

Integrated farming system for livelihood security of small and marginal farmers in tribal area of Chhattisgarh

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Integrated Farming System is characterized by temporal and spatial mixing of crops, livestock, fishery and allied activities on a single farm. IFS plays a major role in biodiversity conservation through adoption of diversified cropping system and through integration of livestock components. IFS also played an important role in improving soil organic carbon from 0.75 to 0.82%. Due to increased carbon sequestration, biomass production by trees, reduced consumption of fertilizers and pesticides, and the greenhouse gas emission could be reduced significantly. This results in a linked system making it sustainable and climate-resilient. The main challenge associated with adoption of IFS is requirement of skill, knowledge, resources, labour and capital which are mostly not available with small and marginal farmers. There is a need for integrating productivity, profitability and environmental sustainability dimension in a single evaluation framework to effectively generate information towards enhancing adaptability of IFS.

Keywords: Impact, Integrated farming system, Intervention and performance indicator

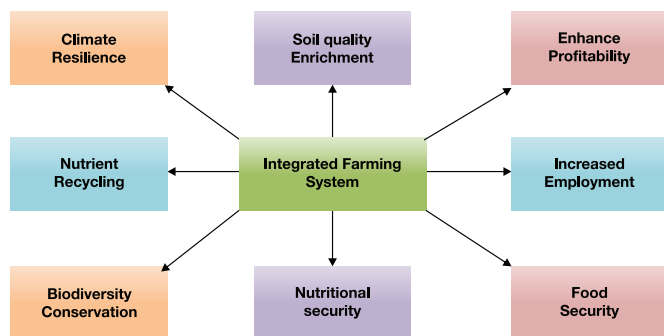
IN India, shrinking average farm size and financial constraints for higher investment in agriculture are due to the fact that 80% of the farm families belong to small and marginal farmer categories. For securing nutrition and food security for massive population, productivity enhancement may provide a vital solution. Modern agriculture has caused many problems associated with constant production of crops, increased costs of energy-based inputs and decreased farm incomes. It has also produced ecological problems such as poor ecological diversity, soil and water pollution and soil erosion. The adoption of integrated farming system for agricultural production involved lower use of inputs like fertilizers, pesticides etc. The systems are dependent upon a good understanding of the nature of interactions between the four main components, which are fertilizers, pesticides, cultivations and rotations and these interactions influence crop yields and farm income. Alternatives to energy-based inputs include: legume crops rotations; use of waste organic matter as well as that from animals and crops; integrated pest management; pest and disease forecasting; biological pest control; living mulches and mechanical weed control; conservation tillage; specialized innovative cultural techniques, including intercropping, strip cropping, trap crops and double-row cropping. It is essential to integrate the components of agricultural systems fully so that their impact of other inputs could

be taken into account.

Integrated farming system approach

IFS is an integrative whole farm approach and effective in solving the problems of small and marginal farmers. Aim of IFS is boosting employment and income from small-holding by integrating various farm enterprises and recycling crop residues and by products within the farm itself. The farmers need to be settled of regular income for living at least above poverty line. The progress in production or steady growth in output is necessary to face the challenges posed by present economic, political and technological environment. In this context, farming system approach is one of the important solutions to face this peculiar situation as in this approach the different enterprises can be carefully undertaken and the location specific systems are developed based on available resources which will result in sustainable development.

Chhattisgarh has often been dubbed "Rice Bowl" of Central India, with the main crop being Paddy. The total geographical area of the state is around 138 lakh ha. with net sown area of 46.51 lakh ha, which is 34% of its total geographical area. About 57% area has medium to light soil. About 70% population is engaged in agriculture. There are around 37.46 lakh farm families in the state, with about 80% farmers falling under small and marginal category. Chhattisgarh has one of the



Benefits of Integrated Farming System

richest bio-diverse area in the country with around 63.4 lakh ha area under forest cover, which is 46% of its total geographical area. Apart from paddy, cereals like maize, kodo-kutki and other small millets, pulses like tur and kulthi and oilseeds like Groundnut, Soybean, Niger and Sunflower are also grown but the productivity is not high of these crops.

In Rajnandgaon district, where majority of the farmers are either small or marginal, the income from agriculture sector in their farm is not at all sufficient to run their families. Due to fragmentation of land-holdings, even after adoption of improved agricultural technology and practices, their economic condition has not improved. Integration of different agricultural and allied enterprises with crop activity as base would provide ways to reuse and recycle waste material of one component as input in the other linked component and to reduce the cost of production of the economic produce of the component two and finally to enhance the net-income which is the major challenge in tribal areas. Constraints responsible for yield gaps, constraints analysis is most important exercise to find out or suggest specific solutions to specific problems. With the help of survey following problems/constraints were analyzed to identify researchable issues/interventions to make the different enterprises more profitable. The major constraints in agriculture in the district are given here.

