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Integrated farming system for marginal landholders

A lane towards livelihood security

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Marginal landholders, who own less than one hectare of land, make up a significant portion of the total landholders in the country and face the challenge of securing year-round income and employment. Integrated Farming System (IFS), which emphasizes enterprise diversification, offers a promising solution by boosting productivity per unit area while meeting the nutritional needs of farming families. The diverse components in the IFS model not only provides consistent employment throughout the year but also ensures regular income. Moreover, IFS leads to a higher marketable surplus with a range of products. When efficiently implemented, it serves as a viable solution to the challenges faced by marginal farmers.

Keywords: Employment generation, Nutritional security, Sustainability

In India, marginal landholders (with less than one hectare of land) make up about 68.5% of all landholders, but they operate on only 24% of the total cultivated area. The average landholding for this group is just 0.38 hectare equivalent to about one acre. This inequality in land ownership continues to grow due to land fragmentation. These farmers are among the most vulnerable groups to be affected by the adverse conditions, facing numerous challenges such as limited access to water, fertilizers, seeds, and credit, along with the impacts of drought, floods, and other environmental factors. They also struggle with irregular employment and income. Climate change further aggravates their difficulties, posing a serious threat now and in the future. The sustainable growth of Indian agriculture largely depends on the success of these marginal farmers. To improve their livelihoods, a holistic development approach, starting at the farm level, is essential. Among the limited options available to address the diverse needs of marginal farmers, the Integrated Farming System (IFS) stands out as the most suitable. It aligns with six out of the seven key growth strategies proposed for doubling farmers' income (DFI), offering benefits in several areas, including i. increased crop productivity, ii. enhanced livestock productivity, iii. cost savings in production, iv. higher cropping intensity, v. diversification into high-value crops, vi. improved real prices for products; while the seventh strategy, a shift from farm to non-farm activities, is not directly addressed, IFS effectively supports most of the other sources of growth, making it a comprehensive solution for improving farmers' livelihoods.

Characteristics of an IFS model for marginal landholders

- ***Year-round employment***: The IFS model provides consistent employment opportunities throughout the year, ensuring stability for marginal landholders.
- ***Monthly income generation***: It is designed to generate regular income, helping farmers meet their recurring financial needs.
- ***High productivity on small land***: The system focuses on maximizing productivity from limited land areas, optimizing the use of available resources.
- ***Enterprise diversification***: IFS includes a variety of enterprises that collectively ensure a balanced supply of essential nutrients, viz. carbohydrates, proteins, vitamins, and minerals.
- ***Labour-intensive enterprises***: Labour-intensive activities are preferable to create employment for the farmers and their families.
- ***Low-capital enterprises***: The model prioritizes enterprises with low capital investment, such as beekeeping, vermicomposting and low-tunnel vegetable cultivation etc.
- ***Short-term crop preference***: Crops that provide quicker returns are favoured over long-term crops to ensure steady income generation.
- ***Year-round cultivation***: The system incorporates the cultivation of summer vegetables and other crops that

allows continuous farming throughout the year.

- ***Climate resilient varieties selection***: In light of climate change, resilient varieties ensure stable income generation over conventional varieties.

IFS Components suitable for marginal farmers

***Field crops*:** Marginal farmers can opt for cereal crops like rice, wheat, and maize, which typically yield more than climate-resilient crops such as millets. Short-duration pulse crops can be grown in the summer, while oilseeds can be an optional addition.

***Vegetable production*:** Vegetables are highly profitable as compared to field crops, making them a better option for marginal farmers. However, vegetable farming requires more intensive management.

***Livestock*:** Starting with one or two milch cows is recommended. Farmers should choose breeds based on yield potential, disease resistance, and market demand.

***Bee rearing*:** Beekeeping is essential for pollination in oilseed and fruit crops, requiring minimal investment and maintenance while offering a high benefit-cost ratio.

