

Integrated approaches for food, nutrition and livelihood security

of rural households in Fatehpur district of Uttar Pradesh

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Location and selection of area

The Farmer FIRST programme at the ICAR-IIPR, Kanpur has been implemented in four villages namely Karchalpur, Mirai, Khadra and Kharauli from Devmai block of Fatehpur district in Uttar Pradesh. The villages are in one cluster connects to each other. The crops grown in *rabi* were wheat, mustard, toria, chickpea, chilli, bean, potato etc. whereas *zaid* were mungbean, urdbean, cucurbits etc. The *kharif* crops were paddy, sorghum, pearl millet, pigeonpea, etc. Different interventions related to pulses, cereal, horticulture and livestock implemented in participatory mode in project area to enhance the productivity, production, income, and over all development of farming community.

Number of farm families

Total farmers covered under different interventions were 3384 and area covered was 443.5 ha

OBJECTIVES

- To increase economic yield, productivity, and net return of farmers through crop, livestock, and other enterprises.
- To develop capacity of farmers in enhancing productivity and sustainability in IFS of farmers in project area.
- To strengthen institutional linkage for seed Production system and value addition of pulses and other crop through society/FPOs.

Crop based module

Cereal-pulse-fodder-oilseed based: High yielding varieties of rice/wheat/

mustard for higher production and income.

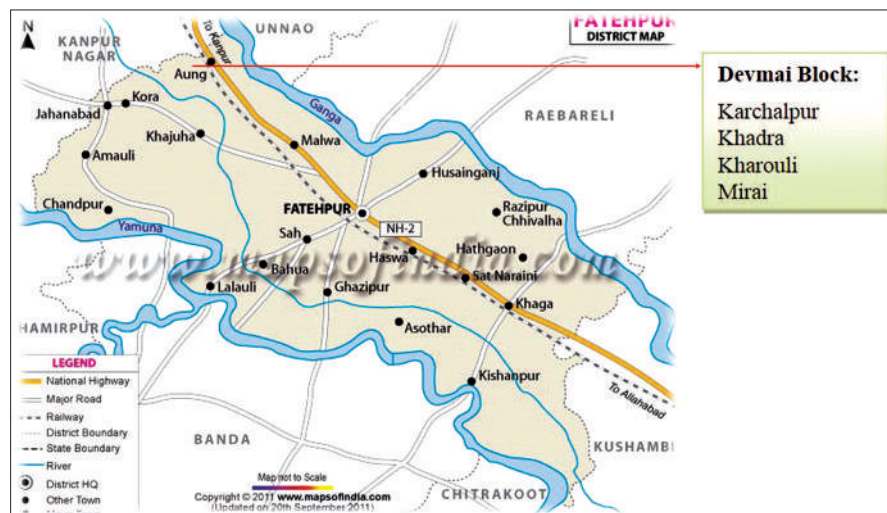
Name of technology	Recommended high yielding varieties
Potential solutions	Replace local cultivar with improved varieties

Cereal based intervention

Rice was demonstrated through introduction of new varieties. Total 22 farmers and 5.00 ha area was covered with hybrid and high yielding variety of rice. The recorded yield at farmers field was 67.5 q/ha of hybrid paddy (Variety 'Bioseed 799') and 60.4 q/ha (Variety 'NDR 2064') in comparison to local yield 44.7 q/ha. The average net return obtained was ₹ 88585 and ₹ 75410 in comparisons to local variety ₹ 67923/ha.

System of rice intensification (SRI): SRI Method of paddy cultivation was conducted in project area to show the new method for enhancement of the productivity and income of the farmers through introduction of new varieties of Rice. One demonstration was conducted for SRI Method to cover 0.1670 ha area. The recorded yield under farmer field was 69.8 q/ha 'NDR 2064' variety and net return of ₹ 66190/ha recorded.

