

## Empirical Proof on Benefits of Integrated Farming System in Smallholder farms in Odisha

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### ABSTRACT

Integrated farming system (IFS) is considered as one of the best option towards intensification of small holder farm income to ensure sustainable livelihood. Integration of resources is made through a combination of land, water and animal resources of a farm through careful planning including recycling of bio-resources. Governments and development agencies have designed projects/programmes in promoting IFS through demonstration of successful models and other means. Integration of resources is a process which involves great thought in investing in one of the resource combined and gaining benefits. This paper entails information on IFS adopted farms by analyzing three cases promoted by Krishi Vigyan Kendra-Khordha under ICAR-Central Institute of Freshwater Aquaculture mandated to work on technology assessment, refinement and demonstration. All the IFS analyzed are pond based integrations involving crop-livestock and fish as major with minor integrations of enterprises like mushroom cultivation. The gross income of case 1 farmer was found to be Rs 5,19,600 from 0.8 ha in a pond based farming system followed by case 2 earning Rs 3,75,920 ( gross income) from an area of 1.872 ha crop based farming system and Rs 1, 50, 300 ( gross income) from an area of 0.8 ha crop based farming system adopting. The details of the case studies and economics are presented and these model farms play a great role in motivating nearby farmers in adoption of IFS. The study also concluded that adoption of IFS is profitable.

**Key words:** Integrated Farming System, Small holder farms, Odisha, Krishi Vigyan Kendra.

### INTRODUCTION

In India, Agriculture and allied sector provides livelihood support to about two third of the population and still continues to be the main stay employing and feeding most of the rural mass. It is not only main source of employment, income and food for over 70 percent of the population but also the main culture of the rural families. In Odisha, 82 percent of the farmers are considered small and marginal with an average holding size of 0.8 hectare, own 52 percent of the farm land and rest being owned by the medium and large farmers. Farming is mainly rice-based as much as 52 per cent of the gross cropped area is under rice of which more than 61 per cent is rainfed. Irrigation availability is

31 percent of the total potential created with 160 percent cropping intensity. The per capita food grain production is 156 kg and the share of food grain to National production is 2.04 per cent. The per capita income is limited to Rs 12, 388 as compared to national average of Rs 20, 989 per year, which is expected to cause nutritional insecurity (Nanda et., al 2007) . According to the reports of Indian Council of Medical Research (ICMR) the per capita daily requirement for an adult is worked out to be 420 gm cereals, 40 gm pulses, 50 gm leafy vegetables, 60 gm other vegetables, 150 ml milk and 40 gm fat and oil to get 2738 calories of energy and 65 gm of protein to perform voluntary as well as involuntary functions of body ( Ray, 2009).

In the context of burgeoning human population, increase in demand for food grains and natural resources, shrinking land mass, conversion of cultivable land into non-agricultural purpose, change in ecological environment, less availability and high cost of labour etc., now the livelihood of the small and marginal farmers' is on stake. Marginal and small farmers in general are literally illiterate, financially handicapped, their holdings are small and scattered not suited for high tech agricultural machinery, work in resource poor and risk prone diverse conditions. A rural family having six members including two children requires approximately Rs 64, 000/- per annum for livelihood security. This has to be derived from the income from farming and allied enterprises (Ray, 2009). No single farm enterprise is likely to support the small and marginal farmers for generation of adequate income and gainful employment year round (Mahapatra, 1994). 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 would bring prosperity in the farming. (Agri Portal, TNAU). This paper is based on the inferences from the three case studies of small scale farmers who were facilitated by KVK to develop integrated farming systems. Krishi Vigyan Kendra-Khordha is the Farm Science Centre of Indian Council of Agricultural Research (ICAR) mandated to work in Khordha district with the mandate of technology assessment, refinement and demonstration on agricultural and allied sector advanced technologies.

