Indian Farmer
Volume 12, Issue 06, 2025, Pp. 290-299
Available online at: www.indianfarmer.net
ISSN: 2394-1227 (Online)

Original article

Integrated Farming System for Sustainable Livelihood

Soumya Dash[1]*, Arkaprabha Roy[2], Shravani Sanyal[2] and Priyanka Meena[3]

[1]School of Crop Health Management Research, [2]School of Crop Health Biology Research,*

[3]School of Crop Health Policy Support Research,

ICAR-National Institute of Biotic Stress Management, Raipur, Chhattisgarh, India

Corresponding author: soumya.nibsm11@gmail.com

Received: 26/05/2025 *Published:01/06/2025*

INTRODUCTION

"Farming is not just about crops anymore. It's about creating a self-sustained lifestyle." — **Kamla Bai**, Smallholder Farmer, Chhattisgarh.

India's agriculture is at a critical turning point. Small and marginal farmers who make up nearly 86% of the farming community, are grappling with problems like shrinking landholdings, degrading soil, rising input costs, and climate uncertainties. In this complex scenario, Integrated Farming System (IFS) emerges as a smart, sustainable, and secure solution. Instead of depending solely on a single crop, IFS encourages farmers to combine crops, livestock, poultry, fisheries, horticulture, and even agroforestry into one interconnected farm unit. This holistic approach ensures year-round productivity, better income, lower risks, and improved food security—making farming not just viable, but thriving. An Integrated Farming System is like a living ecosystem, where every component of the farm supports the others so that the waste from one becomes food or fertilizer for another. "An integrated farm works like a well-oiled wheel: each spoke-crop, animals, trees, water-supports the others, and the farmer at the centre keeps the system turning smoothly toward sustainability and resilience."

Figure: Integrated Farming System works as spokes of the wheel

Key Reasons to Adopt the Integrated Farming System Approach:

Farming system is an integrated set of activities that farmers perform in their farms under their resources and circumstances to maximize the productivity and net farm income on a sustainable basis. The farming system takes into account the components of soil, water, crops, livestock, labour, capital, energy and other resources, with the farm family at the centre managing agriculture and related activities. An intensive integrated farming system addresses two issues viz. reduction in risk with the monoculture activities and promoting enterprise diversification, value addition and development of alternative income sources with efficient utilization of farm resources.

- **Small Landholdings**- Due to the ever-increasing population and shrinking land resources, IFS provides the suitable solution to obtain maximum productivity per unit area.
- **Diversification**- Diversifying farming system reduces risk of crop failure and dependency on one source of income.
- **Resource Recycling and Sustainability**- Farm waste like cow dung is recycled into compost or biogas, reducing input costs and improving soil health.
- **Nutritional Security**- IFS ensures a mix of food—cereals, milk, eggs, vegetables—improving the family's diet.
- **Rural Employment**- Different components demand labour throughout the year, generating year-round jobs and empowering women and youth.
- **Optimization**- Efficient use of land, labour, and inputs

Different IFS modules

The integrated farming system (IFS) approach alters agricultural operations for higher productivity in the cropping system with the utilization of on-farm resources. There are nine different modules of Integrated Farming by including different agriculture components.

Module 1 (Livestock-crop integration): The combination of livestock with crop production provides benefits such as nutrient

Module 2: Agriculture + Livestock

Module 3: Agriculture + Livestock + poultry

Module 4: Agriculture + Horticulture + Sericulture

Module 5: Agro-forestry + Silvipasture

Module 6: Agriculture (Rice) + Fish culture

Module 7: Agriculture (Rice) + Fish + Mushroom cultivation

Module 8: Floriculture + Apiary (beekeeping)

Module 9: Fishery + Duckery + poultry

1. Crop Component:

- Primary Activity: The main source of food, feed, and income.

- Types: Cereals (rice, wheat, maize), pulses, oilseeds, vegetables, fruits, spices.
- Cropping Systems: Intercropping, crop rotation, multi-tier cropping.
- Functions: Provides food security, crop residues for livestock and soil health.

2. Horticulture Component:

- Sub-Components: Fruits (mango, banana, guava), vegetables (tomato, okra), tubers (potato), spices (turmeric).
- Role: Income diversification, nutritional security, and employment generation.

