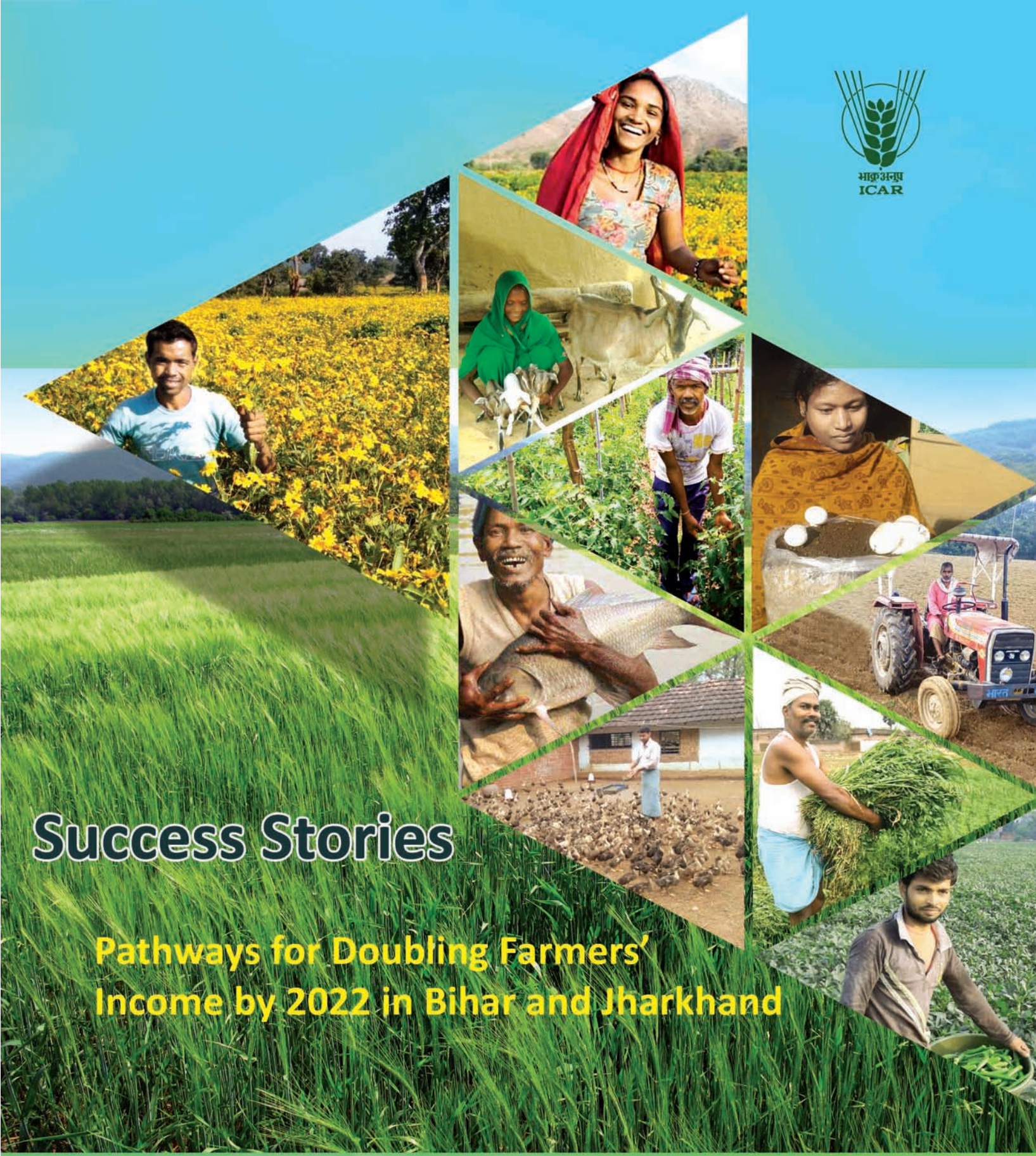

Success Stories

Pathways for Doubling Farmers' Income by 2022 in Bihar and Jharkhand

ICAR-Agricultural Technology Application Research Institute (ATARI) Patna

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

Central Potato Research Station

P.O. Sahaynagar, Patna- 801506, Bihar

Success Stories:

Pathways for Doubling Farmers' Income by 2022 in Bihar and Jharkhand

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Success Stories:
Pathways for Doubling Farmers' Income by 2022 in Bihar and Jharkhand

Dedicated

To

The Farmers, Scientists and Extension Personals

jeOee ceenve emen
RADHA MOHAN SINGH

Jeàe<e Ske eJeàmeeve Jeàu³eeve ce$ee
Yeejle mejJeàej
MINISTER OF AGRICULTURE & FARMERS WELFARE
Government of India

meoMe

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(jeOee ceenve emen)

TRILOCHAN MOHAPATRA, Ph.d.
FNA, FNASc, FNAAAS
SECRETARY & DIRECTOR GENERAL

सत्यमेव जयते

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GOVERNMENT OF INDIA
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MESSAGE

India is expected to achieve the ambitious goal of doubling farmers' income by 2022. The agricultural sector in India is poised to generate better momentum in the next few years owing to increased investment in agricultural infrastructure such as irrigation facilities, warehousing and cold storage. In addition, the growing use of genetically modified crops will likely improve the yield for Indian farmers. India is also set to become self-sufficient in pulse production in the coming few years due to concerted efforts of scientists to get early maturing varieties of pulses and the timely increase in minimum support price. Among the development initiatives of the government, the goal to double the farmers' income assumes special into implementation for the welfare of the farmers rather than focusing on increased output. To secure future of agriculture and to improve livelihood of half of India's population, adequate attention needs to be given to improve the welfare of farmers and raise agricultural income. Achieving this goal will reduce persistent disparity between farm and non-farm income, alleviate agrarian distress, promote inclusive growth and infuse dynamism in the agriculture sector. Respectable income from farm sector will also attract youths towards farming profession and ease the pressure on non-farm job, which is not growing as per the expectation.

Research Institutes should come with technological breakthroughs for shifting production frontiers and raising efficiency in use of inputs. ICAR and SAUs should develop models of farming systems for different types of socio-economic and bio-physical settings combining all their technologies in a package with focus on farm income. This would involve combining technology and best practices covering production, protection and post-harvest value addition for each sub-system with other sub-systems like crop sequence, crop mix, livestock, horticulture, fishery, forestry and others. Such shift requires interdisciplinary approach to develop on knowledge of all disciplines.

ICAR-Agricultural Technology Application Research Institutes Patna has shouldered a timely responsibility to identify a good number of successful cases related to farming through the KVK network in the eastern part of the country. Documentation of such successful practices by the resource-poor farmers will go a long way to motivate other farmers across the country to contribute significantly towards the noble goal of doubling farmers' income.

I congratulate the entire team of ATARI for the efforts in bringing out this valuable document.

(T. MOHAPATRA)

Dated the 8th May, 2019
New Delhi

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उप महानिदेशक (कृषि प्रसार)
Dr. A.K. Singh
Deputy Director General (Agricultural Extension)

MESSAGE

Agriculture continues to remain the major pillar of the Indian economy. Current Knowledge-intensive and market-led agricultural practices have resulted into the increase in food grain production and enhanced food and nutritional security in India, which makes the country net food exporter. Throughout the whole gamut of operations, the farmers are the key players, whose income, in spite of the above developments, remains constantly low. To improve the situation, the national government has been taken up a time-bound income-enhancing prorammes for farmers. In order to help in this endeavour, ICAR-ATARI, Patna has compiled the real life success stories on the proven profitability of the seleced agricultural technologies. I strongly believe that this compilation will make a footstep forward in encouraging the stakeholders to achieve the goals in the states of Bihar and Jharkhand.

I congratulate the Director, ICAR-ATARI Patna and the team of Scientists and appreciate their efforts for bringing out the document.

Dated :21.01.2019.

(A.K. Singh)

ICAR-Agricultural Technology Application Research Institute (ATARI) Patna
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Dr. Anjani Kumar
Director
ICAR-ATARI Patna

PREFACE

Farming is the most important enterprise in our country and farmers are an integral part of it. During the period of last 50 years from 1965 to 2015, since the adoption of green revolution, India's food production multiplied 3.7 times, while the population multiplied by 2.55 times. The net result has been a 45% increase in per person food production, which has made India not only food self-sufficient, but also an exporting country. While the country achieved commendable position in food production, farming itself turned non-profitable overtime due to rising costs and uneconomical holdings. Farmers' income remains low in relation to income of those working in the non-farm sector. The low and highly fluctuating farm income is causing detrimental effect on the interest in farming community and is also forcing more and more cultivators, particularly young generation, to leave farming. Hence, the goal set to double farmers' income by 2022 is central in the entire country to provide income security to the farmers, reduce agrarian distress and attract rural youth in agricultural farming.

Doubling farmers' income by 2022 is quite challenging, but it is possible. Agriculture is a predominant source of occupation in Bihar and Jharkhand with about 70% of people engaged in agriculture and allied sectors. Over the years, technological advances have been taken place in agriculture in Bihar and Jharkhand. Many technologies have already been realized for doubling the income of the farmers depending on resources and facilities. These technologies are Natural Resource Management (NRM), Resource Conservation Technologies (RCTs), Integrated Farming System (IFS), Integrated Crop Management (ICM), Integrated Nutrient Management (INM), Integrated Pest Management (IPM), farm mechanization, crop diversification, cultivation of high-value crops, protected cultivation practices, improved animal husbandry practices, modern fish production techniques, climate resilient technologies, secondary agricultural practices and post-harvest technologies.

The publication of 'Success Stories: Pathways for Doubling Farmers' Income by 2022 in Bihar and Jharkhand' is an attempt to document result-oriented, potential technologies for bringing about the target of doubling farmers' income into reality. The content of this document aims at exposing the present status of agriculture and allied sectors and opening scope for scaling up various proven technologies under different agro-ecological situations in view of doubling the farmers' income by 2022 in Bihar and Jharkhand. Efforts have been made to use the updated data in the document. Many success stories on farmer centric technological modules covering different districts in seven chapters have been included so that the stakeholders can be benefited to adopt different technological modules. The editors have included befitting pictures in this document most of which have been photographed by the staff of KVKs of different districts in Bihar and Jharkhand.

This document will be useful to all the stakeholders including the farmers, scientists, extension personals and policy makers who are interested in the subject. Although utmost care has been taken to include latest and authentic information yet the editors seek constructive criticism and suggestions to improve the document.

Place: Patna
Date: 17.02.2019

(Anjani Kumar)

ACKNOWLEDGEMENTS

The editors take an opportunity to express their deep sense of gratitude to Dr. T. Mohapatra, the Hon'ble Secretary (DARE) and Director General (ICAR) for his constant guidance and encouragement. The editors express their heartfelt gratitude to Dr. A.K. Singh, Deputy Director General (Agriculture Extension), ICAR for his valuable suggestions and remarks to improve the document.

The editors take an opportunity to put on record the enormous appreciation to all the Heads and Subject Matter Specialists of KVKs located in different districts of Bihar and Jharkhand for collecting data, compiling and preparing manuscript out of success of various technological interventions at the farmers' field. We like to acknowledge the efforts and cooperation extended by the KVK personnel for bringing out this document for the first time in the Zone IV, ICAR-ATARI, Patna.

The editors are highly thankful and grateful to the farmers of different districts of Bihar and Jharkhand for their vital information and data portrayed in success stories.

In the course of preparing the present document, the authors have received enormous help and supports from individuals. It is a great pleasure to acknowledge all who helped directly or indirectly to get ready this document. Our sincere thanks and gratitude are due to all the staff of ICAR-ATARI Kolkata as well as ICAR-ATARI Patna for their help and support during the preparation of 'Success Stories: Pathways for Doubling Farmers' Income by 2022 in Bihar and Jharkhand'.

Sincere thanks are also extended to the staff of M/s. CAPS Micrographics Pvt. Ltd., Kolkata for their cooperation to bring out this publication in time.

Date: 17.02.2019 Editors

CONTENTS

Crop Science

Rice Cultivation through Direct Seeded Rice (DSR) Technology

Bipul Kr. Mandal and Pramod Kr. Choudhary
Krishi Vigyan Kendra, Agricultural Farm, Raghopur, Distt. Supaul, Bihar

Agro-ecology and Farming Situation

Paddy is a major crop in Supaul district of Bihar. The total paddy area is about 8,000 ha. Paddy is grown in all the category of land covering upland, medium land and low land. The paddy is basically grown by transplantation method which is more labour intensive and time consuming method. It also causes green house gas emission.

Technological Intervention and KVK Support

In Direct Seeded Rice (DSR) technology, there is no need to raise paddy seedlings. Paddy seeds are directly sown in the prepared field. DSR can be classified into two categories: Dry DSR and Wet DSR. In Dry DSR, puddling is not required. Seeds are sown either manually or with the help of Zero tillage machine. In Wet DSR, field is puddled and seeds are sown with the help of Paddy Drum Seeder. Proper weed management with pre and post emergence weedicide is applied to ensure weed free crop. Also alternate wet and dry (AWD) condition is maintained for proper utilization of available moisture and plant growth by means of soil aeration. The other crop managements followed are similar to transplanted rice. KVK scientists demonstrated the technology in the field and encouraged the farmers to practice DSR technology in Supaul district of Bihar.

Benefits

The intervention on rice cultivation through promotion of direct seeded rice with paddy drum seeded has been accepted by the farmers owing to labour problem during uprooting of paddy seedling and transplanting it to the pulled field. It saved 30-35 man days per ha in comparison to transplanted rice. Farmers also reported about less cropping time, increase in yield and water saving.

Adoption, Spread and Up Scaling of Technology

The most of the farmers who have seen the performance of DSR are well convinced about the technology and they have taken it to the next year also. It has also been observed that the small and marginal farmers are more interested to adopt this technology. The acceptance of the technology is increasing as large number of farmers adopting cultivation through DSR.

Economic and Socio-Psycho Impact

Impact Factor	Before Adoption	After Adoption
Farmer Practice	Transplanted rice	Pinset seeded rice with paddy drum seeder
Yield of Product (q / ha)	24	29
Fixed cost (Rs. / ha)	-	6,000
Recurring cost (Rs. / ha)	26,500	20,250
Gross income (Rs. / ha)	41,600	43,800
Net profit (Rs. / ha)	15,100	23,550
BC Ratio	1.56	2.14
Knowledge gain based on 1- 5 scale*	3	4
Feeling of economic security based on 1- 5 scale*	3	4
Ability to understand and solve problems based on 1- 5 scale*	4	4
Self image in community based on 1- 5 scale*	3	4
Self confidence based on 1- 5 scale*	4	3

* 1- 5 scale indicates 1 = lowest and 5 = highest

Transformation of Grain Producing Village to Seed Village

A. P. Thakur and Ravi Shanker
Krishi Vigyan Kendra, Godda-Pirpaiti Road, Rautara Chowk, Distt. Godda, Jharkhand

Agro-ecology and Farming Situation

The farmers of Nonmati and Nemotari villages of Godda district, Jharkhand were unaware about the seed production of paddy. Every year they were purchasing paddy seed from local market and their quality was also not satisfactory. They were growing paddy only for grain purpose and were not getting attractive price. During the year 2014 - 15, NABARD funded to implement a pilot project on 'Seed production of paddy' in 50 acre of land in both the villages.

Technological Intervention and KVK Support

The year 2014 - 15, the pilot project on 'Seed production of paddy' was started in Nonmati and Nemotari villages covering 50 acres of land with the involvement of total 50 farmers (25 farmers from each village). Before the initiation of the project, awareness - cum - training programme was organized in both the villages. The farmers were convinced about the facilitation made by GVT - KVK, Godda and NABARD. Total 50 farmers were enrolled as a seed producing group and the group was named as Nonmati Shah Nemotari Dhan Beej Uthapadan Samuh, Godda. GVT - KVK, Godda provided foundation seed of paddy (Var.: *MTU - 7029*) to the selected farmers. Team of GVT - KVK, Godda visited the field from time to time and provided technical advices. Soil analysis was done and fertilizers were applied based on soil health card. The paddy seed field was registered with the Jharkhand State Seed Certification Agency. The seed certification officer also visited the field. They were also provided reaper for mechanized harvesting. The seed was processed in GVT - KVK, Godda. The Samuh was also registered in cooperative department. The processed seed was purchased by the Jharkhand State Government through DAO, Godda.

Benefits

Farmers were trained about scientific production of certified seed which would make them self-sustainable in seed production. Farmers became able to produce quality seed for their own and fetch good amount of money out of selling quality seeds.

Adoption, Spread and Up Scaling of Technology

Initial 50 farmers and additional more than 50 new farmers have adopted for seed production activity in these villages and nearby the villages. Presently, more than 20 new villages involving more than 1200 farmers are engaged in seed production in Godda district. The seed producing groups are now interested to purchase seed processing plant. The details of the seed

production programme are as below:

Year	Variety	Area (Acre)	No. of farmers involved	Processed Seed (q)	Supply to Govt. Agency (q)	Sell by farmers to other agency (q)
2014-15	*MTU-7029*	50	50	900	600	300
2015-16	*MTU-7029, Rajendra mansoori, Sahbhagi*	100	75	1800	800	1000
2016-17	*MTU-7029, Rajendra mansoori, Sahbhagi*	225	125	3900	620	3280
2017-18	*MTU-7029, Rajendra mansoori, Sahbhagi, Shatabadi*	190	105	3400		

Economic and Socio-Psycho Impact

Impact Factor	Before Adoption	After Adoption
Farmer Practice	Grain production of paddy	Seed production of paddy (Var.: MTU - 7029)
Yield of Product (q / ha)	40	60
Fixed Cost	-	-
Recurring Cost (Rs. / ha)	50,400	78,500
Gross Income (Rs. / ha)	68,000	1,23,000
Net Profit (Rs. / ha)	17,600	44,500
BC Ratio	1.35	1.57
Marketing	Local for grain purpose	Jharkhand State Beej Nigam for seed purpose
Dissemination of knowledge in the locality	Advisory service	Training, Field day, Group discussion, Kisan mela
Knowledge gain based on 1- 5 scale*	2	4
Feeling of economic security based on 1- 5 scale*	2	4
Ability to understand and solve problems based on 1- 5 scale*	3	4
Self image in community based on 1- 5 scale*	2	5
Self confidence based on 1- 5 scale*	1	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Translation of a Farmers' Group into a Seed Company

Shashi Bhushan Kumar Shashi, Pravin Kumar Dwivedi, Anil Kumar Yadav and Sachidanand Singh
Krishi Vigyan Kendra, SCADA, PO. Ara, Distt. Bhojpur, Bihar

Agro-ecology and Farming Situation

The village Hematpur and adjoining areas of Ara Block, Bhojpur in Bihar are traditionally known for growing maize and paddy during Kharif and many of times there is no yield in Kharif season due to flood. Thus, *Kharif crop* is uncertain in this northern part of Ara Block of Bhojpur district due to Gangetic floods.

Technological Intervention and KVK Support

Shri. Pravin Kumar Singh, 32 years old young farmer with academic qualification of matriculation is living in Hematpur village of Ara Block. He owns 8 ha land in flood prone area with minimum or no Kharif crop. During 2010-11, under "Technology Demonstration for Harnessing Pulses Production" programme, KVK, SCADA, Bhojpur initiated for lentil demonstration with a very promising variety *HUL-57* having 12-16 q/ ha yield. There was a huge demand for this cultivars in Hematpur village and also in adjoining villages. The farmer's feedback had given an idea to Shri. Pravin Kumar Singh that pulses seed production might be a profitable avenue. Shri. Singh approached KVK for a meeting and technological help. Training was organized by KVK scientists. Shri. Singh and other farmers had shown lentil in their fields. In 2012-13, Shri. Singh along with other 18 farmers formed an Association of Seed Producer and this group was attached with Bihar Rajya Beej Nigam (BRBN) for marketing.

In 2012-13, Sri Singh and his associates (18 farmers) produced 375 q lentil and 237 q gram seeds with a gross turnover of Rs. 22 Lakh. In second year, Sri Singh has motivated a large numbers of farmers in an area of 352.0 ha. Sri Singh and his associates (177 farmers) started production of Pulses seeds which was largest in Bihar. During 2016-17, more than 210 active members in 10 villages produced various crops seeds. Mr. Singh and his group members produced 3622 qt Lentil, 1088 qt Chickpea, 2800 qt Wheat, 5200 qt Oat, 5 qt Coriender Seeds (worth of Rs. 40 million).

Benefits

Now, Praveen Kumar Singh with the help of KVK and Government agencies has established his own Composite Seed Processing Plant with a capacity of 3.5 Ton/hr on Wheat base (In 2016, Cost Rs. 28 Lakh) and Registered Seed Company (M/s Shiv Ganga Seeds Village -Tenua, P.O.-Dhamar, Dist,-Bhojpur, Bihar). The Present turnover of the M/s Shiv Ganga Seed Company is more than Rs. 40 million.

Adoption, Spread, Up Scaling of Technology and Future Projection

The seed production technology had spread to more than 11 Villages in having trained farmers more than 450 in numbers who are producing various Seeds of Certified and Foundation category related to Cereals, Pulses, Oilseeds, Fodder and Spices.

During Rabi season 2017-18, 60 farmers for Chickpea, 110 farmers for Lentil, 250 farmers for Wheat, 12 farmers for Barley, 12 farmers for Oat and 8 farmers for Toria applied for registration in Bihar State

Seed and Organic Farming Certification Agency, Mithapur, Patna for seed production as the Seed Grower Company (M/s Shiv Ganga Seed).

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice(In case of lentil seed production)	Local cultivar for consumption	Seed production for marketing
Yield of Product (q/ha)	8.1	12.3
Fixed Cost (Rs./ha)	100	100
Recurring Cost (Rs./ha)	17,995	31,420
Gross Income (Rs./ha)	32,400	67,650
Net Profit (Rs./ha)	14,305	36,130
BC Ratio	1.79	2.15
Marketing	Local middle man	Seed Company
Dissemination of knowledge in the locality		
Knowledge gain based on 1- 5 scale*	2	4
Feeling of economic security based on 1- 5 scale*	2	5
Ability to understand and solve problems based on 1- 5 scale*	2	4
Self image in community based on 1- 5 scale*	3	4
Self confidence based on 1- 5 scale*	3	5

* 1- 5 scale indicates 1 = lowest and 5 = highest Non Seed sell Price Rs. 4000/qt

Seed Sell Price Rs . 5500/qt

Planning of Contingent Crop Niger on Rice Failed Crop Field

Chanchila Kumari, Manish Kumar, Sudhanshu Shekhar, Binit Kumar and Rupesh Ranjan
Krishi Vigyan Kendra, Jainagar, Distt. Koderma, Jharkhand

Agro-ecology and Farming Situation

Climatic condition is the most variable factor in upland rainfed crop system in which cropping pattern, timing, intensity and area cover under cropping system totally depend upon availability of rainfall and other irrigation facilities. Nearly 86% of agriculture practices in kharif season in Jharkhand depend upon rainfall and forcibly face the challenge of unavailability of rainfall during south west monsoon. Unfortunately, aberrant weather is a common feature in Jharkhand state agriculture from last one decade (minimum rainfall received 860mm during kharif season whereas the normal rainfall recorded up to 1050mm annually, Data collected from State Agriculture Department, Koderma, Jharkhand). The State of Jharkhand solely depends on mono cropping pattern with rice cultivation which is directly associated with rainfall and harvested water collected naturally or from constructed water bodies.

Technological Intervention and KVK Support

Before plantation of contingent crop following important factors are kept in mind:

- Selection of efficient crops and cropping systems matching the length of growing season. Some of the promising non-rice crops for rainfed uplands are maize, cowpea, pigeon pea, chick pea and niger.
- Choosing of short duration varieties which possess faster rate of growth, deep and penetrating root system and ability to escape drought.
- Storage of rain water to use as life saving irrigation.
- Performing off season ploughing to conserve moisture, reducing pest and weed problem and facilitating early sowing. Two to three ploughings and sowing the crops across the slope are practiced to develop a ridge and furrow type of land configuration for effective soil moisture conservation to overcome drought for longer period.
- Following of partial mechanization to ensure timeliness and precise of operations (desired depth and tilth) to utilize land, rainfall and other natural resources effectively.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	Yield loss due to un certainty of rainfall and mono cropping	Adaption of contingent crop (Niger) & Double cropping
Yield of Product (q / ha)	25.3	25.3 (rice)+5.6 (Niger)
Fixed Cost (Rs. / ha)	7,540	10,230
Recurring Cost (Rs. / ha)	28,540	36,230
Gross Income (Rs. / ha)	42,560	58,110
Net Profit (Rs. / ha)	6,480	11,650
BC Ratio	1.17	1.25
Marketing	State govt.	State govt. And local market
Dissemination of knowledge in the locality	No	Yes
Knowledge gain based on 1- 5 scale*	1	4
Feeling of economic security based on 1- 5 scale*	1	3
Ability to understand and solve problems based on 1- 5 scale*	1	3
Self image in community based on 1- 5 scale*	1	3
Self confidence based on 1- 5 scale*	1	4
Impact factor	**Before Adoption**	**After Adoption**
Farmer Practice	Yield loss due to unavailability of rainfall	Drought resistant contingent crop placed (Niger)
Yield of Product (q / ha)	20-22	5-6
Fixed Cost (Rs. / q)	8,540	6,230
Recurring Cost (Rs. / q)	2,540	1,230
Gross Income (Rs. / q)	17,560	15,550
Net Profit (Rs. / q)	6,570	8,090
BC Ratio	1.6	1.1
Marketing	State govt.	State govt. And local market
Dissemination of knowledge in the locality	Yes	Yes
Knowledge gain based on 1- 5 scale*	1	4
Feeling of economic security based on 1- 5 scale*	1	4
Ability to understand and solve problems based on 1- 5 scale*	1	5
Self image in community based on 1- 5 scale*	1	5
Self confidence based on 1- 5 scale*	1	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Contingency planning refers to mitigate any unexpected, unusual, unfavorable and unwanted accidental weather situations occurring at any time without prior knowledge before the crops are sown or even after the crops are sown. The contingency crop planning therefore is proposed to mitigate such situations through the choice of appropriate crops and varieties, cropping systems or other necessary relevant farm practices. Timely formulation and implementation of contingent agricultural plans help to mitigate the adverse effects of scanty rainfall on production and productivity of crops. Use of resource-conservation technologies (Zero Tillage Seed Drill Cum Fertilizer machine and Direct Seeded Rice) and a shift from sole cropping to diversify farming system are highly warranted. The success of contingent cropping system shows the suitable crop compatibility, production potential and economics during failure of main crop.

Adoption, Spread, Up Scaling of Technology and Future Projection

After demonstration of contingent crop on rice failed field of Koderma district, the farmers have shown their interest in cultivation of more relevant crops like chick pea, mustard and sunflower in crop failed condition. The input cost of cultivation for contingent crop was comparatively lower than the main crop. Moreover, the marketable value of contingent crop was high. The demonstration would be up scaled in nearby villages in the next year if the drastic natural conditions would occur. To make it popularize among the farmers, several Kisan Gosthi and training were organized by the KVK scientists in different villages of Koderma district.

Crop Diversification in Jute Field

Bipul Kr. Mandal and Manoj Kumar
Krishi Vigyan Kendra, Agricultural Farm, Raghopur, Distt. Supaul, Bihar

Agro-ecology and Farming Situation

In Supaul district, the predominant cropping system is Rice-Wheat-Jute. Farmers follow traditional method of cultivation resulting poor yield and thus lead to higher cost of cultivation. Farmers generally raise poor seedlings of paddy with the improper agronomic management practices without considering the situation of rice-ecosystem lead to low yield of paddy. Similar situation is faced by the farmers in wheat cultivation. Presently, the major wheat varieties used by the farmers are NL, SRI RAM 303 purchased from local market with higher prices. Farmers generally apply organic fertilizers as well as irrigation. Crop is mixed with mustard leads to poor yield of wheat *i.e* 20-20 q/ha. In the case of Jute only one variety i.e JRO-524 has been used by the farmers since 2 years. The crop is sown after the harvest of wheat leading to delay as well as poor management of nutrients. It results in higher cost of cultivation and deterioration of fibres.