### **Materials and Methods**

The study was conducted in Khordha district of Odisha state and employed a case study approach for deriving inferences. Over the years KVK has been working on developing integrated farming system models with the objective of utilizing farm resources effectively. The KVK has developed more than 40 IFS models and among them three were selected for the study towards understanding the system and benefits upon adoption of IFS. The three cases were selected based on the maximum number of integrations adopted by the farmers from Baliana, Balipatna and Tangi blocks of Khordha district, Odisha state. The respondents were directly interviewed using a questionnaire that was pre-

tested to elicit data. A literature review was also performed to understand the different integrations in different agro-climatic zones of Odisha state and also for Khordha district. Both primary and secondary information from the responses of the cases and records from their farm were taken into consideration. Simple percentage analysis were used to interpret the data. The study was conducted in the year 2013-14.

## **RESULTS AND DISCUSSIONS**

### **Nature of Integration**

Before presenting case studies on IFS, the definition of IFS is highly context based. The definition by Agbonlabor *et al* (2003) in their studies undertaken in Nigeria defined the concept as a type of mixed farming system that combines crop and livestock enterprises in a supplementary and/or complementary manner. Okigbo (1995) defined these systems as a mixed farming system that consists of at least two separate but logically interdependent parts of a crop and livestock enterprises. Contrasting these definitions Radhammani *et al.* (2003) describes IFS's as a component of farming systems which takes into account the concepts of minimizing risk, increasing production and profits whilst improving the utilization of organic wastes and crop residues. Jayanthi *et al.*, (2000) based on experiences from Tamil Nadu, India, described these systems as a mixed animal crop system where the animal component is often raised on agricultural waste products while the animal is used to cultivate the soil and provide manure to be used as fertilizer and fuel.

Integrated Farming System can be defined as integration of more than one different types of agriculture and allied enterprises based on the sound principles of scientific agriculture for optimum utilization and management of available resources, recycling of waste / bi-products, engagement of family labour, decrease in cost of cultivation and increase in input use efficiency to maximize production, productivity, income generation and provide gainful employment from unit land area over stipulated time period. The farm family is the owner, manager and beneficiary of the farming system (Khanda, 2009). The farm family gets scope for gainful employment round the year there by ensuring good income and higher standard of living even from small holdings (

**Table 1: Identified IFS in different agro climatic zones of Odisha**

Agro climatic zone / District	Farming System modules identified
North Western plateau( SunderGarh, Deogarh)	Crop ( rice – mustard / green gram ) – Dairy – Goatery – Poultry - Agro forestry
North Central plateau( Keonjhar,Mayurbhanja)	Crop ( rice / maize - pulse / mustard) – Dairy – Goatery –Poultry – Apiculture -Agro forestry
North Eastern Coastal Plain ( Balasore, Jajpur, Bhadrak)	Crop ( rice- pulse / oilseed) –Dairy – Fish culture - Mushroom
East & South-Eastern Coastal Plain( Kendrapara, Jagatsinhpur, Khordha, Puri, Nayagarh,Cuttack)	Crop ( rice- pulse / oilseed / vegetable ) – Dairy – Fish culture - Mushroom
North East ghat(Kandhamal, Rayagada, Gajapati, Ganjam)	Crop ( rice / millets - pulse / oilseeds / vegetables) – Goatery – Sheep - Poultry - Agro forestry
Eastern ghat Highland( Nawarangpur, Part of Koraput)	Crop ( rice / millets – niger / pulse) – Goatery – Sheep -Agroforestry
South Eastern ghat ( Malkangiri, Part of Koraput)	Crop ( rice / maize / ragi / til - vegetables) – Poultry – Goatery –Sheep - Agro forestry
Western Undulating Zone( Kalahandi, Nuapada)	Crop ( rice / cotton –pulse / oilseeds) - Dairy –Poultry-Piggery - Goatery
Western Central Table Land(Baragarh, Bolangir, Boudh, Sonapur, Jharsuguda, Sambalpur)	Crop ( rice / groundnut / arhar / til – pulse / oilseeds / vegetable) – Dairy – Poultry – Piggery - Goatery
Mid-central Table Land (Angul, Dhenkanal)	Crop ( rice / groundnut / arhar / til – pulse / oilseeds) – Poultry –Dairy – Apiculture – Goatery -Mushroom