Nutrient rich variety of wheat: Total 11 ha area belonging to 50 farmers was covered with variety 'K 1006' of wheat. The average yield of 'K 1006' of wheat was recorded at farmers field was 56.6 q/ha compared to local





Demonstration of rice variety under Farmer FIRST Project.



Comparison between 'K 1006' and local variety.

variety of wheat which was 45.9 q/ha. The net return gained by the farmers was ₹ 65288/ha in comparison to local variety ₹ 45766/ha.

Effect of micronutrient on the cereal crops: Application of micronutrients at flowering stage increased the number of grain per ear/cobs and the weight of grain and finally increased the yield of crops. The effect of micronutrients on yield of cereal crops was better than those without spray of micronutrient. The yield increased in rice, maize and wheat was 13-14% , 21-23% and 19-20% respectively.

Pulse based intervention

Increasing cropping intensity with summer mungbean and urdbean: Farmers did not cultivate any crop after harvesting of wheat, mustard and potato. The fields were left vacant after harvesting of wheat, mustard and potato. The farmer FIRST team discussed after thorough survey to introduce the short duration varieties

of mungbean i.e. IPM02-14, IPM-205-7 and IPM2-3 which matured in 60 days. Out of that IPM205-7 was found very suitable for the cultivation after harvesting of wheat and the yield was found IPM2-14 (9.5 q/h), IPM 205-7(13.88 q/ha) and IPM2-3 (10.15 q/ha). Presently 733 farmer are cultivating 178 ha whereas before 2016-17, the area was 3.50 ha only.

- Demonstration of wilt resistant variety and pest management in chickpea for higher production and income:

Name of technology	Seed of wilt resistant variety; Effective management of <i>Helicoverpa</i> /Pod borer.
Potential interventions	Quality seed; demonstration on pheromone trap and application of insecticides. Training of farmers.

Bringing additional area of pulses through chickpea interventions:

Demonstrations were also conducted in project area by covering 236 farmers to solve the problem of wilt disease and pod bores. The critical inputs seed, insecticide were provided. The average yield recorded was 26.80 q/ha and income gained was ₹ 83545 /ha.

- Summer mungbean (spring/summer) for additional income

Name of technology	Recommended high yielding and resistant varieties.
Potential solutions	Demonstration of appropriate varieties (IPM 02-3, IPM 205-7).
Nature of intervention	Improved variety; Insect Management; Local variety and management.

Summer mungbean in zero tillage: Five farmers cultivated summer mungbean under zero tillage by covering 1 ha area and the average yield gain at farmer's field was 12.06 q/ha. The income gained by farmer ₹ 68101/ha, compared to control ₹ 55809/ha.



Mungbean (IPM 02-3) at project village in Fatehpur district.



Harvesting of chickpea crop (JG-16) under Farmer FIRST project.

Table 1. Effect of varieties on yield and economics of pulse crops

Name of crop	Variety	Yield (q/ha)	Cost of cultivation (₹)	Gross income (₹)	Net return (₹)	B:C ratio
Mungbean	IPM 2-14	9.5	14890	34200	19310	2.29
	IPM 205-7	13.88	25114	99880	74766	2.97
	IPM 02-3	10.15	15760	36540	20780	2.31
	Local variety	8.25	14950	29700	14750	1.98
Urdbean	IPU 2-43	8.35	13785	29225	15440	2.12
	Local variety	7.15	11990	25025	13035	2.08
Chickpea	JG 16	26.8	29015	112560	83545	3.87
	Local variety	22.5	29090	95220	70330	3.27

- Summer maize for additional income

Name of technology	Hybrid maize varieties suitable in summer season.
Potential solutions	Demonstration of appropriate varieties.
Nature of intervention	Agronomical measures.