Technological Intervention and KVK Support

In order to doubling farmers income by 2022 in Bihar with respect to the above mentioned technology following important point are taken into consideration. First of all, selection of the rice varieties as per land situation as well as tips of raising healthy seedling of paddy with proper adoption of organic management practices lead to higher yield i.e 40-42 q/ha and lowering the cost of cultivation 25-35% as compared to the traditional method of paddy cultivation. In irrigated situation, rice variety of Rajendra Sweta and Rajendra Mahsoori-1 were found better in low land situation. In deep water, Swarna Sub-1 along with application of 5 kg PSB- 5 Kg Azospirlum along with 75% RDF and green manuring by Dhaincha were better as compared to farmers' practices. In Rabi season, especially in the plot of jute crop local wheat crop was replaced by the wheat varities i.e DBW-14, WR-544, K-307, HW-2045. Mustard was replaced by *R. Suflam, Rajmash, PDR-14* varieties, field pea by *HUDP-15, Prakash, Azad Matar-3* varieties and lentil by *HUL-57, PL-406, Shivalik, Potato, Kufari Pokhraj, Kufri Ashoka, Kufari Lalima* varieties. In the case of Jute the popular varieties has been introduced i.e *JRO-66, JRO-128, JRO-8432*, instead of *JRO-524* by the adoption of 75% RDF @ 5 Kg PSB + 5 Kg Azotobactor per ha along with application of pre-imergemce herbicides *i.e* Pendimethilin 1.0 Kg a.i /ha in 500-600 litres of water. During the last 3-4 years, previous experiment was conducted at farmers' field. The cropping system Rice-Rajmash/ Potato/ field pea/ lentil/ mustard-Jute by the adoption of above mentioned

interventions has been found better and contributed to doubling farmers' income. Soil samples have been collected before and after the sowing and harvesting of crops for NPK determination as well as nutrient recommendation on the basis of soil test value.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	Rice-Wheat-Jute	Rice-Mustard-Jute Rice-Field Pea-Jute Rice-Rhizamah-Jute Rice-Potato-Jute
Yield of Product (q / ha)	13 (jute)	321
Fixed Cost (Rs. / ha)	1,3,000	1,80,000
Recurring Cost (Rs. / ha)	9,500	24,500
Gross Income (Rs. / ha)	40,500	73,000
Net Profit (Rs. / ha)	11,000	43,500
BC Ratio	1.37	2.47
Marketing	Sold at lower price	Sold at higher price
Dissemination of knowledge in the locality	2	4
Knowledge gain based on 1- 5 scale*	-	-
Feeling of economic security based on 1- 5 scale*	3	4
Ability to understand and solve problems based on 1- 5 scale*	1	3
Self image in community based on 1- 5 scale*	2	4
Self confidence based on 1- 5 scale*	2	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Technology Option	Yield of Jute fibres Q / ha	Cost of culti-vation Rs. / ha	Gross return Rs / ha	Met return Rs. / ha	BC Ratio
F.P *i.e* Rice-Wheat-Jute	13	29,500	40,500	11,000	1.37
Rice-Mustard-Jute	21	29,500	73,000	43,500	2.47
Rice-Field Pea-Jute	20	31,600	76,000	44,400	2.40
Rice-Rhizamah-jute	24	27,500	78,600	51,100	2.85
Rice-Potato-Jute	30	29,500	10,2000	72,500	3.46

The above mentioned cropping system and economics in Supaul district with respect to cropping diversification for profitability in Jute have proved better and satisfied with the afore said interventions.

Adoption, Spread, Up Scaling of Technology and Future Projection

Due to better performance of the technology, large area could be covered with this intervention to make the availability of above mentioned varieties of seed. Emphasis would be given for the production of seed at few more areas and awareness programme would be organized for farmers.

Sugarcane Cultivation through Improved Techniques and Intercropping with Potato

Ram Niwas Singh and Rajendra Prasad
Krishi Vigyan Kendra, Near Zero Mile, Distt. Sheohar, Bihar

Agro-ecology and Farming Situation

Type of land- Up land and mid land, Soil type- Sandy loam and loam, pH- neutal to alkaline, Soil organic carbon low to medium.

Problems are:

(i) Traditional method of Sugarcane cultivation,
(ii) Imbalance use of fertilizer,
(iii) Improper use of fungicide and insecticide,
(iv) Improper use of weedicide,
(v) Unawareness about the use of agricultural improved implements and tools.

Technological Intervention and KVK Support

CoP-2061 variety of sugarcane having high cane yield, better juice quality, more ratooning potential and resistance to insect pests and diseases was used in field of Sri Alok Kumar Singh. Paired row plantation of sugarcane through trench method at a distance of 120 cm was adopted by him for better interception of light and also to maintain optimum plant population. Paired row sowing of potato variety K Pokhraj with early bulking character was done as an intercrop to increase productivity as well as the profitability. Sugarcane seedling production through single bud method was also adopted to maintain the optimum plant population in main crop as well as in ratoon crop through gap filling. Sugarcane seed treatment by carbendazim @0.1%integrated with chlorpyriphos @0.3% was practiced by Sri Alok Kumar Singh.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	Traditional method	Improved scientific method
Yield of Product (q / ha)	480	900
Fixed Cost	-	-
Recurring Cost (Rs. / ha)	72,000	1,15,000
Gross Income (Rs. / ha)	1,39,200	4,41,500
Net Profit (Rs. / ha)	67,200	3,26,500
BC Ratio	1.93	3.8
Marketing	Sugarcane factories at Riga	Sugarcane factories and progressive farmers
Dissemination of knowledge in the locality	3%	27%
Knowledge gain based on 1- 5 scale*	2	4
Feeling of economic security based on 1- 5 scale*	2	4
Ability to understand and solve problems based on 1- 5 scale*	2	4
Self image in community based on 1- 5 scale*	3	4
Self confidence based on 1- 5 scale*	4	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

These practices resulted in a bumper crop of sugarcane with higher yield and income which multiplied Alok's farm output considerably. He got a net profit of 9,79,500 lakhs from 7 acres of land by cultivating intercropping of sugarcane variety CoP 2061with potato in scientific mode. The demand of sugarcane is high due to sugarcane factories situated near to his farm at Riga. He also sold some of the sugarcane as seed because this variety CoP 2061 became the first choice by the farmers in the district. Early uprooting of potato and selling in the market also provided additional income. After getting handsome income, Sri Alok Kumar Singh built his own house and admitted his son in convent school. Today he is known as sugarman of this district and many farmers follow the path of Sri Alok Kumar Singh.

Adoption, Spread, Up Scaling of Technology and Future Projection

The farmers' community has observed technical, social and economical empowerment of Sri Alok Kumar and thus the farmers are adopting the technologies applied by Sri Alok Kumar in his field. Training of farmers, kishan gosthi, workshop, diagnostic visit have been organized.

The following technologies are adopted and spreaded in the farmers' fields.

S.No.		Adoption %	Spreaded in Area (ha)
1.	Productivity and production enhancement through potential high yielding variety Cop-206	18	180
2.	Production technologies through single bud seedling production and gap filling in the main field of sugarcane	14	140
3.	Trench method of plantation	21	210
4.	Protection technologies such as sugarcane set treatment method and mode of pesticide application with proper dose and time	32	320
5.	Intercropping with potato	16	160

The quality seeds of sugarcane and potato are now available to the farmers. Development of integrated seed supply system to popularize new varieties of sugarcane and potato through creation of linkages between research institution, private sector and farmers are needed for mitigating quality seed shortage. Development of seed village concept as a tool to bridge the gap between the quality seed requirement and availability of quality seed would be helpful for the end users.

Paddy Cultivation through SRI and Direct Seeding

Vinod Kumar and Mukesh Kumar
Krishi Vigyan Kendra, PO. Shankarpur, Distt. Munger, Bihar

Agro-ecology and Farming Situation

The Munger district having agro-ecology of moderate rainfall and humidity, temperature is suitable for paddy cultivation. Paddy crop is grown with SRI method in assured irrigation facility area. In case of late arrival of monsoon, he has sown direct seeded paddy with zero tillage and drum seeder machine. It reduces the cost of cultivation and achieves higher yield with best quality. Farmers face difficulties in transplanting the tender seedlings in the field with SRI method. The transplanted plantlets have changed their position due to intensive rainfall. Farmers have noted intensive weeds growth in direct seeded rice.

Technological Intervention and KVK Support

SRI method is an innovative latest method of paddy cultivation. Six technologies are assembled in SRI method of cultivation. Those are seed purification and treatments, planting of 7 days old plantlets, proper planting distance (10" x 10"), one plant per heel mechanically weed control, alternate light irrigation (not ponding water) and use of maximum organic fertilizer. Direct seeding of paddy includes zero tillage and drum seeder machine. It reduces about 25% of cost of cultivation and uses entire rainfall water in paddy production. It saves environment with less emission of green house gasses like methane and nitrous oxide.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	Traditional method (transplanting old seedling notin line, traditional water management, pest and disease control, harvesting and threshing)	Innovative scientific methods (transplanting inline, weed control, pest and disease control, harvesting and threshing mechanically)
Yield of Product (q / ha)	33	77
Fixed Cost (Rs. / ha / crop season)	12,200	14,000
Recurring Cost (Rs. / ha)	18,000	15,000
Gross Income (Rs. / ha)	49,600	98,400
Net Profit (Rs. / ha)	19,400	69,400
BC Ratio	1.64	3.40
Marketing	Selling of product to local grocery and purchase of agril. inputs from local market	Selling of product to cooperative society and near town and purchase of agril. inputs from local market
Dissemination of knowledge in the locality	Dissemination of knowledge only through conversion	Dissemination of knowledge through training and by exhibiting FLD plot

Impact factor	Before Adoption	After Adoption
Yield of Product (q / ha)	33	7 7
Knowledge gain based on 1- 5 scale*	1	5
Feeling of economic security based on 1- 5 scale*	1	3
Ability to understand and solve problems based on 1- 5 scale*	1	5
Self image in community based on 1- 5 scale*	1	5
Self confidence based on 1- 5 scale*	1	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

The farmers have adopted this technology and fetched higher income from paddy cultivation. This technology has reduced cost of cultivation and enhanced productivity and profitability. Farmers got higher social status due to adoption of these technologies. Other farmers of adjacent village have interacted with him to give them detail knowledge about it. Thus, this technology has scaled up economically and lifted up social status of the farmers.

Adoption, Spread, Up Scaling of Technology and Future Projection

This technology is latest, innovative and beneficial. It enhances productivity and reduces cost of cultivation. About 40 % of local farmers have adopted this technology. Farmers are adopting rapidly this technology for fetching high returns from their fields. The refinement of this technology has also done by the progressive farmers. So, this technology is spreading among the farmers.

Quality Seed Production

Anand Kumar Tiwari, Vivek Kashyap and Rajan Kumar Ojha
Krishi Vigyan Kendra, Sujani, PO. Ghorlash, Distt. Deoghar, Jharkhand

Agro-ecology and Farming Situation

Deoghar District covers an area of 2479 sq. km. The district extends from 24003´ to 23038´ N latitude and 86028´ to 87004´ E longitude. District containts several clusters of rocky hills with forest. District experiences hot summer (March to May), heavy monsoon (June to September) and cool dry winter (October to February). Annual rainfall is 1239 mm, mean summer maximum temperature is 430C and mean winter minimum temperature is 80C. Nearly 44.0 percent area of the total area of the district is utilized for cultivation, out of which only 10.55 percent is irrigated. Most common sources of irrigation are dug, well, surface flow water, lift irrigation. Rice is the main crop followed by maize, sugarcane and vegetables.

Technological Intervention and KVK Support

Our centre selected Palojori block and Madhupur block for paddy seed production during the year 2017-18. In the Palojori block, Pokhria village and in Madhupur block, Govindpur village were selected as seed village programme in 5.5 and 28.0 hactare area covering 21 farmers fields. For paddy seed production, the farmers used the foundation seed of Sahbhagi variety. For promoting the seed village programme, State Govt. procured seeds on the basis of Rs 1600/- per quintal and thus the farmers did not have any risk in regards to sale of seeds.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	No quality	Good quality
Yield of Product (q/ha)	17.8	31.6
Fixed Cost (Rs./ha)	23,530	29,470
Recurring Cost (Rs./ha)	21,920	27,510
Gross Income (Rs./ha)	28,480	50,560
Net Profit (Rs./ha)	6,560	23,050
BC Ratio	1.30	1.84
Marketing	Local market	State Govt. level
Dissemination of knowledge in the locality	Nil	Spread in more than 20 village
Knowledge gain based on 1- 5 scale*	1	3
Feeling of economic security based on 1- 5 scale*	1	4
Ability to understand and solve problems based on 1- 5 scale*	1	4
Self image in community based on 1- 5 scale*	1	3
Self confidence based on 1- 5 scale*	1	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Farmers have got 3-4 times more financial benefit than the previous practice. The quality seeds are now available within the village. The farmers have felt higher social status than the earlier situation, as few farmers have been recognized by giving prize and award at State or District level Kisan Mela or other programmes.

Adoption, Spread, Up Scaling of Technology and Future Projection

Now-a-days, this technique is spreading in and around adjoining seed villages covering huge area. Its impact would come in reality within 4-5 years, when maximum farmers would grow seed at their own fields and not depend on local market for quality seeds.

Chickpea Production as Source of Income

Shobha Rani and Ajit Kumar Paswan
Krishi Vigyan Kendra, Seed Multiplication Farm, Mussi, Makhdumpur, Distt. Jahanabad, Bihar

Agro-ecology and Farming Situation

Jehanabad disrict is having rice-wheat cropping system comes under rainfed situation. Shri.Yogendra Sharma is a small farmer of Gandhar village, Block- Modanganj of Jehanabad disrict. He is having 2 acres of land.

Technological Intervention and KVK Support

Shri.Yogendra Sharma is a small farmer of Gandhar village, Block- Modanganj of Jehanabad district. Having 2 acres of land, he was facing economic scarcity due to bigger family size. But he had keen interest in high income cropping system. He received training on sustainable crop production from KVK Jehanabad and started cultivation of chickpea instead of wheat. In the starting phase, local variety of chickpea yielded very less. But gradually by taking technical advice, he improved his skill and knowledge and adopted scientific methods of cultivation.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	Rice-Wheat	Rice - Chickpea
Yield of Product (q / ha)	29.5	16.5
Fixed Cost	-	-
Recurring Cost (Rs. / ha)	27,500	19,475
Gross Income (Rs. / ha)	44,988	90,750
Net Profit (Rs. / ha)	17,488	71,275
BC Ratio	1.63	4.65
Marketing	Local Market	Local Market
Dissemination of knowledge in the locality		
Knowledge gain based on 1- 5 scale*	1	3
Feeling of economic security based on 1- 5 scale*	1	4
Ability to understand and solve problems based on 1- 5 scale*	2	2
Self image in community based on 1- 5 scale*	2	4
Self confidence based on 1- 5 scale*	1	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

In rabi season 2016-17, Shri.Yogendra Sharma got cluster demonstration by KVK, Jehanabad for one hectare area with improved seed variety and seed treatment inputs which resulted a good yield and higher income as compared to his previous year grown wheat and local variety of chickpea. The net

income / ha of Shri.Yogendra Sharma from chickpea production was Rs.71275 during 2016-17. Earlier it was Rs.17488 / ha from wheat production. He shared his knowledge and experience with other farmers. Scientific cultivation of chickpea resulted about 4-5 times of net income as compared to wheat during same period of cropping. It was preferred by the farmers, because of downward movement of water level and scarcity of water for wheat production.

Adoption, Spread, Up Scaling of Technology and Future Projection

Farmers suffering from water scarcity are adopting cultivation of pulses. Pulse production requires less input with higher return as compared to wheat production. So, the farmers are now accepting the crops which require less water, minimum input and give maximum output in the situation of limited resources.

Rice Nursery Business

Ram Pal, Devendra Mandal and Reeta Singh
Krishi Vigyan Kendra, Bikramganj, Distt. Rohtas, Bihar

Agro-ecology and Farming Situation

Rohtas is situated in South Bihar Alluvial Plain Zone (III-B). Soil of the district is heavy clay. Annual rainfall is about 746.6 mm. Rice wheat is the major cropping system with 167.1 cropping intensity. About 86 % of the cultivable area has assured canal irrigation. Paddy productivity is 74.81% higher whereas the wheat productivity is 28.72% lower than the national average during 2014-15. Late sowing of wheat is the main reason of low wheat productivity. Farmers use to grow long duration paddy variety (*MTU-7029*). Canal irrigation and long duration variety paddy are major players for high paddy productivity and delayed wheat sowing. High yielding wheat varieties and zero-tillage sowing of wheat are quite popular in the district. Many technologies; *viz* short duration paddy, direct seeded rice, SRI *etc.* have been tried to advance the wheat sowing, but they could not generate the required result. Farmers of the Rohtas district feel socially insecured because their wheat productivity in the post-green revolution era is not increasing in line with the investment they make in raising their crop. They need to cope-up with both weak and variable monsoon as well as lower factor productivity (productivity per unit labour and capital).

The delayed rice transplantion basically results late sowing of wheat. The long standing practice of raising rice nurseries is only after the outbreak of monsoon. Hence, the farmers are in dire need of quality rice seedlings on time for increasing the wheat yield.

Technological Intervention and KVK Support

Rice transplanting is delayed as nursery is not available on time. It is now time to break the long standing practice of raising rice nurseries only after the outbreak of monsoon. It means that it needs to focus on the availability of quality rice seedlings when the regular monsoon sets in. So, the first action point that needs to be incorporated is timely availability of rice nursery for transplanting. This will make the famers less vulnerable to weak and variable monsoon including excess rains received within few days after transplanting. Once the nursery is made available, the farmers would automatically be able to take up timely transplanting of rice followed by right time sowing of wheat leading to increase wheat yield. Thus, timely establishment of rice should be kept at first priority in order to work towards increasing the benefit of both production and profitability of small and marginal farmers. KVK, Rohtas introduced nursery business to ensure timely transplanting of rice by ensuring timely supply of rice seedlings.

Economic and Socio-Psycho Impact

This short duration business is profitable not only for entrepreneur, but also for very small land holding farmers, leased-in farmers, women farmers and farmers engaged in other part time activities.

Table: Economic analysis of one acre rice nursery business

Particulars			Amount (Rs)
Seed, 176 kg @ 40/kg			7,040
Seed treatment, (carbendazim 552 gm @608/kg)			336
Ploughing (4 times @ 800/ pass/Ac)			3,200
Irrigation (32 hrs @120/hr)			3,840
Fertilizers			
DAP	40 Kg@ 25/Kg =	1000	
Urea	30 Kg@ 6/Kg =	180	
Potash	8 Kg @ 15/Kg =	120	
Zink Sulphate	10 Kg @ 46/ Kg =	460	1,760
Labour	8 @ 200/day		1,600
Land rent for one month			1,600
Plant protection			384
Weed management			448
Others (loss etc)			2,816
Total Cost			23,024
Total return (50 ac @ 800/ Ac)			40,000
Net Profit			16,976
BC Ratio			1.74

The overall income of the farmers increased from 20.43 to 28.04% in different villages as shown in the following Table.

Table: Impact on system productivity

Site	No of farmers	Area, Ac	Land use pattern, Ac						Yield equivalent of wheat qt/ ha		% increase
			(before) Rabi-2016-17			(after) Rabi-2017-18			201-17	2017-18	
			Wheat	Pulse	Oil seed	Wheat	Pulse	Oil seed			
KVK	99	89.84	68.4	15.6	5.84	61.62	18.6	9.62	771.36	969	25.62
Dedhgaon	69	252.5	209.5	36.7	6.3	182.3	45.6	24.6	2136.4	2728.3	27.71
Motha	14	18.34	14.4	2.74	1.2	12.6	3.2	2.54	156.14	196.66	25.95
Taradh	11	23.8	16.4	5.6	1.8	11.24	7.51	5.05	209	251.7	20.43
M-1	12	26.88	18.6	6.4	1.88	12.6	9.4	4.88	236.12	285.92	21.09
M-2	17	48.75	36.8	8.54	3.41	28.8	12.6	7.35	419.03	521.55	24.47
M-3	10	54.38	41.52	9.5	3.32	35.2	16.5	2.64	466.54	592.46	26.99
Surhuriya	10	45.31	38.6	5.4	1.31	29.6	9.8	5.91	379.99	486.59	28.05

The following table depicts that rice nursery business can benefit each and every aspects of farming if implemented in proper ways. It is expected that some successful enterprises will bring more innovations

leading to better quality of nursery covering more area with less amount of nursery, saving in money incurred on both seed as well as cost of transplanting. The nursery entrepreneurs can choose his/her best field with good facility of irrigation preferably near the village, earn profits and then use the same field for transplanting any medium or short duration rice after sale of nursery. Rice nursery business can lead the best use of even a small piece of land.

Table: Impact on transplanting time, seedling age, yield and socio- psycho factors

Particulars	Before	After
Average paddy transplanting time	10 July-15 Aug	20June-10 July
Seedling age at the time of transplanting	35-45 days	20-30 days
Yield (kg/ ha)	5687-6546	6029-7308
Wheat sowing	20 Nov-10Jna	05 Nov-20Dec
Dissemination of knowledge in the locality	1	4
Knowledge gain based on 1- 5 scale*	1	5
Feeling of economic security based on 1- 5 scale*	1	5
Ability to understand and solve problems based on 1- 5 scale*	1	5
Self image in community based on 1- 5 scale*	1	5
Self confidence based on 1- 5 scale*	1	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

This short duration (month long) remunerative business offers opportunity to the farmers, youth, landless person and even women. Persons with no land can lease-in land and earn. The share of self-employed service providers (SPs) will increase in the labor force in the rice season.

The creation of rice nursery enterprise is expected to help improving wheat yields in three ways.

1. It is an enabling factor to ensure timely rice transplanting.
2. It facilitates the transplanting of relatively young seedlings. The transplanting of young and healthy seedlings is an efficient way of improving tillering, early crop growth, maturity and harvesting and consequently wheat sowing.
3. It will increase the scope of using lesser seed rate than farmers are using now. The seed saved is equal to seed produced.

Adoption, Up scaling of technology and future projection

Rice nursery could supply rice seedlings to 69 small and women farmers directly. Technology has enough strength to upscale. If rice nursery business is up scaled in the district, it would be a business of more than Rs. 1000 lakhs and could provide directly employment to 6250 persons.

Natural Resource Management

Application of Zero Tillage Technology in Sowing of Wheat Seeds

Vimlesh Kumar Pandey
Krishi Vigyan Kendra, Agwanpur, Distt. Saharsa, Bihar

Agro-ecology and Farming Situation

The physical characteristic of the soil is Eastern middle Gangatic plain having alluvial soil with loam to loamy clay texture with high soil moisture. The existing cropping system in the area is rice-wheat-green gram. Preparation of fields for sowing of rabi crops, particularly wheat after harvesting of rice, is time consuming and costly affair resulted into delay in sowing of wheat seeds, thus there is decrease in productivity of wheat.

Technological Intervention and KVK Support

Sowing of seeds without tillage in the field is basically known as Zero Tillage Technology (ZTT). Application of this technology not only reduces the cost of field preparation but also it reduces the quantity of irrigation water, the number of weed population along with environment friendly method of sowing due to less burning of fuel. As far as critical inputs like seeds and fertilizers are concerned, this method applies these inputs at proper depth and hence beneficial for better germination. This technology also supports timely sowing of rabi crops particularly wheat specifically in late sown conditions, although this technology is also beneficial for sowing of timely sown wheat. Work on implementation of practicing ZTT in wheat sowing has been implemented by KVK, Saharsa since 2009 through front line demonstration programme. By introducing ZTT in wheat crop, there was a saving of 45 litres diesel per hectare which resulted in reduction of cost of sowing Rs. 3500 per hectare. An average increase in the yield by 18 percent has been observed during demonstration. BC ratio with introduction of this technology in wheat has been found as 2.57. Due to this fact, nearly 10 percent annual horizontal spread has been observed for practicing ZTT in wheat sowing within the district.

Economic and Socio-Psycho Impact

Impact factor	Before adoption	After adoption
Farmer practice	Manual Sowing with conventional tillage practice three to four times nearly one week after harvesting of rice crop and planking	Sowing with ZTT after harvesting of rice crop without any special field preparation
Yield to product (q / ha)	22.5	24.6
Fixed cost (Rs. / ha)	9,000	6,060
Recurring cost (Rs. / ha)	9,250	8,265
Gross income (Rs. / ha)	33,750	36,900
Net profit (Rs. / ha)	15,500	22,575
BC ratio	1.84	2.57
Marketing (Rs. / ha)	1500	1,500
Dissemination of knowledge in the locality	Nil	10 per cent annually

Impact factor	Before adoption	After adoption
Knowledge gain based on 1-5 scale*	1	4
Feeling of economic security based on 1-5 scale*	1	3
Ability to understand and solve problems based on 1-5 scale*	2	4
self image in community based on 1-5 scale*	3	5
Self confidence based on 1-5 scale*	2	5

*1-5 scale indicates 1=lowest and 5=highest

Benefits

Application of Zero Tillage Technique for sowing of wheat seeds is the need of the days due to economic use of critical inputs and natural resources like petroleum and irrigation water. The technology is environment friendly due to less quantity of fuel required particularly during preparation of field. No till field requires 25 per cent less quantity of irrigation water. The implement used for the purpose has been accepted by small farmers on hired basis at a rate of Rs. 1500/ha for sowing purpose.

Adoption, Spread, Up Scaling of Technology and Future Projection

The technology is well accepted by the District Agriculture Department and spreading among farmers with 10 to 15 per cent annually in wheat sown area. For future projection, this technology may be applied in sowing of lentil seeds as this is tested at the instructional farm of KVK, Saharsa in cultivation of lentil crop.

Zero Tillage Technology : An Option for Sustainable Rice-Wheat Cropping System

Mandhata Singh, V. Dwivedi and Deokaran
Krishi Vigyan Kendra, Lalganj S.M. Farm, Distt. Buxar, Bihar

Agro-ecology and Farming Situation

The climate of the area is semi-arid subtropical, characterized by very hot summers and cool winters. The hottest months are May and June, when the maximum temperature reaches 45-46^{0}C, whereas during December and January, the coldest months of the year, the temperature often drops below 5^{0}C. The average annual rainfall is 1100 mm, 65-82% of which is received through the northwest monsoons during July to October. Rice-wheat cropping system is dominant cropping system of Buxar district and covers 108,000 ha area. Farmers of the district growing long duration rice varieties (MTU 7029) and semi-medium duration variety (BPT 5204). Transplanting of rice started end of June and completed up to first fortnight of August. Late harvesting of rice leads to delayed sowing of wheat. Wheat crop faced the terminal heat problem at the time of heading and grain filling stage, sometime crop lodge due to poor and shallow root establishment and productivity of wheat is very low up to 2.8 t/ha.

Technological Intervention and KVK Support

KVK started the training, awareness and frontline demonstration programme for advancing the sowing date of wheat crop by using zero tillage machine. KVK, Buxar started front line demonstration on zero tillage sowing of wheat in several parts of district in 2012 and continuously giving more emphasis on zero tillage technology (ZTT). KVK organized the field tour, front line demonstration and developed the private service providers for promotion of zero tillage. On and off campus training programme were organized for operation and maintenance of zero tillage machine. Result of zero tillage sowing was glaring, input saving, early crop establishment and producing the high crop yield. The terminal heat and lodging problem were also reduced due to early sowing and establishment of crop in proper depth. Zero tillage sowing of wheat was also promoted by different projects of KVK viz. Farmers Participatory Action Research Programme (FPARP), National Innovation on Climate Resilient Agriculture (NICRA), Improved Rice Based Rainfed Agricultural System (IRRAS) and Cereal System Initiative for South Asia (CSISA) project.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	Conventional tillage and broad-casting of wheat seed @ 160 kg/ha	Zero tillage sowing of wheat @ 100-120 kg/ha
Yield of Product (kg/ha)	2800	4500
Fixed Cost (Rs./ha)	23,000	20,000
Recurring Cost (Rs./ha)	5,000	4,000
Gross Income (Rs./ha)	44,800	72,000
Net Profit (Rs./ha)	16,800	48,000
BC Ratio	1.71	3.0

Impact factor	Before Adoption	After Adoption
Marketing	Local market	Farmers producer groups / ITC etc
Dissemination of knowledge in the locality	Farmers knowledge sharing	Group meeting, Training, Field day, Tour and exposure visit, Kisan Mela etc
Knowledge gain based on 1- 5 scale*	1	5
Feeling of economic security based on 1- 5 scale*	1	4
Ability to understand and solve problems based on 1- 5 scale*	1	4
Self image in community based on 1- 5 scale*	2	5
Self confidence based on 1- 5 scale*	1	5

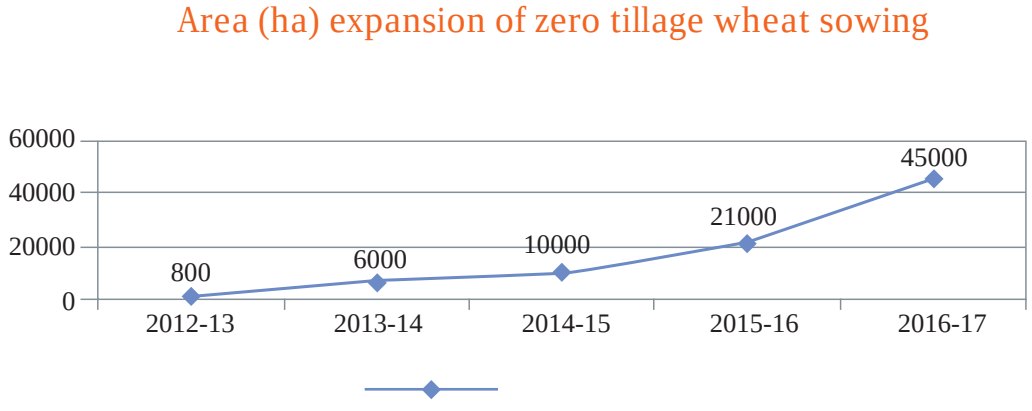
* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Adopting of zero tillage technology with high yielding wheat varieties; productivity of wheat per unit area has been increased and input cost viz. field preparation, seed rate, fertilizer cost, irrigation cost and weed management cost have been reduced and thus the farmers were benefitted more. The Government subsidy on zero tillage has accelerated the adoption of technology.

Adoption, Spread, Up Scaling of Technology and Future Projection

In year 2012 the total area under zero tillage was very low and scattered and limited number of farmers adopted in 800 ha area. KVK, Buxar has given more emphasis on promoting of zero tillage sowing of wheat for sustainable rice-wheat cropping system in 2016-17 and thus zero tillage sowing of wheat has covered 45000 ha area.