3. Livestock Component:

- Types: Dairy (cows, buffalo), small ruminants (goats, sheep), poultry, pigs.
- Outputs: Milk, meat, eggs, manure.
- Synergy: Manure for composting, crop residues as feed.

4. Fishery/Aquaculture Component:

- Inclusion: Integrated in wetland or pond-based systems.
- Types: Carp polyculture, integrated paddy-fish farming.
- Advantage: Additional income and protein source.

5. Agroforestry Component:

- Role: Timber, fodder, fruit, and fuelwood supply.
- Examples: Boundary plantations (Gliricidia, Subabul), alley cropping.
- Function: Soil fertility improvement, microclimate regulation, carbon sequestration.

6. Apiculture (Beekeeping):

- Benefit: Enhances crop productivity through pollination.
- Byproducts: Honey, beeswax.
- Integration: With horticulture and field crops.

7. Mushroom Cultivation:

- Use of waste: Utilizes agro-waste such as straw, husk.
- Output: High-value protein food.
- Scope: Off-season income, employment for rural youth and women.

8. Sericulture:

- Integration: With mulberry cultivation.
- Benefit: Income and employment from silk production.

9. Biogas/Composting Unit:

- Purpose: Recycling of organic waste, generation of renewable energy.
- Output: Biogas for cooking, slurry as bio fertilizer.

10. Vermicomposting Unit:

- Use: Conversion of farm and livestock waste into organic manure.
- Advantage: Enhances soil fertility and reduces dependence on chemical fertilizers.

11. Nutrient Cycling and Water Harvesting Structures:

- Techniques: Farm ponds, check dams, bunding.
- Role: Water-use efficiency, drought resilience.

A common IFS model (Agriculture + Livestock + Poultry + Fish)

Agricultural system that integrates livestock, poultry and fish is popularly known as integrated farming system (IFS). No single farm enterprise is likely to be able to sustain the livelihood of small and marginal farmers without resorting to integrated farming systems (IFS) for the generation of adequate income and gainful employment year-round. Therefore, the integration of livestock, dairy, goatery, fishery, poultry, duckery, apiary, field and horticultural crops, etc. within the bio-physical and socio-economic environment of the farmers to make farming more profitable and dependable.