Summer maize cultivation: Total 40 farmers and 8.0 ha area was covered. Hybrid variety of maize as critical input was provided to the farmers for enhancing production and income in project area. The recorded yield under farmer field were 52.6 q/ha (Variety 'DKC 9108') compared to local variety (44.15 q/ha), an yield increase of 23%. The average net return obtained was ₹ 37320/ha as against ₹ 26490 under local variety. The farmers that grew summer maize could get good source of additional income and better utilization of fallow land in summer season.

Horticulture based module

Okra/pumpkin, sponge gourd in summer season for additional income

Name of technology	Improved varieties.
Nature of intervention	T-1 Improved variety T-2 local variety and management.

Vegetable based module

Introduction of okra: The farmers were provided with okra for regular income and nutritional value. The average income of ₹ 169120/ha was recorded. Total 195 demonstrations of okra were conducted by covering 56.5 ha area. This became a source of income in off season.

Bottle gourd/sponge gourd/pumpkin: Farmers gained ₹ 113588/ha income with total 91 demonstrations on bottle gourd in 10.0 ha area.

Similarly, total 81 demonstrations of the sponge gourd were conducted in summer season on 9.50 ha. Thus, farmers gained net return ₹ 11303/ha. Summer pumpkin was grown in fallow land and nutritional value was demonstrated and gain of average ₹ 79350/ha was seen. Total 76 demonstrations of the pumpkin were conducted on 9.50 ha area.

Oil based intervention for higher income and return

Sesame: Demonstration of high yield variety of sesame (Til) in project area for obtaining income and improved oil consumption of rural people was done. Farmers were provided critical input to conduct the demonstration on mustard and til to enhance yield and oil security through high yielding varieties of til (Pragati and Shekhar). The average yield 'Shekhar' variety of sesame (Til) was 8.10 q/ha (25% increase), 'Pragati' variety of sesame was 7.80 q/ha (15% increase) compared to local variety (6.80 q/ha). The average



Zero tilled summer mungbean (Variety IPM 205-7).

net income gained by farmers from Shekhar variety of sesame was ₹ 33448/ha, Pragati variety of sesame was ₹ 27634/ha compared to local variety ₹ 22474/ha respectively.

Demonstration on mustard: Total 80 farmers were given Kanti variety of mustard. The average yield of Kanti variety of mustard was recorded 22.50 q/ha compared to local variety (18.20 q/ha), an yield increase of 23.62%. The average net income gained by farmer through 'Kanti' variety of mustard was ₹ 60250/ha, compared to local variety ₹ 45800/ha respectively.

Livestock based module

- Backyard poultry and goat farming for income, employment and nutritional security for rural youths

Name of technology	Poultry feed and goat introduction.
Potential solutions	Regular income, employment generation for rural youths and production of egg and meat for increase in nutritional status of the rural people.
Nature of intervention	Introduction of dual purpose poultry breed; Calcium liquid.

Additional income and employment generation through poultry farming: Poultry units were established in project area to demonstrate the survivability, income, and employment for rural youths and women farmers. Altogether 134 farmers were provided 3700 poultry chicks breed namely CARI Nirbheek, Shyama, and Devendra brought from CARI, Izatnagar, Bareilly for increasing income, employment and nutrition. Farmers rearing 15-20 birds were getting net income ₹ 1010 per month and 60 hours employment per month. Similarly farmers rearing 25-50 birds were getting ₹ 5110 and 90 hours employment per month and farmers rearing at large scale between 55-110 poultry birds were getting ₹ 12680 and 120 hours employment per month (Table 2).

Livestock based intervention provided additional income, employment generation, and nutritional security: Total 33 goats (28 goat and 5 Buck) of two breeds 'Barberi' and 'Bundhelkhand Local' were provided



Okra under Farmer FIRST Project enhanced farmer's income

to woman Self Help Groups in the project area for enhancing additional income and employment generation under farmer FIRST project. Buck was used for breeding purpose to improve the local breed of goat in project villages; 7 goat were kidding 9 kids of goat. Also an establishment of mango orchard for 10 farmers in project area was made.

