Integrated Farming System for Food Security and Nutritional Security in Hilly Regions

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All over the world, farmers work hard to earn a living. However, not all farmers make money, especially small family farmers. There is very little leftover after they pay for all their inputs *viz.* seeds, livestock breeds, fertilizers, pesticides, energy, feed, labor, etc. The emergence of integrated farming systems (IFS) has enabled farmers to develop a framework for an alternative development model to improve the feasibility of small sized farming operations. In the last few decades, "modern" technologies have been widely used to enhance the productivity per acre of land to ensure that there is enough food for the increased global population. Due to the indiscriminate and erratic use of chemical pesticides and fertilizers, our food and ecosystems have been poisoned.

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The integrated farming system is a commonly used term to explain a more integrated approach to farming compared to monoculture approaches. It refers to agricultural systems that integrate livestock and crop production or integrate fish and livestock and may sometimes be known as integrated biosystems. In this system, an inter-related set of enterprises is used so that the “waste” from one component becomes an input for another part of the system. This reduces costs and improves production and/or income. Since it utilizes waste as a resource, farmers not only eliminate waste but they also ensure an overall increase in productivity for the whole farming system.

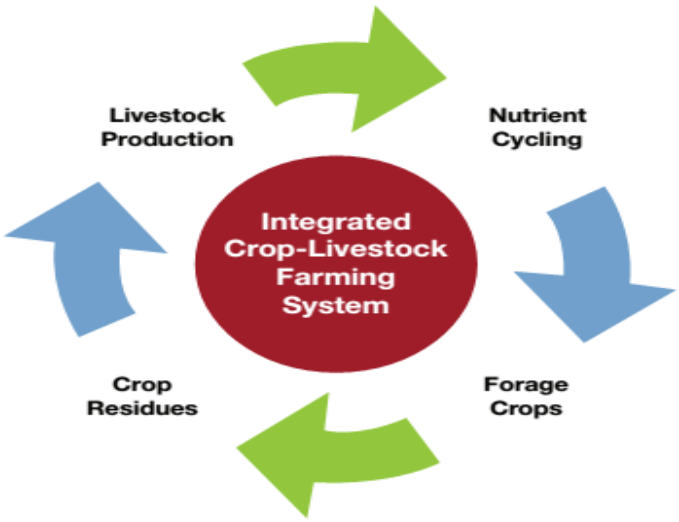


Fig. 1: Integrated crop-livestock farming system

Integrated farming tries to imitate nature's principle, where not only crops but also varied types of plants, animals, birds, fish, and other aquatic flora and fauna are utilized for production. The basic principle is to enhance the ecological diversity:

- By choosing the appropriate cropping methodology with mixed cropping, crop rotation, crop combination and inter-cropping so that there is less competition for water, nutrition and space and by adopting eco-friendly practices
- By utilizing a multi-story arrangement so that the total available area is used effectively and there is a high level of interaction between biotic and abiotic components
- By integrating subsystems by which the various components interact positively, so that the overall farm productivity is increased.

The integrated farming system is also a sustainable system which focuses on increasing farm productivity by increasing diversification, resource integration and creating market linkages. Thousands of small and marginal family farmers in resource-poor regions in Asia and Africa have converted their farming to this sustainable farming system to diversify farm production, increase cash income, improve the quality and quantity of food produced and the exploitation of unutilized resources. It usually takes three to four years to establish a well-integrated farm with market linkages to ensure nutrition and the livelihood of a family. Benefits provided by using an integrated farming system are:

- The integrated farming system approach introduces a change in farming techniques for maximum production in the cropping patterns and ensures the optimal utilization of resources

- The farm waste is recycled for productive purposes in the integrated system
- A judicious mix of agricultural enterprises like dairy, poultry, piggery, fishery, sericulture etc. suited to the given agro-climatic conditions and socio-economic status of the farmers can bring prosperity to the farming operations.

Many farmers and even entire countries throughout the world are adopting the integrated farming system which use practices that consider the present and future climatic conditions, soil characteristics, the food habits of the population and estimates the future food requirements of the ever increasing human and animal population.

The new integrated practices include improved farming technologies like integrated nutrient management, site-specific nutrient management, conservation technology, use of bio-fertilizers, crop rotation, zero tillage, and the use of farm management systems like Agrivi which helps farmers track their activities on fields, as well as the whole farm productivity and profitability. Agrivi also supports farmers with integrated farming by providing them with a knowledge base of the best practice processes in the form of required tasks that allow them to plan the season in advance.

Through the conversion to an integrated farming system and the adoption of modern farming practices, the problems of food security and global warming mitigation should definitely be solved.

Objectives of integrated farming system:

1. Maximization of yield of all component enterprises to provide steady and stable income at higher levels.
2. Rejuvenation/amelioration of system's productivity and achieve agro-ecological equilibrium.
3. Control the buildup of insect-pests, diseases and weed population through natural cropping system management and keep them at low level of intensity.
4. Reducing the use of chemical fertilizers and other harmful agro-chemicals and pesticides to provide pollution free, healthy produce and environment to the society at large.

Advantages of Integrated farming system:

1. It improves space utilization and increase productivity per unit area.
2. It provides diversified products.
3. Improves soil fertility and soil physical structure from appropriate crop rotation and using cover crop and organic compost.
4. Reduce weeds, insect pests and diseases from appropriate crop rotation.
5. Utilization of crop residues and livestock wastes.
6. Less reliance to outside inputs – fertilizers, agrochemicals, feeds, energy, etc.
7. Higher net returns to land and labour resources of the farming family.