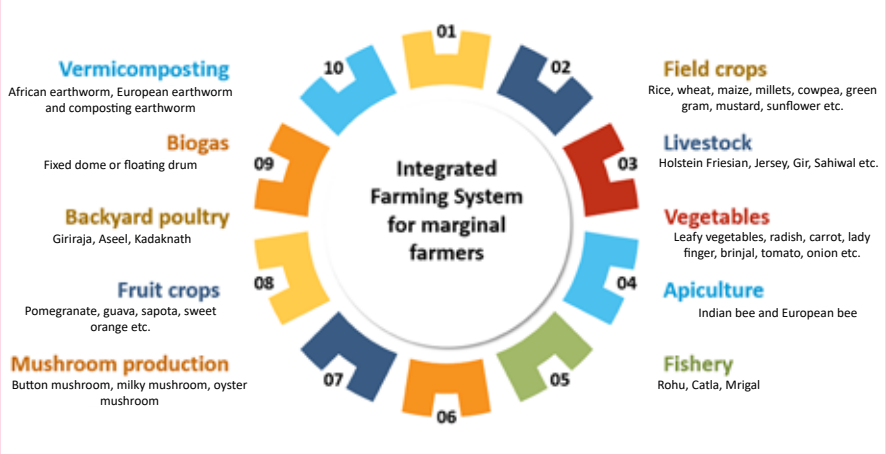
***Vermicomposting*:** With the intensive nature of IFS, vermicomposting is a low-cost, farm-based technology that provides additional income by selling compost.

***Fruit crops*:** Early-bearing fruit crops like pomegranate, guava, sapota, sweet orange, and karonda can be included, providing yields within a few years of establishment.

***Mushroom production*:** Mushrooms can be cultivated either as a standalone or supplementary enterprise. As a supplementary activity in IFS, mushroom production enhances profit with reduced costs.

***Low tunnel vegetable cultivation*:** Low-cost tunnels allow the growth of leafy vegetables or nursery plants. Leafy vegetables can be harvested within 1-1.5 months, offering quick returns.

***Backyard poultry*:** Requiring minimal input and maintenance, backyard poultry can be fed with farm products, providing a steady source of income.



Integrated farming system components suitable for marginal farmers

***Fisheries*:** Farm ponds with composite fish rearing present great opportunities. Fish can be fed with poultry droppings, making this an efficient, low-cost addition to IFS.

***Biogas plant*:** Livestock dung can be used for biogas production, providing domestic fuel. The by-product of the biogas plant serves as an excellent organic manure for crops.

Marginal farmers may adopt other components based on internal factors (viz. family needs, knowledge, skills, interest, capital) and external factors (viz. input availability, market access, transportation).

Case study 1

The land allocation in this system was designed to meet the nutritional needs of a five-member family. The field crops component occupied 525 m², yielding 577 kg of maize equivalent yield (MEY). Compared to field crops, vegetable cultivation produced significantly higher yields. More emphasis was placed on vegetable cultivation than field crops due to its higher productivity and potential for income generation. The highest contribution was from protected vegetable cultivation, yielding 11,790 kg MEY, mainly because of the intensive methods used in protected environments. Despite being allocated just 50 m², the mushroom component delivered an impressive 9,480 kg MEY, making it the most productive component on a per-unit area basis. Additionally, the beekeeping component provided 410 kg MEY without competing for significant land space from other components. The total productivity from the one-acre area is 35,453 kg per acre, which is several times higher than that of a conventional cropping system. This high output not only met the nutritional needs of a five-member family but also provided a significant marketable surplus, ensuring additional income for the family. The integration of diverse components in the farming system, thus, maximizes land use

Table 1. Area allocation and maize equivalent yield of an IFS model on one acre

Component	Area (m²)	Maize equivalent yield (kg)
Field crops	525	577
Open field vegetable cultivation	1575	5657
Agri-horti system	1200	4083
Protected vegetable cultivation	600	11790
Mushroom production + farm shed	50	9480
Bee keeping	Installed on bunds	410
Vermicomposting	50	3456
Total	4000 (one acre)	35453

(*Source*: Shyam *et al.* 2023)

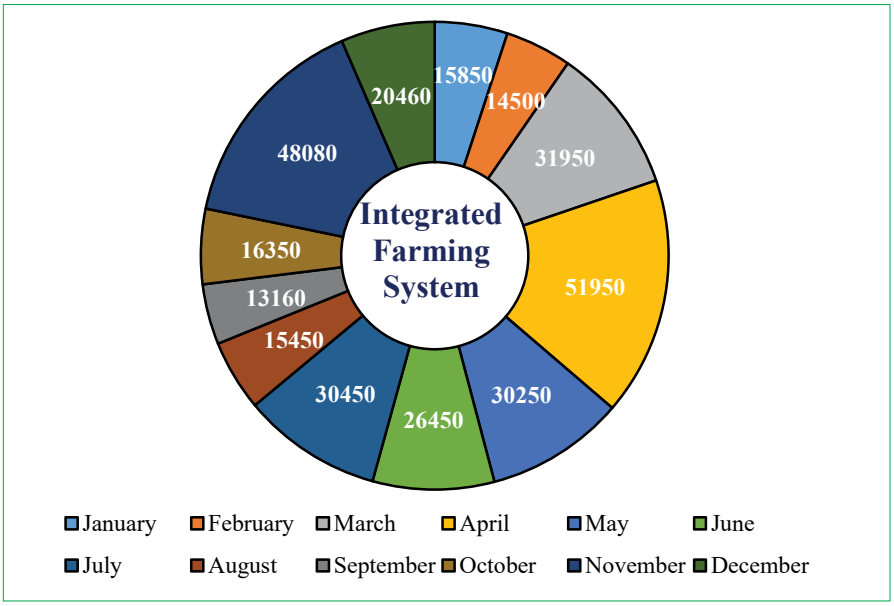
and boosts overall productivity.