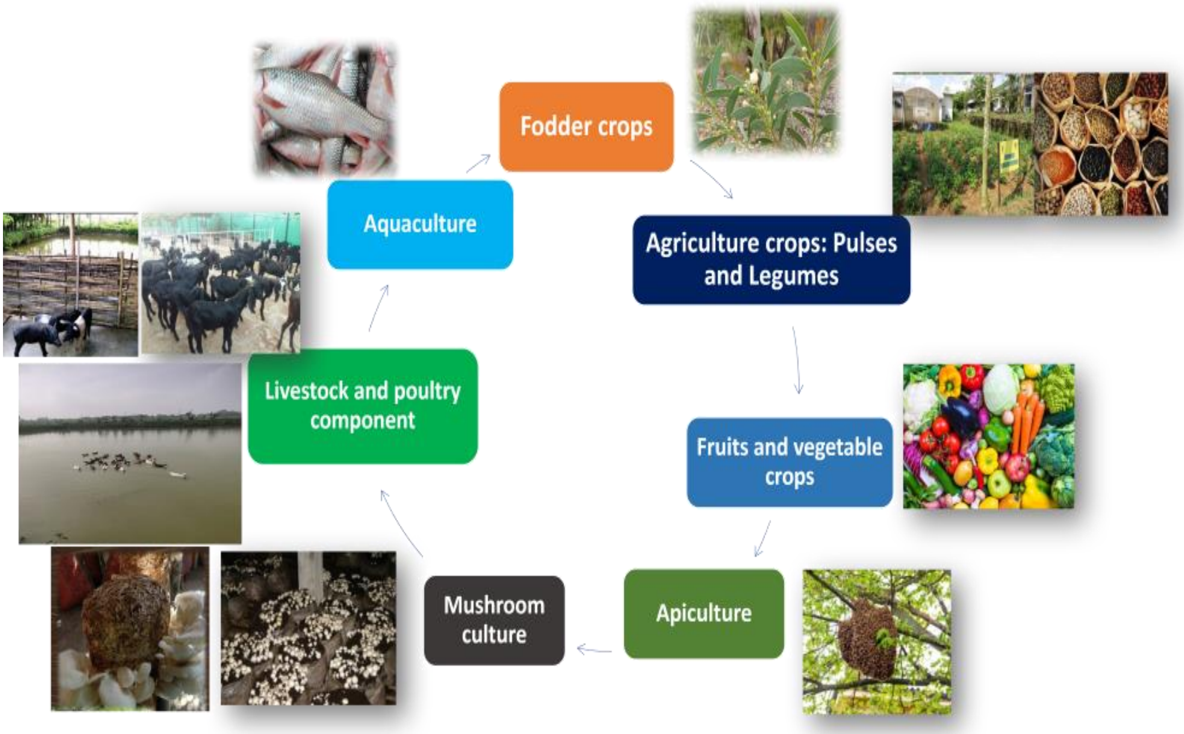

Figure 1. Livestock based IFS model

Agriculture: The crops including agricultural crops, horticultural crops and fodder crops are the core component of any IFS model. Mono culture system relies mainly on external inputs while in integrated system, recycling of nutrients help in reducing the cost of production and therefore, the adoption of multi-cropping pattern instead of mono cropping would provide the maximum benefit. Furthermore, Leguminous crops like mung bean, soybeans and peanuts increase soil fertility. Low land area can be utilized for rice+ Azolla cum fish cultivation. Fodder crops like maize, berseem and Hybrid Napier are used to raising livestock and poultry. Straw of paddy can also be used for mushroom cultivation.

Livestock: Farm yard manure (FYM) acts as an excellent fertilizer that can enhance the agricultural productivity through improving soil fertility and reduce the use of chemical fertilizers. The advantages of the application of livestock manure in crop production provide N, P, K and other minerals and also increase the soil organic matter. Fishes feed directly on the livestock excreta and therefore, two weeks before stocking of fingerlings pond water is fertilized with cow dung, urea, super phosphate and potash.

Duck farming: Ducks are integrated with the pisciculture in the pond. A duck shed/platform is to be made near the bank or inside the pond for resting during night. Fish ponds provide ducks with an excellent, essentially disease-free environment. Ducks consume juvenile frogs, tadpoles, and dragonfly larvae, thus eradicating many predators of fingerlings. The effect of aeration due to the movement of ducks in the pond water enhance the growth of fishes. Droppings of the duck act as a feed for fishes. Duckery unit also generate additional income to the farming family.

Fish farming: Fish Pond should be integrated to other enterprises like duckery, poultry, sheep and goat farming, dairy farming. Integrating Fish farming systems utilize the organic waste of livestock, poultry and agriculture by-products for fish production as fresh animal manure can be applied directly to the fish ponds. Livestock feeds that are not fully digested can be directly utilized by the fish. The pond silt becomes rich in nutrient due to ongoing fish culture and this is utilized as fertilizer for fodder crops. Pisciculture with stocking density of 7500 numbers per hectare in the ratio of 4:3:3 (Catla, Rohu and Mrigal) may be followed. fish and livestock farming reduces the necessity to purchase fertilizers and fish feeds and increases the income generated by the fish farm (Kumar et al., 2018)

Allied components of (Agriculture + Livestock + Poultry + Fish) IFS model

Mushroom cultivation: Mushroom with regards to its high nutritional value and digestibility is gaining importance to human diet. The crop residues viz. Paddy straw is commonly utilized for mushroom cultivation. Low-cost house to be constructed for mushroom cultivation, which provide additional income to the farm family. Furthermore, mushroom cultivation might serve as a means of employment generation. The utilized straw can be used as compost for field crops and vegetables.

Apiculture: Bee keeping is one of the most important agro-based industries. Nectar and pollen from flowers are the raw materials which are available in plenty in nature. The most important source of nectar and pollen are maize, great millet, bulrush, sunflower and palm.

Sericulture: The practice of integrating mulberry cultivation, silkworm rearing and silk reeling is known as sericulture. In fish-cum sericulture system, the silkworm pupae pupae are used as fish feed, while worm faeces and wastewater from silk extraction processing plants are used as pond fertilizers. Thus, a complete recycling of waste is achieved in these systems.