**Table 2: Enterprises/Components of IFS, area and economics of the farmer in adoption of IFS**

S. No	Enterprise /Components	Area(ha)/ No. of plants /beds	Gross Income (in Rs)	Monthly Gross Income (in Rs)	Contribution to total gross income( in%)
1	Fish culture (Major Enterprise)				
i	Fish (Pond-1)	0.4	2,55,000	13,419	77.04
ii	Fish Seed(Pond2)	0.2	98,300	5,174	
iii	Fish Seed(Pond3)	0.2	47,000	2,474	
2	Horticulture (Supplementary Enterprise)				19.73
i	Bitter gourd + Snake gourd	77 planting pits	12,000	632	
ii	Pointed gourd	0.08	35,000	1,842	
iii	Cucumber	0.032	5,000	263	
iv	Marigold (flower + Planting material)	500 plants	25,000	1,316	
v	Mango	47 plants	12,500	658	
vi	Papaya intercropped in Pointed gourd	75 plants	13,000	684	
3	Mushroom(Supplementary Enterprise)				3.23
i	Paddy straw mushroom	300 beds	16,800	884	
	Total		5,19,600	27,346	100

Biswas, 2009). Integrated Farming System can be broadly categorized as

#### Byproduct / waste utilization

The byproduct / waste of one system/ enterprise are used directly in another system. With this enterprise is expected to maximize production and minimizing the cost of cultivation as well as environmental pollution. e.g Fish culture + Dairy; Fish culture + Poultry ; Dairy + Vermicompost; Crop (rice) + Dairy + Mushroom etc.

#### Space utilization

Emphasis is given for optimum utilization of the available land/space rather than by-product / waste utilization. In this category there exists no direct / very less relationship between the enterprises. e.g Fish culture + Horticulture; Horticulture + Mushroom; Fish culture + Apiary etc.

#### Both by-product / waste and space utilization

In this category both the byproducts and waste/space utilization is considered like Fish culture + Dairy +Horticulture; Fish culture + Dairy +Mushroom etc.

With the experience of KVK-Khordha in promoting IFS, it could be understood that the possible integrations and the broad classification in Khordha district was evolved and it is presented in Table: 1. Promotion of IFS in different agro climatic zones of Odisha has been researched and data pertaining to such integrations and their economics of operation and benefits have been documented. Nanda (2009) has in detail studied the possible promotion of IFS in different agro climatic zone is presented in the table below. (Table-2)

**Table 3: Enterprises/Components of IFS, area and economics of the farmer in adoption of IFS**

S. No	Enterprise /Components	Area(ha)/ No. of plants /beds	Gross Income (in Rs)	Monthly Gross Income (in Rs)	Contribution to total gross income( in%)
1	Crop (Major Enterprise)				
i	Paddy Seed (Kharif) 2013 under certified seed production programme of OSSC ltd.	1.6	90,000	6,923	56.4
ii	Paddy Seed (Summer) 2013-14 under Hybrid seed production programme of Private Seed Company	0.4	62,000	4,769	
iii	Paddy (Summer) 2013-14	1.0	60,000	4,615	
2	Pulses(Supplementary Enterprise)				1.5
i	Horse gram	0.096	2,000	154	
ii	Green gram	0.24	3,600	277	
3	Horticulture (Supplementary Enterprise)	10.6			
i	Hybrid Okra	0.048	8,000	615	
ii	Pointed gourd	5 planting pits	1,920	148	
iii	Banana (Champa)	100 plants	10,000	769	
iv	Coconut(Green)	35 plants	20,000	1,539	
4	Dairy(Supplementary Enterprise)				3.6
i	Milk	Deshi Cow-1no.	12,000	923	
ii	Compost	2 tractorload	1,600	123	
5	Mushroom(Major Enterprise)				27.9
i	Paddy straw mushroom(Rainy Season)	400 beds	32,000	2,462	
ii	Paddy straw mushroom(Off- Season)	700 beds	72,800	5,600	
	Total		3,75,920	28,917	100

Case studies of successful farmers adopted IFS promoted by KVK-Khordha

There are no exact studies to speak about the integration and economics of IFS as they are dependent only through analyzing the existing resources with farmers. In such a situation KVK-Khordha has promoted IFS in Khordha district which has been documented for eliciting data on such integrations with appropriate economics. This section of the paper in detail presents the models analyzed through case study approach.