Case study 2

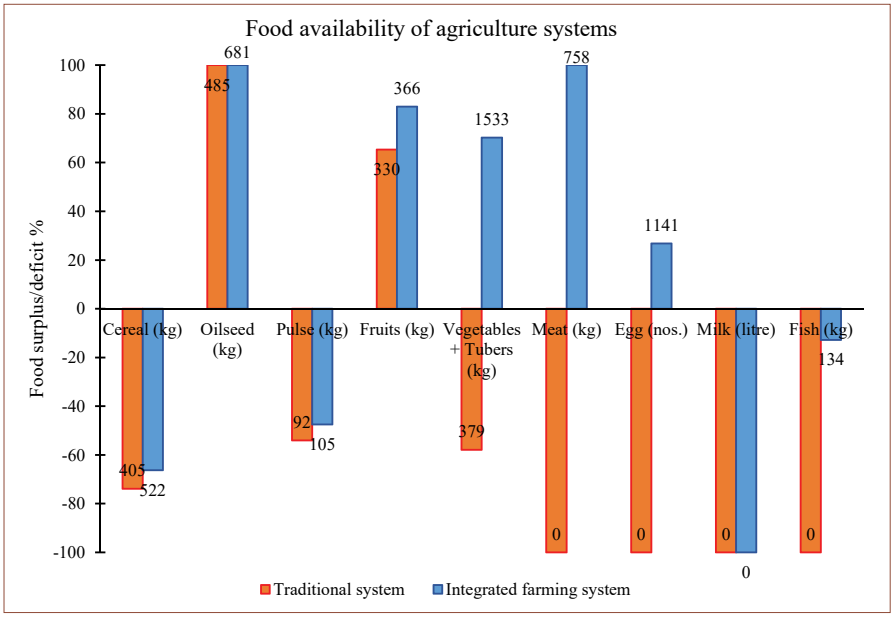
An IFS model having 0.5 ha of land at Central Coastal Agricultural Research Institute (CCARI), Goa, revealed that the cropping system component provided the highest monetary benefits, with gross returns of ₹137,460 and net returns of ₹86,718 (Table 2). This was followed by the dairy component, which generated gross returns of ₹113,110 and net returns of ₹75,260. The cost of production was also highest in the cropping system component due to the inclusion of multiple crops, such as rice-green gram, rice-cowpea, rice-chilli and rice-baby corn. This was followed by the dairy component, which had higher costs associated with concentrates. The fishery component yielded the highest net return per unit of production cost due to its lower production expenses and higher equivalent yield. Overall, the model generated ₹198,838 in net returns, with the major contribution coming from the cropping system (40.5%), followed by the dairy component (37.8%). This demonstrates that the IFS, with its integrated components, resulted in increased farm net returns, achieving a benefit-cost ratio of 3. As a result, IFS has the potential to enhance the income of farm families, addressing the seasonal income challenges commonly faced in conventional systems.

Case study 3

A one-hectare Integrated Farming System (IFS) model at Bihar Agricultural University (BAU), Sabour, Bihar, incorporating eight components of farming including, cropping system, orchard, dairy, goatery, fishery, duckery, vermicomposting and boundary plantation offers year-round income generation. The detailed monthly income distribution reflects this. The total annual income was ₹314,000 per hectare per year which was five times higher than the traditional rice-wheat or rice-maize systems, coupled with two cows. The integration of diverse components in the model increased employment opportunities, ranging from 400 to 950 man-days per hectare, which can be easily distributed among 3-4 family members. The highest income was recorded in April (₹51,950), followed by November (₹48,080), primarily due to the sale of summer and *kharif* season crops, respectively. The lowest monthly incomes were noted in September (₹13,140) and February (₹14,500), mainly due to fewer sales from the model during these months.