Fish based module

Fish farming

Performance indicators for each intervention:

Technical observations	Agronomic observations, Yield attributes.
Economic indicators	Cost of cultivation, Net returns, B:C ratio.
Farmers reaction	Social acceptance impact, perception, feedback.

Effective utilization of community

ponds for job creation and income augmentation: Fish farming was introduced to utilize the community pond for income and employment generation as well as nutritional security. Altogether 50 kg (10810 fingerlings/fish fry) were purchased from ICAR-

NBFGR, Lucknow and stocked in community ponds of villages in the project area. On an average, production of fish was 4.86 q/year (rate/kg : ₹ 150). Farmers earned ₹ 38,180 and consumed fish to the tune of 14.75 kg/year.

Enterprise based module

Enterprise based: Management of mango orchard

Nature of intervention	Mango + chickpea/ mungbean cultivation
Source of technology	CISH, Lucknow and IIPR, Kanpur
Expected output	Increase in income and nutritional security

Agri-horti based model in project area: In the year 2019-20 mango orchards ('Amrapali', 'Dashahari', 'Langra') and guava orchard ('Lalit') were established. This intervention will help in long term income and employment generation and

nutritional value for rural household in project area. Inter-cropping of fodder bajra (39.5 q) with mango orchard for higher income was promoted. Inter-cropping of summer maize (49.20 q/ha and net income ₹ 58260/ha) with Guava orchard for higher income. Other plants like Sagaun and Moringa were planted.

NRM based module

Vermicompost (Training and Multiplication)

Detail of vermicompost	Quality earthworm
Micro-farming situation	Large /Medium/small farmers
Problem	Lack of knowledge and Non availability of quality earthworm
Potential solutions	Demonstration of appropriate vermi-compost unit
Nature of intervention	Vermi compost units

Resource conservation through zero tillage and conservation agriculture

Name of technology	Zero tillage
Micro-farming Situation	Resource poor farmers
Problem	Soil erosion/ degradation
Potential solutions	Soil and water conservation
Nature of intervention	Zero tillage
Source of technology	IIPR, Kanpur
Expected output	Soil and water conservation
No. of farm families	One model farmer/ group of farmers

TRAINING

Training program, Field day and Farmer-Scientist Interaction programme is a very important component for upgrading of knowledge and skill of farmers. As per action plan, three training programme on different aspects of *rabi* crops, vegetable crops, pulse crops and poultry management were organized by covering 2033 farmers under the programme (Table 3). Scientist-Interaction sessions were organized in the villages to discuss the problems and interventions suitability and suitable farmers. Total farmers covered: 5417

Table 2. Economics of poultry based intervention.

Particular	Category of poultry rear farmer		Dual purpose breed
	15-20 poultry	25-50 poultry	
Number of farmer	81	38	15
Egg laying start	After 5 th month	5-5.6 month	5-5.6 month
Number of egg/month/poultry	22	22	22
Rate of per egg	10-15	10-15	10-15
Rate of meat Rs/kg	500-600	500-600	500-600
Work done in poultry farm per day	1-2 hr	2-3 hr	3-4 hr
Feeding calculation after grazing	1350 (90 kg*Rs.15)	2700 (180 kg*15)	6075 (405*15)
Health	100	500	2000
Labour charge per month	1500	2250	3000
Total expenditure	2950	5450	11075
Gross income	3960	10560	23760
Net income	1010	5110	12680



Poultry rearing augmented farmer's income and nutritional security under Farmer FIRST project.



Goat rearing provided additional income under Farmer FIRST project.

DRAWBACKS AND LESSONS LEARNT

- Periodical outbreak of disease in animal (like Foot & Mouth in Goat).
- Socio-economic condition of the farmers.
- Traditional mindset of the farmers.

IMPACT

- Zero-tillage: In mungbean with five demonstrations in 1 ha.
- Bio-fortified wheat variety (Zn and Fe rich) K-1006. Yield increase over local: 14.7%.
- Scented variety of rice PB 1. Yield increase: 22.2%.