Socio economic

- Tribal farmers are resource poor
- Fragmented land holding size
- Poor literacy and lack of awareness for adopting the technology
- Poor risk bearing ability
- Time and labour consuming agriculture

Crop production

- Monocropping
- Delayed planting of paddy
- No seed treatment and improper seed rate
- Improper sowing methods of all the crops and mainly broadcasting in paddy
- Excess use of N, imbalanced use of nutrients and improper application methods
- Use of poor quality FYM
- Lack of knowledge about disease and pests management in respect of application methods, time of application, rates of pesticides and use of right pesticides.

Horticultural crops

- In vegetable main problems were non-availability of good quality seed
- Sowing of seed without proper treatment
- Lack of suitable varieties and suitable growing techniques and pests and disease problems.

Animal husbandry

- Rearing of uneconomical animals
- Feeding of animals with poor quality feed and lack of nutritious green fodders
- Incidence of diseases and other problems
- Fertility problem, anestrus, repeat breeding, low conception rate, improper time of service
- Little use of minerals, salts and vitamins

Poultry and quail

- Lack of technical knowledge for rearing of chicks to farmers
- Poor housing facilities for poultry farming
- Non-availability of electricity
- Not taking regular batches of poultry

Fishery

- Social factor and use of small size ponds
- Lack of technical knowledge and un-awareness among farmers of improved rearing techniques
- Poor fish feed availability

IFS : Potential solutions for sustainable income for in tribal areas

- Recycling of waste material within the system
- Round the year income and employment generation
- To increase risk bearing ability
- In any circumstance farmer get income from one enterprise
- Family labour engage as a whole time working
- Family labours are hard working in nature

Technology

Rajnandgaon is one of the tribal districts of Chhattisgarh state and nearly 80 km away towards west from Raipur capital of the state. Five villages namely Kaudikasa, Bhagwantola, Muretitola, Arajkund and Netamtola were selected in the project to demonstrate the technology. These villages are nearly 65 km away from district headquarters. Geographical area of the five village cluster is 1485 ha with 1189 ha culturable area and the irrigated area is only 13% against 30% in the state. Mostly monocropping of rice is prevalent in the cluster of villages and cropping intensity is 113%. Individual enterprises like cropping, livestock etc. cannot give assurance to farmers for livelihood security therefore farmer adopt more than one enterprise but with traditional management. The local crop varieties lead to high risk, low income and insecurity.

The integrated farming system with cropping system along with other subsidiaries livestock, boundary plantation, seasonable vegetables, horticultural crops, fishery, poultry production, vermicompost, azolla production and farm pond is the most beneficial system which can augment the income of small and marginal farmers to improve their socio-economic status with

Table 1. Performance indicators of integrated farming system model for marginal and small farmers under irrigated condition

Economic indicators	Tomato		Cabbage		Pea		Cowpea		Poultry		Fish		Azolla	
	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22
Technical observations														
Yield (q/ha)	88.9	98.5	110.05	128.07	34.09	40.5	33.7	38.5	300/ farmer	450/ farmer	8q/pond	11q/pond	5q/pit	7q/pit
Economic indicators														
Cost of cultivation (₹/h)	95760	98500	79690	87530	52840	54920	45250	48150	38560	45730	39540	48740	780/pit	950/pit
Net returns (₹/ha)	259840	295500	250460	296680	83520	107080	89550	105850	96440	179270	96460	160260	8000/pit	13050
Market rate (₹/q)	4000	4000	3000	3000	4000	4000	4000	4000	450/kg	500/kg	180/kg	190/kg	2000	2000
B:C ratio	3.7	4.0	4.1	4.3	2.5	2.9	2.9	3.1	3.5	4.9	3.4	4.2	11.2	14.7

assured livelihood and nutritional security for long term in tribal area of Rajnandgaon district. Implementation of the Integrated Farming System leads to sustainability and constancy in farm income through multiple enterprises that aim at the utmost utilization of available natural resources to meet the family desires. It aims at generating a threshold level of farm income required for the farm family to maintain sustained interest in farming thus preventing migration of people from the farming sector.