Monthly income distribution of an IFS model at Sabour, Bihar (Panwar *et al.* 2021)



Food availability from an IFS for a 7 membered farm family (Ray *et al.* 2020)

Table 2. Component-wise economics of the IFS model

Activity	Cropping system	Forage crops	Kitchen garden	Dairy	Fishery	Poultry	Total
Gross returns (₹)	137460	4350	4650	113110	22400	13350	295320
Cost of production (₹)	50742	1000	500	37850	3800	2590	96482
Net returns (₹)	86718	3350	4150	75260	18600	10760	198838

Source: Paramesh *et al.* 2019

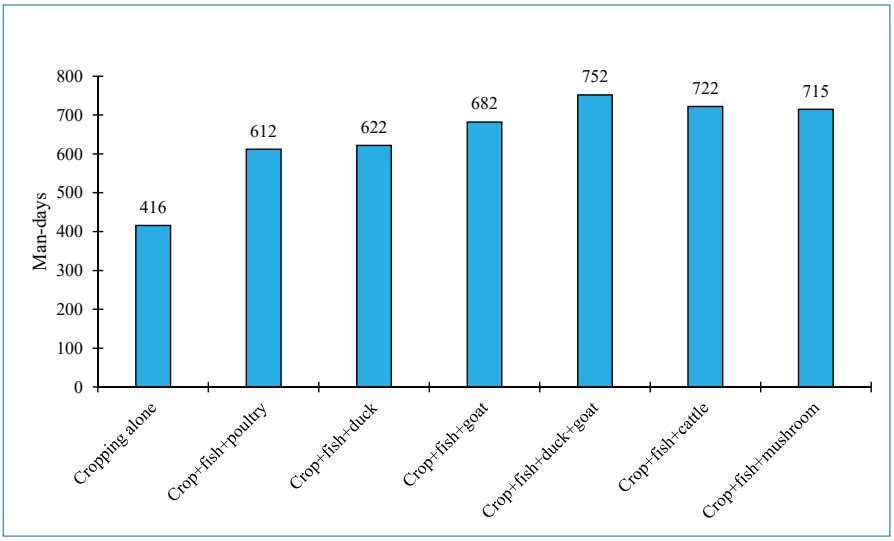
Case study 4

An IFS model developed in Wokha district of Nagaland,

designed to meet the food requirements of a seven-member farm family (comprising five adults and two children), was assessed based on the Indian Council of Medical Research (ICMR) recommendations. The food contributions from both the traditional system and the IFS were compared. The traditional shifting cultivation system met the family's needs only for oilseeds and fruits, providing a surplus of 485 kg and 330 kg, respectively. In contrast, the IFS, through enterprise diversification, successfully met the family's needs for oilseeds, fruits, vegetables, tubers, meat and eggs, with a significant surplus of these items. However, the IFS showed deficits in cereals (66.3%), pulses (47.5%), milk (100%) and fish (12.8%). The availability of food from individual components is detailed in the graph bars. Overall, the IFS was more effective in meeting the diverse nutritional needs of the farm family compared to the traditional system, which supplied fewer of their requirements.

Case study 5

Another IFS model at ICAR Research Complex for Eastern Region (ICAR-RCER), Patna, demonstrated that the employment generated by various integrated systems was compared to traditional cropping alone. The findings revealed that incorporating additional components into the model significantly increased employment opportunities. The lowest employment generation was recorded in cropping alone (416 man-days), while the highest was achieved in the system combining crops, fish, ducks, and goats (752 man-days). Among other integrated systems, the crop+fish+poultry model generated lowest employment of 612 man-days, which was considerably higher than cropping alone. Thus, the integrated farming system substantially contributed to providing employment for marginal farmers compared to cropping alone. Additionally, diversifying enterprises within the system ensured a more evenly distributed employment opportunity throughout the year.



Employment generation across IFS modules (Kumar *et al.* 2012)

Constraints for adoption of IFS

Although the adoption of Integrated Farming Systems (IFS) for marginal landholders is highly recommended due to its numerous advantages, there are several constraints that limit its widespread implementation. Some of the key challenges include insufficient irrigation facilities, limited access to credit, lack of superior quality vegetable seeds, inadequate availability of essential inputs, poor market facilities, seasonal price fluctuations of produce and minimal or no income generation during the incubation period (the time from the establishment of an enterprise until it begins generating income).

CONCLUSION

The adoption of IFS offers marginal farmers the opportunity for consistent income and employment throughout the year. As a holistic approach that emphasizes enterprise diversification, IFS reduces production costs, enhances productivity per unit area and provides additional income while minimizing the risk of crop failure. Compared to conventional systems, IFS effectively meets the diverse needs of farm families while generating a substantial marketable surplus. It emphasizes year-round cultivation ensuring adequate employment and income for the farm family. Given the goal of doubling farmers' income, IFS stands out as an ideal approach for marginal farmers in the country.

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