Azolla: Azolla, a small aquatic fern is recently considered in the IFS model component for improving soil fertility, promoting eco-friendly agriculture, and enhancing the milk productivity as azolla is used an alternate fodder for livestock feeding. Azolla can easily be grown in the cement tank of 10 feet long, 2 feet wide and 1 feet deep spread with 25-30 kg of soil mixed with 5 kg of decomposed dung. The water level is adjusted up to 5 cm and to which 5 kg of Azolla is added and within two weeks, 35-40 kg Azolla can be collected. Furthermore, azolla also acts as a biofilter, absorbing harmful nutrients from fishponds.

Table 1: An Integrated Farming System (IFS) under 2-hectare land area

Components	**Items**	**Area (ha)**
Forest tree crops	*Acacia nilotica* (Babul), *Leucaena leucocephala* (Subabul), *Eucalyptus spp., Terminalia arjuna* (Arjun), Neem, Ber tree, *Dalbergia sissoo* (Shisham), *Artocarpus heterophyllus* (Jackfruit), Tamarind tree, Anacardium occidentale (Cashew)	0.4
Legumes/Pulses/ Fodder crop/grass fodder	Pigeon pea, Mung bean, Black gram, Garden pea, Cowpea Berseem, Sorghum, Saybean, Hybrid Napier, Para grass, Lemon grass	0.3
Fruits and vegetable crops	Guava, Custard apple, Bael, Papaya, Moringa, Citrus spp, Banana, Mango, Brinjal, Tomato, Okra, Cabbage	0.5
Livestock and poultry	Goat and Duck farming	0.2
Aquaculture	Fish	0.4
Allied components	Honey bee, Mushroom, Composting	0.2
Total		2

In Odisha, the ICAR-Indian Institute of Water Management developed an IFS model for rainfed tribal areas integrating rice, vegetables, backyard poultry, goats, and fishery. The system yielded a net return of ₹1.65 lakh/ha/year, showing a 2.8-fold increase in income over traditional rice monoculture (Sahoo et al., 2020).

In Chhattisgarh, a model developed for rainfed areas of Gariyaband district that integrated paddy, soybean, fish, goat, poultry, and horticultural crops generated net returns of ₹2.05 lakh/ha/year with a BCR of 2.6 (Lakra et al., 2024). This model particularly benefited smallholders through income diversification and reduced risk.

In Tamil Nadu, an IFS model by Tamil Nadu Agricultural University combining rice, banana, poultry, and dairy in wetland conditions showed net returns of ₹2.9 lakh/ha/year. The system utilized rice straw for dairy fodder and dung for biogas and vermicompost, ensuring internal resource circulation (Balusamy et al., 2019).

Agroforestry Component of Integrated Farming System: A Tree in the Hand is Worth Two in the Forest

Agroforestry is the crown jewel of the Integrated Farming System (IFS), weaving together trees, crops, and sometimes livestock into a single, harmonious unit. In the Indian context, where every inch of land has to "give its all," agroforestry makes it possible to reap multiple benefits from the same plot of land. At its core, agroforestry is the practice of integrating woody perennials—trees, shrubs, or palms—on the same land used for agriculture and/or animal husbandry (Pantera et al., 2021). Selected species of trees like *Gliricidia sepium*, *Leucaena leucocephala* (Subabul), *Azadirachta indica* (Neem), *Dalbergia sissoo* (Shisham), *Moringa oleifera* (Drumstick) etc are chosen for their multi-purpose roles—as nitrogen fixers, fodder suppliers, firewood sources, or soil ameliorators.

India's small and fragmented landholdings, combined with climate uncertainties and soil degradation, demand a system that is resilient, remunerative, and resource-conserving. Agroforestry fits the bill perfectly. It creates vertical diversity—trees towering above crops—and enhances land-use intensity. Like the idiom "don't put all your eggs in one basket," farmers following agroforestry spread their risks. If the monsoon plays truant and crops fail, timber, fuelwood, or fruits from trees can still bring in income. Besides providing year-round income security, agroforestry also:

⇒ Improves soil fertility through leaf litter and root biomass, reducing the dependency on chemical fertilizers.

⇒ Prevents erosion by anchoring the soil during heavy rains, especially on sloped lands.