Under the Farmer FIRST Project, scientists continuously monitored and observed the problem in farmer's field and gave potential solutions by organizing farmers meeting in adopted villages. Total 25 farm families of five villages were selected for development of integrated farming system model under the Farmer FIRST Programme during 2020-21. Farming system models included crop + vegetable crops + backyard

poultry + goatry + quail farming+ fishery production + vermicompost production + azolla production + animal husbandry. Scientists organized training for skill development of IFS model under selected areas and selected the farmer for creation of IFS model in farmers' field. Each farmer was provided primary initial inputs like improved variety seed, fruit plants, drip and mulching, fertilizer, goats, poultry and quail chicks, animal feed, fish, vermicompost and azolla unit etc. Cropping was done by the farmers with recommended package of practices. Farm pond, dug well, vermi pit and azolla pit was initiated through Farmer FIRST Programme. Farmer was linked with veterinary department for animal procurement, vaccination and skill development trainings. Site specific changes were done during execution of the units in the models.

Two different farming system models were introduced in the small and marginal farmers fields

Table 2. Performance indicators of integrated farming system model for marginal and small farmers under rainfed condition

Economic indicators	Rice		Wheat		mustard		Cowpea		Mushroom		Vermi-compost		Iac	
	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22
Technical observations														
Yield (q/ha)	51.4	53.7	19.2	20.4	7.9	9.5	32.6	37.4	14.8	15.2	30-40	35-40	23.7	24.9
Economic indicators														
Cost of cultivation (₹/ha)	34110	39850	16320	16700	12780	15320	44000	47500	59315	60205	4850	6950	268/ pit	950/ pit
Net returns (₹/ha)	86925	100900	22688	25565	22178	33505	86400	102100	168940	175630	19250	28050	800/ pit	13050
Market rate (₹/q)	2500	2500	1840	1975	4425	4650	4000	4000	2000	2000	1200	1200	9000	9000
B:C ratio	3.5	3.5	2.3	2.5	2.7	3.1	2.9	3.1	3.8	3.9	4.9	5.0	3.9	4.0



Paddy



Cabbage



Cowpea



Poultry



Azolla



Fishery

Crops and activities under IFS

on need basis under Farmer FIRST Programme. The major components/enterprises of integrated farming system model in tribal area of Rajnandgaon district in Chhattisgarh are given below.

IFS model for marginal and small farmers under irrigated condition: Vegetables with drip + back yard poultry (35) and quail (30) + fishery + azolla production (Table 1).

IFS model for marginal and small farmers under rainfed condition: Rice + wheat + mustard + cowpea + mushroom + vermi-compost production + lac production (Table 2).

The model developed on 1.0 ha area comprised crops (0.35 ha), dairy (0.10 ha), horticulture (0.20 ha), fishery (0.09 ha), poultry (0.08), quail (0.08), goatry (0.05) and (0.05) other miscellaneous activities used for vermicompost, threshing floor and farm building etc. This model initially consisted of field crops including fodders, meat with improved animals (35 poultry chicks of sonali, Kadaknath, ashil, vanraja breed and quail Japani breed), horticulture (a hydroponics unit and vegetables unit), a mix culture of fishes including rohu, katla, mrigal and telpiya. This was further strengthened by establishment of a small vermicompost and azolla unit (0.01 ha). All the farm wastes, byproducts and crop residues etc. were properly recycled into the system itself so that nothing went as waste and output of one enterprise served as an input for other enterprise. Under crop production besides food for family consumption, provided green fodders and feed concentrates to the dairy animals and also green biomass as feed of fish and goat. In turn animals, goatry and poultry dung

after proper composting and in the form of FYM and vermicompost was used as a major source of nutrients in field and plantation crops or sold in open market. Also animal wash was directly diverted from animal shed to fish pond to serve as fish feed.

SUMMARY

Development of integrated farming system is very important as the system has multi-fold benefits to increase the income and wealth of farmers. Integrated farming systems would be a solution to overcome the problems that arise in the regional development. Under the farmer FIRST Programme successful development of integrated farming system model in farmers' field was done. At present, 14 farmers in adopted villages developed crops+vegetables+livestockbased IFS model. The primary input for IFS model like crop and vegetable seeds, poultry and quail, goatry and fingerling, drip system and mulching etc. all component were provided under Farmer FIRST Programme. In this improved technology, tribal farmers were able to generate income round the year and also motivate other farmers to adopt IFS model. Further, in this system visible advantages include minimized risk and increased profitability as well as efficient integration of field crops with farm animals for sustainable production, income generation, and employment opportunities for resource-poor rural farm families.

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