



Encashing remunerative returns from integrated farming system model through farmer participatory approach

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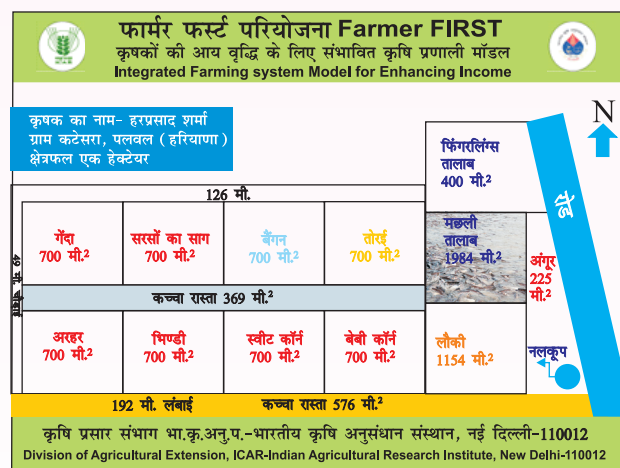
Weaning away from the conventional rice-wheat cropping system has been very challenging for the farmers of Indo-Gangetic plains. Technological interventions were designed on Integrated Farming System (IFS) through farmer participatory approach for diversification of the traditional rice-wheat cropping system, to generate higher returns for the smallholder farmers under Farmer FIRST initiative of ICAR. The IFS model has been designed by incorporating crops (rice, wheat, mungbean), vegetables, marigold, fish, mushroom and fodder cultivation in 1 ha land. The model has resulted in a net profit of ₹2.0–2.5 lakhs/ha per annum approximately. The model has resulted in efficient utilization of the farm resources and thus has effectively reduced farm wastage. The same model has generated employment around the year and helped in getting additional income.

Keywords: Diversification, Fish culture, Mushroom, Vegetable cultivation

IN India, the focus in agriculture has been majorly on increasing the production. Slowly, the trend is transforming towards increased emphasis on the returns of the farmers. India is predominantly constituted by small and marginal farmers and thus, the need to generate more from fewer resources has always been challenging for Indian agricultural scenario. In Farmer FIRST project of ICAR, we made an attempt to design technological intervention on Integrated Farming System (IFS) models in the farming system to move beyond the existing rice-wheat cropping system. The core strength of the programme lies in continued and enhanced farmers-scientists contact, to make the best possible use of the farmer's farm, innovations, resources, science and technology (FIRST). Through the Farmer FIRST project, attempts were made to introduce diversified agriculture amongst the cereal growing farmers. Agricultural diversification has amassed increasing popularity amongst the farmers as it ensures manifold increase in farmers' income from the same amount of farm resources. The inclusion of fruits and vegetables, flowers, fish and mushroom component along with the traditional crop component have been proven to successfully enhance the farmers' income in complex, diverse and risk prone regions. It helps the farmer to cover the production risk effectively. The results were very encouraging and thus, the project interventions can be regarded as highly successful. As

the intervention has been conducted in farmers' fields and has been supervised by the farmers themselves, the results have been widely accepted by the farmers and diffused to nearby areas too. These farmers' experiments on the farm diversification model i.e., the Integrated Farming System (IFS) model were carried out in the project village of Katesra, Palwal tehsil, Haryana.

An IFS model has been designed with the concept of integrating multiple enterprises (crops, horticulture, mushroom, fisheries, etc.) in a single farm unit with the objective of ensuring year round income and



Lay-out of IFS Model for 2019–20

Table 1. Economics of the Integrated farming system (1 ha area, 2019–20)

Crop	Variety	Yield (q)	Cost of cultivation (₹/ha)	Net income (₹/ha)	Activities of intervention
Rice	PB 1121	35.60	41420.50	72499.50	Traditional cropping pattern
Wheat	HD 2967	47.85	35510.20	52533.80	
Net income from rice-wheat (per hectare)				₹1,25,033.30	
Pigeon pea	Pusa 991	1.06	1785.00	2773.00	Integrated farming system (IFS)
Vegetables	Bottle gourd (P. Santushti)	23.28	5578.00	13046.00	
	Brinjal (P. Uttam)	39.36	11408.00	25984.00	
	Sponge gourd (P. Sneha)	23.16	6020.00	14824.00	
	Okra (P. A-4)	15.46	3069.50	9826.00	
	Mustard sag (P. Sag 1)	12.86	2082.00	5634.00	
	Baby corn	G 5414	3.84	9678.00	
Sweet corn	Sugar 75	15.74	9358.00	22122.00	
Marigold	P. Arpita	8.22	2996.00	8512.00	
Fish	Katla, Rohu & Mrigal	10.28	52370.00	55570.00	
Fodder	Sorghum (Chari)	Fodder for animals			
Net income from IFS model (per hectare)				₹1,79,333.00	
Increase in net income				43.43%	

