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Implementing Integrated Farming Systems to Boost India's Profitability, Employment and Climate Resilience Through Promoting Food and Nutritional Security

Manish verma[1]
College of agriculture CCS Haryana Agriculture University, Hisar (125004)

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Introduction

Small-scale and marginal farmers, who make up 85% of the total farming community in India, are at the heart of the rural economy. An integrated farming system (IFS) has been identified as a solution to meet the growing demand for food production and to provide income stability and nutritional security, especially for these farmers with limited resources.

The IFS approach involves combining various farm enterprises, including crop cultivation, livestock rearing, aquaculture, poultry farming, sericulture, and agroforestry, to achieve economical and sustainable agricultural output through efficient resource utilization. This integrated system operates by recycling farm and animal waste, with one component's waste serving as inputs for other components. This approach also promotes crop intensification and diversity, resulting in higher yields per unit area. Furthermore, IFS reduces the reliance on harmful agrochemicals for farm productivity and naturally manages insect pests, diseases, and weeds through crop management techniques.

IFS Model Development

The IFS model integrates a variety of complementary agricultural activities, including growing field and horticultural crops, practicing agro forestry, raising livestock, engaging in fisheries, cultivating mushrooms, and beekeeping, in a synergistic manner. This approach ensures that the byproducts of one process are utilized as inputs for other processes, maximizing farm productivity. Field crops are cultivated to produce food, while horticultural and vegetable crops, grown on the same land, yield 2-3 times more energy than cereal crops, ensuring both food security and sustainable income. After harvest, crop residues can be used as animal feed, contributing to milk and goat production. Animal waste can be converted into organic fertilizer or vermicompost, enhancing soil fertility and reducing the need for chemical fertilizers. Additionally, animal waste can be further processed to generate biogas and energy for domestic use. Fish in the system improve soil fertility by increasing the availability of essential nutrients like nitrogen and phosphorus, leading to higher rice yields in integrated farming. When chickens or ducks are raised near ponds, their waste becomes nutrients for the fish, enhancing fish production. This holistic approach, combining crops, fish, and poultry, results in the highest net revenue and land health improvement. By integrating various elements, including vegetable and fruit crops, cultivation costs are reduced, and households receive essential nutrients. Furthermore, the IFS model, encompassing agriculture, dairy, fisheries, horticulture, beekeeping, and mushroom cultivation, generates year-round employment opportunities.

Advantages of IFS

- By consolidating crops and related businesses, IFS enhances productivity per unit area.
- Implementing proper crop rotation, utilizing cover crops, and incorporating organic compost not only improve soil quality and structure but also reduce nutrient losses.
- Effective crop rotation minimizes weed, insect pest, and disease issues.
- The family's labor and land resources in agriculture result in higher net profits.
- Integrated farming, which includes products like eggs, milk, mushrooms, vegetables, honey, and silkworm cocoons, also ensures a steady and dependable income.
- It cuts down the production cost of components by recycling inputs from the by-products of associated enterprises, preventing waste buildup and subsequent pollution.

Constraints

In spite of several benefits, farmers in various parts of the nation are unable to implement IFS systems because of various obstacles. These limitations fall under a variety of headings, including institutional, policy, biophysical and sociocultural, financial, and so forth. The adoption of an integrated crop-animals system in Madhya Pradesh has been hindered by financial constraints, such as high input costs and lack of essential funding, mostly because of the high initial costs associated with setting up an animal shed and buying livestock, among other things. Moreover, biophysical barriers to IFS system adoption included the scarcity of high-quality planting materials, ignorance of novel crops like fodder, and the lack of veterinary services. These factors constituted the main obstacles to the crop-livestock system's adoption in Tamil Nadu's Salem District. Furthermore, farmers in Indonesia are resilient to change and are shown to be laggards in the adoption of new technologies, improved crops, and livestock breeds. These sociocultural restrictions, namely the unique character and attitude of the farmers, are

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determined to be the key factors in implementing an IFS system. In Southern Karnataka, India, where the study was conducted, about 30% of farmers who belonged to the scheduled caste expressed disapproval towards the adoption of IFS. Therefore, the farmer's attitude and acceptance of integrated farming systems might be effectively transformed by anchoring suitable motivation and encouraging through training and demonstration together with finance facilities and an assured supply of essential quality planting materials. However, insufficient institutional or governmental support exists for the implementation of IFS in the various agro climatic zones of the nation. Farming will affect soil, water, landscape, and biodiversity more than other environmental factors because of its direct relationship to the environment. Therefore, agro-ecological assets must be preserved, ecological balance must be maintained through sustainable use of natural resources, and farmers must be protected against market volatility by means of region- or location-specific policies that offer crop-specific pricing, insurance, and income support.

Conclusion and Way Forward

The article underscores the significance of Integrated Farming Systems (IFS) in efficiently managing farm resources for income generation, environmental protection, and livelihood security in rural areas. Exploiting the synergies among farming components is crucial for improving resource-use efficiency and recycling farm by-products. IFS, relying more on local resources, proves to be both sustainable and profitable, accommodating various crops, livestock, trees, honeybees, etc. This diversity enhances the system's resilience to climate changes, offering a potential approach to mitigate climate change through increased carbon sequestration. Creating awareness and securing government support are essential for widespread adoption of region-specific IFS models.

Several limitations and opportunities were identified in farming system research. Initially, the focus on production outcomes like yield and income enhancement raised the need for future research to explore the relationships between landholding size and livelihoods for farmers and laborers. For instance, while IFS yields higher production, the lower absolute levels of marketable produce raise questions about the sustainability of livelihoods. Small farm families should explore both agricultural and non-agricultural income sources, such as value addition, for sustainable livelihoods. Secondly, limited studies on production types and their associated environmental implications underscored the importance of assessing specific farm sizes, types of enterprises, and recycling methods in IFS to better understand scale-specific relationships between farm size and environmental impacts. Lastly, few studies have considered the comprehensive ecosystem services provided by different types of IFS systems, such as homestead farming, agro forestry-based, and livestock-based. Future research should delve into the well-being of laborers, farmers, and consumers, exploring their interaction with farm size and other social and environmental outcomes.