Economics of Zero tillage demonstration

Year	Average yield (t/ha)	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	Cost benefit ratio
2012-13	4.1	21500	55350	33850	2.57
2013-14	4.3	23200	60200	37000	2.59
2014-15	3.9	24800	56550	31750	2.28
2015-16	4.6	25100	70150	45050	2.79
2016-17	5.1	25700	82875	57175	3.22

MSP: 2012-13: Rs 1350, 2013-14: Rs 1400, 2014-15:Rs 1450, 2015-16:Rs 1525, 2016-17:Rs 162

Popularization of Zero Tillage Technique for Wheat Cultivation in Low Land

Ram Eshwar Prasad, Sachchidanand Prasad and Manohar Panjikar
Krishi Vigyan Kendra, Village and PO- Chainpura, Distt. Sitamarhi-843320, Bihar

Agro-ecology and Farming Situation

Sitamarhi district is flood prone district which normally comes in the month of June and continues till October. District Sitamarhi comes under Agro climatic zone-I and it is situated in north western part of the state Bihar. Wheat is the most popular Rabi crop grown in the district, about 47% area of the district is covered by wheat, but productivity of wheat is very low due to non-adoption of timely sown cultivar of wheat in low land ecology. Before intervention of zero tillage technique, farmers grew only late shown cultivar of wheat due to higher moisture availability in the field. In this existing problematic situation, zero tillage technique has been found most suitable for timely sown wheat cultivar. The principal crops of the district are wheat, Rice, Maize, Pulses, Oilseeds, Vegetable and Spices with number of crop rotation like, Rice-Wheat, Maize-Wheat, Rice-Wheat-Green Gram, Rice-Mustard *etc.*

Technological Intervention and KVK Support

Agriculture in the district is prone to natural calamity. Due to availability of higher moisture content in the low land ecology of the district any timely sown cultivar had not been found suitable in traditional broadcasting method. In order to further tap the potential of zero tillage technique under low land ecology, Best Management Practices (BMPs) including time of sowing and method of crop establishment were standardized. To test the performance of zero tillage technique under low land and ecology, On Farm Adoptive Trial was conducted by KVK, Sitamarhi and cultivation of timely sown cultivar by using zero tillage technique was found most suitable in all locations. After evaluation zero tillage technique with timely sown cultivar of wheat, it was popularized in the low land ecology of the district through F.L.D., Kisan Gosthies, Field day and Exposure visit programme organized by KVK, Sitamarhi.

Economic and Socio-Psycho Impact

Impact factor	Before	After
Farmer practices	Broadcasting	Zero tillage method
Yield of product (q/ha)	25	35
Fixed Cost (Rs./ha)	2,600	2,600
Recurring Cost (Rs./ha)	30,000	23,500
Gross Income (Rs./ha)	40,000	56,000
Net Profit (Rs./ha)	7,400	29,900
BC Ratio	1.22	2.14
Dissemination of Knowledge in the locality	Lack of knowledge	Farmers have appropriate knowledge and practices of high yielding wheat through zero tillage technique
Knowledge gain based on 1-5 scale*	1	5
Feeling of economic security based on 1-5* scale	2	5

Impact factor	Before	After
Ability to understand and solve problems based on 1-5 scale*	1	4
Self image in community based 1-5 scale*	1	4
Self confidence on 1-5 scale*	1	5

Benefits

Zero tillage technique found most suitable for wheat cultivation in low land ecology of district Sitamarhi and majority of farming community easily accepted this technique.

Adoption, Spread, Up Scaling of Technology & future projection

Zero tillage technique with high yielding variety of wheat HD- 2967 was found most popular within the farmers of district Sitamarhi. This technology spread up through farmers to farmers extension approach. At present about ten thousand farming families have adopted zero tillage technique.

Use of Zero Tillage Technology in Wheat Sowing

Shobha Rani and Jeetendra Kumar
Krishi Vigyan Kendra, Seed Multiplication Farm, Mussi, Makhdumpur, Distt. Jahanabad, Bihar

Agro-ecology and Farming Situation

The area comes under NARP Zone -III B. The soils of the zones are classified as old alluvial. Climate of the area is humid-hot and Rice-Wheat is major cropping system in his village. Wheat is major crop during Rabi season. Wheat crop is sown traditionally in which farmers plough the field 3-4 times with tractor operated cultivator and wheat seed is broadcasted @ 160-200 kg / ha and then planking is done. This method of wheat sowing requires heavy investment particularly in field preparation and sowing time is delayed by 15-20 days.

Technological Intervention and KVK Support

Mr. Devendra Kumar is a progressive farmer of village Sakrorha, Block-Modanganj, Jehanabad. Rice-Wheat is major cropping system in his village. During Rabi season, wheat is prominent crop. He sow wheat after 3-4 ploughing followed by planking then broadcast seed and fertilizer, which caused delay in wheat sowing and involved high cost of cultivation. He came in contact with Krishi Vigyan Kendra, Jehanabad where he got technical training by the Scientist (Agril. Engg.) on use of improved agricultural implements and machineries and then he used 11 rows zero till seed cum ferti. drill for wheat sowing.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	Broadcasting method of wheat	ZT in wheat
Yield of Product (q / ha)	34	40.4
Fixed Cost		
Recurring Cost (Rs. / ha)	27,000	24,000
Gross Income (Rs. / ha)	54,400	64,600
Net Profit (Rs. / ha)	27,400	40,600
BC Ratio	2.01	2.69
Marketing	Local Market	Local Market
Dissemination of knowledge in the locality	-	Yes
Knowledge gain based on 1- 5 scale*	1	4
Feeling of economic security based on 1- 5 scale*	1	3
Ability to understand and solve problems based on 1- 5 scale*	1	4
Self image in community based on 1- 5 scale*	2	4
Self confidence based on 1- 5 scale*	2	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Zero tillage technology saved Rs. 3000/- per ha in cost of ploughing, labour as well as irrigation water. This technology advanced wheat sowing by 8-10 days and caused a yield increase of 15-18 % as well less weed infestation

Adoption, Spread, Up Scaling of Technology and Future Projection

the zero tillage technology. As a result, area under this technology has been spreaded in the village and surrounding villages.

Intensive Agricultural Operations through Farm Mechanization for Enhancing Income

Ashok Kumar and Mukesh Kumar
Krishi Vigyan Kendra, PO. Shankarpur, Distt. Munger, Bihar

Agro-ecology and Farming Situation

Farm mechanization plays pivotal role to enhance the profitability and sustainability of agriculture. It reduces drudgery labour in performing agricultural operations. It performs accurately agricultural operations in short time with less cost. Tal land is irrigated but during three monsoon months water logged condition prevails. Tal land is cultivated with *rabi* crops (lentil, pea, gram, mustard, maize *etc.*).

Technological Intervention and KVK Support

Mechanization in agriculture is essential for timely performing agricultural operations in case of intensive farming situation. All agricultural practices/ operations may be performed with suitable improved agricultural machinery, equipment or tools. Shri. Vinod Roy, an innovative farmer, is living in the Village- Farad, Block- Jamalpur of Munger District. He has modified several agricultural implements according to need of the local farming situation. He has modified seed drill, thresher, pump set and other agicultural implements. He has made a manual drawn zero tillage for sowing millets after receding of flood water and timely sowing of lentil in late drainage of water from tal area. Shri. Vinod Roy has also modified thresher's threshing drum speed and structure suitable for threshing of different crops. He has modified centrifugal pump establishment in case of declining of water table in summer season.

Economic and Social Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	Performed traditionally with using manual and animal powers. It was slowly fatigue, time consuming and less beneficial.	Most of agricultural operations have been performed by mechanization using mechanical, solar or electric power. It is drudgery free less costly, rapidly and safely.
Fixed Cost (Rs./ha/crop season) per year	10,200	2,12,000
Recurring Cost (Rs./ha year)	1,75,000	1,22,000
Gross Income (Rs./ha year)	2,25,944	7,85,000
Net Profit (Rs./ha year)	40,744	4,51,000
BC Ratio	1.22	2.35
Marketing	There is no village market. So, he sells his product in munger market or sells to village's small trader.	He sells perishable fruit, vegetable in sabji Arhat Munger. He sells milk in village's milk collection centre which is running by local youth associated with ITC.

Impact factor	Before Adoption	After Adoption
Dissemination of knowledge in the locality	He disseminated agril. Techniques in mutual conversion	He has trained farnmers and advised them in field as well as in training.
Knowledge gain based on 1- 5 scale*	1	5
Feeling of economic security based on 1- 5 scale*	1	5
Ability to understand and solve problems based on 1- 5 scale*	1	5
Self image in community based on 1- 5 scale*	1	5
Self confidence based on 1- 5 scale*	1	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Shri Vinod Roy has earned many fold higher income after adopting mechanization. He has mitigated agril. input cost and achieved higher income. He has earned more income by giving machinery to other farmers on hiring basis. He has used agricultural machinery as a commercial venture. He has earned more money after cutting of operational cost and fixed cost of implement or machinery. His economical and social status has been impoved after adopting mechanization in agriculture.

Adoption, Spread, Up Scaling of Technology and Future Projection

Intensive farming has been practiced by the farmers to achieve higher income. So, intensive agricultural operations could be performed timely, accurately with low cost by adopting mechanization. It is necessary for commercial agriculture. Through the adoption of mechanization is about 25% due to small land holdings as well as low purchasing capacity. But, it is most urgent to adopt mechanization to scale up in near future for generating more income. This technology is essential for doubling farmer income by performing timely, accurate and beneficial agricultural operations. The future plan of adopting mechanization in agriculture needs to be established at panchayat level to do farming on cooperative basis.

Cultivation of Green Gram through Zero Till Seed Drill cum Fertilizer Machine for Increasing Farm Income

H.C. Chaudhary, K.K. Singh and J. Prasad
Krishi Vigyan Kendra, P.O. Saraya, Distt. Muzaffarpur, Bihar

Agro-ecology and Farming Situation

The district Muzaffarpur comes under Indo-Gangatic plane and Rice-Wheat cropping system. Total geographical area of the district is 3.176 lakhs ha and total cultivable area 2.48 lakhs ha. Out of which net sown area is 2.20 lakhs ha. The area under irrigation is 0.83 lakh ha. Average rainfall of the district is 1046 mm. The major pulse crops of the district are lentil, green gram and black gram. Since last five years farmers have cultivated green gram by the use of rotavator. However, it has drastically reduced the yield due to heavy infestation of wed as well as green gram bean yellow mosaic virus and root rot disease.

Technological Intervention and KVK Support

Through various programmes like Training on farm mechanization, FLD, CFLD and OFT on cultivation of greengram varieties, *i.e., SML-668, Pusa Vishal, Meha, TBM-37* by the KVK, Saraiya, Muzafafrpur, Shri. Rama Shankar Singh, a progressive farmer, acquired skill in these aspects. He also visited different institutions for theoretical and practical aspects of line sowing of green gram through zero till seed drill cum fertilizer machine. He started adopting the package of practices given by KVK and Dr. RPCAU, Pusa with 2 acre of land during the year 2014-15. More frequent visits were also made to the site of demonstration by KVK scientists and officials of District Agriculture Department. KVK, Scientist also focused on the concept of soil test based fertilizer recommendation, seed treatment, INM and IPM. Shri. Rama Shankar Singh has gradually increased area every year. As a result, his production has been increased substantially.

Economic and Social Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	Cultivation of green gram through rotavtor, no seed treatment and weed control measure practiced by the farmers	Sowing of seed through zero till seed drill cum fertilizer machine, weeding is done by weeder, soil application of test based fertilizer and sulphur and seed treatment with FIR technology
Area (ha)	0.8	2.4
Yield of Product (q/ha)	5.3	8.50
Gross Cost (Rs./ha)	12,750	21,500
Gross Income (Rs./ha)	18,550	38,250
Net Profit (Rs./ha)	5,800	16,750
BC Ratio	1.45	1.77
Marketing	Selling to the broker	Selling in rural and urban market

Impact factor	Before Adoption	After Adoption
Dissemination of	Motivate the farmers for adopting new package of practices.	The idea for new technology for cultivation of green gram through zero till seed cum fertilizer machine is transmitting from farmer to farmer in nearby villages as well as KVK, ATMA and DAO are providing demonstration facility to the farmers. Now this technology followed by 350 farmers of the district around 1300 ha of land.

Benefits

Green gram cultivation through zero till seed drill cum fertilizer machine has several benefits in economical as well as social term. This technology has led to minimize risk of crop failure. Overall income increases, which may serve as a best medium to double farmers' income. If most of the farmers adopte this technology, they will able to earn more income. Green gram cultivation through this technology has brought positive impact on different aspects of livelihood of the beneficiaries. Annual income, standard of living and household condition of the farmers could be improved.

Adoption, Spread, Up Scaling of Technology and Future Projection

KVK, Saraiya, Muzafafrpur plays a great role in dissemination of this technology along with Shri. Rama Shankar Singh among the farmers by organising training programmes and demonstrations. The technology has been spreaded into 5 villages of the district.

Use of 2% Urea as Foliar Spray in Chicpea for Increasing Yield and Income

Manoj Kumar Singh, Prashant Verma and R.K. Singh
Krishi Vigyan Kendra, Holycross, Near Kanari Hill, Distt. Hazaribagh-825 301, Jharkhand

Agro-ecology and Farming Situation

Hazaribagh district of Jharkhand is sub humid tropical area. Maximum temperature is recorded at 40^{0}C with average relative humidity 71% and annual rainfall 1000 - 1400 mm. Soil is gentle slopy low and with occasional steep stop, hill and hillrocks, meta morphic rocks like granite, grieve horn blending and similar rock type, red and yellow soil sandy loam. The soil is acidic with pH 5 to 6.3 low in organic carbon. There is low to medium range of phosphorus with low to medium range of potash. Agriculture is rainfed.

Technological Intervention and KVK Support

The stage of flowering and pod formulation plant need more nitrogen for protein formation. Farmers are not applying nitrogen in this state. Spraying of 2% urea at flowering and pod formation stage could help for more flowering in plant and more fruit setting, bold size grain filling in pod leading to increase of chickpea yield by about 20 - 30%.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	No use of urea as foliar spray	Use 2% urea as foliar spray
Yield of Product (q / ha)	12.50	16.50
Fixed Cost (Rs. / ha)	6,250	6,250
Recurring Cost (Rs. / ha)	28,448	30,004
Gross Income (Rs. / ha)	81,250	1,07,250
Net Profit (Rs. / ha)	52,766	77,246
BC Ratio	2.85	3.57
Marketing	Less demonstration	Easy Marketing and more demonstration
Dissemination of knowledge in the locality	Poor	Good
Knowledge gain based on 1- 5 scale*	1	5
Feeling of economic security based on 1- 5 scale*	1	5
Ability to understand and solve problems based on 1- 5 scale*	1	5
Self image in community based on 1- 5 scale*	1	3
Self confidence based on 1- 5 scale*	1	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Foliar spray of 2% urea at flowering stage and pod formation stage recorded higher net profit (Rs. 77246.00) and BC ratio (3.57) compared to earlier farmers practice. The technology has been well accepted by the farmers.

Adoption, Spread, Up Scaling of Technology and Future Projection

Adoption of technology is 100% and technology has been spreaded through farmer to farmer and through training organized by KVK and also spreaded by line department. This technology may be applied for the cultivation of other pulses crops.

Plastic Mulching in Vegetables for Soil Moisture Conservation and Augmenting Income

Bipul Kr. Mandal and Pramod Kr. Choudhary
Krishi Vigyan Kendra, Distt. Agricultural Farm Raghopur, Distt. Supaul, Bihar

Agro-ecology and Farming Situation

Vegetable crops are basically grown in upland and medium land areas. The productivity of the vegetable crops is affected by high infestation of weed. The proper weed management requires huge amount of labour and capital, where as vegetable crop requires light and frequent irrigations which further increase the labour and capital requirement.

Technological Intervention and KVK Support

The application of plastic mulch in vegetable refers to the covering of open space available between plant rows with suitable plastic film in order to control weed and moisture conservation. This helps in proper plant growth, less disease infestation. The higher seed germination under mulched condition has also been observed. The paddy straw, water hyacinth, wood straw, dry leaves *etc.* can also be used as an organic mulch material for vegetable crops.

Economic and Socio-Psycho Impact

Impact Factor	Before Adoption	After Adoption
Farmer Practice	Yes / No Mulching in okra	Mulching in okra
Yield of Product (q / ha)	70	120
Recurring cost (Rs. / ha)	24,500	36,000
Gross income (Rs. / ha)	56,000	96,000
Net profit (Rs. / ha)	32,000	60,000
BC Ratio	2.28	3.2
Dissemination of knowledge in the locality	Moderate	High
Knowledge gain based on 1-5 scale*	3	5
Feeling of economic*	4	5
Ability to understand *	3	5
Selfimage communation*	3	5
Self confidence *	4	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

The plastic mulching in Okra save about 40-50 % of irrigation water. The average yield obtained varies from 110 to 130 quintals / ha most importantly farmers were able to take their produce in the market much early and fetched higher price. The Okra farmers have sold their produce with ranging rate of Rs. 40 / -kg Rs.30 / -kg and Rs.10 / -kg.

Adoption, Spread, Up Scaling of Technology and Future Projection

The application of plastic mulch in vegetable has enhance potential to not only increase the production but also to increase the farmer's income significantly. It reduces the water requirement in the range of 40-50% and yield enhancement of 50-80%.The technology is simple easy to adopt, However it requires higher initial capital to procure mulch material.

Diversification in Agriculture Practices for Increasing Farm Income

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Krishi Vigyan Kendra, Regional Research Station, Bhagabanpurhat, Distt. Siwan, Bihar

Agro-ecology and Farming Situation

Sri Surendra Singh, village- Chorauli, Block- Bhagwanpur Hat, is an educated (Intermediate) farmer. He has 5.0 ha land with Pumpset, Boring, Sprinkler, Tractor Thresher, and other agricultural implements. Earlier his farming was mostly subsistence and traditional bearing less profit Rs. 6,61,000/- in a year.

Technological Intervention and KVK Support

Sri Surendra Singh came to KVK for some improved technologies in view of betterment of his farming. KVK scientists have suggested him for diversification in his farming approach. Sri Surendra Singh followed all suggestions and increased his cropping intensity by intercropping, mix cropping and relay cropping. He used zero tillage for timely sowing of wheat and DSR (Paddy) with low cost of cultivation. He enriched soil fertility with soil amendment and green manuring. He planted one acre Allahabad Safeda, guava under High Density Planting. He has grown cowpea variety Kashi Kanchan in 1 acre.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	Subsistence	Commercialize
Yield of Product	Low	Higher
Fixed Cost (Rs./ha)	40,000	40,000
Recurring Cost (Rs./ha)	3,01,435	3,25,000
Gross Income (Rs./ha)	6,61,000	9,22,000
Net Profit (Rs./ha)	3,19,565	5,57,000
BC Ratio	1.94	2.53
Marketing	Difficulty in selling	Selling at home
Dissemination of knowledge in the locality	Low	High
Knowledge gain based on 1- 5 scale*	2	4
Feeling of economic security based on 1- 5 scale*	1	4
Ability to understand and solve problems based on 1- 5 scale*	1	3
Self image in community based on 1- 5 scale*	2	4
Self confidence based on 1- 5 scale*	2	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Earlier Sri Surendra Singh had subsistence mode of farming and traditional farming bearing profit of Rs. 6,61,000/- in a year. After adopting diversification in agriiculture farming, he could able to earn Rs. 9,22,000/- in a year. He has received innovative farmer award 2017-18 from Dr. RPCAU, Pusa.

Adoption, Spread, Up Scaling of Technology and Future Projection

Sri Surendra Singh adopted in some new technologies like inter cropping, line sowing, green manuring, intensive cropping, high density planting, Sugarcane cultivation by bund method, mentha cultivation *etc.* The fellow farmers experienced for the first time by observing the benefits of these technologies. The following inter cropping may be scaled up: Inter cropping with Sugarcane-01 line + linseed-03, Sugarcane-01 line + Potato-02 line, Sugarcane-01 line + Rajama-03 line, Potato- 01 line + Maize-01 line, Wheat- 01 line + Linseed-02 line, Mustard-01 line + lentil-01 line, Red gram- 01 line + Maize- 01 line + Til-01 line.

Organic Farming: An Approach for Increasing Yield and Income

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Krishi Vigyan Kendra, Harnaut, Distt. Nalanda, Bihar

Agro-ecology and Farming Situation

Sri Harivansh Prasad belongs to village premanbigha under Nagarnausa block in Nalanda district. He is a graduate having 10 acre cultivable land with annual income 1-1.5 lakh. This area comes under agro-climatic zone IIIB (southern west). The soil type of this village is sandy loam, clay loam, loam and clay with pH range from 6.8 to 8.0, organic matter percentage (0.5-1), available nitrogen (200-400 kg / ha), available phosphorus (10-100kg / ha), available potash (150-350 kg / ha). The major cropping patter is rice - wheat, rice-gram, rice-lentil, and rice -rye.

Technological Intervention and KVK Support

Sri Harivansh Prasad is presently doing rice-wheat based cropping system. Initially, he was doing traditional farming due to absence of technical knowledge of farming. Without use of organic inputs and latest agriculture equipments, there was more attack of insect, pest and diseases. Previously, he faced lots of problems like heavy attack of insect, pest and diseases with low yield. After adoption of organic farming, he overcame this problem. Presently he is doing rice-wheat based organic farming. He is also involved in production of tomato and brinjal. Sri Harivansh Prasad introduced new technology like "cow urine with neem leaves" in in tomato and brinjal field.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	Paddy, Wheat, Lentil, Dairy	Paddy,wheat,Lentil, Tomato, Brinjal, Chillies, Dairy
Yield of Product (q / ha)	Paddy : 42 Wheat : 30 Lentil : 09	Paddy : 50 Wheat : 35 Lentil : 11
Fixed Cost (Rs. / ha)	Land Revenue : 250	Land Revenue 250 + Cow 48,000
Recurring Cost	Paddy : 37,000 Wheat : 28,000 Lentil : 16,000 Total : 81,000	Paddy : 38,000 Wheat : 25,000 Lentil : 16,000 Tomato : 30,000 Brinjal : 42,000 Cucurbits : 20,000 Dairy : 22,000 Total : 1,93,000
Gross Income	Rs 1,30,000	Crop 1,50,000 Vegetables 22,5000 Dairy 1,00,000

Impact factor	Before Adoption	After Adoption
Net Profit (Rs / ha)	34,000	48,500
BC Ratio	1.91	2.02
Marketing	Through middle man	Directly to retailer / consumer
Dissemination of knowledge in the locality	-	Through training / demonstration
Knowledge gain based on 1- 5 scale*	1	4
Feeling of economic security based on 1- 5 scale*	1	4
Ability to understand and solve problems based on 1- 5 scale*	2	4
Self image in community based on 1- 5 scale*	2	4
Self confidence based on 1- 5 scale*	1	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Earlier, Sri Harivansh Prasad was doing traditional farming. Before 2011, he was using inorganic fertilizer. Consequently, his soil converted into problematic soil. After following the suggestions of the scientist of KVK, Nalanda, he started organic farming and slowly-slowly he got tremendous results in terms of production and productivity as well as keeping quality of vegetables. Sri Harivansh Prasad incorporated cow urine with neem leaves in tomato and brinjal field. The incorporation of this inputs in vegetable crops resulted least attack of insect, pest and diseases and higher yield. After adoption of organic farming technology, the financial and social status of Sri Harivansh Prasad has been improved a lot.

Adoption, Spread, Up Scaling of Technology and Future Projection

Sri Harivansh Prasad has implemented organic farming technology most successfully. Other farmers also followed him to start organic farming. Thus, Sri Harivansh Prasad became the role model for organic farming in the area. He has taken lead role and established the FPO namely, Nagarnausa Farmer Producer Company Ltd. and he is now chairman and chief managing director of the company.

Bamboo Boring: A Low Cost Technology for Saving Money

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Krishi Vigyan Kendra, Distt. Agricultural Farm Raghopur, Distt. Supaul, Bihar

Agro-ecology and Farming Situation

The Agro ecology of the Supaul and Koshi region varies from hot dry to moist sub humid. It lies in North East alluvial plain of Bihar developing from non calcareous and non saline deposits of river Koshi. The topography of the area is broadly classified into three categories like upland, medium land and low land. The soil in uplands areas varies from sandy to sandy loam. It hardly holds water due to poor content of organic matter. It faces dry condition in case of less and scanty rain fall. The majority of land belongs to medium land category. The medium land also shares major part of cultivated area. The major crops are Paddy, Wheat, Moong and Jute. Low land area remains inundated most of the time due to seepage water of Koshi river. This low lying area is basically used for Makhana cultivation. The upland requires irrigation in case of less rainfall. Light soil permits installation of low cost bamboo boring to provide timely irrigation.

Technological Intervention and KVK Support

The bamboo boring is a low cost technology, because bamboo is locally available material. In this technology, a bore well of 6" diameter is constructed. The length of the bore well is kept at 40-45' in which 25' bamboo strainer is provided as a filter. The rest 20' a PVC pipe of 4" is inserted. The filter is made from bamboo, nylon net and iron rings. This filter is used in place of pipe filter to reduce the cost and it is easy in fabrication with locally available material. The ground water is pumped out from these wells by means of pumpsets of 2-5 HP.

Economic and Socio-Psycho Impact

Impact Factor	Before Adoption	After Adoption
Farmer Practice	No irrigation	Irrigation as and when required
Yield of Product (q / ha)	25	36
Fixed cost (Rs. / ha)	50,000	21,000
Recurring cost (Rs. / ha)	85,000	70,000
Gross income (Rs. / ha)	1,20,000	1,20,000
Net profit (Rs. / ha)	35,000	50,000
BC Ratio	1.41	1.71
Dissemination of knowledge in the locality	3	4
Knowledge gain based on 1- 5 scale*	3	Width 5 spread 5
Feeling of economic security based on 1- 5 scale*	4	5
Ability to understand and solve problems based on 1- 5 scale*	4	5
Self image in community based on 1- 5 scale*	4	5
Self confidence based on 1- 5 scale*	2	5

Benifits

Bamboo boring is one of the easiest methods of making a shallow tube wells below 100' depth. Bamboo boring can provide Rs. 150 per h for irrigation and 800 h can be utilized in a year. It is a time saving and labour saving technology. It does not require heavy machinery. It can be shifted to other place within a day and with minimum expanses.

Adoption, Spread, Up Scaling of Technology and Future Projection

This Bamboo boring technology is widely accepted across the Koshi and Simanchal area of Bihar comprising about 10 districts. It has huge potential of up scaling in the areas of light soils and where water table is high. At present about 80% of the tub wells constructed by the farmers are based on bamboo boring.

Horticulture

Phal Udyog Nursery in Ranchi- A Journey of Success in Agri-Entrepreneurship Business

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Agro-ecology and Farming Situation

Agro ecological condition of Ranchi district is quite different from plain areas. It is a part of Hazaribagh and Ranchi plateau region. It is primarily having rainfed agriculture and crop production largely depends on monsoon. More than 60 percent population is rural based. About 82 percent of households have holdings less than two hectares with the average holding size being 1.18 ha.

A progressive farmer working in Ranchi district, Sri Sarwan Gupta is a native of Jariagarh village of Khunti district, a remote village 60 km away from district capital Ranchi. He belonged to a resource poor family with insufficient income to meet his family needs. He was eager to get involved in some agriculture based business for earning more money. Sri Sarwan completed his graduation in economics from Marwari college, Ranchi University in 1996. During his graduation he visited Divyayan Krishi Vigyan Kendra, Ramakrishna Mission Ashrama, Morabadi, Ranchi. Being inspired and trained by KVK scientists, he started his own nursery. Initially he faced some problems like less survival of saplings and poor health of plants developed. The goal of establishing nursery for better income was not fulfilled at the begining.

Technological Intervention and KVK Support

Inspired from the activities of Divyayan Krishi Vigyan Kendra, Sri Srawan Kumar visited KVK several times and took training on vegetative propagation techniques of horticultural and forest plants. After graduation assessing his capability and competition in education for a job, Sri Srawan Kumar went back to his village with the aim to start his own nursery business. After learning about nursery raising technique, he started his business with grafting in 100 mango plants and raising 500 papaya seedlings in 1998 in 5 decimal land and sold plants door to door using his bicycle. Considering his deep interest in nursery business his father borrowed money from bank and managed to give him Rs.30000/- to start his business in the year 2000. Sri Srawan Kumar planted about 1600 mother plants in his family land as well as villagers' land to get scion for grafting purpose. Then, he started his commercial nursery at Tupudana area of Ranchi on 3 acre private land situated on Ranchi- Khunti road during 2002. Seeing his progress, the owner of land refused to lease out his land to Sri Srawan Kumar and forced him to shift his nursery overnight. Sri Srawan Kumar then took shelter in a sister organization of Ramakrishna Mission Ashrama, Morabadi, Ranchi situated nearby for the time being. Latter in 2007, he shifted his nursery to other place Tupudana area of Ranchi and took lease of 16 acres of land. Sri Srawan Kumar produced and marketed plants with well-developed roots; he also assured the establishment of plants in the main field of his customers and regularly followed the progress of the plants. This unique nature of business of Sri Srawan Kumar has gained the faith of farmers on him and his nursery business. Presently, he is dealing with various crops like mango (13 varieties), litchi, guava (6 varieties), sapota, jamun, pomegranate, lime, lemon, jackfruit, banana, papaya and tik etc. His nursery houses more than 2 lakhs fruit plants and 2.5 lakhs timber plants like sagun, mehogini etc and has become the largest private supplier of saplings in Jharkhand. He has expanded his business out of Jharkhand too and he

is supplying plants to Orissa, Chhattisgarh and Bihar also. Sri Sarwan Gupta is now selling about 2.5 to 3.0 lakh plants in a year and earning approximately Rs. 1.5 crore annually with a net profit of around Rs 25.0 lakh per year. Sri Sarwan Gupta got recognition as Innovative farmer's category by Indian Institute of Horticulture Research (IIHR), Bangalore. He received appreciation letter for State of Art Commercial Fruit Plant Nursery from ICAR Research Complex for Eastern Region Research Centre, Palandu, Ranchi. Sri Sarwan Gupta received Innovative Farmer Award from Birsa Agriculture University during 2013-14 and then from Ministry of Agriculture & Farmers Welfare, GOI in 2017. Shri. Sudesh Mahto, Hon'ble Deputy CM, Jharkhand, Dr. S. Ayappan, Secretary, DARE and DG, ICAR, Shri. R.S. Sharma, Chief Secretary, Jharkhand and other prominent personalities of national and international repute visited the nursery and appreciated the work being done by Sri Gupta.