employment for a farm family with 1 ha irrigated land is as follows: The pulses will be grown in an area of 700 m², vegetables will be cultivated in an area of 3954 m². The marigold plant will be spread over an area of 700 m². The fruit plants will be introduced in an area of 225 m² and fish pond in an area of 1984 m². The Mushroom unit was taken up in a space of 120 sq. ft. The results of this intervention were compared with the results obtained from the plots with the traditional rice-wheat cropping system. The economics, cost of cultivation, net income and B:C ratio of this model were calculated and compared with the conventional rice-wheat cropping system. Along with the training on the IFS model, the project staff was also provided with timely guidance and supervision of the crucial farm operations like sowing, irrigation, fertilizer application, plant protection from pests and diseases, maintenance of the records of the yield at various intervals of time. Total 54 guava, 35 mango, 52 papaya plants were planted on the bunds of the fish pond and adjoining area.

In the year 2019–20, the model was laid out on an area of 1 ha. Bottle gourd (Pusa Santushti), Brinjal (Pusa Uttam), Sponge gourd (Pusa Sneha), Okra (Pusa A-4), Mustard sag (Pusa Sag 1), Baby corn (G 5414), Sweet corn (Sugar 75) and Marigold (Pusa Arpita) along with Pigeon pea (Pusa 991) were cultivated as per the layout. The crop based components thus generated net returns of ₹1,23,763.00 in total. Sorghum was grown as a fodder crop in the area. The farmer was involved in the production of Rohu, Katla and Mrigal in an area of 1000 sq. m. In total, 2500 fish were captured, weighing 1028 kg and the net returns from fisheries were ₹55,570.00, by investing ₹52,370.00. Thus, the total net income from the IFS model reaped by the farmer was ₹1,79,333.00 per ha, which was 43.43% higher than the conventional rice-wheat cropping system (Table 1).

During 2020–21, the model included the components of paddy, wheat, mungbean, vegetables (Okra, Bottle gourd, Brinjal, Palak, Carrot, Sweet corn), Marigold, Sorghum (as fodder) and fish (Table 2). In case of



Paddy variety (PB 1718) in farmer's field



Sponge gourd variety Pusa Sneha in the farmers' field

Table 2. Economics of major crops module of Integrated farming system (IFS) (2020–21)

Indicator		Paddy		Wheat		Mungbean		
Variety		PB 1509		HD 3086		Pusa 1431		
Yield (kg/4800 m²)		2085		2460		525		
Cost of cultivation (₹/4800 m²)		20880.00		20528.00		11616.00		
Grain Market price (₹/kg)		27.00		19.25		60.00		
Straw rate for grain (₹/4800 m²)		0.00		12600.00		0.00		
Gross Income (₹/4800 m²)		56295.00		59955.00		31500.00		
Net returns (₹/4800 m²)		35415.00		39427.00		19884.00		
B:C Ratio		2.69		2.92		2.71		
Indicator	Okra	Bottle gourd	Brinjal	Sweet corn	Marigold	Palak	Carrot	Fodder
Variety	A 4	Pusa Santushti	Pusa Shyamla	Sugar 75	Pusa Narangi	Pusa All Green	Pusa Rudhira	Fodder for animals
Yield (kg/700 m²)	780.00	1250.00	1980.00	784.00	765.00	825.00	1365.00	
Market price (₹/kg)	11.00	9.50	8.00	18.00	14.50	9.00	9.00	
Cost of cultivation (₹/700 m²)	3025.00	3520.00	5150.00	4710.00	3105.00	2140.00	3690.00	
Gross Income (₹/700 m²)	8580.00	11875.00	15840.00	14112.00	11092.50	7425.00	12285.00	
Net returns (₹/700 m²)	5555.00	8355.00	10690.00	9402.00	7987.50	5285.00	8595.00	
B:C Ratio	2.83	3.37	3.07	2.99	3.57	3.47	3.33	
Fish		Yield (kg/120 sq. feet)		Market rate (₹/kg)		Cost of cultivation (₹/1000 sq. m.)		Net income (₹/1000 sq.m.)
Rohu, Katla and Mrigal: 2200 Nos		1016.00		100-110		50180.00		56500.00
Net income from IFS model (per hectare)								₹2,07,095.50
Increase in net income								65.63%