#### Case -1

##### Fish-Vegetable-Fruit-Flower-Mushroom Integration

Mr. Prakash Chandra Nayak, an educated rural youth of village Puran Pradhan of Baliana block in Khordha district. Mr. Prakash is one of farmers of KVK who have benefitted from the activities of KVK through On farm testing, front line demonstration and trainings. With the advice of KVK Mr. Prakash adopted pond based integrated farming systems in his farm. During the period 2013-14, Mr. Prakash earned a gross income of Rs 5,19,600 from 0.8 ha in a pond based farming system adopting Fish - Fish Seed - Vegetables(Bitter gourd, Snake gourd, Pointed gourd, cucumber) - Fruits (Mango, Papaya) – Flower (Marigold) – Mushroom (Paddy straw mushroom). The enterprise, area and economics of the farmer adopting IFS are presented in Table-2.

Horticulture and mushroom components. This may due to larger area dedicated for fish culture than vegetables, fruits and flowers. However, substantial income from non fishery activities has supported the farmer to have an economic gain in adopting IFS. It was inferred from the farmer that the income from non fishery activities helped him to invest for fishery sector towards

#### Case-2

##### Crop - Horticulture- Dairy-Mushroom based Farming System

Ganesh Mallick, a rural youth of village Belamara, of Balipatna block in Khordha District earned Rs 3,75,920 ( gross income) from an area of 1.872 ha crop based farming system adopting Paddy Seed – Paddy – Pulses ( Green gram, Horse gram) –Vegetables (Hybrid Okra, Pointed gourd) - Fruits (Coconut, Banana) – Dairy (Desi Cow) -Mushroom (Paddy straw mushroom) cropping system over a period of 13 months (June'2013- June'2014). The enterprise, area and economics of the farmer adopting IFS are presented in Table-3.

#### Case -3

##### Crop – Horticulture based Farming System

Ashok Bishoi, a farmer of village Tankol in Tangi block in Khordha district earned Rs 1, 50, 300 ( gross income) from an area of 0.8 ha crop based farming system adopting Paddy – Vegetables (Capsicum, Pointed gourd, Snake gourd, Bitter

**Table 4: Enterprises/Components of IFS, area and economics of the farmer in adoption of IFS**

S. No	Enterprise /Components	Area(ha)/ No. of plants /beds	Gross Income (in Rs)	Monthly Gross Income (in Rs)	Contribution to total gross income( in%)
1	Crop (Major Enterprise)				34.7
i	Paddy	0.8	46,100	3,841	
ii	Paddy Straw	3 tractor load	6,000	500	
2	Horticulture (Major Enterprise)				65.3
i	Capsicum(Hybrid)	0.036	21,300	1,775	
ii	Pointed gourd	0.137	54,000	4,500	
iii	Snake gourd(Off-season)	0.029	8,300	692	
iv	Bitter gourd	0.014	6,000	500	
v	Brinjal	0.09	8,600	717	
	Total		1,50,300	12,525	100

gourd, Brinjal) cropping system over a period of 12 months. (July'2013- June'2014). The enterprise, area and economics of the farmer adopting IFS are presented in Table-4

### CONCLUSION

Integrated Farming System approach not only fulfills the household needs but enrich diet of human being and animals both for nutritional security. Further, diversified nature of the model provides employment opportunity for unemployed rural youth. Economic and livelihood analysis of the system revealed that beside household food, feed, fodder and fuel security, the system generates a sizable amount of savings which will assist to meet other

liabilities of the family including education, health and social obligations and overall improvement in livelihood of small farm holders. Over two decades extension agencies have been encouraging farmers to adopt ways of integrating resources for better efficiency and to reduce dependency on adopting practices with high input cost. Any planning in this regard to be ecologically sound, economically viable, adaptable, socially acceptable and humane should be based on the need of the targeted population and take into account the "6-M Kits" which consists of Manpower, Money, Material, Market, Motivation and Management aspects with Knowledge, Information, Technology and Skill of both extension worker and beneficiaries for its' successful promotion and propagation.

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