⇒ Improves microclimate by providing shade and reducing temperature extremes, benefitting shade-loving crops or livestock.

⇒ Enhances biodiversity, acting as a refuge for birds, bees, and beneficial insects, which in turn support pollination and pest control.

Agroforestry contributes significantly to nutrient recycling (Sileshi et al., 2020). The leaf litter from leguminous trees enriches soil with organic carbon and nutrients like nitrogen and potassium. Moreover, tree roots bring up nutrients from deeper soil layers, making them available to shallow-rooted crops. In today's climate-sensitive world, agroforestry is also an important tool in carbon sequestration (Panwar et al., 2022). It acts like a sponge, absorbing atmospheric carbon dioxide and storing it in biomass and soil organic matter. Of course, agroforestry is not without its challenges. It demands careful planning to minimize shade on sun-loving crops and requires a clear understanding of tree-crop compatibility to avoid problems like root competition or allelopathic effects. Patience is also key, as trees take years to mature and yield returns. Additionally, land tenure issues, particularly in tribal regions, can discourage long-term tree planting. Nevertheless, the outlook remains encouraging. Supportive initiatives like the National Agroforestry Policy (2014) and government schemes such as MGNREGA have begun promoting farm forestry, helping to overcome institutional barriers and pave the way for sustainable agroforestry adoption.

Common Agroforestry based IFS model in India

India's IFS benefit from a diverse array of agroforestry models tailored to its varied agro-climatic zones. Agri-silviculture, for instance, involves cultivating crops like wheat or sugarcane between tree rows such as *Neem, Subabul*, or Poplar, and is widely practiced in Punjab, Haryana, and Uttar Pradesh. Agri-horticultural systems, commonly found in tribal regions of Chhattisgarh and Jharkhand, feature fruit trees like mango, guava, or custard apple intercropped with vegetables or pulses, offering early income to marginal farmers before orchards reach full productivity. Silvi-pasture systems, prevalent in areas like Karnataka and Maharashtra, combine fodder trees with pasture grasses to support livestock—particularly valuable in regions with limited fodder and fuelwood. At the most integrated level, agri-horti-silvi-pastoral systems incorporate crops, fruit trees, timber species, and pasture components into a comprehensive model that addresses food, income, fuel, and fodder needs holistically.

Advantages of Integrated Farming System (IFS)

Integrated Farming System is a sustainable, eco-friendly approach to farming that interlinks multiple agricultural components—such as crops, livestock, poultry, fishery, horticulture, agroforestry, apiculture, sericulture, and biogas—within a single farm unit to optimize resource use and enhance farm income. Its advantages are multidimensional, covering economic, ecological, and social aspects:

Enhanced income and livelihood security: IFS diversifies income sources by integrating allied enterprises with cropping. This reduces the risk of total income loss due to the failure of one component, thus ensuring more stable and year-round income. For example, combining dairy with crop production allows a farmer to earn even during off-seasons when no crops are harvested.

Efficient resource recycling: In IFS, the output of one component serves as the input for another. For instance, crop residues can be used as livestock fodder, animal dung can fuel biogas plants or fertilize fields, and biogas slurry can improve soil organic matter. This cyclical use of resources minimizes external input costs and improves nutrient cycling.

Soil health and environmental sustainability: The use of organic waste, green manures, and farmyard manure enhances soil microbial activity, boosts organic carbon, and improves physical structure. Livestock integration, particularly when manure is composted and applied to fields, has been shown to reduce reliance on chemical fertilizers, thereby lowering the risk of soil and water contamination.

Water use efficiency: Components like agroforestry and livestock can help reduce water use through microclimatic regulation and moisture retention. The use of mulches, organic matter, and integration of fish-cum-duck farming or bund cultivation in lowland areas further enhances water productivity.

Agroforestry as a key component: Agroforestry, the deliberate inclusion of trees and shrubs with crops and/or livestock, plays a crucial role in IFS. It contributes to long-term sustainability by improving soil fertility through litter fall and nitrogen fixation (in the case of leguminous trees), reducing erosion, providing shade, fuelwood, timber, and fodder, and enhancing carbon sequestration. Trees like *Gliricidia*, *Leucaena*, *Moringa*, and *Subabul* are frequently integrated with cropping systems to provide ecosystem services and additional income streams.

