption and performance of Integrated Farming Systems (IFS). Among the 48 surveyed farmers, the majority (36 farmers, 75%) practiced crop-livestock integration, confirming that livestock remains the most common complementary enterprise in Punjab's farming system. Poultry was maintained by 3 farmers (6.25%), while only 1 farmer (2%) had adopted aquaculture by establishing a fishpond. Horticulture was practiced by 4 farmers (8%). The remaining 8 farmers (16.6%) relied solely on crop cultivation. Here is a graphical representation of total farmers performing IFS in (figure 3).

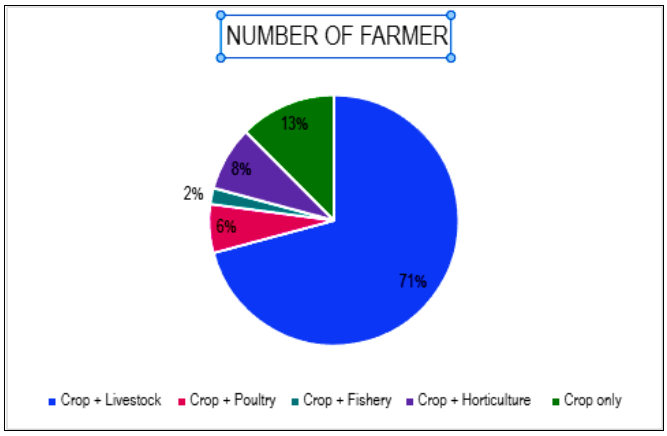

Fig: Number of farmers performing IFS

The results indicate that crop-livestock integration continues to be the backbone of IFS in Punjab, primarily because it provides steady income from milk and manure while improving nutrient recycling within the farm (Behera *et al*., 2020; Singh *et al*., 2021) [1, 10]. The inclusion of horticultural crops among some farmers reflects a gradual shift toward diversification, intended to enhance profitability and reduce dependence on traditional cereal-based systems (Sharma & Singh, 2022) [8]. However, the adoption of other enterprises like poultry and aquaculture remains limited due to lack of technical knowledge, high initial investment, and inadequate market support (ICAR, 2023; FAO, 2022) [4, 3].

The pattern of enterprise distribution among the surveyed farmers showed a clear relationship between resource availability, landholding size, and the degree of diversification. Farmers with medium to large landholdings were more likely to integrate livestock, horticulture, or poultry into their systems, as they had sufficient capital and space to manage multiple enterprises (Kaur & Sidhu, 2023) [5]. In contrast, small and marginal farmers primarily relied on crop cultivation due to limited resources and higher vulnerability to financial risks (Dhillon & Sandhu, 2024) [2]. Younger and better-educated farmers showed greater interest in adopting horticulture and poultry, indicating a generational shift toward more market-oriented and sustainable farming practices (Nair & Garrity, 2021) [7].

Marketing and input access were identified as major concerns, particularly for smallholders. Farmers engaged in livestock-based systems benefited from steady income through milk sales, whereas crop-only farmers depended on seasonal harvests (Singh, Yadav, & Tiwari, 2020) [9]. Most farmers marketed their produce locally, facing challenges such as price fluctuations, lack of transportation facilities, and dependence on intermediaries. Those engaged in multiple enterprises were more resilient, as income from livestock, poultry, or horticultural produce provided financial stability throughout the year (Sharma & Singh, 2022) [8].

Conclusion

According to the study, Punjab's agricultural revenue, resource efficiency, and sustainability are all greatly increased by Integrated Farming Systems (IFS). While some farms expanded into aquaculture, horticulture, or poultry, most farmers engaged in crop-livestock integration. Awareness, resources, and landholding size all had an impact on adoption levels. IFS was successful in increasing livelihood stability and lowering environmental impact despite obstacles, including high input costs and a lack of expert assistance. IFS is a workable route to resilient and sustainable agriculture in the area, and adoption can be further encouraged by bolstering farmer training, institutional aid, and market connections.

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