During production of plants in nursery, Sri Sarwan Kumar has made some innovative efforts for better survival of plants and establishing credibility as supplier. These innovations were published by IIHR.

Innovation - I

The survival rate of Mango plant is only 50 to 60 percent, whereas in Guava plant it is around 70 percent in Jharkhand. To increase the survival rate, Sri Sarwan Gupta tried many methods and at last found a new way to increase the survival rate of the Mango Plants. He increased the tube size and used pond mud as base material. He kept the plant in the tube for 3 years and allowed the roots to grow substantially. He always sales a 3 year old plants to the customer. By this method the survival rate of these plants increased to 95% in mango and 90% in guava. Today, he is having more than 2 lakh mother plants.

Innovation - II

For growing maximum number of female papaya seedling, Sri Sarwan Gupta tried many methods and found a method which produced maximum number of female seedling. He cuts the Papaya into three equal parts and throws out the top part. 80% to 90% seeds from the middle part grow into female seedling and it gives round shape fruit, where as 80% to 90% seeds from the lowest part grow into female seedling and it gives elongated shape. By adopting different technologies, Sri Sarwan Gupta is the most successful farmer in Ranchi district and in Jharkhand state as well. He is now a source of inspiration for the young farmers who are learning the things for improving their livelihood. Sri Sarwan Gupta may be a model rural youth for district, state and our country.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer's Practice	Mango-Preparing saplings in small tube and short period to attain maturity.	Preparing saplings in big tubes and allowing the plants for three years for better root development.
	Papaya- Seed of whole fruit was used for growing papaya seedling. Only 30 to 40 percent seeds bore female seeding.	Cuts the Papaya into three equal parts and throws out the top part. 80% to 90% seeds from the middle part grow into female seedling and it gives round shape fruit where as 80% to 90% seeds from the lowest part grow into female seedling and it gives elongated shape.

Impact factor	Before Adoption	After Adoption
Yield of Product	Unhealthy saplings with 50 percent survival rate in mango and 70 percent in guava.	Healthy sapling with 95 percent survival rates both in mango and guava.
Fixed Cost (Rs.)	30000	30.0 lakhs
Recurring Cost (Rs./year)	1.1 lakh	90.0 lakhs
Gross Income (Rs./year)	1.8 lakhs	145.0 lakhs
Net Profit (Rs./month)	4000 to 5000	2.0 to 3.0 lakh
BC Ratio	1.28	1.56
Marketing	2000 to 3000 plant/year	2.5 to 3.0 lakh/year
Dissemination of knowledge in the locality	-	Thousands of farmers visit his nursery annually and adopt the technology. Trained and provided employment to 40 rural youth in his nursery.
Knowledge gain based on 1- 5 scale*	2	4
Feeling of economic security based on 1- 5 scale*	1	5
Ability to understand and solve problems based on 1- 5 scale*	3	4
Self image in community based on 1- 5 scale*	3	5
Self confidence based on 1- 5 scale*	3	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Sri Sarwan Gupta is now owner of 'Phal Udyog Nursery' in Ranchi district. His nursery has been rated as Three Star by National Horticulture Board. Sri Gupta has produced about 35 lakh plants of fruit and forest plants during last eight years of his business and supplied plants to Jharkhand, Bihar, Orissa, Bengal and Assam. He has provided job to around 40 rural youth in his nursery.

Adoption, Spread, Up Scaling of Technology and Future Projection

Adoption scientific method of nursery raising along with his own innovations, Sri Sarwan Gupta is now able to manage his nursery successfully with handsome income. He is very well established and most successful entrepreneur in Ranchi district and Jharkhand state as a whole. He is now a source of inspiration

for young farmers of the district. Thousands of farmers from different parts of the state used to visit his nursery. He accompanies them during visit and also explains about the technologies in detail. He also provides training to the farmers. His 3-star nursery is a well-known place for exposure visit. Many farmers are encouraged to start their own nursery by taking plants from there. As a result, more than 100 nurseries are working successfully in Ranchi district. Sri Gupta is continuously making efforts to upscale the technologies along with the scientists and institutions. He used to take classes as master trainer in KVK and research institutes. He is a role model for Ranchi district farmers, encouraging them to develop as successful agripreneurs.

Banana Cultivation- A Successful Venture for Regular Income Generation

Ramakrishna Roy and Brajesh Shahi
Krishi Vigyan Kendra, Gopalganj, Bihar

Agro-ecology and Farming Situation

Sri Manish Tiwari from Sipaya village of Gopalganj district inherited flood prone land from his father. He was cultivating paddy, wheat and sugarcane; however not getting profit out of such cultivation. When he approached the neighbouring Krishi Vigyan Kendra (KVK), he was suggested to put up a bund so that he could increase cropping intensity and get return on his investment by planting rows of eucalyptus trees at regular intervals and papaya on the bund, besides ensuring safety of crops from flood.

Technological Intervention and KVK Support

Sri Manish Tiwari laid a bund and levelled his land. Then, he went for banana plantation on large scale with variety G9 intercropped with vegetable crops such as cauliflower and tomato. To save labour cost, he made extensive use of small farm equipments such as power weeder, rotary tiller and pump sets. For maximizing water use efficiency, drip irrigation was installed in the banana plantation. He marketed cauliflower curds and later also seed of cauliflower.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmers Practice	Paddy (BPT 5204), Wheat (PBW 154), Sugarcane (BO 147)	Paddy (BPT 5204), Wheat (PBW 154), Sugarcane (COP 2061), Banana (G 9) + Cauliflower vegetable and seed, Tomatoes
Yield of Product	Paddy- 40 q/ha, Wheat-33.50 q/ha, Sugarcane-673q/ha	Paddy 40 q/ha, Wheat 33.5 q/ha, Sugarcane-670 q/ha, Banana- 3125 bunches/ha, Cauliflower-201 q/ha (sole), Cauliflower- 134 q/ha + 0.4q /ha seed, Tomatoes- 201 q/ha
Fixed Cost	Land- 13 ha Mechanization- 6 lakhs	Land-13 ha Mechanization equipment- 12 lakh (approx.)
Recurring Cost (Rs./ha)	22,000 for paddy 18,000 for wheat 68,000 for sugarcane	75,000 for banana 67,000 for Cauliflower as well as tomatoes
Gross Income (Rs.)	12,31,125/-	21,44,845/-
Net Profit (Rs.)	6,91,125/-	13,46,045/-
BC Ratio	2.27	2.68
Marketing	Wholesale	Wholesale
Dissemination of knowledge in the locality	He was an ordinary farmer	Farmers used to visit his field and get motivated
Knowledge gain based 1-5 scale*	2	4
Feeling of economic security based on 1-5 scale*	2	4
Ability to underst and and solve problems based on 1-5 scale*	3	4
Self image in community based on 1-5 scale*	3	4
Self confidence based on 1-5 scale*	3	4

*1-5 scale indicates 1=lowest and 5=highest

Benefits

Sri Manish Tiwari earns a net income of Rs. 4.75 lakh annually from Banana cultivation alone. In recognition of his effort, Kisan Shree has been bestowed on him by Government of Bihar. He has also been conferred the "Abhinav Kisan Puraskar" by Dr. RPCAU, Pusa, Bihar. Farmers know him for adoption of advanced technology.

Adoption, Spread, Upscaling of Technology and Future Projection

The success with banana cultivation of Sri Manish Tiwari motivated other farmers in his locality to take up banana cultivation in large scale. Hence, large number of banana bunches from the village finds its way to the district market and elsewhere. As far as recent technology adoption and changes are concerned, he has gone for solar pump for irrigating field, dairy entrepreneurship and seasonal fodder cultivation for feeding dairy animals.

Papaya Cultivation- A Potential Source of Income and Household Food Security

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Agro-ecology and Farming Situation

Khagaria district falls under North East alluvial plain and climate of the district is subtropical and humid with average annual rainfall of 170 cm. This makes it favourable for cultivation of papaya. Total cultivable land of the district is 1,04,000 ha of which almost 20 percent of the land is under upland condition which is being utilized for cultivation of cereals and fruit crops. Among the fruit crops, 1500 ha is under banana cultivation while 800 ha and 300 ha under mango and litchi cultivation, respectively, while papaya is being cultivated mostly in kitchen gardens involving mostly unidentified and local varieties. Though papaya is very renurative fruit crop compared to mango, banana and others, it is not being cultivated on large scale in Khagaria district due to some reasons: (i) high cost of cultivation, (ii) papaya is highly sensitive to diseases, pests and water logging, (iii) poor availability of good quality seed of high yielding varieties, (iv) poor knowledge of scientific management practices and (v) pollination problem due to single sex.

Technological Intervention and KVK Support

Sri Chandrakant Singh is an interested farmer for cultivating papaya at a large scale in Khagaria district. He adopted papaya cultivation after taking technological guidance from KVK, Khagaria. Then, Sri. Chandrakant Singh cultivated red lady variety, hermaphrodite having the property of good taste and longer shelf life. He had sown seeds in perforated poly bags filled with 50% soil and 50% vermicompost. Watering of the bag was done at 2 to 3 days interval. He prepared pit of 40 cm depth and 30 cm width in which 5 kg vermicompost, 250 gm gypsum, 20 gm boric acid and 20 gm Zinc Sulphate were applied 15 days before transplanting. Polybag was removed carefully keeping ball undisturbed and one seedling was planted per pit. Seed treatment with Captan @ 2-3 gm per kg of seed followed by solarization of the bed prior to seed sowing and drenching of Ridomil MZ 2 gm per litre was applied as preventive measure for the control of damping and collar rot at the time of seed sowing and after transplanting.

Mixture of fertilizers consisting of 400 gm Urea, 1200 gm SSP and 500 gm MOPwas applied as top dressing in 4 doses. First dose was given in the month of July and rest of the doses were applied every month up to October. Light irrigation was provided frequently during dry season, while during rainy season quick drainage of water was done. Clean cultivation, destruction of infested leaves and fruits with insects and application of Dimethoate 40 EC @ 2 ml/l at 15 days interval was followed.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmers Practice	Low yield per acre	High yield per year
Yield of Product (q/acre)	350	500
Fixed Cost	Nil	Nil
Recurring Cost (Rs./acre)	1.5 lakh	1.5 lakh
Gross Income (Rs./acre)	3.00 lakh	6.00 lakh
Net Profit (Rs./acre)	1.50 lakh	4.50 lakh
BC Ratio	2.0	4.0
Marketing	Local	Retail
Dissemination of knowledge in the locality	No	Yes
Knowledge gain based on 1- 5 scale*	1	5
Feeling of economic security based on 1- 5 scale*	1	5
Ability to understand and solve problems based on 1- 5 scale*	1	5
Self image in community based on 1- 5 scale*	1	5
Self confidence based on 1- 5 scale*	1	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Productivity of kitchen gardens can also be enhanced by cultivating improved variety of papaya. It has been estimated that income from papaya cultivation may be 3 times more than that of banana cultivation and 5 to 10 times more than that of mango cultivation. Hence, papaya cultivation can play a great role in enhancing farmers' income. Papaya cultivator gained several benefits of purchasing good quality TV, bed, storage bins and agricultural implements. Papaya cultivation has a great potential for improving household food security and alleviating micronutrient deficiency.

Adoption, Spread, Up Scaling of Technology and Future Projection

More than 100 farmers have visited the farm of Sri. Chandrakant Singh to have exposure of the papaya farm and interaction regarding management practices involved. A number of them have also contacted the KVK scientists and got technical knowledge about papaya farming. Many farmers have started papaya cultivation.

Papaya is a highly remunerative crop and gives much higher net return per unit area than other fruit crops. Most of the horticultural crops have long gestation period and initial cost of establishment of orchard or plantation is high, it becomes almost impossible for the marginal farmers to go for such ventures. Under existing condition, papaya may be one of the better crops for higher return in shorter time, since it is quick growing and starts bearing within 8-10 months of transplanting. The characteristics of quick growing, short gestation, highly remunerative, non- perishable nature, easy transport, longer storage under normal conditions, export potential and medicinal and industrial value are some of the distinct advantages offered by papaya over other fruits and therefore, papaya is poised to become as the most important commercial crop of the interior and far-flung areas where roads and transport facilities are not developed fully and the growing of other perishable fruit is not a remunerative proposition. Backyards or homestead gardening with other components are predominant feature of agriculture system in Bihar. Thus, papaya may be very remunerative crop, as it is an ideal fruit for growing in kitchen gardens, backyards of home or as a filler plant in the other orchards. Papaya cultivation may be expanded vertically through the adoption of more intensive systems of orchard management such as greater use of fertilizers and drip irrigation, higher tree densities, as a filler / inter crop to such intensive system of orcharding in intensive integrated farming systems. The future strategies for area expansion and enhancing productivity in papaya, thus, need to be undertaken.

Commercialized Banana Farming for Augmenting Income

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Agro-ecology and Farming Situation

Sri Suresh Prasad is an educated small farmer living in village- Karpalia under block- Goriyakothi of Siwan district. The area is under North West Alluvial Plain Zone in rural part of Bihar. The climate is sub-humid and hot. The main source of income of Sri Suresh Prasad is farming. Earlier he used to grow cereals in his field. His annual income was Rs. 2,12,000.00 from 2-acre land.

Technological Intervention and KVK Support

Sri Suresh Prasad came to KVK to consult about commercialized farming vis-a-vis technological guidance. He was suggested for few horticultural ventures. Gradually, he participated in different trainings like vegetable cultivation, papaya cultivation and banana cultivation. He also consulted with the concerned persons of NABARD, Siwan and BAU, Sabour. He decided to focus on banana cultivation. He planted G9 for table purpose and Batisha for vegetable purpose at 2m x 2m spacing. Besides, he is also cultivating papaya.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmers Practice	Subsistence	Commercialized
Yield of Product	Low	High
Fixed Cost (Rs./acre)	2500	2500
Recurring Cost (Rs./acre)	60,000	2,49,500
Gross Income (Rs./acre)	1,06,000	4,56,000
Net Profit (Rs./acre)	43,500	2,04,000
BC Ratio	1.76	1.82
Marketing	Difficulty in selling	Marketing at home
Dissemination of knowledge in the locality	Low	High
Knowledge gain based on 1- 5 scale*	2	4
Feeling of economic security based on 1- 5 scale*	1	3
Ability to understand and solve problems based on 1- 5 scale*	1	3
Self image in community based on 1- 5 scale*	2	4
Self confidence based on 1- 5 scale*	2	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Earlier, the annual income of Sri Suresh Prasad was Rs. 2,12,000.00 from 2-acre land. Presently, he is earning Rs. 9, 12,000.00 annually. He became a model for neighbouring farmers. Now he wants to have 2-acre land on lease and extend his banana cultivation. Many people from nearby area come and become encouraged for growing banana. Local farmers used to visit his field and purchase banana suckers from him.

Adoption, Spread, Up Scaling of Technology and Future Projection

Sri Suresh Prasad has adopted new technology like banana cultivation in cereal based cropping system for the first time in Siwan district. The fellow farmers of the surrounding areas become motivated by observing this new technology. This technology may be up scaled for doubling income of the farmers in Siwan district.

Organic Cauliflower Seed Production

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Agro-ecology and Farming Situation

Cauliflower seed production is a major source of income for the vegetable growing farmers of Vaishali district. The majority of the farmers are in this business. They sold their seed to all over India under the brand name of Hajipur seeds. Due to high use of insecticides and pesticides, the cost of cultivation is becoming more. Tremendous loss is seen to the flora and fauna of the district due to pesticide use. There is a severe loss of honey bee and other eco-friendly insects. Overall there is a loss to agriculture. So, quality seed production is an issue in the district.

Technological Intervention and KVK Support

Sri Bindeshwari Pd. Singh is a resident of Hariharpur village in Vaishali district and doing cauliflower seed production for last many years. He was getting 1 quintal seed per ha and cost was Rs. 2000/- per kg. When he came in contact with Krishi Vigyan Kendra, Vaishali, he was suggested for organic cultivation of seed production. Subsequently, he started to use bio-fertilizer and bio-pesticide and thus, there was control of seedling mortality in cauliflower. There was an increase of 1.5 quintal per ha of land. Quality of seed was also improved. Due to good quality of seed, there was good demand of seed in the market. Seed price increased from Rs. 2000/- per kg to Rs. 7000/- per kg. For pest control, he has developed a noble technique. In this technique, he used vermi wash, 2 kg neem leaf, 250 gram garlic, 250 gram chilli and 250 gram ginger in a mixture. He also used Pheromone trap. Due to high price of seed in market, his income increased up to 5 lakh per annum.

Vegetable Seed Production of KVK, Vaishali at Hariharpur

Economic and Social Impact

Impact factor Before Adoption	After Adoption	
Farmer Practice	High use of pesticide	Home made technique for pest control
Yield of Product (q / ha)	1	2.5
Fixed Cost (Rs. / ha)	700	200
Recurring Cost (Rs. / ha)	50,000	45,000
Gross Income (Rs. / ha)	2,35,000	2,80,000
Net Profit (Rs. / ha)	1,50,000	2,00,000
BC Ratio	4.7	6.2
Marketing	All over India	Do
Dissemination of knowledge in the locality	More farmers are adopting	Producing in group for marketing
Knowledge gain based on 1- 5 scale*	2	4
Feeling of economic security based on 1- 5 scale*	2	4
Ability to understand and solve problems based on 1- 5 scale*	2	4
Self image in community based on 1- 5 scale*	2	4
Self confidence based on 1- 5 scale*	2	5

Benefits

There is more income by the farmers who are using this technique for cauliflower seed production. So, the farmers are now coming under one umbrella for seed production by this organic method. There is direct benefit to the agriculture, as organic farming has positive impact on honey bee production and thus productivity of other agricultural crops. Saving on pesticides also improves soil micro-flora.

Adoption, Spread, Up Scaling of Technology and Future Projection

There is an urgent need to brand this cauliflower seed for getting more return. Thus, more farmers can start this business of organic cauliflower seed production.

Cultivation of Elephant Foot Yam as A Cash Crop

Prashant Verma and Manoj Kumar Singh
Krishi Vigyan Kendra, Holycross, Near Kanari Hill, Distt. Hazaribagh, Jharkhand

Agro-ecology, Farming Situation

Elephant foot yam performs well under hot and humid climate. In Hazaribagh district, the rainy season is the best time for cultivation of elephant foot yam successfully. Since the monsoon commences in the middle of June, the crop is planted in the beginning of May with the pre monsoon showers. Elephant foot yam cannot tolerate water stagnation. Thus, upland areas may be suitable for its cultivation. This crop grows well in sandy loam soil. Adding farm yard manure in pits makes soil rich in organic manure and improves the soil texture. This crop is not consumed by the cattle so the upland areas are the potential area during rainy season for its cultivation. Cultivation of this crop in upland during rainy season also checks soil erosion. This crop can be intercropped with short duration leafy vegetables like red amaranthus, poi or coriander for leaf production which fetches high price during rainy season and becomes ready for harvest before the canopy spread of elephant foot yam.

Technological Intervention and KVK Support

The size of seed corm of elephant foot yam is directly related to the yield of the crop. The corm size between 500 - 750 gm is the optimum size of seed corm for obtaining high yield. The corm may be whole corm or cut corm from bigger corms. The big corms are cut vertically from the top of the corm. Seed treatment with Carbendazim and Trichoderma is done before planting of corm. After two ploughings, pits of size 20 cm x 30 cm x 30 cm is made keeping row to row distance of 75 cm and plant to plant distance of 60 cm. Approximately, 8880 pits are made in one acre of land and average seed rate is 44 q per acre. The seed corms are planted at the depth of 10 cm after filling the pits with rotten cow dung manure or farm yard manure. Dry leaves, grasses or straws are spread over the pits so there is enough space for growing short duration leafy vegetables like red amaranthus, poi or coriander laves. Some farmers prefer to take okra as intercrop, because okra grows taller by the time the elephant foot yam leaves spread.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmers Practice	Planted 50- 100g lighter corms in pits at depth 15 - 20 cm	Planted 500 - 750 gm seed corms in pits at depth 10 cm
Yield of Product (ton / acre)	20	35-40
Fixed Cost (Rs. / acre)	15,000	17,500
Recurring Cost (Rs. / acre)	8,000	1,68,000
Gross Income (Rs. / acre)	2,60,000	6,60,000
Net Profit (Rs. / acre)	2,02,000	4,74,500
BC Ratio	2.59	3.56
Marketing	During Oct. - Nov.	During August - March
Dissemination of knowledge in the locality	Poor	Good
Knowledge gain based on 1- 5 scale*	1	3
Feeling of economic security based on 1- 5 scale*	1	4
Ability to understand and solve problems based on 1- 5 scale*	2	4
Self image in community based on 1- 5 scale*	1	5
Self confidence based on 1- 5 scale*	1	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Elephant foot yam cultivation is highly remunerative. The corm is sold as fresh corm during August to November in the market. The demand is at its peak during the festival season of October - November. During peak season the retail price of fresh elephant foot yam in market varies between Rs. 35 - 40 per kg. Some farmers prefer to keep the crop in field for another couple of months and sell the corm as seed. The price of seed corm varies between Rs. 40 - 50 during March to May when farmers start its planting depending on the availability of irrigation facilities. The crop gives better return per unit area in comparison to other vegetable crops. The crop is consumed by people as a popular vegetable, sometimes as a substitute to potato. This crop has the potentiality of value addition. The elephant foot yam pickle is always in demand. The crop is equally consumed by poor and rich. Recently, the crop has fitted well in the cropping system of homestead land.

Adoption, Spread, Up Scaling of Technology and Future Projection

The crop has been adopted by farmers for cultivation in the homestead land as well as upland located far from house as a kharif crop. Since the initial investment is high, so resource rich farmers are cultivating the crop in larger areas compared to resource poor farmers. However, resource poor farmers initially produce the crop as seed crop and after few years when they have sufficient quantity, start selling. The technology involved in its cultivation is simple. Recently, seeing the drudgery involved in harvesting and to reduce damages to crop while digging, the depth of planting has been reduced and earthing up of the crop after 50 - 60 days of planting is more focussed. In future, vast area of land might come under cultivation of elephant foot yam as the labour requirement in this crop is less compared to other crops. Moreover, it provides scope of introduction of intercrops of shorter duration which provides additional income.

Cultivation of Elephant Foot Yam in Dryland Areas for More Income Generation

Rajiv Kumar, Ramesh Kumar, Sunita Kumari Kamal, Ashok Kumar Sinha,
Sanjay Kumar Ram and Dilip Kumar Pandey
Krishi Vigyan Kendra, Daltonganj, Chianki, Distt. Palamau, Jharkhand

Agro-ecology and Farming Situation

Palamu district falls under semi-arid zone and receives monsoon rains during June to September with an average rainfall of about 1257 mm against the state average of 1340 mm. The district is characterized by warm climate in March to June and later on there is a gradual decline in temperature from October onward to December and January is the coolest month of the year. Palamu has 52, 19,113 ha of irrigated area under different sources of irrigation like well, tank and pond. The farmers of this district are not aware about soil health management, water management and natural resources management.

Technological Intervention and KVK Support

In Palamu district, large patch of upland area is left unused or under low productivity crop. Sometimes, maize is cultivated. Thus, proper utilization of such land is of prime importance. Cultivation of elephant foot yam may address the issue and make the land more productive. Even, upland areas may be suitable for cultivation of elephant foot yam which also performs well under hot and humid climate. Farmers mostly sow maize crop in upland areas during last week of June and face a dry spell during crop growth period, so they intend to leave the areas as fallow. Thus, KVK, Palamu has motivated the farmers for cultivation of elephant foot yam (Var.Gajendra) during last week of May to mitigate the effect of dry spell and utilize the land as well as fetch more income.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmers Practice	Traditional system (Maize)	Cultivation of elephant foot yam (Var.Gajendra)
Yield of Product (q / acre)	12	200
Fixed Cost (Rs. / acre)	7,000	1,14,000
Recurring Cost (Rs. / acre)	3,000	11,000
Gross Income (Rs. / acre)	24,000	4,00,000
Net Profit (Rs. / acre)	14,000	2,75,000
BC Ratio	2.4	3.2
Marketing	Local	Inter-district
Dissemination of knowledge in the locality	Village level	District level
Knowledge gain based on 1- 5 scale*	1	3
Feeling of economic security based on 1- 5 scale*	1	2
Ability to understand and solve problems based on 1- 5 scale*	1	3
Self image in community based on 1- 5 scale*	1	2
Self confidence based on 1- 5 scale*	1	3

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Farmers of 5 adopted villages utilized fallow land and mitigated the effect of dry spell and thus, gained high return from cultivation of elephant foot yam (Var. Gajendra). Farmers got monetary benefit of Rs. 2, 75,000/- from cultivation of elephant foot yam in one acre land, in place of Rs. 14,000/-from cultivation of maize in one acre land. Elephant foot yam cultivation requires high input cost, but minimum attention is required towards insect pest management.

Adoption, Spread, Up Scaling of Technology and Future Projection

This technology has given high benefit cost ratio and farmers became motivated. They have already adopted this technology in nearby villages.

Elephant Foot Yam based Multilayer Vegetable Cropping System

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Agro-ecology and Farming Situation

Generally, the farmers in the villages of Godda district sow elephant foot yam in the backyard of their houses. Sri Amrit Lal Singh was also cultivating elephant foot yam but of local variety having high calcium oxalate content causing more acridity and less acceptability. He has also been cultivating cucurbits like sponge gourd, ridge gourd, and bottle gourd since long. Both the crops were cultivated in separate land. No sincere and scientific efforts were made before an innovative idea provided by GVT - KVK, Godda.

Technological Intervention and KVK Support

Elephant foot yam can be cultivated in shady area. Thus, cropping intensity can be increased by adopting multitier cropping system. After the technical guidance of GVT - KVK, Godda, the improved variety of elephant foot yam (Gajendra) and hybrid variety of bottle gourd (Mahima), ridge gourd (local) and bitter gourd (US - 6214) were grown simultaneously in the same piece of land with leafy vegetables. So, it has been named elephant foot yam based multilayer vegetable cropping system. A *machan* like structure was erected with the help of bamboo, wire and threads over 6.5 feet high from the ground level over the main crop i.e. elephant foot yam to spread the vines of bottle gourd, ridge gourd and bitter gourd.

Elephant foot yam variety Gajendra was planted during the second fortnight of June at 75cm x 75cm spacing in the plot size of 1000 m2. A pit size of 30 cm x 30 cm x 30 cm was dug out and 2 kg well decomposed cow manure was filled up to 3/4th of pit. 500 g cut tubers of elephant foot yam were treated with cow dung slurry (one kg of fresh cow dung in one litre of water) one day before planting on the pit and then filled the pit with the remaining soil and small mound was formed on the pit. The seeds (hybrid) of cucurbits bitter gourd, ridge gourd, and bottle gourd were sown in between two rows of main crop i.e. elephant foot yam at the recommended spacing for each crop.