8. Regular stable income through the products like egg, milk, mushroom, vegetables, honey and silkworm cocoons from the linked activities in integrated farming.
9. Reduced production cost of components through input recycling from the byproducts of allied enterprises.
10. Integration of allied activities will result in the availability of nutritious food enriched with protein, carbohydrate, fat, minerals and vitamins.

List of the components/enterprises in integrated farming system:

Agriculture	Mushroom cultivation	Seed Production
Sheep/goat rearing	Horticulture	Sericulture
Vermiculture	Piggery	Forestry
Azolla farming	Pigeon rearing	Rabbitory
Dairy	Poultry	Apiary
Value addition	Fish farming	Fodder production

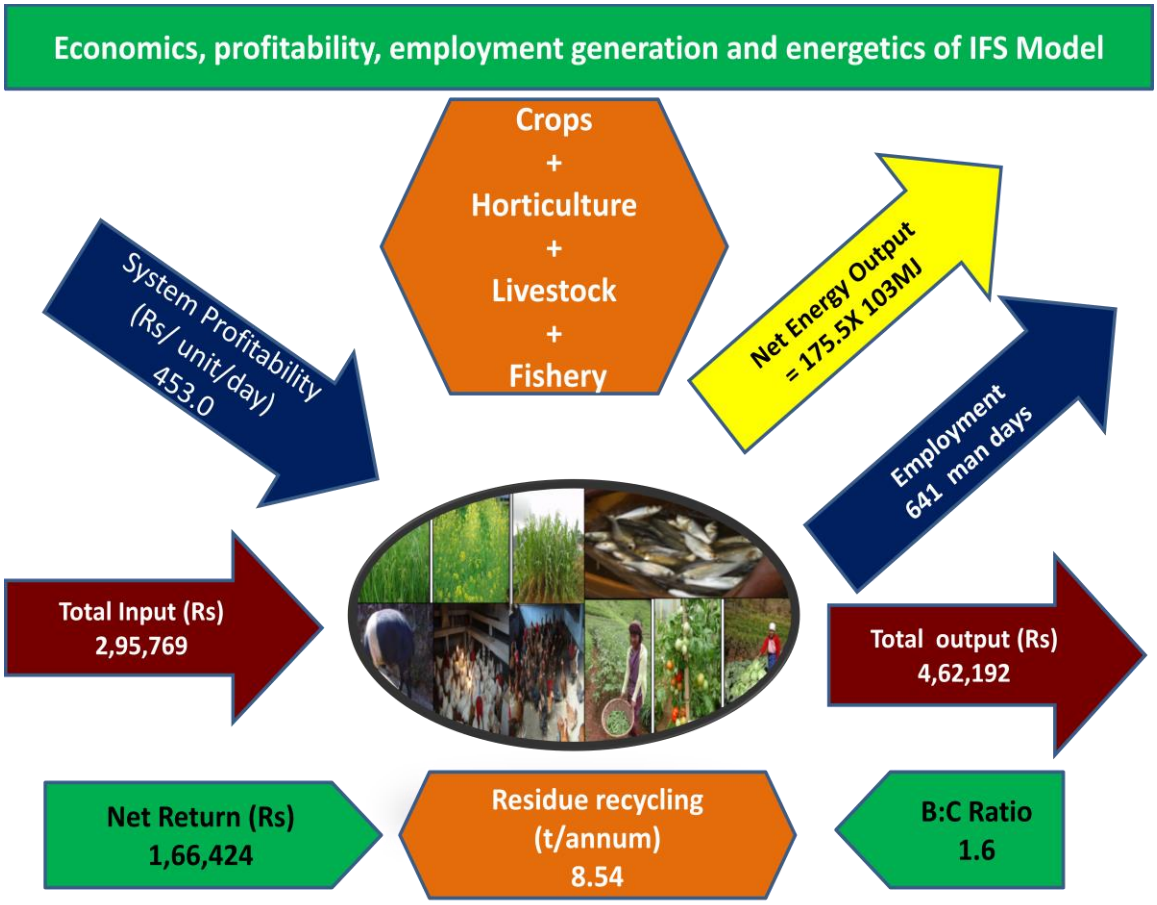
Elements of integrated farming system:

Watershed	Farm ponds	Bio-pesticides & Bio-fertilizers
Plant products as pesticides	Bio-gas	Solar energy
Compost making	Green manuring	Rain water harvesting

Integrated farming system model for hilly regions/slopping lands (One hector):

Area under different components

Sl. No.	**Particulars**	**Area (Sq. m.)**
1	Area under Crops (cereals, pulses, oilseeds etc.)	7000
2	Area under horticultural crops	2000
3	Area under fish pond	500
4	Area under poultry unit	100
5	Area under piggery unit	200
6	Area under vermi-compost unit	100
7	Area under threshing floor	100
	Total	**10,000**



Conclusion:

- There are always integrations at different levels in the existing family farming system practiced by the small holding farmers in the hilly region. Inculcation of scientific approach like integrated precision farming in management of different components will not only improve resource use efficiency in existing production system but will also help to climb up a step towards sustainability of small holder family farming production system in future by mitigating its negative on environment through proper recycling of nutrients.
- Integrated framing systems is a holistic approach to ensure the food and nutritional security, farm income, enhanced environmental and soil quality and social status of small and marginal farmers, particularly in hilly areas.
- Location specific farming components are required to be intelligently identified to harness complementarities between enterprises and bio-resource flow within the system.