- High yielding short duration variety: Kanti. Yield increase: 21.69%.
- Poultry enterprise module for income in summer season ₹ 250-300/day and winter season ₹ 450-500 per day.
- Agri-Horti model has been source of long term income generation.
- Community pond: 08 farmers and 1.0 ha area for fish farming. Helped in income and employment generation.
- Line sowing practice to conserve the resources.
- 20 SHG: women groups facilitate different interventions

Milestone achievements

Analysis of cropping system: Analysis of cropping system was carried out for 10 farmers to understand the effectiveness of best combination of crops and livestock. It was found that rice-chickpea-okra-poultry system had higher net returns than others (Table 5).

Economic impact

Presented in Table 6.

Impact of goat farming for empowerment of women: Barberi breed of goat was provided to woman Self Help Groups in the project area for income and employment generation under farmer FIRST project. Woman farmers expressed their satisfaction as they were earning income as well as they were getting milk for the consumption by family members. It helped in earning additional income by selling of milk to the range of ₹ 1800-2000/year after the implementation of project (Table 7).

WAY FORWARD

Farmer FIRST project has been a successful model in doubling the farmers' income through multiple components guaranteeing sustainable development of the adopted villages. In this model, appropriate interventions were formulated based on baseline survey, interaction with farmers, experts, developmental agencies, etc. Proper implementation of such interventions has helped farmers to earn additional income, reduced risks associated with farming, created farmers' societies for processing and better marketing of produce. It also helped the farmers to adopt scientific farming practices.

Table 3. Crop wise demonstration under Farmer FIRST project

No	Crop/ livestock	No. of demonstration	Area (ha)	Total production (q)	Total revenue (₹) generated under farmer FIRST Project
1.	Mungbean	360	85.00	973.25	6788418.75
2.	Urdbean	326	70.00	675.50	3782800.00
3.	Chickpea	236	37.5	1115.62	5154164.4
4.	Summer vegetables	187	37.00	2799.05	6157910.00
5.	Summer maize	87	8.00	389.04	661368.00
6.	Paddy	126	21.00	1171.80	2050650.00
7.	Wheat	174	43	2306.95	4244788.00
8.	Oilseed	222	46.5	813.75	3417750.00
9.	Poultry	134	3700	57500	460000.00
10.	Goat	33	1.0-1.5 lit milk/goat	(poultry) (egg production) 4060 lit x 20	81200.00
				Total	32799049.15

Table 4. Achievements

Item	Before project	After project
Cropping intensity	210%	290%
Area under summer mungbean & no of farmers	3.5 ha and 28 farmers	178 ha and 733 farmers
Area under summer vegetables & no of farmers	2.5 ha and 25 farmers	42 ha and 241 farmers
Area under summer maize & no of farmers	1.8 ha and 10 farmers	12 ha and 123 farmers