All the plots were fertilized with 150 Kg N, 100 Kg P_2O_5 and 150 Kg K_2O / ha. Half dose of nitrogen and potash and full dose of phosphorus were applied at the time of planting of main crop in pits and rest half of nitrogen and potash were applied after harvesting the companion crops i.e. at 95 days after planting (DAP). Recommended dose of fertilizer was also given to the companion crops i.e. bottle gourd, ridge gourd and bitter gourd as per schedule. All other cultural practices as per schedule for the cultivation of main crop as well as companion crops were followed to raise healthy crop.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption		After Adoption		
Farmers Practice	Sole crop of elephant foot yam with desi variety and cucurbits		Elephant foot yam based multilayer vegetable cropping system (MLVCS)		
Yield of Product	Crop	Yield (Kg / ha)	Crop	EFY Yield (Kg / ha)	Yield of companion crop (Kg / ha)
	Elephant foot yam (EFY)	36000			
	Ridge gourd	15860			
	Bitter gourd	15640			
	Bottle gourd	27789			
			EFY+Ridge gourd	35000	14000
			EFY+Bitter gourd	35800	15000
			EFY+Bottle gourd	35500	25000
Recurring Cost	Crop	Expenses (Rs. / ha)	Crop		Expenses (Rs. / ha)
	Elephant foot yam (EFY)	1,46,500 / -	EFY+ Ridge gourd		1,60,000 / -
	Ridge gourd	54,940 / -	EFY+ Bitter gourd		1,66,400 / -
	Bitter gourd	55,480 / -	EFY+ Bottle gourd		1,73,400 / -
	Bottle gourd	59,200 / -			
Gross Income	Crop	Expenses (Rs. / ha)	Crop		Expenses (Rs. / ha)
	Elephant foot yam (EFY)	4,86,000 / -	EFY+ Ridge gourd		5,49,500 / -
	Ridge gourd	87,930 / -	EFY+ Bitter gourd		6,63,300 / -
	Bitter gourd	1,87,680 / -	EFY+ Bottle gourd		6,04,250 / -
	Bottle gourd	1,38,945 / -			
Net Profit	Crop	Net Return (Rs. / ha)	Crop		Net Return (Rs. / ha)
	Elephant foot yam (EFY)	3,39,500 / -	EFY+ Ridge gourd		3,89,500 / -
	Ridge gourd	32,990 / -	EFY+ Bitter gourd		4,96,900 / -
	Bitter gourd	1,32,200 / -	EFY+ Bottle gourd		4,30,850 / -
	Bottle gourd	79,745 / -			

Impact factor	Before Adoption		After Adoption	
BC Ratio	Crop	BC ratio	Crop	BC ratio
	Elephant foot yam (EFY)	3.32	EFY+ Ridge gourd	3.43
	Ridge gourd	1.58	EFY+ Bitter gourd	3.99
	Bitter gourd	2.38	EFY+ Bottle gourd	3.48
	Bottle gourd	2.34		
Marketing	Local		Distant	
Dissemination of knowledge in the locality	Discussion		Through training, field day, group meeting	
Knowledge gain based on 1- 5 scale*	2		4	
Feeling of economic security based on 1- 5 scale*	2		5	
Ability to understand and solve problems based on 1- 5 scale*	1		3	
Self image in community based on 1- 5 scale*	1		4	
Self confidence based on 1- 5 scale*	1		3	

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

- Better utilization of land and inputs like fertilizer and irrigation etc.
- Upliftment of livelihood and social status.
- More return / unit area.
- Crop intensification.

Adoption, Spread, Up Scaling of Technology and Future Projection

Farmers of the district were cultivating elephant foot yam (desi variety) in a very limited area of land since long back with unscientific manner. Elephant foot yam based multilayer vegetable cropping system has been implemented first in two villages i.e. Nipania, Belbathan (Godda block), Mohanpur (Sunderpahari block). After knowing the result, the surrounding villages of the area have started the cultivation of elephant foot yam based multilayer vegetable production. NABARD has sectioned a pilot project on the same cropping system in two villages Chilra and Pipra of the Pathargamme block of the Godda district. A survey has indicated that this type of elephant foot yam based multilayer vegetable cropping system is being carried out in 6070 households in Godda district. Thus, elephant foot yam based multilayer vegetable cropping system has tremendous scope for expansion in Godda district in the days to come.

Two Tier Cropping System with Elephant Foot Yam and Vine Vegetables

Mukesh Kumar and Ashok Kumar
Krishi Vigyan Kendra, PO. Shankarpur, Distt. Munger, Bihar

Agro-ecology and Farming Situation

The Agro-ecology of Munger, Bihar is suitable for elephant foot yam cultivation. Moderate rainfall, suitable temperature and humidity are appropriate for elephant foot yam cultivation. Farming situation is irrigated with clay loam soil. The soil type has been modified for foot yam cultivation by adding nutrients and organic fertilizers. Elephant foot yam is cultivated in sandy loam soil having pH 6.5 to 7.5. Irrigation is necessary in summer season for foot yam cultivation. Irrigation facility along with soil suitability for foot yam cultivation has artificially been modified.

Technological Intervention and KVK Support

Elephant foot yam is a high returning crop. It can also be cultivated in shady area. Cropping intensity can be increased by adopting two tier cropping system. The vine vegetables like gourds, beans and cucumber have been cultivated above elephant foot yam crop to achieve maximum returns from unit area. Elephant foot yam takes 270-280 days for maturity and gives yield 250-450 quintal per hectare. Farmers get extra income by growing other vine vegetables that are full of nutrients, fibre and medicinal value.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmers Practice	Farmers have cultivated their field with cereal crops and achieved low income on unit land.	Commercial and high returning crop like elephant foot yam and vine vegetables have grown above elephant foot yam plant.
Yield of Product (q/ha)	32 (grain)	120
Fixed Cost (Rs./ha)	6,000	8,000
Recurring Cost (Rs./ha)	14,000	40,000
Gross Income (Rs./ha)	40,000	1,08,000
Net Profit (Rs./ha)	20,000	60,000
BC Ratio	2.00	2.25
Marketing	Agri. produce has been sold to local trader and achieved low income.	Elephant foot yam and vegetables have been sold in district as well as local market to achieve maximum return.
Dissemination of knowledge in the locality	Only adjacent farmers get agriculture techniques by seeing plot and conversion.	Knowledge has been disseminated by giving training, showing techniques with FLD and OFT.

Impact factor	Before Adoption	After Adoption
Knowledge gain based on 1- 5 scale*	1	5
Feeling of economic security based on 1- 5 scale*	1	5
Ability to understand and solve problems based on 1- 5 scale*	1	5
Self image in community based on 1- 5 scale*	1	5
Self confidence based on 1- 5 scale*	1	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Farmers have adopted this elephant foot yam cultivation to achieve maximum returns. Farmers have uplifted their economic condition along with social status by cultivating elephant foot yam along with vine vegetables. Agricultural land is engaging throughout the year with crops. It fulfils nutritive along with economical requirement of the farmers.

Adoption, Spread, Up Scaling of Technology and Future Projection

The adoption of elephant foot yam cultivation among the farmers is satisfactory, because it gives higher returns. Elephant foot yam cultivation has been proved as boon for the farmers in Munger district. Elephant foot yam cultivation is spreading rapidly among the farmers as a cash crop. This technology has been up scaled by growing vine vegetable over elephant foot yam crops. Future projection of this technology is to grow other crops as intercrops in early stage of elephant foot yam crop.

Sweet Potato Cultivation for Source of Income and Nutrition

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Agro-ecology and Farming Situation

The village Kusma is situated in the Godda - Meharma main road, about 45 Km away from Godda town belongs to block Boarijore of Godda district. This village is dominated by the scheduled tribe population. The livelihood of this tribe depends upon the traditional agriculture, monocropping practices and forest produce. This village is situated very near to the open coal mines of Lalmatia. The total population of the village is about 355, out of which 302 are scheduled tribe. The male members of the village are engaged in coal mines. The female members spend their life as house wife. The economic condition of the farmers are not so good, all of them fall under BPL. Two self help groups (SHGs) of female members viz. Muchkundwah Mahila Mandal and Bhararwah Mahila Mandal having 22 members were formed by PRADAN, a national level NGO, during the year 2010- 11 to work on vegetable cultivation and thus improve their livelihoods. The village Kusma was further selected by GVT - KVK, Godda for implementation of various activities under Tribal Sub Plan (TSP). During the visit to the village by the team of GVT - KVK, it was noticed that about 5000 sqm land was lying fallow under the foot hills. Since long time, nobody tried to cultivate crop on that land. The land was undulated and rocky. The soil of the field was analysed and found that the pH was 5.8, available N 246 Kg/ha, P_2O_5 8.2 Kg/ha, K_2O 79 Kg/ha and OC 0.38. Based on soil profile, it was found that this soil was suitable for sweet potato cultivation.

Technological Intervention and KVK Support

The members of SHGs of village Kusma were keenly interested to grow tuber crops and vegetables. A meeting was organized with the SHG members and discussion was made with them about the programme. Thereafter, a training programme on "Scientific cultivation of sweet potato" was organized. Some farm equipment like pump sets, plant protection equipment, ridge makers etc. were also provided to SHGs through TSP scheme. The female members started to plough the land and sieve the small pieces of stone. With the ridge makers they prepared the ridge for the planting of sweet potato vines. The planting material of sweet potato var. S - 14 was provided by the GVT - KVK. The vines of the sweet potato were planted, and other agronomical practices were followed in the close supervision of GVT - KVK, Godda. The vegetative growth of the sweet potato was satisfactory, and the total yield obtained in the 5000 sqm land was 75q.



Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmers Practice	Cultivation of Sweet potato with local variety	Cultivation of Sweet potato with improved variety (S - 14)
Yield of Product (q/ha)	105	150
Recurring Cost (Rs./ha)	89,600	91,400
Gross Income (Rs./ha)	1,89,000	2,70,000
Net Profit (Rs./ha)	99,400	1,78,600
BC Ratio	2.10	2.97
Marketing	Local	Local
Dissemination of knowledge in the locality	Discussion among Villagers and relatives	Field day, training, visit of officials
Knowledge gain based on 1- 5 scale*	2	4
Feeling of economic security based on 1- 5 scale*	2	4
Ability to understand and solve problems based on 1- 5 scale*	1	3
Self image in community based on 1- 5 scale*	1	4
Self confidence based on 1- 5 scale*	2	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

The group members earned Rs. 89,300/- as net profit after cultivating sweet potato in 0.5 ha area which was otherwise kept fallow. After dividing among the group members the share of each member was Rs. 4059/- during the span of about 105 days besides the other sources of their income. β-Carotene-rich orange-fleshed sweet potato (OFSP) is an excellent source of pro-vitamin A. Sweet potato is a secondary staple food and thus it may play a role in controlling vitamin A deficiency.

Adoption, Spread, Up Scaling of Technology and Future Projection

This demonstration was the first-time introduction of β-Carotene-rich orange-fleshed sweet potato variety S - 14 in the area. The farmers of the area are still cultivating the variety. Presently about 1700 households are engaged in the cultivation of sweet potato.

Early Production of Vegetables for Maximizing Benefits from Market

Bibha Kumari and Surendra Chaurasia
Krishi Vigyan Kendra, Lodhipur Agriuclture Farm, Distt. Arwal, Bihar

Agro-ecology and Farming Situation

Smt. Nagmani Devi, wife of Sri Nawal Kishor Singh, Vill - Muradpur Huzra, Block- Arwal, having 5 acres of irrigated land, utilizes 2 acres for vegetable production and 3 acres for crop production in an organized way. She produces broccoli, cauliflower, cabbage, onion, radish, tomato and other vegetables in early season to get maximum profit from its marketing. She grows oyster and button mushroom at her home in Rabi season. She is well trained in mushroom spawn production. Smt. Nagmani Devi is the chairperson of a women self-help group, named "Shanti Mahila Krishak Hit Samooh" in which 20 female members are involved in mini-entrepreneurship programmes like mushroom production, papad and achaar preparation.

Technological Intervention and KVK Support

Smt. Nagmani Devi is very active and hard-working innovative lady who grows early vegetables and markets to obtain maximum yield and profit from a small piece of land. She obtained training regarding early cultivation of vegetables and mushroom production from Krishi Vigyan Kendra, Arwal. She adopted the techniques of early planting of vegetables like broccoli, cauliflower, cabbage, onion, radish, tomato and others to get maximum benefit from market.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmers Practice	Conventional	Early cultivation of vegetables
Yield of Product	Moderate	High
Recurring Cost (Rs.)	1,75,000	1,90,000
Gross Income (Rs.)	2,75,000	4,00,000
Net Profit (Rs.)	1,00,000	2,10,000
BC Ratio	1.57	2.10
Marketing	Local	Local
Dissemination of knowledge in the locality	Village level	District level
Knowledge gain based on 1- 5 scale*	2	5
Feeling of economic security based on 1- 5 scale*	2	5
Ability to understand and solve problems based on 1- 5 scale*	1	4
Self image in community based on 1- 5 scale*	1	5
Self confidence based on 1- 5 scale*	2	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Smt. Nagmani Devi produces 100 kg of vegetables per year and earns a net return of Rs.2, 10,000.00 per year. She has two milch animals and thus she prepares feeds for animals from crop and vegetables waste. She has been awarded for innovative hard-working farm woman in 2015 by Bihar Agricultural University, Sabour, Bhagalpur.

Adoption, Spread, Up Scaling of Technology and Future Projection

Smt. Nagmani Devi spreads knowledge and technology as a trainer to other farmers whenever needed. Nearby villages and self-help groups are in the process to adopt her technology in the production system.

A Handicapped Farmer Finds Magic Stick

Sudhir Kumar Jha, Ashok Kumar, Sushma Lalita Baxla and Bindhyachal Ram
Krishi Vigyan Kendra, Sub-Divisional Agricultural Farm, Distt. Garwah, Jharkhand

Agro-ecology and Farming Situation

Garwah is hot moist / dry sub-humid area. It has 1.0 lakh ha cultivable land and 1.6 lakh ha forest land out of total 4.2 lakh ha geographical area. 0.35 lakh ha land is under irrigation facility. The soil is sandy loam or red loam. The major field crops are paddy, maize, wheat, mustard, pigeon pea, chick pea etc.

Technological Intervention and KVK Support

Md. Faiyajuddin Khan is physically handicapped farmer living in village- Uchari of Garhwa district. Mr. Khan was searching some business for livelihood. One day he visited KVK, Garhwa for finding some agricultural ventures. He discussed in detail and tried to understand the possibilities of agricultural farming in some barren land which could be available easily as lease on low rate. He came to know that cultivation of drum stick in barren land was possible. Thereafter, he took 7-acre low fertile permanent barren land on lease @ Rs. 25,000 / acre / year and determined to engage himself in agricultural farming and business. Keeping in mind of low water requirement and minimum management practice, he started cultivation of drum stick (Var ODC) in 7-acre leased land after taking training from KVK, Garhwa. Seed of drum stick was procured from Sri Hars Saxena, Bhopal. The fruiting started within 2 years age of plant. Variety ODC of drumstick is now bearing fruits twice in a year.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmers Practice	Fallow land	Cultivation of drum stick
Yield of Product (q / acre)	Nil	5,700
Recurring Cost (Rs. / acre / year)	Nil	15,000
Gross Income (Rs. / acre / year)	Nil	1,50,000
Net Profit	Nil	1,35,000
BC Ratio	Nil	10.0
Marketing	Nil	In local market
Dissemination of knowledge in the locality	-	Disseminated in locality
Knowledge gain based on 1- 5 scale*	1	5
Feeling of economic security based on 1- 5 scale*	1	5
Ability to understand and solve problems based on 1- 5 scale*	1	5
Self image in community based on 1- 5 scale*	1	5
Self confidence based on 1- 5 scale*	1	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Md. Faiyajuddin Khan is earning Rs.1,35,000.00/ acre/ year from a barren land having low fertility. He really sees drum stick as his magic stick which has empowered him and changed his life with prosperity and respect in the society. He has been awarded as an innovative farmer at State level. He is also going to produce vermi compost by using the waste of drum stick (waste of thinning/pruning).

Adoption, Spread, Up Scaling of Technology and Future Projection

Cultivation of drum stick in barren land by Md. Faiyajuddin Khan has opened the eyes of other villagers. Inter cropping along with drum stick cultivation may add more income. Such technology needs to be scaled up in the days to come.

Doubling Farmers' Income from Cereal Based Farming to Intercropping of Vegetables

Anand Prasad Rakesh and Arun Kumar
Krishi Vigyan Kendra, Jale, Distt. Darbhanga, Bihar

Agro-ecology and Farming Situation

Darbhanga district is having alluvial calcarious soil with neutral to alkaline pH. Fertility status of soil is low to medium. About 1/3rd of the cultivable land is low which is mainly suitable for paddy in kharif and summer vegetable, rest 2/3rd of area is medium to upland suitable for vegetable cultivation. The cultivable area occasionally come across flood in the month of September which hampers rabi crop.

Technological Intervention and KVK Support

The farmers generally cultivated hybrid vegetables like cauliflower, pumpkin, cucumber, tomato, vegetable pea. KVK Jale, Darbhanga took a programme on intercropping of cauliflower + pumpkin, vegetable pea + pumpkin, sugarcane + vegetable pea + cucumber/ pumpkin for augmenting farmers' income. Two-tier cropping system with sponge guard + spinach/ amaranthus + coriander/ radish was also suggested to the interested farmers.

Economic and Socio-Psycho Impact

Impact factor	Before adoption	After adoption
Farmer practice	Cereal based conventional farming	Intercropping of vegetables
Yield of product (q/ha)	160	389
Recurring cost (Rs./ha)	66,000	1,18,600
Gross income (Rs./ha)	1,86,400	6,32,000
Net profit (Rs./ha)	1,20,400/-	2,31,400
BC ratio	2.82	5.32
Marketing	Trough middle man	Mostly self, cereals trough middle man
Dissemination of knowledge in the locality	-	Yes
Feeling of economic security based on 1 - 5 scale*	1	3
Knowledge gain based on 1 - 5 scale*	1	4
Ability to understand and solve problems based on 1-5 scale*	1	4
Self image in community based on 1-5 scale*	1	4
Self confidence based on 1-5 scale*	1	4

*1-5 scale indicates 1 = lowest and 5 = highest

Benefits

Through intercropping of vegetables, the income has been increased double than the previous income of cereal based conventional farming. This technology has improved economic, nutritional and social status.

Adoption, Spread, Up Scaling of Technology and Future Projection

Different types of intercropping along with two-tier cropping system need to be up scaled for doubling farmers' income. Technologies like mulching, drip irrigation, polyhouse, net-house may also be undertaken for augmenting income further.

Protected Cultivation of Vegetables for Doubling Income

Hemant Kumar Singh and K. M. Singh
Krishi Vigyan Kendra, PO. Thakurganj, Distt. Kishanganj, Bihar

Agro-ecology and Farming Situation

Kishanganj district of Bihar comes under middle gangetic alluvial plain region. The soil is mostly very deep, fine and loamy. The major field crops are rice, wheat, maize, pulses and oilseeds. Kishanganj is flood prone area. Infestation of pests and outbreak of diseases in crops are common.

Technological Intervention and KVK Support

Ali Hasmat Rehan (B.A., M. Ed.) is a progressive farmer in Village - Dhadhar, Block - Terhagachh of Kishanagnj. He has 4 acres of land of which 2 acres are irrigated. He was engaged in vegetable production mainly along with the cultivation of cereal crops by traditional methods. However, he did not find much profit out of his agricultural practices. He came to KVK, Kishanagnj and knew the details of vegetable production under poly house condition. Thereafter, he constructed poly house and started cultivation of tomato / capsicum during off season and thus received high returns after selling tomato / capsicum during off season. Earlier, Ali Hasmat Rehan did not fetch good returns in the season due to large availability of these vegetables in the market.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmers Practice	Traditional	Scientific
Yield of Product	Seasonal vegetables	Tomato / Capsicum under protected
Fixed Cost (Rs.)	35,000	25,00,000
Recurring Cost (Rs.)	25,000	30,000 x 3 seasons = Rs. 90,000
Gross Income (Rs.)	90,000	6.2 kg / m^2 (average) 2,87,500 / - x 3 season = 8,62,500
Net Profit (Rs.)	65,000	7,72,500
BC Ratio	3.6	9.58
Marketing	Kishanganj and local	Kishanganj, local, Kanki (WB)
Dissemination of knowledge in the locality	No	Some farmers are interested but construction cost very high, for which govt. subsidy is required

Impact factor	Before Adoption	After Adoption
Knowledge gain based on 1- 5 scale*	2	4
Feeling of economic security based on 1- 5 scale*	1	3
Ability to understand and solve problems based on 1- 5 scale*	3	4
Self image in community based on 1- 5 scale*	2	5
Self confidence based on 1- 5 scale*	2	5

*1-5 scale indicates 1 = lowest and 5 = highest

Benefits

The yield of tomato / capsicum per unit area was higher in comparison to the yield under field condition. The cropping intensity in poly house condition could be maximum with quality product. The infestation of diseases / pest could be lowered down under such protected cultivation. Cultivation in poly house also minimizes water wastage. Weed management is easier in the case of poly house cultivation.

Adoption, Spread, Up Scaling of Technology and Future Projection

The initial cost of investment is high. However, this technology could double the income. This technology may be recommended for large farmers. Some large farmers are interested in adoption of such technology. This technology may be promoted through providing subsidy by the Government.

Marigold Becomes Gold for Doubling Farmers' Income

Arti Beena Ekka
Krishi Vigyan Kendra, Darisai, Giridhi, Distt. East Singhbhum, Jharkhand

Agro-ecology and Farming Situation

East Singhbhum district is enriched with natural resources and mostly monoculture is in prevalence. Rice being the most important crop is grown by all the farmers, as it is staple food. In very few pockets in the district, two or three crops are taken annually. The district is totally rainfed and soils of the district are sandy loam, sandy clay with yellow in texture. The climatic condition is tropical to sub humid with average of 1200 mm rainfall. The soil of the district is acidic in reaction, but very much suitable for horticultural crops like vegetables, fruits and flowers after amendment of soil with lime @2-3 quintal per hectare. The major climatic vulnerability faced in the district is drought due to uneven distribution of rainfall. In addition to this, the district faces problems like low water holding capacity of soil, poor fertility status, slow farm mechanization, imbalance use of chemical fertilizers and pesticides, lack of proper irrigation facilities and stray cattle grazing.

Technological Intervention and KVK Support

Upland and midland are not suitable for rice cultivation in East Singhbhum. Thus, KVK, East Singhbhum took a programme for the promotion of Marigold cultivation among the farmers in such upland and midland areas of East Singhbhum district. Marigold flower can be grown round the year in the district, however, it's preferable month of transplanting is January as zaid, June as rainy and September as rabi season crop. Three varieties namely, Pusa Basanti, Yellow drop and Orange drop have been found as the promising varieties. The cultivation of Marigold has been done in ridges with double rows. Plant and row distance has been maintained by 45 × 60 cm for better crop development and more bloom. The techniques of pinching have been done after 40 days of transplantation. The recommended dose of fertilizers in the form of NPK has been given @ 100:60:60 kg/ ha with 20 ton/ ha of FYM. Mulching with black silver coated polythene sheet with drip irrigation is preferred. Time to time plucking of flower is also recommended for getting high production and profit.



Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Crop	Paddy Variety: Lalat	Marigold Variety: Pusa Basanti
Yield (q/ha)	39.52	260
Cost of production (Rs./ha)	32,500	1,84,437
Gross Income (Rs./ha)	47,400	6,50,000
Net Profit (Rs./ha)	14,900	4,65,563
BC Ratio	1.45	3.52
Marketing	Local Market	Local Market, home delivery, other district and also neighboring state like West Bengal
Dissemination of knowledge in the locality	No	More and more farmers are coming up in Marigold cultivation
Knowledge gain based on 1- 5 scale*	0	5
Feeling of economic security based on 1- 5 scale*	0	5
Ability to understand and solve problems based on 1- 5 scale*	2	4
Self image in community based on 1- 5 scale*	2	5
Self confidence based on 1- 5 scale*	2	5

*1-5 scale indicates 1 = lowest and 5 = highest

Benefits

Replacement of paddy with Marigold can be helpful in doubling of farmers' income. A study conducted in the district clearly shows that the farmers can get net profit of Rs. 14,900.00 out of rice cultivation from a hectare of land, but the farmers may get net profit of Rs. 4,65,563.00 after replacement of rice with Marigold and thus the farmers can get Rs. 3.52 from Marigold cultivation in place of Rs. 1.45 after the investment of Rs. 1.00. The increased income may improve their social status in the community. The farmers can change their living status and can uplift the standard of children's education.

Adoption, Spread Up Scaling of Technology and Future Projection

The farming community of the district is very much aware of benefit of Marigold cultivation in upland/midland situation instead of paddy. Through workshop, newspaper coverage, success stories and documentary film, the farmers could know the benefit of its cultivation. There is ready to sale market also in the district to encourage the farmers to sell their produce. The market rate never goes below Rs. 25.00 per kg. Therefore, this technology is disseminating from farmer to farmer. Some the district horticulture department officials are also involved in dissemination of this technology in other parts of the district.

Cultivation of Medicinal Plant and Oil Extraction for Doubling Income

Bipul Kr. Mandal and Sunil Kr. Choudhary
Krishi Vigyan Kendra, Distt. Agricultural Farm, Raghopur, Distt. Supaul, Bihar

Agro-ecology and Farming Situation

Supaul district comes under Zone II Sub humid temperate region of Bihar. Rice-Wheat-Jute is major farming situation in sandy loam soil. The sandy loam soil is low in organic matter and other major and minor nutrients. The major area of the district is affected by Koshi river with high sand deposition in fields. Hence, the major crops like paddy, wheat, jute, moong do not perform well in such sand affected area.

Technological Intervention and KVK Support

Sandy loam soil is better for growing medicinal plants like Mentha, Artimisia, Lemon grass, Japanees Pudina etc. After Koshi flood in 2008, major part of Supaul district especially Basantpur, Chhatapur, Raghopur and Pratapganj Blocks came under more than 2-3 ft sand deposition in cultivable lands. KVK, Supaul started campaign for cultivation of medicinal plants in such areas. A few farmers like Bhikari Mehta, Gyaneshwar Bariyaat, Sukhdeo Mehta and Bidur Narayan Singh started cultivation of Mentha crops. In early days, the cultivation started in 20-25 acre land which was gradually increased upto 500 acre. They also established Oil extraction plants and sold their oil in U.P Markets.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmers Practice	Moong/Jute	Mentha/ Lemon grass
Yield of Product	9 q per ha/18 bale/ha	100 kg Oil/ ha
Fixed Cost (Rs./ ha)	-	1,00,000
Recurring Cost (Rs./ ha)	17,500	25,000
Gross Income (Rs./ ha)	40,000	1,10,000
Net Profit (Rs./ ha)	22,500	85,000
BC Ratio	2.2	4.4
Marketing	Local market	Mostly in U.P.
Dissemination of knowledge in the locality	Very low dissemination	High dissemination
Knowledge gain based on 1- 5 scale*	1	5
Feeling of economic security based on 1- 5 scale*	1	3
Ability to understand and solve problems based on 1- 5 scale*	1	4
Self image in community based on 1- 5 scale*	1	3
Self confidence based on 1- 5 scale*	1	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Cultivation of medicinal plants has been polularized by expanding upto 500 acre. Medicinal plants are grown in low fertile lands where no other crop performs well. The total agricultural production of the area has been increased. Economic and social status of the farmers has been improved due to additional income.

Adoption, Spread, Up Scaling of Technology and Future Projection

At present total area of medicinal plants cultivation is approx. 500 acres which needs to be extended upto 1000 acre. Besides mentha crops, other crops like Japanese Pudina, Artimisia, Sataber Lemon grass need to be increased. At present total Oil production is nearly 15,000 kg which has to increase upto 50,000 kg. There is huge scope and opportunity to up scaling this technology.



Augmenting Income through Management of Vegetable Insect using Non Chemical Methods

Praveen Kumar, Prashant Verma and Manoj Kumar Singh
Krishi Vigyan Kendra, Holycross, Near Kanari Hill, Distt. Hazaribagh-825301, Jharkhand

Agro-ecology and Farming Situation

In present scenario, pests of vegetables and other crops are mostly resistant to chemicals. Insect pests are the major biotic constraints to vegetable production in India. Many Insect pests also act as vector for sevral viral diseases. The crop loss due to insect is 30 to 40% has been reported in vegetable crops.

Technological Intervention and KVK Support

KVK, Hazaribag has promoted non-chemincal methods for the management of vegetable insect among the farmers of Hazaribag. Management of brinjal fruit and shoot borer insect through pheromone trap with the help of lure (*Leucinodes orbonalis*) could decrease the yield losses up to 70-80% in case of brinjal. Management of fruit fly in cucurbits crop through furit fly trap could reduce crop losses up to 75-80% in bittergourd, cucurbit etc. Instead of market trap, farmers are using KVK made trap under the technical guidance from KVK Hazaribag.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	Chemical Pesticide	Biopesticides & traps
Yield of Product (q/acre)	170 - 175	170 - 175 (Fresh)
Fixed Cost (Rs./acre)	2500	2500
Recurring Cost (Rs./acre)	1,01,000	1,01,000
Gross Income (Rs./acre)	2,10,000	3,50,000
Net Profit (Rs./acre)	1,09,000	1,40,000
BC Ratio	2.02	3.38
Marketing	2	5
Dissemination of knowledge in the locality	1	3
Knowledge gain based on 1- 5 scale*	1	5
Feeling of economic security based on 1- 5 scale*	1	5
Ability to understand and solve problems based on 1- 5 scale*	1	4
Self image in community based on 1- 5 scale*	1	5
Self confidence based on 1- 5 scale*	1	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

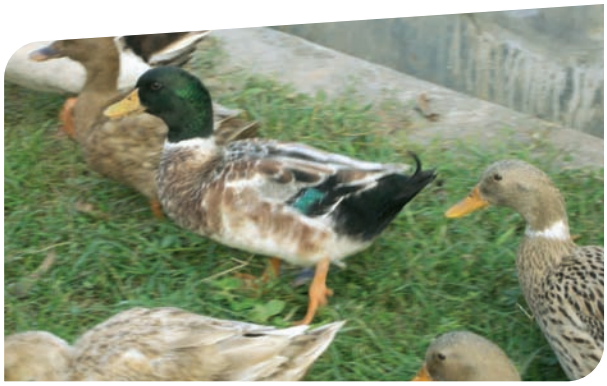
Benefits

In terms of money, farmers could save their 50% money by using biopesticides and traps in comparison to chemical management. Use of biopesticides and traps could reduce biotic strees which is one of the major threats to sustainable vegetables production in India. Through this technology, we could get pesticides free, fresh, and comparatively less toxic produces.