Employment generation: By integrating multiple components, IFS creates more employment opportunities throughout the year. Livestock care, horticultural activities, agro-processing, and marketing offer jobs for family members, especially women and youth, helping reduce rural-to-urban migration.

Constraints of Integrated Farming System

While IFS has numerous advantages, its adoption is constrained by several technical, socio-economic, and institutional factors:

Knowledge and capacity barriers: Many small and marginal farmers lack the technical know-how to design and manage a balanced and efficient IFS model. The complexity of managing multiple interlinked enterprises requires proper training and decision-making skills.

Initial investment and labour requirements: IFS often demands higher initial investments to establish infrastructure such as animal sheds, fish ponds, vermicomposting pits, and irrigation systems. Additionally, labor requirements increase significantly, which can be a burden for small families or aging farmer populations.

Market linkages and value chains: Access to reliable markets for perishable products like milk, eggs, vegetables, or fish is often limited in rural areas. Inadequate cold chains, transportation, and value addition facilities restrict income potential and discourage diversification.

Land fragmentation and size: In many regions, landholding sizes are too small to accommodate all desired IFS components, particularly for integrating agroforestry or larger livestock. Uneven land topography can also hinder the layout of different enterprises.

Policy and institutional support: While the importance of IFS is recognized in policy documents, implementation on the ground is uneven. Lack of integrated extension services, limited financial support tailored to IFS, and absence of convergence among agricultural departments (crops, livestock, fisheries, forestry) restrict its widespread adoption.

Environmental and climate challenges: While IFS builds resilience, erratic climate conditions like droughts, floods, and extreme temperatures can still affect multiple components simultaneously. For example, drought can affect both crop yield and fodder availability, impacting livestock.

CONCLUSION

Integrated Farming System is not just a farming technique—it is a sustainable livelihood strategy that strengthens economic resilience, enhances ecological balance, and fosters inclusive rural development. By efficiently utilizing natural resources, recycling farm waste, and integrating diverse components, IFS addresses the economic and environmental challenges faced by small and marginal farmers. However, its broader adoption requires targeted interventions: capacity building through participatory training, better access to credit and subsidies, convergence of sectoral schemes, and robust market infrastructure. With collaborative efforts from institutions, policymakers, and farming communities, IFS has the potential to become the cornerstone of sustainable agriculture in India.

REFERENCES:

Kumar, S., Bhatt B.P., Dey A. et al. (2018). Integrated Farming System in India: Current status, scope and future prospects in changing agricultural scenario. *Indian Journal of Agricultural Sciences*, 88(11): 1661-1675.

Sahoo, L., Senapati, P. C. and Mohanty, A. (2020). Evaluation of economic feasibility of IFS models in tribal villages of Odisha. *Indian Journal of Agricultural Economics*, 75(2), 255–262.

Lakra, R., Kashyap, V., Sahu, L. and Yadaw, P. K. (2024). Advancing strategies for exploring innovative integrated farming systems for rainfed areas in Gariyaband, Chhattisgarh. *ShodhKosh: Journal of Visual and Performing Arts*, 5(6), 129–137.

Balusamy, M., Selvakumar, R., & Jayanthi, C. (2019). Integrated farming systems for enhancing productivity and profitability. *Journal of Agronomy*, 115(3), 145–149.

Pantera, A., Mosquera-Losada, M. R., Herzog, F., & Den Herder, M. (2021). Agroforestry and the environment. *Agroforestry Systems*, *95*(5), 767-774.

Sileshi, G. W., Mafongoya, P. L., & Nath, A. J. (2020). Agroforestry systems for improving nutrient recycling and soil fertility on degraded lands. *Agroforestry for Degraded Landscapes: Recent Advances and Emerging Challenges-Vol. 1*, 225-253.

Panwar, P., Mahalingappa, D. G., Kaushal, R., Bhardwaj, D. R., Chakravarty, S., Shukla, G., Thakur, N. S., Chavan, S. B., Pal, S., Nayak, B. G., & Gurung, T. (2022). Biomass production and carbon sequestration potential of different agroforestry systems in India: a critical review. *Forests*, *13*(8), 1274.