Table 5. Cropping system analysis of farmers

Name of farmer	Cropping pattern before project (Net profit in ₹)	Cropping pattern after project (Net profit in ₹)	Net income (₹/ha)	
			Before project	After project
Mr. Milan	Chilli (₹ 41232)-potato (₹ 48760) – fallow	Rice (₹ 34390) – wheat (₹ 41286) –okra (₹ 39322) –poultry (₹ 9165)	89992	124163(II)
Mr. Bhola	Rice (₹ 32762)–wheat (₹ 39725) – fallow	Rice (₹ 35236) –chickpea (₹ 49795) –okra (₹ 38534) –poultry (₹ 9852)	72487	133417(I)
Mrs. Sudama	Rice (₹ 32890)–wheat (₹ 41450) – fallow	Rice (₹ 33790)–chickpea (₹ 46466) – okra (₹ 40482)	74340	120738(III)
Mrs. Vimla	Rice (₹ 33892)–wheat (₹ 39354) – fallow	Rice (₹ 35268) –chickpea (₹ 51967) –summer mungbean (₹ 21835)	73246	109070
Mr. Jagdish	Chilli (₹ 40125)–wheat (₹ 38950) – fallow	Rice (₹ 35745)–wheat (₹ 42680)–summer mungbean (₹ 22873)	79075	101298
Mr. Prakash	Rice (₹ 35892) Mustard (₹ 29673)–Fallow	Rice (₹ 36062) –wheat (₹ 42763) – summer maize (₹ 23890)–poultry (₹ 10460)	65565	113175
Mr. Babbu	Rice (₹ 31658)–vegetable pea(₹ 35896)– Fallow	Rice (₹ 35975) –wheat (₹ 43762) – summer mungbean (₹ 22685)	67554	102422
Mr. Kauslendra	Rice (₹ 33762)– mustard (₹ 28965) – fallow	Rice (₹ 36210)–wheat (₹ 43762) – summer mungbean (₹ 21745)	62727	101717
Mr. Omprakash	Chilli (₹ 40456)–Vegetable pea (₹ 36765) – fallow	Rice (₹ 36460) –chickpea (₹ 49845) – summer maize (₹ 24765)	77221	111070
Mr. Rajjan	Rice (₹ 34650)–Wheat (₹ 39345)– Fallow	Rice (₹ 36761) –wheat (₹ 41465) – summer mungbean (₹ 23632)	73995	101858

Table 6. Economic impact of intervention

Intervention	2016	2020	Increase (%)
<i>Cereals based interventions</i>			
Paddy (scented variety PB-1)			
Yield (q/ha)	48.4	65.3	35
Net return (₹/ha)	36910	68949	87
Wheat Bio-fortified variety (K-1006)	2016	2019	
Yield (q/ha)	42.8	56.65	32.2
Net return (₹/ha)	43724	65288	49.31
Chapati (nutrition rich)	Normal	Good	
<i>Pulses and oil seed based interventions</i>			
Chickpea(JG-14 and JG-16)	2016	2019	
Yield (q/ha)	20.9	24.7	18.2
Net return (₹/ha)	65208	80134	56
Summer mungbean (IPM-2-3 and virat)	2016	2019	
Yield (q/ha)	7.2	10.15	40.97
Net return (₹/ha)	21400	36482	70.74
Mustard (Kanti)			
Yield (q/ha)	10.9	13.9	28.2
Net return (₹/ha)	15005	23348	55
Oil/ protein content	Low (34%)	High (36%)	
<i>Summer interventions</i>			
Maize (DKC-9108)	2016	2020	
Yield (q/ha)	40.3	47.14	17
Net return (₹/ha)	39890	54447	39.49
Okra (Navya)	2016	2020	
Yield (q/ha)	54.9	72.42	31.91
Net return (₹/ha)	87255	108630	24.50

Table 7. Impact of goat intervention on women

Particular	Before (Year round income) implementation of project (₹)	After (Year round income) implementation of project (₹)
By selling of milk	3800-4000	5000-6000
Selling of Buck	5000-6000/buck	6000-8000/buck

This project is focussed on farmer centric decision making and suitable technological interventions. It has benefitted all stakeholders i.e.

implementing organization (ICAR-IIPR), facilitating agencies of state department and farmers. The success behind the program can be attributed to proper planning, problem identification and introducing need based interventions specifically to increase income. Some of the significant technologies such as bio-fortified varieties of wheat (K1006) and lentil (IPL220) with quality seed, horticulture component of vegetable and fruits, poultry and goat breed along with skilled training has brought a big change among farmers. This model of integrated farming system with diverse components has been successful among the farming community, provided market access and customer preference. It can be replicated in other villages on large scale through State agriculture department network and other developmental agencies. With the increasing population and decreasing per capita land availability in India, diverse agriculture practices of integrated farming and making available potential production technologies at farmers door steps will definitely double the farmer's income by 2022.

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