Adoption, Spread, Up Scaling of Technology and Future Projection:

Adoption rate of farmers is good, but we need more focus in this area in future and we require marketing facilities of biopesticides, bioagents at the farmer's doorsteps.

Livestock Farming



Dairy Farming- A Way for Transformation from Poverty into A Path of Prosperity

Dhananjay Kumar and Jaywant Kumar
Krishi Vigyan Kendra, Sarvodya Ashram, PO: Sokhodeora, Distt. Nawada, Bihar

Agro-ecology and Farming Situation

Shri. Santosh Kumar Singh, S/o- Shri Arjun Singh is a resident of Village - Kharat, Block - Pakribarawan, Nawada district of Bihar. He was educated upto class 9th. He had no sufficient money to meet the expenses of his family. He was unable to provide better education to his children due to scarcity of money. He was also struggling to fulfil his own and the family demands. He was engaged in agriculture in about 8 acres of land. He was a small and traditional dairy farm having 4 numbers of cows with avg. production of 20 lit/ day. He was confused about the type of business to start but was eager to engage in dairy farming in bigger way. Very soon, he realised that the dairy industry was unorganised at grass root level and the farmers were not getting the right price for the milk they produced. Still he did not give up.

Technological Intervention and KVK Support

One day in year 2016, Shri. Santosh Kumar Singh came to Krishi Vigyan Kendra for taking advice for health related issue of his cattle and thus he came in contact with the Scientists of KVK, Sokhodeora, Nawada and subsequently he was advised to gain knowledge on scientific dairy farming and business. The scientists guided him and provided him training on dairy farming. Thereafter, Shri. Santosh Kumar Singh decided to increase the number of animals at his farm. Thus, he has now 22 animals (crossbred cattle- 10, indigenous buffalo - 12) with an average milk production of 125 lit per day (cattle - @ 12-16 lit/ day and buffalo - @ 8-10 lit/day). In the span of last two years, he has achieved many milestones; these include supplying of milk to local market and cooperatives. Besides increasing milk yield, he is also benefitted by the KVK in getting scientific guidance on feeding, preventive health care and other management practices. He is using homemade concentrate for balancing the feed of the animals. The animals are now healthy. Mostly feed and fodder are self-cultivated and fulfiled the requirement of green fodder (25kg/day/animal). Additional income is incurred also by selling cow dung (150 tonnes @ Rs. 500/tonne).

Economic and Social Impact

Impact factor	Before Adoption	After Adoption
Farmers' Practice	No. of cows- 04	No. of cows- 10 No. of buffaloes- 12
Yield of Product (lit/ annum)	Total milk production- 7,680 lit./ annum Total dung- 18 tonnes	Total milk production- 45,600 lit./ annum Total dung- 150 tonnes
Fixed Cost (Rs.)	1,75,000	12,15,000
Recurring Cost (Rs./annum)	2,20,800	10,30,000
Gross Income (Rs./annum)	2,97,500	19,29,000
Net Profit (Rs./annum)	76,700	8,99,000
BC Ratio	1.34	1.87
Marketing	Local market @ Rs.40/kg	Local market and dairy cooperatives @ Rs.40/ kg
Dissemination of knowledge in the locality	Lack of awareness	Awareness after training and technical guidance by KVK and dissemination of technology in nearby locality
Knowledge gain based on 1- 5 scale*	2	4
Feeling of economic security based on 1- 5 scale*	2	4
Ability to understand and solve problems based on 1- 5 scale*	3	4
Self image in community based on 1- 5 scale*	3	5
Self confidence based on 1- 5 scale*	3	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Shri. Santosh Kumar Singh started dairy farming at large scale with 22 milch animals with average milk production of 125 lit /day. Before coming into contact of KVK, Nawada, he was not aware of scientific rearing of his cattle, the production of the cows was very low and his expenditure was more on animal health care. With the scientific guidance and training provided by KVK scientists, the milk production of his cows and buffaloes has been increased significantly. He is now earning (net income) about Rs. 70-75,000/- per month. The scientific guidance of feeding, preventive health care and other management practises helped him to save expenditure on health care of cattle and buffalo. Additional income is also incurred by selling cow dung (150 tonnes@ 500/tonne). His family is also enjoying good socio economic status in the village and they are leading a comfortable life. The life style and his good

socio-economic condition is the reason behind his being role model to other unemployment youths. His whole family appreciates KVK Nawada for bringing happiness and changes in their lifestyle.

Adoption, Spread, Up Scaling of Technology and Future Projection

Shri. Santosh Kumar Singh has become an example for a number of unemployed rural youths in the locality. The unemployed youth of nearby area are showing interest to start and engage in dairy farming by seeing his improvement in lifestyle and in economic condition. He is guiding and motivating them to be engaged into this high earning job with less input cost. The rural youth of nearby villages are taking training and guidance from KVK Nawada also, and some of them have started this business in small scale. Other farmers are taking advice from him on dairy related different issues. The farmers are using balanced diet after preparing feed using local ingredients. This is featuring to sell the farmers' produce in a cooperative basis by making a cooperative group.

Dairy Farming Entrepreneurship

Shobha Rani and Dinesh Mahto
Krishi Vigyan Kendra, Seed Multiplication Farm, Mussi, Makhdumpur, Distt. Jahanabad, Bihar

Agro-ecology and Farming Situation

Jehanabad district with rainfed situation is predominantly based on rice-wheat cropping system. Shri. Braj Kishore Sharma is a progressive farmer of village- Rampur Charui, block- Modanganj. He cultivates paddy, wheat, onion etc. in his 4.0 hectare land. He has some fruit plants for some income. He has also established an Automatic Rice Mill for income generation. Due to uncertain monsoon in past few years, crop production was decreased remarkably. So, he decided to adopt some other enterprise besides conventional agriculture farming.

Technological Intervention and KVK Support

One day, Shri. Braj Kishore Sharma came to KVK Jehanabad and showed his interest to do some regular income generating venture! He was told many enterprises and ultimately he decided to start dairy farming. Thereafter, he took training on dairy farming and thus, he became very much interested in dairy farming and business. Initially, he started a dairy farm with 2 cows for additional income. He found that dairying was a very successful business. So, he increased the number of animals gradally. Now, he has altogether 35 cows. He is connected with Magadh Dairy Cooperative (COMFED, Jehanabad) and getting money back in time. Milk marketting is not any more issue for him. At his dairy centre, milk is tested first for fat percentage and SNF and then milk is sold to Magadh Dairy Cooperative.

Economic and Social Impact

Impact factor	Before Adoption	After Adoption
Farmers' Practice	2	20
Yield of Product: Milk (litre/day)	20 litre	180 litre
Recurring Cost (Rs./year)	80,000	7,00,000
Gross Income (Rs./year)	1,80,000	16,20,000
Net Profit (Rs./year)	1,00,000	9,20,000
BC Ratio	2.25	2.6
Marketing	Local market	Local market
Dissemination of knowledge in the locality	No	Yes
Knowledge gain based on 1- 5 scale*	2	4
Feeling of economic security based on 1- 5 scale*	1	4
Ability to understand and solve problems based on 1- 5 scale*	1	3
Self image in community based on 1- 5 scale*	1	4
Self confidence based on 1- 5 scale*	2	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Besides economic benefits, the milk produced is very much important for nutritional security and it has high social value. Shri. Braj Kishore Sharma has also established one vermicompost production unit as well as a gobar gas plant by which he is additionally benefitted in terms of biogas manure and fuel for cooking. As a result of dairy entrepreneurship, his living standard has been uplifted and also his children are getting better education with positive impact on socio- economic status.

Adoption, Spread, Up Scaling of Technology and Future Projection

Shri. Braj Kishore Sharma is a source of inspiration for the livestock owner of his locality. Many farmers of nearby areas have started dairy farming with 3-10 cows after getting motivation from him. He has already planned to develop a milk centre with many value added milk products like ghee, paneer, flavoured milk and peda. He also wants to establish a chilling plant and start the facility of milking machine and A.I. technique. He wants further to increase the number of cattle upto 100.

Dairy Farming and Business- The Way Forward

Nidhi Sinha and S.B. Singh
Krishi Vigyan Kendra, Seed Multiplication Farm, Manpur, Distt. Gaya-823003, Bihar

Agro-ecology and Farming Situation

Shri Santosh Kumar, S/o Shri Baldev Yadav of Village - Shekhwara, Block - Bodh of Gaya, is an innovative farmer. After completion of Bachelor Degree in Arts, he was not able to fulfil his family's demand only from farming. Therefore, he started his dairy unit with only 2 cows in 2003 utilizing his own capital. Experience the profit from 2 cows, he took loan (Rs. 3.00 lakh) from Bank of India and thus purchased few more cows and gradually increased the number of cows from 2 to 20. However, he had no exposure of training or improved knowledge on dairy farming.

Technological Intervention and KVK Support

One day, Shri Santosh Kumar visited KVK Gaya to know about training facility on dairy farming. Once he was informed about the training, he expressed his desire to take part in training programme on dairy farming. Thereafter, he participated in training on dairy farming. KVK Gaya provided him avenue for training and visit to learn the experiences from different training centres. Then, Shri Santosh Kumar took loan of Rs. 19.80 lakh from Canara Bank in 2010 and developed a modern dairy unit with the capacity of 200 cows. He planned to utilize cow dung for making vermicompost. KVK Gaya assisted him to prepare a project on vermicompost unit with a cost of Rs. 52 lakhs. Thus, he obtained Rs. 25 lakh subsidies from the Govt. of Bihar and established a grand vermicompost unit of 3000 mt of capacity. Presently, he has 186 milch cows in his dairy unit. He has 1000 liter of cooling chamber to store extra milk and making them some processed products like Paneer, Khoa, Curd and Ghee for market purposes.

Economic and Social Impact

Impact factor	Before Adoption	After Adoption
Farmers' Practice	2 cows	200 cows, vermi-composting, dairy processing
Yield of Product	12 lit.	400-500 lit.
Fixed Cost (Rs.)	-	77 lakh
Recurring Cost (Rs./ year)	0.25 lakh	43.6 lakh
Gross Income (Rs./ year)	0.35 lakh	68.2 lakh
Net Profit (Rs./ year)	0.1 lakh	24.6 lakh
BC Ratio	1.40	1.56
Marketing	Local market	At Present, he is producing 400-500 liter milk per day and providing to colleges hostels. In lean period, he has capacity of 1000 liter of cool chamber to store extra milk and making them some processed product like Paneer, Khoa, Curd and Ghee for market purposes.
Dissemination of knowledge in the locality	-	Sri Santosh Kumar developed a Training Centre for other farmers to educate and motivate them
Knowledge gain based on 1- 5 scale*	-	5
Feeling of economic security based on 1- 5 scale*	-	5
Ability to understand and solve problems based on 1- 5 scale*	-	5
Self image in community based on 1- 5 scale*	-	5
Self confidence based on 1- 5 scale*	-	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

He earned many awards like Jagjivan Ram Innovative Farmers Award 2012 (ICAR, New Delhi) and National Dairy Farmer Award 2011 (NDRI, Karal).

Adoption, Spread, Up Scaling of Technology and Future Projection

Sri Santosh Kumar developed a Training Centre for other farmers to educate and motivate them. ATMA, Gaya used him as a Master Trainer for both the dairy and vermicomposting enterprises. Many farmers from Gaya and other adjoining districts as well as other states come and get the experiences on dairy farming, processing and business as a successful venture. His future plan is to establish bio-gas filling plant to utilise dairy unit by-product.

Goat Farming As a Profitable Enterprise for Livelihood

Anjali Chandra, Bharat Mahto and Ajeet Kumar Singh
Ramakrishna Mission Ashrama, Swami Vishuddhanand Road, Morabadi, Ranchi- 834008, Jharkhand

Agro-ecology and Farming Situation

Ranchi district is a part of Chotanagpur plateau, having hilly forest areas. Through out the district, small and marginal farmers with very small land holding are to work hard to earn some income in addition to farming. The agriculture is rainfed and they hardly grow paddy with some vegetables in Kharif season. In this situation, farmers have to migrate for employment to support their families. This situation is always critical for farm women of this area. They are hard working and always try to fulfill their family needs through subsidiary occupation. Among available alternatives, goatery is an integral part of tribal livelihood since years. Goatery is being done by 70% farm women of the district as an integral part of their farming system. The tribal villages of Ranchi also have very good resources for goat rearing, but it is not so profitable due to traditional style of goatery management. Improper housing, no vaccination and deworming along with poor management of goat farms discourage farmers to increase the size of farm as the mortality and morbidity rates become high (up to 20%).

Technological Intervention and KVK Support

Forest area for goat grazing was identified as the best area for the promotion of goat farming among farm women. Tribal women had some revolving funds with their self help groups. KVK Ranchi started its intervention among women farmers under NABARD Sponsored pilot project 'Livelihood and enterprise Development program'. Farm women were organized and provided 7 days training on scientific goatery management including skill development on vaccination, deworming and minor treatments. They were provided basic inputs like medicines, thermometer, weighing scale etc. They were also motivated by scientists of KVK to construct goat sheds with raised platforms. About 200 goat sheds with raised platforms were constructed with financial support from TSP of KVK. All these interventions brought a very positive impact in reducing morbidity and mortality rates of goats and hence in increasing their farm size.

Economic and Social Impact

Impact factor	Before adoption	After adoption
Farmers' practice	i) Improper housing management of small sized goat farms. No regular vaccination and deworming. ii) Goat farming on individual basis with average flock 10 goats.	i) Proper housing of goats with raised plantform with regular vaccination and deworming. ii) Goat farming on enterprise basis with average flock 30 goats.
Yield of product	Number of salable goats: 14-15 goats in 2 years Salable age: 12-14 months Weight approx: Male- 10-12 kg; Female- 8-10 kg	Number of salable goats:35-38 goats in 2 years Salable age: 12-14 months Weight approx: Male- 12-15 kg; Female- 8-10kg
Fixed cost (Rs.)	22,000	43,000
Recurring cost (Rs./year)	700	4,500
Gross Income (Rs./year)	22,750	73,500
Net profit (Rs./year) = Gross Income - (20% depreciation of Fixed cost + Recurring cost)	17,650	60,400
BC ratio	4.46	5.61
Marketing	Local Market	Local Market
Dissemination of knowledge	_	More than 1000 women farmer adopted this technology
Knowledge gain based on 1- 5 scale*	1	3
Feeling of economic security based on 1- 5 scale*	2	4
Ability to understand and solve problems based on 1- 5 scale*	2	4
Self image in community based on 1- 5 scale*	2	4
Self confidence based on 1- 5 scale*	2	3

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

The Programme "Livelihood and enterprise development through scientific goatery" among farm women really has been found to be very effective. The intervention of KVK like housing management, regular deworming and vaccination and all related management aspects had a very positive impact on controlling mortality and morbidity rates (from 20% to 5%) of goats, as well as it increased the growth rate of kids (20- 25%). Due to these efforts goatery became a profitable enterprise with higher BC ratio (raised from 4.46 to 5.61). The farm women were encouraged to develop their goat farm as commercial unit. They are now able to manage their goat farm with an income of Rs. 50,000- 80,000/- annually depending upon farm size of 30 - 50 goats. The income was additional to their main source of income, i.e. farming or lac cultivation. The women have more social prestige as entrepreneurs, they feel more and finally their socio-economic conditions are gradually increasing.

Adoption, Spread, Up Scaling of Technology and Future Projection

Observing the success of these 200 farm women, who were trained in a group for goatery, thousands of women SHG members from nearby villages showed their interest in goat farming. About 500 more women were trained under different programmes of KVK with financial assistance from state tribal welfare and other departments. The technology of housing management of goats was upscaled for 200 women farmers. More than 200 goat sheds were constructed under Tribal Sub-Plan. Vaccination of more than 1,000 goats was done under FLD Program of KVK. For sustainable vaccination programme a village wise group of women farmers was formed. Now 2 - 3 identified leaders of the group, well trained by KVK, are doing this work.

Miss Teejani Devi of Sarjamdih village of Angara block constructed a model goat demonstration farm by financial support of Rs. 50,000/- from NABARD alongwith her own contribution. She is now planning to expand her business by increasing the farm size (presently 35 goats).

The LEDP groups of farm women are in initial stage of establishing their own goat farms as commercially viable unit as well as of developing this enterprise in group mode. They are also supplying huge quantities of goat meat to market as well as goats for rearing purposes on demand basis. It is expected that very soon a marketing network will be developed within group and some more members will be added to group. Farm women are also planning to develop this group as Goat Farmers Producer Group with financial support from NABARD, so that the group may emerge as Goat Producers Company in the coming years.

Farming of Barbari and Sirohi Goats for Economic Security

Shobha Rani and Dinesh Mahto
Krishi Vigyan Kendra, Seed Multiplication Farm, Mussi, Makhdumpur, Distt. Jahanabad, Bihar

Agro-ecology and Farming Situation

In Jehanabad district, goat farming is an agricultural activity that especially suited to small and marginal farmers with low socio-economic status. The goat is a versatile animal thrives well in every circumstance. Due to low cost of feeding and management, it is known as poor man's cow in India. Goat is ideally suited for the poorest of the poor. It contributes significantly to rural economy. The goat keeping can provide self- empowerment opportunities to the people and has religious and ritualistic importance in many societies. Goats can thrive under varied climatic condition and sparse vegetation, so goat farming is more economical than farming with others domestic animals.

Technological Intervention and KVK Support

Sri Sudhir Kumar Singh, aged 42 years, is a progressive farmer of Village- Muther, Block- Jehanabad. He has studied upto Graduation level (History). After attending long duration training organized for Rural Youth in KVK Jehanabad, he started goat farming on small scale, initially with 10 local goats. Meanwhile, he always remained in touch with KVK Jehanabad and followed all the technical advices provided by the scientists. The KVK scientists also continuously monitored and supervised his farm. Realising the success and regular income from goat farming, Sri Sudhir Kumar became very much motivated to introduce Barbari and Sirohi breed of goats brought from CIRG, Makhdum, U.P. with the guidance of KVK Jehanabad. He followed the vaccination and deworming schedules for keeping the goats healthy. He recorded an increase in milk yield by 40% with 66% enhancement in body weight. At present, Sri Sudhir Kumar has increased the number of goats up to 55 at his goat farm.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmers' Practice (Goat)	5	55
Fixed Cost (Rs.)	15,000	80,000
Recurring Cost (Rs./year)	10,000	1,25,000
Gross Income (Rs./year)	15,000	2,37,500
Net Profit (Rs./year)	5,000	1,12,500
BC Ratio	1.5	1.9
Marketing	Local Market	Local Market
Dissemination of knowledge in the locality	No	Yes
Knowledge gain based on 1- 5 scale*	2	4
Feeling of economic security based on 1- 5 scale*	1	3
Ability to understand and solve problems based on 1- 5 scale*	1	4
Self image in community based on 1- 5 scale*	1	3
Self confidence based on 1- 5 scale*	1	3

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Sri Sudhir Kumar regularly gets income by selling kids. Besides, he gets milk which is highly nutritious. The farming provides a sense of economic security to Sri Sudhir Kumar.

Adoption, Spread, Up Scaling of Technology and Future Projection

Goat rearing is an enterprise which is practiced by a large section of population in rural areas. Ten farm families have started goat farming after seeing the success of Mr. Sudhir Kumar.

Pig Farming with Jharsuk Pig Breed Turns Income Double

P. Seth and A. Mishra
Krishi Vigyan Kendra, Seed Multiplication Farm, Gamharia, Distt. Saraikela-Kharsawan, Jharkhand

Agro-ecology and Farming Situation

Agro-ecology of Saraikela-Kharsawan comes under Eastern Plateau climatic zone and situated between north latitude 21^0 58' and 23^0 56' and East Longitude 85^0 and 86^0. Farming situation is based on mansoon and rainfed paddy and vegetables cultivation. Agriculture is primary occupation and livestock rearing is secondary activity. District Saraikela-Kharsawan is surrounded with many large scale as well as small scale industries and most of the people of the district prefer meat in their daily diet. Besides poultry meat, there is a good demand of pork. However, pig keepers rear local pigs in a traditional manner and supply the meat of such local pigs in the market. Local breed of pig has low productivity in terms of body weight gain as well as low litter size and high motility causing less profit in pig farming.

Technological Intervention and KVK Support

Pig farming has been found by KVK Saraikela-Kharsawan to be an effective tool for poverty alleviation and employment generation in this area. Jharsuk pig breed has been proved to be superior than other pig breeds due to its black colour, more remunerative market price (approx. five times higher), faster growth rate, high litter size and better feed conversation ratio. Further, this breed has more socio-cultural acceptability among pig farmers, especially in tribal mass. Intervention of KVK Saraikela-Kharsawan by replacement of local pig with Jharsuk pig breed has brought remarkable change in pig farming scenario due to faster growth rate, high litter size and better feed conversation ratio and five times more remunerative price.

Economic and Social Impact

Impact factor	Before Adoption	After Adoption
Farmers' Practice	Local Pig	Jharsuk pig breed
Yield of Product	Av. Litter size-5 piglets	Av. Litter size 12 Piglets
	Av. Body weight- 38 kg	Av. Body weight-95 kg
Recurring Cost (Rs./pig)	1,700	3,000
Gross Income (Rs./pig)	4,560	13,775
Net Profit (Rs./pig)	2,860	10,775
BC Ratio	2.6	4.6
Marketing	Sale of Pork- Rs. 120 per kg Sale of piglet Rs. 600 per piglet Demand-Locally	Sale of Pork- Rs. 145 per kg Sale of piglet Rs. 2500 per Piglet Demand- Local, Regional and interstate market
Dissemination of knowledge in the locality	Little scope for dissemination of knowledge as it remains traditional	Fast dissemination of knowledge on such pig farming with fast growing breed
Knowledge gain based on 1- 5 scale*	2	5
Feeling of economic security based on 1- 5 scale*	2	5
Ability to understand and solve problems based on 1- 5 scale*	2	5
Self image in community based on 1- 5 scale*	2	5
Self confidence based on 1- 5 scale*	2	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Intervention with Jharsuk pig breed has found to be relatively more advantageous in terms of price premium (five times more remunerative), faster growth rate, higher litter size, more consumers' taste preference for Jharsuk meat. It has been found to have more socio-cultural compatibility among pig farmers of district Saraikela- Kharsawan.

Adoption, Spread, Up Scaling of Technology and Future Projection

After intervention of Jharsuk pig breed, it becomes so popular among pig farmers of district Saraikela-Kharsawan that they are now motivated to replace traditional pig farming by improved pig farming with Jharsuk pig breed. It reveals that women pig farmers are adopting for their self-empowerment and uplifting of family income. Now in Saraikela, about 350 pig farmers are earning average income of Rs. 2.5-3.5 lakh per annum through farming with Jharsuk pig.

Feeding of Kitchen Waste to Pigs for Augmenting Income

Satish Kumar and Ravi Shanker
Krishi Vigyan Kendra, Godda-Pirpaiti Road (Rautara Chowk), Distt. Godda, Jharkhand

Agro-ecology and Farming Situation

Mr. Upendra Malto, a matriculate and his wife, a 5th class pass, have only 5 acres upland area for agricultural purpose at Chandana village under Boarijoar Block of Godda District. He was having 5 indigenous pigs and getting very meagre income from his land and pigs. Once he visited Agrotech-Kisan Mela at BAU, Ranchi in the Year 2010. There he saw Tamworth and Desi (T & D) crossbred of pigs and got information about the breed. After returning to Godda, he contacted KVK Godda to get more information about rearing and management of pigs. Then he purchased 4 female + 1 male T & D crossbred piglets for breeding purpose. Due to his poor source of income, he was unable to feed the piglets in proper way for better growth and development.

Technological Intervention and KVK Support

GVT- KVK Godda conducted an OFT on the feeding management of pigs by utilising commercial feeds with kitchen wastes. The trial was conducted in RBD with four technology options viz. commercial feed 100%, 75% commercial feed + 25% kitchen waste, 50% commercial feed + 50% kitchen waste and farmers practice (no commercial feed) as control/ check. The maximum body weight and meat yield were recorded in pigs which were fed either commercial feed 100% or 50% commercial feed + 50% kitchen waste. Feeding of 50% commercial feed + 50% kitchen waste also gave maximum return in respect of BC ratio.

Economic and Social Impact

Impact factor	Before Adoption	After Adoption
Farmers' Practice (Feeding Materials)	Feeding of easily available any local feeding materials 50%	Feeding of 50% commercial feed + kitchen waste
Yield of Product (Body Weight- kg/ pig)	52.24	74.73
Recurring Cost (Rs./ pig)	4965.00	6098.00
Gross Income (Rs./ pig)	5014.80	9616.50
Net Profit (Rs./ pig)	1549.80	5018.50
BC Ratio	1.01	1.57
Marketing	Only meat	Meat + piglets
Dissemination of knowledge in the locality	-	Done through group discussion, training, field day
Knowledge gain based on 1- 5 scale*	1	4
Feeling of economic security based on 1- 5 scale*	1	4
Ability to understand and solve problems based on 1- 5 scale*	1	3
Self image in community based on 1- 5 scale*	1	4
Self confidence based on 1- 5 scale*	2	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Ø Better utilization of kitchen waste which is easily available at home

Ø More return/ animal

Ø Enhancement of self image in community

Adoption, Spread, Up Scaling of Technology and Future Projection

In the year 2012-13, Gramin Vikas Trust (GVT) provided a piggery unit to GVT-KVK Godda. The piglet production at KVK gave a big support to pig rearing community of Godda. The farmers are getting piglets as well as the technical knowhow for getting maximum benefit from their piggery unit. Rearing of T & D piglets is being carried out in 325 households of Godda. After realising the success of T & D pigs, various NGOs like PRADAN, WORLD VISION, MAA YOGINI MAHILA MANDAL, BADLAO FOUNDATION, AMBUJA CEMENT FOUNDATION (W.B.), JTDS etc. came forward for disseminating this technology in Godda as well as neighbouring states too.

Benefit of Azolla Feeding as A Low Cost Protein Source in Pigs and Ducks

R. M. Mishra and Arti Beena Ekka
Krishi Vigyan Kendra, Darisai, Vill-Barakhurshi, PO- Giridhi, Distt. East Singhbhum, Jharkhand

Agro-ecology and Farming Situation

East Singhbhum is the district where mixed farming, integrated farming and diversification in farming exist well since time immemorial. It is almost a complete undulated topography. Sixty per cent and above land situation here is either upland or medium land. The agriculture practiced here is rain-water dependent. Being rain-fed farming, the farmers here are well prepared to face the consequence of vagaries of weather. It is a typical location where agriculture is critical, risk prone and diversified. As per Newton's saying- "Survival of the fittest and struggle for existence", farmers here sustain their livelihood through adopting various resource they have like forest, rivers and lakes, hills, rocks, mines, and to a great extent, the human resources. The various activities they do to earn their livelihood are animal husbandry, horticultural crops, agro-forestry and aqua-culture in agriculture and allied fields. The role of animal husbandry towards sustainable livelihood promotion is clearly identified here. This is a region where food habit is mainly non-vegetarian. Additionally the farming community relies upon livestock at the time of financial crisis. Livestock are the then ready to be sold immediately or act as ATMs.

Major problems in livestock farming identified are as follows-

Ø Variable feed resource availability leading to variation in productivity

Ø High cost involved in feeding- especially protein rich feed.

Ø Poor attitude on investment in farming.

Technological Intervention and KVK Support

Azolla is a water plant high in edible protein and minerals, highly palatable to ducks, chicken, pigs, cattle and other livestock. It can be grown on any closed water body. Azolla is found to be cost effective protein and mineral rich feed source to livestock. It contains about 25% protein and 15% minerals. It

is low in lignin which makes it digestible to many livestock. It is rich in essential aminoacids, vitamin A, B_{12}, Beta carotene, growth promoters, minerals like calcium, phosphorus, potassium, ferrous, copper, magnesium etc. on a dry weight basis. Additional advantage of azolla is its highly regenerative quality. Hence, KVK East Singhbhum has promoted hugely azolla for feeding livestock, particularly pigs and ducks among the farmers through front line demonstration, training etc.

Economic and Social Impact

Impact factor	Before adoption	After adoption
Farmers' practice	No use of azolla	Livestock fed feed mixed with azolla
Yield of product	Variable productivity based on availability of feed naturally	Supplementation of balanced feed using azolla as a sustainable source of protein in feed
Recurring cost	Ducks-Rs 2/duck/ day in feed Rs 72,000/ 100 ducks/year Pig- Rs 15/pig/day Rs 5,000/pig/year	Duck- Rs 1.5/duck Rs 54,750/100 ducks/year Pig- Rs 11/pig/day Rs 3,960/ pig/ year
Gross income	Ducks- R s 1,40,000/100 ducks Pig- Rs 9,000/ pig/ year	Ducks- Rs 1,75,000/100 ducks Pig- Rs 10,000/ pig/ year
Net income	Duck- Rs 68,000/100 ducks/year Pig- Rs 4,000/ pig/ year	Duck- Rs 1,20,250/ 100 ducks/year Pig- Rs 6,040/ pig/ year
BC ratio	Ducks- 1.9 Pig- 1.8	Ducks- 3.2 Pig- 2.5
Marketing	Local haat	Local haat, within district and adjoining districts
Dissemination of knowledge in the locality	-	Well disseminated among the duck and pig farmers
Knowledge gain based on 1-5 scale	-	4
Feeling of economic security based on 1-5 scale	2	5
Ability to understand and solve problem based on 1-5 scale	2	4
Self image in community based on 1-5 scale	1	5
Self confidence based on 1-5 scale	2	5

Benefits

Farmers have gained economical benefits of feeding azolla to pigs and ducks in terms of BC ratio. Farmers have started duck cum fish cum vegetable production, pig cum crop production with an aim

of better utilization of resources and recycling of farm waste. Azolla feeding has been found to be the best feeding practice which is economical as well as nutritious feed ingredient.