cereals and pulses, the B:C ratio ranged from 2.69–2.92. The crops grown were Paddy (PB 1509), Wheat (HD 3086) and Mungbean (Pusa 1431) and the net income realised was ₹94,726.00. Each of the vegetables was grown in an area of 700 m². The vegetables cultivated were Okra (Pusa A4), Bottle gourd (Pusa Santushti), Brinjal (Pusa Shyamla), Palak (Pusa All Green) and Carrot (Pusa Rudhira). From sweet corn (Sugar 75) and marigold (Pusa Narangi), the net income generated was

₹9402.00 and ₹7987.50 respectively. The net returns for the vegetables were ₹38,480.00. The fishery unit with (2200 nos.) Katla, Rohu and Mrigal generated returns of ₹56,500.00. Green fodder crop (Sorghum-Chari) was also raised to feed the milch cattle. The total net returns generated were ₹2,07,095.50/ha/year (Table 2).

During 2021–22, the components included in the 1 ha IFS model were rice (PB 1718), wheat (HD 3226), Mungbean (Pusa 1431), vegetables (Okra Pusa A-5,



Marigold variety Pusa Narangi in the farmers' field



Palak variety Pusa All green in the farmers' field

Table 3. Economics of Integrated farming system (IFS) in 1 ha for 2021–22

Indicator		Paddy		Wheat		Mungbean		
Variety		PB 1718		HD 3226		Pusa 1431		
Yield (kg/4800 m²)		2022.60		2515.40		546.00		
Cost of cultivation (₹/4800 m²)		22,300.80		19,891.20		11,688.00		
Market price (₹/kg)		32.00		19.75		60.00		
Straw rate for grain (₹/4800 m²)		0.00		9,600.00		0.00		
Gross Income (₹/4800 m²)		64,723.20		59,279.15		32,760.00		
Net returns (₹/4800 m²)		42,422.40		39,387.95		21,072.00		
B:C Ratio		2.90		2.98		2.80		
Indicator	Okra	Bottle gourd	Brinjal	Sweet corn	Marigold	Palak	Carrot	Fodder
Variety	A 5	Pusa Santushti	Pusa Shyamla	Sugar 75	Pusa Narangi	Pusa All Green	Pusa Rudhira	Fodder for animals
Yield (kg/700 m²)	795.20	1278.20	2114.00	786.00	849.10	661.00	1407.00	
Market price (₹/kg)	11.20	10.00	8.20	17.50	14.00	9.60	9.10	
Cost of cultivation (₹/700 m²)	3069.50	3761.80	5225.50	4860.00	3696.70	2270.00	3780.70	
Gross Income (₹/700 m²)	8906.24	12782.00	17334.80	13755.00	11887.40	6345.60	12803.70	
Net returns (₹/700 m²)	5836.74	9020.20	12109.30	8895.00	8190.70	4075.60	9023.00	
B:C Ratio	2.90	3.40	3.32	2.83	3.22	2.79	3.39	
Fish		Yield (kg/1000 sq. m.)		Market rate (₹/kg)		Cost of cultivation (₹/1000 sq. m.)		Net income
Rohu, Katla and Mrigal: 2200 nos		1010.00		110.00		48886.50		62213.50
Mushroom cultivation		Yield (kg/120 sq. ft.)		Market rate (₹/kg)		Cost of cultivation (₹/120 sq. ft.)		Net income (₹/120 sq. ft.)
		590.00		70-80		18350.00		25900.00
Net income from IFS model (per hectare)								₹2,48,146.39
Increase in net income								98.46%

Bottle gourd Pusa Santusthi, Brinjal Pusa Shyamla, Palak Pusa All green, Carrot (Pusa Rudhira), Marigold (Pusa Narangi), Sweet corn (Sugar 75), fish culture of Katla, Rohu and Mrigal, in 1000 sq. m. pond, a small

button mushroom unit and Sorghum-Chari as fodder. The net income realized from paddy, wheat and pulses was ₹1,02,882.35 by investing ₹53,880.00 as cost of cultivation. The net income from vegetable cultivation



Fish Pond



IFS model in project village

was ₹40,064.84. From Sweet corn (Sugar 75) and Marigold (Pusa Narangi), the net income was ₹8895.00 and ₹8190.70 respectively. The fish were sold at ₹110 per kg. The income additionally raised from fish was ₹62,213.50. From mushroom unit of 120 square feet, the net income realised was ₹25,900.00. The farmers witnessed a whopping (98.46%) rise in the net income, as compared to the conventional rice-wheat cropping system. From 1 ha of IFS unit, the farmer could make a net profit of ₹2,48,146.39 (Table 3).