Adoption, Spread, Up Scaling of Technology and Future Projection

The benefits of feeding of azolla in ducks and pigs have been disseminated well in the district East Singhbhum. Pig farming is already popular in East Singhbhum. Duck farming is rapidly being disseminated as the demand for both meat and egg are equally seen in the district. Media coverage like success stories feature articles / documentary/ CD Doordarshan Ranchi, Krishi Darshan- documentary on pig farming based farming have been done in the year 2015-16.

Innovative And Cost Effective Semi-Intensive Backyard Poultry Farming

Brajendu Kumar and Ranjeet Pratap Pandit
Krishi Vigyan Kendra, Sub-divisional Farm, Distt. Khagaria-851205, Bihar

Agro-ecology and Farming Situation

Khagaria district is situated in the east central part of Bihar under agro-climatic Zone-II. The total population is 17 lakhs (2011 census) of which farmers population is approx. 1.23 lakh, while agricultural labourer population is 2.57 lakh. On the basis of land holding size, about 91.06% are marginal farmers, 5.85% small farmers, 3.06% medium farmers and 0.03% large farmers.

Vanaraja poultry is a dual purpose breed developed by ICAR-Directorate of Poultry Research, Hyderabad. Due to the similarity in phenotypically appearance of the Vanaraja birds to the indigenous birds, it has been well accepted by the farmers of Khagaria. But their growth and egg production are far better than the local poultry breeds. There are some other reasons for the popularity of the birds like attractive multi colour feather, low maintenance cost, high disease resistance and large brown coloured eggs resembling the local eggs. Further, the birds consume insects and leafy grasses and green fodder when they are reared in semi-intensive condition. Hence, the farmers are greatly interested in rearing Vanraja birds for both eggs and chicken meat.

To generate basic information for the implementation of low cost semi-intensive model of backyard Vanraja poultry farm suitable for smallholder farmers in Khagaria district, a survey was conducted through using questionaire which aimed at defining the socioeconomic characteristics of the production environments in village area, understanding farmers objective of backyard poultry farming, identifying farmers' choice of chicken breeds and the underlying factors that determine the choice of genetic stock used. A total of 100 households from five villages were interviewed. The questionnaire was designed to collect data covering general information on village backyard poultry production such as socio-management characteristics, production objectives, population structure, breed choice and trait preferences, market preferences of specific traits, and farmers' selection practices. The results showed that production of eggs and meat for home consumption was the principal objective of backyard poultry farming in most regions. Farmers were not able to commercialise backyard poultry farming as source of income due to poor growth rate, low egg production, high mortality, extensive scavenging management, absence of immunization programs, and increased risk of exposure of birds to disease and predators.

Technological Intervention and KVK Support

Shri. Ranjay Paswan of Village- Budhwa Parri, Block- Alouli in Khagaria started Vanaraja poultry farming under low cost, semi-intensive backyard system in 2016 under the technical guidance of KVK, Khagaria. He built poultry house of 300 sq. ft. using bamboo and net structure with corrugated tin roof for keeping 200 birds. He kept open enclosed area of 5000 sq. ft. made up of nylon net for scavenging of birds. To reduce feed cost and enhance nutritional level, 5 numbers of azolla pits (8 x 4 ft each) were made in close vicinity of poultry farm. The birds forage whole day in open enclosed area. The feed items include homemade concentrate (maize, wheat, soyabean, vitamins, minerals mixture), azolla, greens and insects. Electric bulb is used as insect trapper in night to collect insects which are fed to

poultry as a source of protein. Thus, total feeding cost reduces upto 60 %. Meat and egg produced in such organic way fetch high market price.

Economic and Social Impact

Impact factor	Before Adoption	After Adoption
Farmers' Practice	Local birds, low growth rate, less egg production	Vanaraja poultry birds, high growth rate, more egg production
Yield of Product	Average body wt./bird- 1.2 kg Average no. of eggs/bird/ year-60	Average body wt./bird-2.5 kg Average no. of eggs/bird year-150
Fixed Cost	-	Rs. 0.14 lakh
Recurring Cost (2 cycles annually of 200 birds in each cycle)	Rs. 0.44 lakh	Rs. 0.50 lakh
Gross Income (2 cycles annually of 200 birds in each cycle)	Rs. 0.94 lakh	Rs. 1.70 lakh
Net Profit (2 cycles annually of 200 birds in each cycle)	Rs. 0.50 lakh	Rs. 1.20 lakh
BC Ratio	2.13	3.40
Marketing	Local marketing	Retail marketing
Dissemination of knowledge in the locality	No	Yes
Knowledge gain based on 1- 5 scale*	1	5
Feeling of economic security based on 1- 5 scale*	1	5
Ability to understand and solve problems based on 1- 5 scale*	1	5
Self-image in community based on 1- 5 scale*	1	5
Self-confidence based on 1- 5 scale*	1	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Shri. Ranjay Paswan is now getting more than 20,000 eggs from 400 Vanaraja poultry birds. He is selling eggs as well as old live birds for meat purpose and earning Rs. 1.2 lakhs in a year. Poultry production cost has been greatly reduced by incorporating azolla feeding and feeding with other edible grasses. Apart from it, supplementary feeding with locally available materials such as maize and soyabean has further reduced the feed cost. He is now a model poultry farmer for semi-intensive backyard poultry farming and thus, the self-image of Shri. Ranjay Paswan has been increased a lot. He has created business model of improving household incomes and nutrition for small land holding

farmers through 'Vanaraja' poultry production. This model becomes the hope for self-employment of the rural youth.

Adoption, Spread, Up Scaling of Technology and Future Projection

There has been significant improvement in the awareness and knowledge on semi-intensive backyard poultry farming in Khagaria district. More than 500 farmers have visited the farming site and learnt the skill of semi-intensive backyard poultry farming. At present 50 farmers from 6 villages of Khagaria have already adopted this model and they are earning approx. 1.5 lakh annually by selling meat as well as egg of Vanraja poultry birds. About 300 farmers are in line to establish this model. Farmers from other district like Samastipur, Begusarai etc. are visiting this farm and they are also planning to establish this low cost semi-intensive backyard poultry farm model.

Broiler Poultry Farming for Self-Employment

Shobha Rani and Dinesh Mahto
Krishi Vigyan Kendra, Seed Multiplication Farm, Mussi, Makhdumpur, Distt. Jahanabad, Bihar

Agro-ecology and Farming Situation

Jehanabad district is having dry climate. Due to indefinite pattern of monsoon, crop cultivation is being affected adversely. So, there is an urgent need of some secondary livestock based occupation in order to get some sure income regularly. Broiler demand is increasing very fast due to increase awareness of quality meats. The demand and supply of major source of meat is likely filled up by broiler meat. Chicken meat is the cheapest source of animal protein affordable by mass people. Poultry products account for more than 75% of the non-vegetarian items consumed in the locality.

Technological Intervention and KVK Support

Double layer bamboo and thatched sheltered backyard poultry farming has been found to be a good venture for the farmers of the area. Shri. Manoj Kumar, S/o of Shri. Lalesh Sharma is 33 years young man of Village- Dhongra, Block- Hulasganj of Jehanabad District. He started his first work as a cashier at petrol pump of Jehanabad, but he found that due to very low income, he was not able to manage his family. One day, he came to KVK Jehanabad and came to know about poultry farming. He took training of poultry farming in the batch of rural youth in 2012 and then, he started poultry farming. He started broiler farming with 200 chicks. He tried to follow all the technical advices provided by KVK scientists regarding the housing management, feeding, health hygiene and vaccination schedule

for keeping the poultry birds healthy with low mortality. Gradually, as a result of his intense labour and utmost care, the number of chicks increased to 8000 per lot. He is now producing 4 lots broiler birds per year.

Economic and Social Impact

Impact factor	Before Adoption	After Adoption
Farmers' Practice (Broiler birds)	200	8000 X 4 lots = 32,000
Yield of Product (Ready broiler birds for sale)	140 (Mortality 30%)	31,040 (Mortality 3 %)
Fixed Cost (Rs.)	1000	2,50,000
Recurring Cost (Rs.) [Chicks@ Rs. 25, medicine 1 labour & feeding cost @ Rs. 30 per kg]	13,600	17,71,000
Gross Income (Rs.) @ Rs. 90 per kg (before 1.2 and after 1.5 kg body wt. at 1 month of age)	15,120	41,90,400
Net Profit (Rs.) [= Gross Income - (Recurring Cost + Fixed Cost)]	520	21,69,400
BC Ratio [= Gross Income / (Recurring Cost + Fixed Cost)]	1.03	2.07
Marketing	Local	Local market and other states including Jharkhand and West Bengal
Dissemination of knowledge in the locality	5	260 farmers
Knowledge gain based on 1- 5 scale*	1	4
Feeling of economic security based on 1- 5 scale*	2	4
Ability to understand and solve problems based on 1- 5 scale*	1	4
Self image in community based on 1- 5 scale*	1	3
Self confidence based on 1- 5 scale*	1	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Broiler poultry bird farming has provided self-employment to Shri. Manoj Kumar. He is now very confident. Poultry birds provide manure which contains all the essential nutrients for plant growth and offers a rich source of nitrogen, potassium and phosphorus. Poultry manure may also be used for vermi compost purpose.

Adoption, Spread, Up Scaling of Technology and Future Projection

The success of Shri. Manoj Kumar on broiler poultry farming has influenced many farmers of the village and neighbouring villages. Fifteen farmers have already adopted this technology following him.

Japanese Quail Production for Small and Marginal Famers

Pravin Kumar Dwivedi, Shashi Bhushan Kumar Shashi, Supriya Verma and Sachidanand Singh
Krishi Vigyan Kendra, SCADA, PO. Ara, Distt. Bhojpur, Bihar

Agro-ecology and Farming Situation

Mr. Jitendra Kumar Singh, Village - Baruna, Bihiya, Bhojpur, was a 32 years old farmer having 0.8 ha land in rainfed area. He completed MBA. He was in agricultural practices, but the income from crop husbandry was not sufficient to support his family. He had experience to work in Privet sector for 4 years dealing with organic fertilizers. His marketing experience helped him to make mind for starting some own enterprise!

Technological Intervention and KVK Support

During 2016, he came in contact with KVK Bhojpur and after a long discussion he showed interest to start quail farming with a hope of profitable avenue. He approached KVK for further technological help. Thus, training was organized by KVK Bhojpur. Proper techlogical support for quail farming was shared in collaboration of Veterinary Collage, Patna. Finally, the unit was established with his own investment of Rs. 16 lakh and the lending from friends and relatives. Mr. Jitendra Kumar Singh established a hatchery unit for regular production of quail chicks. Monthly around 90,000 eggs were set and minimum 60,000 quail chicks were ready for sale in a month.

Economic and Social Impact

Impact factor	Before Adoption	After Adoption
Farmers' Practice (In case quail production)	No knowledge	Quail production for marketing
Yield of Product	-	7.0 lakh chicks per year
Fixed Cost	-	4,00,000
Recurring Cost (Rs./year)	-	50,00,000
Gross Income (Rs./year)	-	75,00,000
Net Profit (Rs./year)	-	25,00,000
BC Ratio	-	1.5
Marketing	-	Through 24 outlets involving different Farmers of Bihar and UP
Dissemination of knowledge in the locality		
Knowledge gain based on 1- 5 scale*	2	5
Feeling of economic security based on 1- 5 scale*	2	4
Ability to understand and solve problems based on 1- 5 scale*	3	5
Self image in community based on 1- 5 scale*	2	5
Self confidence based on 1- 5 scale*	3	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Mr. Jitendra Kumar Singh is producing 60,000 quail chicks in one month and thus about 7 lakh quail chicks in a year. His net return per year is Rs 25,00,000/-.

Adoption, Spread, Up Scaling of Technology and Future Projection

The Quail production technology has spreaded to more than 15 villages. More than 24 farmers are now rearing and marketing the Quail birds with minimum one time investment of Rs. 30,000/- (1000 chicks in 30 days become marketable with floor area of 250 sq ft) and they are earning Rs. 1,00,000.00 annually out of 10 cycles. They are linked with the marketing network of Mr. Jitendra Kumar Singh.

Japanese Quail Farming

Narendra Kumar and Devendra Kumar
Krishi Vigyan Kendra, Hariharpur, Rajauli Hajipur Farm, Distt. Vaishali, Bihar

Agro-ecology and Farming Situation

Poultry farming is popular among rural youth and young entrepreneur. Broiler farming is profitable and there is a quick return on investment after 35 - 45 days. But, due to high fluctuation rate in market, poultry farmers are not getting profit all the time. Sometimes, they may have loss due to less price in market and monopoly of big players of the market. So, the farmers are showing less attraction towards poultry farming as compared to other livestock farming. Keeping in mind above factors, KVK Vaishali has organized training to establish quail farm in Vaishali district. Around 120 youths were selected by interview and training was given in all aspect of quail farming.

Technological Intervention and KVK Support

Sri Rajdev Rai of Mukundpur Sarasai village in Vaishali district was involved in vermi compost business with his family. He was sustaining his family from adopted business of vermi compost. With the help NGO (Prem Youth Foundation), Sri Rajdev Rai contacted KVK, Vaishali and decided to take risk and start a quail farming business after interacting with KVK Scientist. Sri Rajdev Rai participated training on quail farming. Thereafter, he submitted a proposal on quail farming to NABARD Vaishali. The DDM, NABARD has taken keen interest and sanctioned the proposal. He started his quail farming and business in 2012-2013. With the loan assistance of Rs. 9,90,000/- for hatchery and another Rs. 9,90,000/- for training and promotion, he completed the training schedule and formed Panch Murti Agro Producer Company Limited. Hatchery was set up at Mukundpur Sarsai and the farmers became associated with the hatchery. Hatchery had the capacity of 1,50,000 x 3 = 4,50,000 eggs. Hatchability was around 50%. Each 3 to 4 days old chick was sold @ Rs. 15/-. Around 40 cycles in hatchery were completed in every year. Net income from one cycle after all payment was around Rs. 7,000/- to Rs. 7,500/-. So, there was an annual earning of around Rs. 3,00,000/-.

Economic and Social Impact

Impact factor	Before Adoption	After Adoption
Farmers' Practice	Vermi- compost business	Quail farming
Yield of Product	-	Quail
Fixed Cost	-	10,00,000
Recurring Cost (Rs./year)	-	1,00,000
Gross Income (Rs./year)	-	4,00,000
Net profit (Rs./year) = Gross Income - (10% depreciation of Fixed cost + Recurring cost)	-	2,00,000
BC Ratio	-	2.0
Marketing	-	Local as well as Patna, Varanasi, Allahabad
Dissemination of knowledge in the locality	-	Producing in group for marketing
Knowledge gain based on 1- 5 scale*	1	4
Feeling of economic security based on 1- 5 scale*	1	4
Ability to understand and solve problems based on 1- 5 scale*	1	4
Self image in community based on 1- 5 scale*	1	4
Self confidence based on 1- 5 scale*	1	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Quail farming is becoming popular among rural youth because there is a big demand of quail dish in hotels and parties. Quail meat is more delicious and healthier as compared to chicken meat. Quail farming is more sustainable because there is no fluctuation in market rate. In place of one poultry bird, four quails can be kept easily with less feed and less expenditure. So there is a chance to grab this opportunity of quail farming for economical and nutritional security of the farmers.

Adoption, Spread, Up Scaling of Technology and Future Projection

Sri Rajdev Rai has become model for quail farming. Many farmers from Bihar visited his hatchery and see to this unit. He is supplying the chicks not only in Bihar but UP also. There is good future of commercial quail farming due to advent of cosmopolitan culture at Patna and other cities of Bihar. People are aware about benefits of quail meat and egg because of less cholesterol and more minerals.

Integrated Farming System

Integrated Farming System- A Way for Doubling Farmer's Income

H. C. Chaudhary, A. K. Singh, S. Kumari, A. Adarsh and J. Prasad
Krishi Vigyan Kendra, P.O. Saraya, Distt. Muzaffarpur, Bihar

Agro-ecology and Farming Situation

The district Muzaffarpur comes under Indo gangatic plane. Rice-Wheat cropping system is followed by several farmers of Muzaffarpur district. This Zone is located in the Nortn of the state between $25^0$54' and $26^0$23' N latitude and $84^0$55' and $85^0$45' E longitude with the altitude of 70 m above the mean sea level. Total geographical area of the district is 3.176 lakh ha and total cultivable area 2.477 lakh ha. Out of which net sown area is 2.20 lakh ha. The area under irrigation is 0.83 lakh ha. Average rainfall of the district is 1046 mm. Climate, with its regional and temporal variability, is a major determinant of agricultural production. All agricultural production is related to the performance of (cultivated) species, which are bound to particular environmental conditions. As climatic conditions change, also production conditions are likely to change with possible positive or negative implications on agricultural production. Integrated Farming System (IFS) is a technique where high quality food, feed, fibre and renewable energy are produced by using resources such as soil, water, air and nature as well as regulating factors to farm sustainably and with the production of little polluting substances for ensuring better and continuous improvements in farm livelihoods i.e. more income, enhanced employment opportunities.

Technological Intervention and KVK Support

KVK Muzaffarpur is working in reversing sick soil to healthy soil through low cost approaches. KVK has standardized the methodologies / approaches for generating gainful rural self employment through improved agricultural technological interventions as well as low cost organic farming practices. The major components include:

a) Intensification and diversification of agricultural activity through integrated farming system approach comprising seed production, farm-based enterprises for self employment etc.

b) Livestock improvement, increasing per unit profitability and integration.

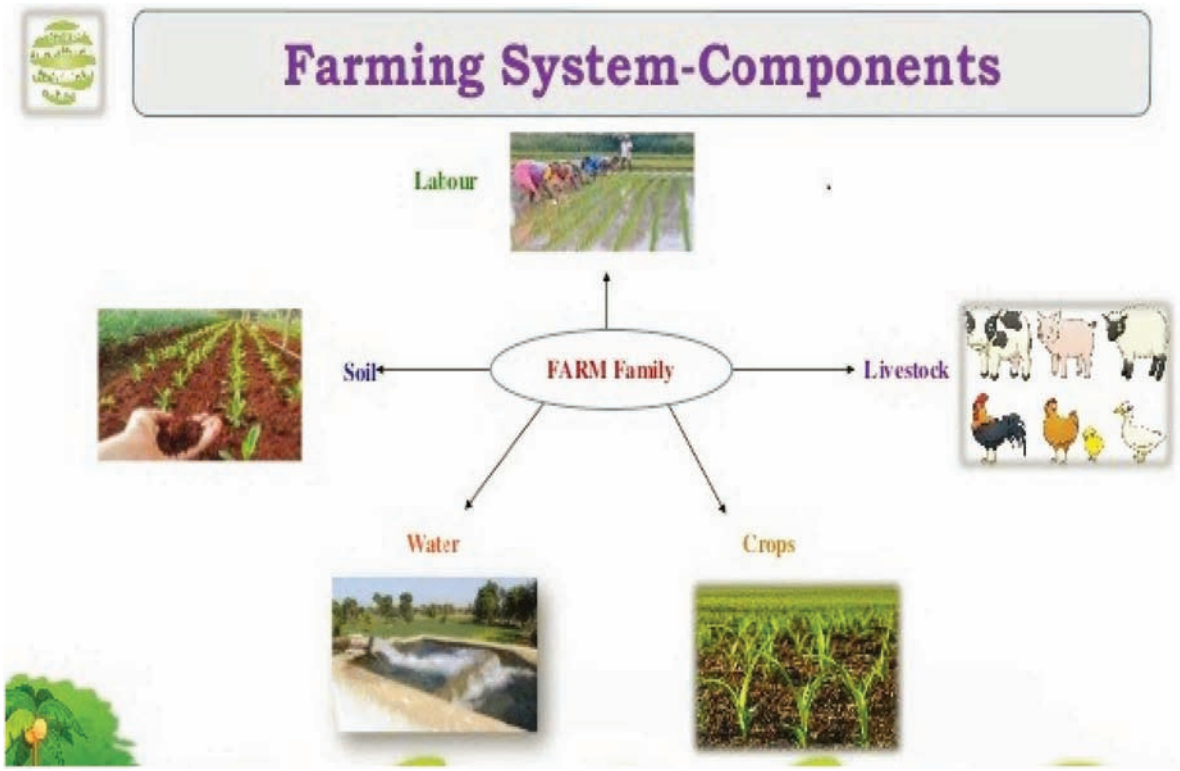
c) Soil health improvement by promoting organic production system, IPM, mass composting, homemade compost etc.

Economic and Social Impact

Model of Integrated Farming system: 10,000 m^2 (1 hectare)

Enterprise identified	Number	Net area allocated (m^2)
Field crops	Cereal + Pulse+ oilseeds+ fodder + Vegetables	7806
	1. Rice-Wheat-Green gram (Grain+ Residue incorporation)	2907
	2. Rice-winter maize+potato-cow pea	2006
	3. Rice-mustard-maize+cow pea	1003
	4. Sorghum + beans-maize+ cow pea	1098
	5. Seasonal vegetables	792

Enterprise identified	Number	Net area allocated (m^2)
Crossbred cows	2 crossbred cows + 2 calves	70
Goat unit	Black Bengal (10 female + 1 male)	80
Duckery	25 Nos.	24
Fishery + Fruits	800 Nos.	1420
Vermicompost unit	3 Nos.	100
Area under bunds, Farm shed, channels and loafing area		300
Farm boundary plantation		125 numbers of subabool (*Leucaena leucocephala*) and 50 numbers of moringa plants were planted along the boundary of fields in 200m^2
Total		10,000



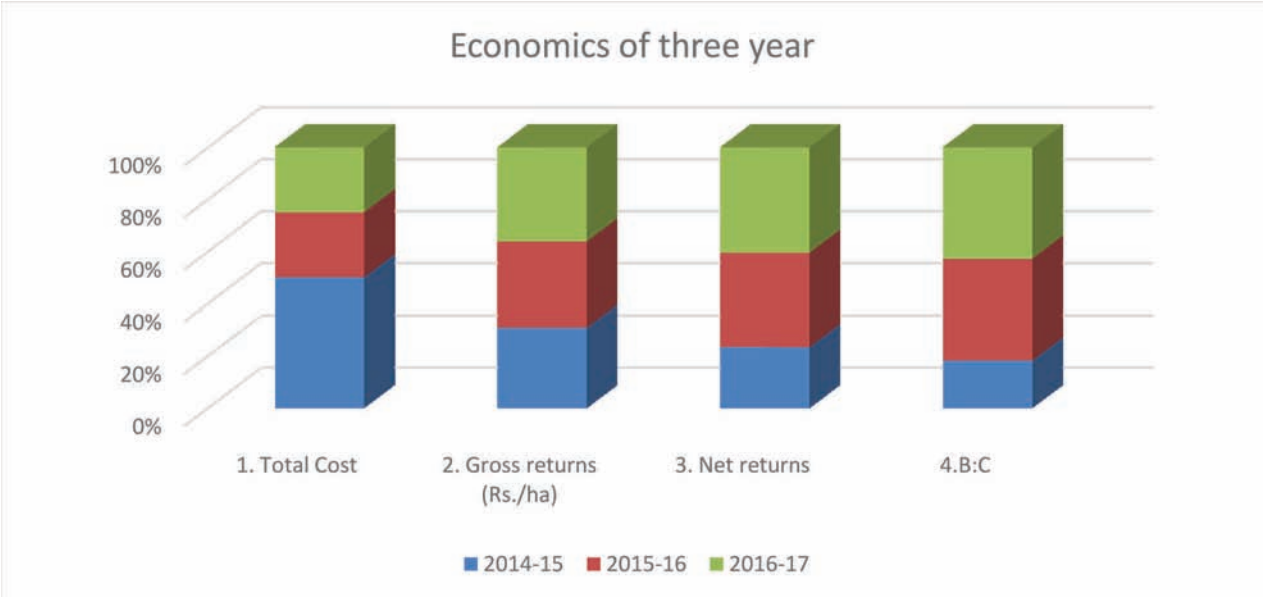
Output

Economics of different component under IFS

S. No.	Components	Net area (m^2)	Equi-valent yield (q)	Total Cost (q)	Gross returns (Rs./ha)	Net returns	BC ratio	Employment generation through IFS scheme (man days)
1.	Cropping system	7806	175.0	85,550	1,76,880	91330	2.06	220
2.	Dairy animals	70	195.0	1,15,780	2,31,620	116020	2.0	200
3.	Goats	80	105.0	75,450	1,40320	64870	1.86	125
4.	Fishery + Fruits	1420	70.0	20,500	75,840	55340	3.69	50
5.	Duckery	25	20.5	16,280	27,250	7,970	1.67	25
6.	Farm boundary plantation	200	25.2	4,520	25,800	21,280	5.71	15
7.	Vermicompost and manure	100	28.5	2,550		27,530	11.79	10
Total		9701		3,20,630	7,07,790	3,19,470		645

Economics of three year

Components	2014-15	2015-16	2016-17
Total Cost	3,20,630	1,60,000	1,60,000
Gross returns (Rs./ha)	7,07,790	7,55,000	8,30,000
Net returns	3,87,160	5,95,000	6,70,000
B:C	2.21	4.72	5.19



Impact analysis

Activities	Impact
Crop intensisification, improved package of practice	Increased income Long term availability of food Improvement of the economic status of the farmer
Intervention on live stock, goatery and poultry	Change in occupational pattern Increase in availability of animal products
Improving the existing methods and structures of composting	Positive impact on nutrient availability and reduced loss of nutrients
In dry land ecosystem, soil and moisture conservation and rain water harvesting and management	Enhanced availability of water Reduced soil erosion and land Degradation by *in situ* conservation of moisture

Benefits

In this model all the farm and animal wastes are properly recycled into system so that nothing goes waste and output of one enterprise works as input for other enterprise. The net income of Rs. 3,19,470 is realized from all the components of farming system.

Adoption, Spread and Up Scaling of Technology

Successful integration of cropping and livestock components can be both profitable and sustainable. It gives us the opportunity to reduce our reliance on external inputs and create robust ecological and biological systems. It improves soil quality, increases recycling of nutrient, reduces water wastage, use of soil amendments, overall farm energy use and thus increases crop yield. These savings double the farmer's income.

Sustainability through Integrated Farming System

Kalpana Sinha, N.P. Singh and Anil Kumar
Krishi Vigyan Kendra, Sarvodya Ashram, P.O.- Sokhodeora Distt. Nawada- 805116, Bihar

Agro-ecology and Farming Situation

Nawada district comes in South Bihar Alluvial plain zone - III. This district is drought prone and the agriculture is mainly rainfed type. Soil of the district is sandy, sandy loam, clay and clay loam. The soil is deficient in micro-nutrients like Boron, Zinc and Iron. Although average rainfall of the district is 1037 mm, dry spell during Kharif season is evident since last 10 years. Eighty to eighty-five per cent farmers of the district are small and marginal. The farmers of the area mostly cultivate cereals, pulses and oilseeds. Their earning remains between Rs. 55,000 to Rs. 65,000 per annum by which it is quite difficult for them to get sustainability in production. Hence to move toward sustainability, it is important that a holistic approach should be followed which is the need of the time.

Technological Intervention and KVK Support

The basic need of every family is sufficient income for food, fiber and shelter. It is not possible through the traditional farming of agriculture by cultivation of cereals, pulses and oilseeds. Majority of the farmers are doing agriculture since long time, but traditional method is not profitable. Integrated farming activity is focused around interdependency of 3-4 production system of crops and animals. This system is not only reliable; it is highly productive and has considerable scope for resource recycling which leads to sustainability. Krishi Vigyana Kendra Nawada is constantly awaring the farmers about Integrated Farming System (IFS) and motivating the farmers to adopt this technology and thus a dozen of farmers in this district have adopted IFS model. An example of Sri Sadanand Singh's IFS model may be considered for understanding the economic and scial benefits.

Economic and Social Impact

Impact factor	Before Adoption	After Adoption
Farmers' Practice	Paddy, Wheat, Chickpea	Paddy, Wheat, Chickpea, Dairy, Fishery, Vermi-compost and Vegetable
Yield of Product	103.02 q	213.97 q
Fixed Cost (Rs./year)	34,780	99,780
Recurring Cost (Rs./year)	23,300	94,300
Gross Income (Rs./year)	1,82,400	6,70,400
Net profit (Rs./year) = *[Gross Income - (Fixed cost + Recurring cost)]*	1,24,320	4,76,320
BC Ratio *[Gross Income/ (Fixed cost + Recurring cost)]*	3.14	3.45
Marketing	-	-
Dissemination of knowledge in the locality	-	15-20

Impact factor	Before Adoption	After Adoption
Knowledge gain based on 1- 5 scale*	1	3
Feeling of economic security based on 1- 5 scale*	1	4
Ability to understand and solve problems based on 1- 5 scale*	1	3
Self image in community based on 1- 5 scale*	1	2
Self confidence based on 1- 5 scale*	0	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Sri Sadanand Singh's annual income has been increased to more than Rs. 6.0 lakh / annum with net profit of Rs. 4.76 lakh / annum and BC ratio of 3.45. The economical and social status has also been increased and his children are getting education at Patna. Integrated farming system provides an opportunity to increase yield per unit of area by intensification of crop and allied enterprises. Waste of one enterprise becomes the input of other enterprise at the minimum cost, thus there is a reduction of cost of production. Organic supplementation through effective utilization of by-product is done leading to sustainability of the product. As in IFS model, waste of one component is used in other component, the waste material is effectively recycled under IFS system round the year. This is the enterprise module by which farmers get fuel, fodder and employment. He has good linkage with district officers,

Adoption, Spread, Up Scaling of Technology and Future Projection

Seeing the benefits of IFS model, the other farmers of same village and nearby village of the district are also visiting Sri Sadanand Singh's IFS model and thereafter adopting the IFS model as a source of income generation. They are now contacting line department to provide subsidy in excavation of pond and approx 20-25 farmers have contacted the scientist of KVK, Nawada for establishing IFS model. Seeing the profitability, a number of IFS model have been prepared and suggested depending upon the available resource and the agro-ecological condition of the village.