SUMMARY

Integrated Farming System (IFS) model helps in efficient utilization of farm resources and risk minimization for farmers. The incorporation of such diversification in the conventional rice-wheat cropping system has led to enhanced returns by 43–98%. The integration of enterprises like mushroom unit has helped in the recycling of farm wastes and thus helped in generating wealth from waste. The component of fish

production is very much profitable and contributes a major share of the total farm income after the cereals and pulse component and thus, needs to be upscaled and promoted effectively. The vegetables cultivation has help ensure nutritional security for the family and also generate handsome returns from the market. Similar is the case with the flower component of the model, which fulfills the household needs along with catering to the urban market and getting handsome returns out of it. Fodder cultivation has improved the soil fertility status and water holding capacity of the soil. The above-discussed model can be an inspiration and eye-opener for young enterprising farmers to follow the market trend and invest in the diversified allied enterprises for generating higher returns.

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Dr Himanshu Pathak joins as Secretary (DARE) and Director General (ICAR)



The Indian Council of Agricultural Research (ICAR) has a new chief, Dr Himanshu Pathak as its new Secretary, Department of Agriculture Research and Education (DARE) cum Director General (DG), ICAR. He took over the charge of Secretary, DARE and DG, ICAR on 29 July 2022.

Dr Pathak, a renowned scientist, was born on 2 February 1965 in Purulia district of West Bengal. He obtained his school education in West Bengal; BSc (Ag) from Banaras Hindu University, Varanasi; and MSc and PhD in Soil Science and Agricultural Chemistry from Indian Agricultural Research Institute (IARI), New Delhi. He joined Agricultural Research Service of Indian Council of Agricultural Research (ICAR) as a Scientist in 1992 and became Senior Scientist in 2001 and Principal Scientist in 2009. Before joining as Secretary (DARE) and DG

(ICAR) Dr Himanshu Pathak was serving as the Director, ICAR-National Institute of Abiotic Stress Management (NIASM), Baramati, India. Prior to this, he was the Director, ICAR-NRRI, Cuttack, India. He has extensive international exposure and was a visiting scientist in the prestigious institutions namely University of Essex, United Kingdom; International Rice Research Institute (IRRI), Philippines; CSIRO Land and Water, Australia and Institute of Meteorology and Climate Research, Germany. During 2007–2009, he worked as the Co-Facilitator, Rice-Wheat Consortium (RWC), IRRI-India, New Delhi. He was the Lead Author of Inter-Governmental Panel on Climate Change (IPCC) 5th Assessment Report. Currently he is leading the baton of the DARE/ICAR as Coordinator for the climate negotiations in the United Nation Framework Convention on Climate Change.

Dr Pathak has several prestigious awards to his credit. He is the Fellow of the Indian National Science Academy (FINSIA), National Academy of Agricultural Sciences (FNAAS) and West Bengal Academy of Science and Technology (FWAST). He is the recipient of the Alexander von Humboldt Fellowship (FAvH) of Germany, Dr B C Deb Memorial Award of the Indian Science Congress Association (ISCA), Golden Jubilee Commemoration Young Scientist Award of the Indian Society of Soil Science, BOYSCAST Fellowship of Department of Science and Technology, Government of India, Young Scientist Award and Prof. S K Mukherjee Commemoration Award of ISCA. He has published more than 200 research papers and 10 books and has h-index of 41, i10-index of 85 with more than 5500 citations in international literature.

Dr Pathak has a vast portfolio which reflects in his work. He was the Principal Investigator, Climate Change Challenge Programme at IARI, New Delhi. He has contributed significantly in quantification of greenhouse gas (GHG) emission from soil, evaluation of the effects of management practices and biotic and abiotic factors on GHG emission and development of inventories of methane and nitrous oxide emission from Indian agriculture. His research has helped in rationalizing the estimates of GHG emission from Indian agriculture. He has developed simulation models such as InfoSoil, InfoFert, InfoCrop, TechnoGAS and InfoRCT for predicting the impacts of management and climate on crop yield and optimizing resource use for increasing production and minimizing environmental pollution.