Integrated Farming System Boosts Farmer Income

Arti Beena Ekka
Krishi Vigyan Kendra, Darisai, Vill-Barakhurshi, PO.Giridhi, Distt. East Singhbhum, Jharkhand

Agro-ecology and Farming Situation

East Singhbhum is located in the south eastern extreme of state Jharkhand and in the mineral rich Chhotanagpur range. The district is rainfed and mostly monoculture is in prevalence. Rice, being the most important crop, is grown by all the farmers as it is staple food. The district soil is acidic in reaction (<4.1 to 7.3) and total annual rainfall received is 1200 mm. The maximum temperature of >450C and minimum of 80C and 35- 80% relative humidity have been recorded. Major area is low land followed by upland and medium land. The farmers of East Singhbhum are doing various activities to earn their livelihood. In East Singhbhum district, majority of the farmers are small and marginal. The nature of farming is subsistence and package of practice is indigenous, based on traditional practices. The farmers are engaged in crop production, horticulture, animal husbandry, agro-forestry and aquaculture, but these components are not intregrated. To optimize farm production and profitability, there is a need to integrate maximum available resources.

Technological Intervention and KVK Support

Sri Jerom Soreng, 72 years old, a retired Professor from Workers College Jamshedpur, Jharkhand has set an example by doing what young people dream. He has an agricultural land of 2 acres 15 decimal, in which he has developed excellent integration of Livestock-Crop-Vegetables-Aquaculture with many creative and innovative ideas after coming in touch with Krishi Vigyan Kendra, East Singhbhum in the year 2007. During the same year, Jharshuk pig breed has been demonstrated at his farm. Now he grows crops including paddy, wheat, maize, mustard, potato, cauliflower, cabbage, okra, tomato, different gourds, banana and papaya. The livestock animals are pig (Jharshuk), poultry (Vanaraja, Gramapriya and Jharshim), duck (Khaki Campbell) along with fish production in a 45 decimal area. He has started digital weighing balance for all age group (1kg to 300kg) of pigs, sprinklers for cooling of pigs during summer, processing of all farm produces for better feed conversion and reduction in cost of livestock production and management, garbage management using self-designed equipments. In poultry breeds like Vanaraja, Gramapriya and Jharshim (15 no each) are reared for meat and egg production. He has focused on time bond agriculture by growing vegetables at early and bringing produces at early in the market to fetch higher return and therefore he grows seedling in low-cost poly house. Prof. Jerom Soreng has adopted crop intensification, crop diversification, recycling of farm by products and value addition techniques after taking technical guidance from KVK scientists. His farm has been developed as a model of crop + horticulture + fish cum duck/poultry cum pig farm.

Economic and Social Impact

Impact factor	Before adoption	After adoption
Farmers' practice	Mono-cropping culture	Mixed crop culture, integrated farming system
Yield of product	Paddy and kitchen garden vegetables	Pork, piglets, seasonal vegetables, processed rice, mustard oil, fish, etc
Fixed cost (Rs.)	10,000	5,00,000
Recurring cost (Rs./year)	7,000	3,90,000
Gross income (Rs./year)	18,000	17,37,000
Net profit (Rs./year) = [*Gross Income - (10% depreciation of Fixed cost + Recurring cost)*]	10,000	12,97,000
BC ratio [*Gross Income / (10% depreciation of Fixed cost + Recurring cost)*]	2.25	3.94
Marketing	House hold consumption, subsistence farming	Local haat, within district and adjoining districts
Dissemination of knowledge in the locality	-	Well disseminated among the unemployed rural and urban youths
Knowledge gain based on 1-5 scale	-	4
Feeling of economic security based on 1-5 scale*	2	5
Ability to understand and solve problem based on 1-5 scale*	2	4
Self image in community based on 1-5 scale*	1	5
Self confidence based on 1-5 scale*	2	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Prof. Jerom Soreng is now earning Rs. 3.94 out of expense of Rs. 1.00 after adoption of improved technologies. There is a better utilization of resources and recycling of farm waste. The farm income has been stabilized. The ways of further expansion has become the dream. Social respect has been increased. Pig based IFS has been proved better. Pig farming has been well disseminated among tribal farmers of East Singhbhum. Since last ten years, many farms have come up in pig farming in integration with duck and vegetable production. The farmers have gained economic and social security by adoption of Integrated Farming System with intensification of different components of farming.

Adoption, Spread and Up Scaling of Technology

Prof. Jerom Soreng motivated more than 200 farmers of East Singhbhum district and also other districts. More than 30 farm families have adopted IFS model with the locally available resources. His success has also been documented by Doordarshan Ranchi, ETV Bihar, Jharkhand and Local newspapers. He received progressive farmers and innovation farmer award from BAU, Ranchi IARI, New Delhi. Various institutions like BAU, ATMA, line departments are sending farmers at his farm for exposure visit. His effort really encourages other farmers to gain economic and social security by adoption IFS model.

Integrated Farming System for Sustainable Development

Neha Rajan and Ajeet Kumar Singh
Krishi Vigyan Kendra, Ramakrishna Mission Ashrama, Swami Vishuddhanand Road, Morabadi, Ranchi, Jharkhand

Agro-ecology and Farming Situation

Agro ecological condition of Ranchi district is quite different from plain areas. It is a part of Hazaribagh and Ranchi plateau region. It is primarily having rainfed agriculture and crop production largely depends on monsoon. More than 60 percent population is rural based. About 82 percent of households have holdings less than two ha with the average holding size being 1.18 ha.

Gurgurjari is one remote village of Mandar block of Ranchi district. The village is situated about 45 km away from district headquarter. Once a remote village is now well connected by road. All the three different types of land situations, i.e., low, medium and upland found in the village. Major area is upland with acidic alluvial soil. Paddy, pulses and seasonal vegetables are the major crops. Among the vegetables, tomato, pea, cauliflower, cabbage, french bean, cowpea, brinjal, radish, carrot, coriander, potato, ginger and elephant foot yam *etc.* are the major vegetable crops grown in upland area of village. Bidgoda river, Tegranala, dugwells and ponds are major source of irrigation. The village is well versed with the forest area situated in entry point of village. Due to remote location, even with plenty of natural resources, farming was a choice for villagers few years back, but the villagers did not have knowledge on scientific practices of cultivation and / or Integrated Farming System (IFS) before KVK intervention and thus major youth population were usually working as labour in cities.

Technological Intervention and KVK Support

Shri Gandura Oraon, 27 years old youth, belongs to Gurgurjari village. He came in contact with KVK, Ranchi in 2013. In view of resources availability in village, IFS was suggested. Thereafter, with the technical help of KVK and convergence of line departments, all the components of integrated farming were established at his farm. He now follows standard scientific practices for cultivation of all crops and also uses resources efficiently in an intregrated manner. Presently, he is holding 23 acre land (8 acre own and 15 acre on lease) available for crop cultivation. Out of which about 15 acre is irrigated and one acre is under mango orchard plantation. Among the animal component, he has 4 indigenous cows and 2 crossbreds, 6 Black Bengal goats, 20 Vigova Super ducks and 12 Divyan Red poultry. He has good composting units and prepares liquid organic manure with the help of cow dung and cow urine. He presently owns Tractor and other implements necessary for his farm. He is also doing fisheries in two acre of pond. He is having 300 m^2 shed net house for nursery raising of horticultural crops and mini sprinkler in 5 acre for vegetable cultivation. He is also doing flower cultivation on two acre land with marigold and gladiolus. He is also doing seed production for KVK under its participatory seed production programme and seed village programme of Department of Agriculture.

Economic and Social Impact

Impact factor	Before Adoption	After Adoption
Farmers' Practice	Mono cropping with paddy in medium and low land and pulses in upland	Integrated Farming System
Yield of Product	60 qtls Paddy, 20 qtls veg.	Paddy seed- 35 qtls, 120 qtls Paddy, 800 qtls veg., 200 qtls flower, 20 qtls oilseed & pulses, 1000 lt. Milk, 3-4 qtls fish etc.
Fixed Cost (Rs.)	20,000	12,00,000
Recurring Cost (Rs./year)	35,000	3,00,000
Gross Income (Rs./year)	75,050	9,69,000
Net profit (Rs./year)	40050	6,69,000
BC Ratio	2.14	3.23
Marketing	In local market	Selling Seed to KVK & Jharkhand govt., Paddy to LAMPS, Milk to Mother dairy and vegetable, flower and fish to Ranchi and nearby cities through VEGFED
Dissemination of knowledge in the locality	-	Many farmers in his village and surrounding villages are opting IFS
Knowledge gain based on 1- 5 scale*	2	4
Feeling of economic security based on 1- 5 scale*	1	5
Ability to understand and solve problems based on 1- 5 scale*	3	4
Self image in community based on 1- 5 scale*	3	5
Self confidence based on 1- 5 scale*	3	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

With the IFS model, Shri Gandura Oraon has achieved economic security. The efforts of Shri Gandura Oraon have been recognised by various institutions. Government of Jharkhand has conferred "Jharkhand Gaurav Samman" to him during 2017 for his contribution in making popular IFS and flower cultivation as well as formation of seed village. He has also received Best farmer award of Mandar block by ATMA, Ranchi and district level best farmer award by Divyayan KVK as well as Birsa Agricultural University.

He has become an entrepreneur and offering jobs to many agricultural labours and preventing the migration from his village.

Adoption, Spread and Up Scaling of Technology

Shri Gandura Oraon has motivated hundreds of farmers of his village as well as nearby villages to adopt flower cultivation, seed production, improved vegetable cultivation, bee keeping, milk production etc. He has helped and guided his fellow villagers to get benefits from various subsidy schemes of central and state government. With his efforts, Mother Dairy has established chilling plant and procurement centre at Gurgurjari village. Many farmers have opted IFS model Gurgurjari village and adjacent villages.

Doubling Income through Integration of Agroforestry with Dairy and Fishery

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Krishi Vigyan Kendra, Ariari, Distt. Sheikhpura-811105, Bihar

Agro-ecology and Farming Situation

Shri Kripa Sindhu Prasad, IFS practising farmer lives in village Aijhi, P.O. Murarpur of district Sheikhpura. The agro-ecology of his farm is irrigated medium land with a land holding of 8 acres (3.2 ha.). He has an experience of more than 10 years in farming. Shri Kripa Sindhu soon felt that rice-wheat crop cannot fulfill his dream of financial self-sufficiency due to scarcity of labour, unfavourable weather as well as market condition.

Technological Intervention and KVK Support

Shri Kripa Sindhu Prasad realized the importance of crop diversification in 2008 when he could not get desired net benefit from the rice-lentil / wheat crop. Thus, he got several need based training from KVK Sheikhpura, Bihar Agricultural University, COH Noorsarai and visited many agricultural research institutes outside state like NDRI Karnal, NHRDF Nasik etc. and learnt on improved agricultural practices since 2008 in different subjects. He started a dairy with 5 cows and planted 100 trees of Sagwan (Teak) in his land. Seeing the satisfactory growth of the tree plants he gradually increased the plantation and reached 1200 trees. He also planted Shatawar (*Asparagus* sp.) at the distance of 3 feet in his orchard of 1 acre and Elephant Foot Yam in 1 Acre and got Rs. 3 lakh / Acre as additional income in the second year. He further developed 2 ponds of 110 x 110 feet size for fish culture. He also grows onion and and other vegetable in 1 acre of land and gets Rs. 1 lakh / acre as annual profit. He is doing vermicomposting and using cow dung and urine at his farm. He earns Rs. 50,000 / - from fishery. He sells the dry wood obtained by pruning the trees @ Rs. 8 / kg and gets Rs. 1 lakh annually. He is going forward for planting of 3800 trees more in his rest of available land and estimates the value of total 5000 trees @ Rs. 40,000 / tree by the year 2033-34 which amounts will be about Rs. 20 crore.

Economic and Social Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	Rice-lentil / wheat	Integrated Farming
Yield of Product (q / ha)	50	75
Fixed Cost	0	0
Recurring Cost (Rs. / year)	1,93,750	1,01,350
Gross Income (Rs. / year)	2,55,750	3,26,350
Net Profit (Rs. / year)	62,000	2,25,000
BC Ratio	1.32	3.22
Marketing	local	local
Dissemination of knowledge in the locality	0	25
Knowledge gain based on 1- 5 scale*	1	5
Feeling of economic security based on 1- 5 scale*	1	5

Impact factor	Before Adoption	After Adoption
Ability to understand and solve problems based on 1- 5 scale*	1	5
Self image in community based on 1- 5 scale*	2	5
Self confidence based on 1- 5 scale*	2	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Shri Kripa Sindhu Prasad gained economic benefit by increasing his net profit, reducing the cost and thereby increasing the BC ratio through his innovative way of diversification in farming through Dairy farming, plantation of Sagwan trees, Inter-cropping with Asparagus/ Elephant Foot Yam, fishery and vegetable cultivation. Besides regular annual income he has secured wood asset of multi crore rupee value for future. He has improved his social values and respect from his farming profession.

Adoption, Spread, Up Scaling of Technology

Various integrated programmes like innovative effort of dairy, vermicomposting, use of cow dung and urine in his farm, plantation of Sagwan trees, intercropping with Satawar (*Asparagus* sp.)/ Elephant Foot Yam, and also fisheries have been popularized in the area. Thirty five (35) farmers have learnt and adopted the technologies at their farms covering about 80 acres. Shri Kripa Sindhu has scaled up his new approach in his total available land of 8 Acre. The dream of Shri Kripa Sindhu Prasad is that when he will be of retirement age of 65 years, he should have asset of more than 40 crore in the form of matured sagwan trees!

Agriculture-Animal Husbandry- Fishery Based Integrated Farming System

Pramod Kumar and Sanat Kumar Sawaiyan
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Agro-ecology and Farming Situation

Sri Ramesh Purty has a farm which is surrounded by hillocks and having a perennial irrigation pond of 2 acre size. Upland is having red lateritic soil (pH ranging from 5 to 6.5) with gravel/ mooram and undulating topography. The area is mono-cropped (rice fallow). The soil and climatic condition are very much suitable for vegetable and fruit production (mango, guava, lemon, orange, papaya etc.). The temperature ranges from 3^0C in winter to 44- 45^0C in summer. The average rainfall is 1254 mm. Common crop cultivated in the village are rice, maize, green gram, black gram, pigeon pea, niger, horse gram, chick pea and vegetables like tomato, cabbage, cauliflower, vegetable pea, cowpea, amaranthus, palak, bitter gourd, sponge gourd. Some farmers practice lac cultivation on Kusum plants. Local varieties of fruits (mango, plum, jack fruit, tamrind, custard apple, papaya) are readily available in the area. Common forest trees are sal, teak, gamhar, bamboo, mahua and semal.

Technological Intervention and KVK Support

Sri Ramesh Purty has developed an integrated farming system (IFS) model with the technical supports of Krishi Vigyan Kendra, West Singhbhum. This IFS consists of components like Mango orchard (1000 plants) in 0.5 ha, Orange (200 plants), Litchi (100 plants), Papaya (200 plants), Lemon (Kagji), Guava (L-49), Vegetables of improved varieties and hybrids (Pea, Cauliflower, Cabbage, Brinjal, Tomato, Capsicum) in 0.2 ha, fish (mixed carp) rearing in 0.8 ha pond, lac cultivation on *Flemingia semialata* (as intercropping between mango plantation), animal husbandry like Goatery (Black Bengal), Poultry (Aseel), Piggery (Jharsuk). Sri Ramesh Purty uses drip and sprinkler irrigation methods by using electricity and solar power system. He also grows traditional crops like rice (Sahbhagi, Lalat, MTU-7029 & local), pulses (pigeon pea, green gram, black gram, kulthi, chick pea) and oilseed like mustard, linseed and niger). He also multiplies mango plants (grafting), orange, lemon as well as guava plants by gooties. His annual income is around Rs. 3.5 to 4.0 lakh. About 30 farmers have adopted this practice from nearby villages.

Economic and Social Impact

Impact factor	Before Adoption	After Adoption
Farmers' Practice	Traditional method	Scientific method
Yield of Product (q)	15	75-100
Fixed Cost (Rs.)	0.50 lakh	3.5 lakh
Recurring Cost (Rs.)	0.45 lakh	1.00 lakh
Gross Income (Rs.)	1.30 lakh	5.5 lakh
Net Profit (Rs.)	0.85 lakh	4.5 lakh
Marketing	Local market	Local market
Dissemination of knowledge in the locality	-	30 farmers

Impact factor	Before Adoption	After Adoption
Knowledge gain based on 1- 5 scale*	2	4.5
Feeling of economic security based on 1- 5 scale*	2	4.5
Ability to understand and solve problems based on 1- 5 scale*	2	4.5
Self image in community based on 1- 5 scale*	2	5.0
Self confidence based on 1- 5 scale*	2	5.0

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Net profit from different enterprises in this IFS model of Sri Ramesh Purty is around Rs. 4.5 lakhs. His farm has become so popular in the distric that many institutions / organizations organize exposure visits of the farmers. He has become role model of the farmers in the locality. Progressive Farmer Award was given to Sri Ramesh Purty by Birsa Agricultural University, Ranchi for his outstanding achievement.

Adoption, Spread, Up Scaling of Technology and Future Projection

By seeing mango orchard (1000 plants) of different improved varieties established by Sri Ramesh Purty, 30 farmers of different nearby villages have started similar practice with the technical support of Krishi Vigyan Kendra, West Singhbhum. Sri Ramesh Purty prepares himself planting material (mango graft, orange, lemon and guava gooties) at his own farm. This model is being replicated on another farm for which he has taken about 4 acres of land on lease and started to establish mango orchard of 500 plants with solar pump irrigation system and intercropping with vegetables.

Livestock Based Integrated Farming System

Bibha Kumari and Surendra Chaurasia
Krishi Vigyan Kendra, Lodhipur Agriuclture Farm, Distt. Arwal, Bihar

Agro-ecology and Farming Situation

Sri Dilip Sharma, 38 years old, S/o- Sri Nageshwar Sharma of Village - Jhunathi, Block- Karpi is having 28 acres of land in which 12 acres are tube-well irrigated. For crop production, he utilizes HYV seeds with scientific production techniques. He has dairy unit of 12 animals with high production potential and a goatery unit of 26 goats. He gets daily milk production of 140 litres which is linked with milk co-operative for marketing. He has a cow of HF breed producing 28 litres milk per day. He uses the animal wastages in crop production.

Technological Intervention and KVK Support

Sri Dilip Sharma is working under technical guidance of KVK. In crop production technology, he has adopted high yielding variety of crop with limited utilization of fertilizer and other medicines. His dairy unit is running under scientific supervision and fully ledgering through computer. He rears goats in an organized manner under semi-intensive system. He applies regular vaccination and deworming to the animals. He is also adopting balanced feeding chart for animals. Being a Chairman of Co-operative Distribution Centre, he sells milk to the milk co-operative society. KVK has provided him suitable breed of buck for upgradation of local goats. Time to time, animal health camps and other related programmes are conducted at his village for his active initiative and leadership qualities. He has a Bio-gas Plant and thus he uses gas for cooking and lighting purpose at home and dairy unit.

Economic and Social Impact

Impact factor	Before Adoption	After Adoption
Farmers' practice	Conventional	Improved
Yield of Product	Moderate	High
Fixed Cost (Rs.)	15,00,000	15,00,000
Recurring Cost (Rs.)	3,85,000	4,00,000
Gross Income (Rs.)	5,60,000	6,90,000
Net Profit (Rs.)	1,75,000	2,90,000
BC Ratio	1.45	1.72
Marketing	Local & COMFED	Local & COMFED
Dissemination of knowledge in the locality	Village level	District level
Knowledge gain based on 1- 5 scale*	3	5
Feeling of economic security based on 1- 5 scale*	3	5
Ability to understand and solve problems based on 1- 5 scale*	2	4
Self image in community based on 1- 5 scale*	2	5
Self confidence based on 1- 5 scale*	2	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Presently, the monthly income of Sri Dilip Sharma is around Rs. 25,000/-. Sri Dilip Sharma has well reputation in the society and people have faith on him. His children are now getting higher education in technical college.

Adoption, Spread, Up Scaling of Technology and Future Projection

In near future, Sri Dilip Sharma plans to start milk co-operative centre and works on group approach. He always shares the working experience with other local farmers and thus, he has already encouraged two farmers to start dairy units.

Economic Empowerment through Composite Fish Culture

Bipul Kr. Mandal and Gyan Chandra
Krishi Vigyan Kendra, Agricultural Farm, Raghopur, Distt. Supaul, Bihar

Agro-ecology and Farming Situation

Supaul district comes under zone II agroclimatic area. The soil is sandy loam to clay. In monsoon season, water level in pond reaches around 1.5- 2.0 m. During dry season, water level decreases to around 0.5 m. The fish pond found in this area is commonly manifested with weeds. Fish farmers usually don't offer feed regularly. In entire season, they provide feed only 6- 7 times. However, fish should be fed with mustard oil cake (MOC) and rice bran mixture 1:1 ratio @2% body weight every day.

Technological Intervention and KVK Support

Sri Ajit Singh is a fish farmer from Sukhanagar, Pratapganj, Supaul. Earlier the production of fish was low and it was around 2 ton/ ha. Sri Singh came in contact with the Fishery Scientist of KVK Supaul who advised him to adopt full package of practice for composite fish culture. He adopted composite fish culture technology by the recommendation of KVK Supaul. In composite fish culture, compatible species of fish with different feeding habits were stocked together in the same pond so that every ecological niche was occupied and utilized by fishes. Now, Sri Singh is culturing Indian major carp and Chinease carp fingerlings @ 10000 per ha in his pond. He is providing regular feed in his fish pond @ 2% body weight of fish. He himself prepares feed from locally available materials. He is adopting bag feeding method and getting the yield around 5 ton fish from one hectare pond.

Socio-economic impact

Impact Factor	Before Adoption	After Adoption
Farmer's Practice	No planning of fish culture along with irregular feeding	Composite fish culture and regular feeding with balanced feed
Yield of product	2 ton/ ha	5 ton/ ha
Fixed cost	-	-
Recurring cost (Rs./ha)	50,000	1,00,000
Gross income (Rs./ha)	2,00,000	5,00,000
Net profit (Rs./ha)	1,50,000	4,00,000
BC Ratio	4.0	5.0
Marketing	One time harvesting and selling in local market	Multiple harvesting and selling in local market
Dissemination of knowledge in the locality	2	3
Knowledge gain based on 1-5 scale	1	4
Feedling of economic security based on 1-5 scale	2	3
Ability to understand & solve problems based on 1-5 scale	2	4
Selfimage in community based	2	3
Self confidence based	2	4

Benefits

Sri Ajit Singh is a progressive fish farmer. His net annual income from agriculture is around Rs. 5.5 lakh. Because of labour problem and high cost of cultivation, the income from wheat and paddy cultivation was not so remunerative. On the other hand, as the fish culture is less labour oriented and the price of fresh fish in local market is very good (@ 125-150/- per kg), at present, Sri Singh not only prefers himself to culture fishes, but also motivates other farmers in his area to adopt composite fish culture for better return. Now, he is holding a good position in his society.

Adoption, spread, up scaling of Technology & future projection

Sri Ajit Singh adopted full package of practices for composite fish culture. However, adoption rate is moderate among other fish farmers of the district. Every year new farmers are starting construction of new ponds for fish culture. The Scientists of KVK Supaul are continuously encouraging farmers in the district to join in this venture through adopting composite fish farming system for year round income. In future, Sri Singh wants to establish fish hatchery to provide fish seed to local fish farmers.

Augmenting Farm Income through Supplemental Irrigation and Integrated Farming System

Shobha Rani, Jeetendra Kumar, Dinesh Mahto, Wajid Hasan and Ajit Kumar Paswan
Krishi Vigyan Kendra, Seed Multiplication Farm, Mussi, Makhdumpur, Distt. Jehanabad, Bihar

Agro-ecology and Farming Situation

Jehanabad district of Bihar comes under NARP Zone - III B. The soils of Jehanabad district are classified as old alluvial. Climate of the area is humid-hot. Due to change in climate, drought like situation prevails in village Sakrorha. The geographical condition is such that the water table of the village is low and that's why there is less number of tube wells in the village. Shri Suresh Singh is a progressive farmer of village Sakrorha of Jehanabad district. Rice-wheat is the major cropping system in his village. In spite of having 18 acres of land, initially he did farming with traditional methods, which was not much advantageous. Due to water crisis, there was a chance of crop failure. Livestock was also facing heat stress that resulted low milk production and fertility problem leading to low profit from agriculture and allied activities. Sakrorha village was lacking of suitable/ capable water harvesting structure. The pyne system was good, but most portions were in defunct stage.

Technological Intervention and KVK Support

Since 2011 Shri Suresh Singh is continuously in touch with KVK Jehanabad. He had one water body in defunct condition. He showed his keen interest in renovation of this water body into a pond. Then, his pond was renovated. Not only he but also the neighbouring farmers are now providing supplemental irrigation during dry spells that minimizes the risk of crop failure and secures crop yield. Shri Singh along with neighbouring farmers are raising staggered community nursery of different duration of paddy varieties (long, medium and short duration) near the pond and performing timely transplantion of paddy.

Shri Suresh Singh has developed an Integrated Farming System having crop production, vegetable production and plantation of tick wood, sisam, guava around pond, goat farming, dairy farming, fish farming, duck farming, vermicompost unit and fodder production. He has acquired modern techniques and technology from KVK scientists. He uses modern agricultural implements for performing agricultural operation in time. He uses zero tillage machine to save agricultural inputs like seed, fertilizer and water, sprinkler system to irrigate wheat and pulses, power reaper for harvesting of wheat, paddy and jai, rotavator for quality field preparation. Shri Singh has installed a Biogas plant on his dairy farm and besides using it for cooking purpose; he also uses the biogas slurry as bio-compost. He has established a small goat farm with local goats. Presently, he has 3 buffalos, 5 cows, 55 goats, 18 duck and culturing fish (*rohu, katla,* grass carp) in his pond. He is also running a milk society under name "Sakrorha Dugdh Utlpadak Sahyog Samity" and selling fodder seed to Magadh dairy, Gaya.

Economic and Social Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	Traditional Farming	IFS
Yield of Product	Paddy@ 36.5q / ha, wheat @ 34.5 q / ha, lentil @11.8 q / ha, chickpea @16 q / ha	Paddy @ 45 q / ha, Wheat @ 39.5 q / ha, lentil @ 16.4 q / ha, chickpea @ 22.8 q / ha, Goatry @ Rs. 0.40 lakh / yr, Dairy farming @ Rs. 2.5 lakh / yr Fish@8q / year
Fixed Cost	-	Cost of Pond construction bear by govt.
Recurring Cost (Rs.)	3,70,000	3,20,000
Gross Income (Rs.)	5,80,000	9,41,255
Net Profitm (Rs.)	2,10,000	6,21,255
BC Ratio	1.56	2.94
Marketing	Local Market	Local Market, Magadh dairy
Dissemination of knowledge in the locality	-	Yes
Knowledge gain based on 1- 5 scale*	1	4
Feeling of economic security based on 1- 5 scale*	1	3
Ability to understand and solve problems based on 1- 5 scale*	1	4
Self image in community based on 1- 5 scale*	2	3
Self confidence based on 1- 5 scale*	2	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefit

Sri Singh has increased his income from Integrated Farming System. Thus, he has improved his status of living. His childrens are now getting better education. The neighbouring farmers are getting benefit from his farm pond in the form of community irrigation.

Adoption, Spread, Up Scaling of Technology and Future Projection

Shri Suresh Singh is a source of inspiration for so many farmers. The farmers of neighboring villages follow him as master trainer for improved cultivation practices as well as use of farm implements. More and more dairy farmers are becoming members of dairy society. The marginal and small farmers of surrounding villages are also adopting goatery as alternate enterprise by seeing the success of goat farming of Shri Suresh Singh

Climate Resilient Technologies





Enhancement of Income through Cultivation of *Anjali* and *Bandana* Variety of Rice in Drought Prone Area

Ranjay Kumar Singh, Dharma Oraon, V.K. Pandey, Zunaid Alam and Upendra Kumar Singh
Krishi Vigyan Kendra, Distt. Chatra, Jharkhand

Agro-Ecology and Farming Situation

Chatra falls under rainfed rice- based agro ecosystem. Rice is the main food of the households. Tribal people have given it an important place in their food habit. Local people celebrate their socio and spiritual function and festivals with rice made food materials. But the productivity of rice is very low in upland and medium land due to early arrival and early excision of rainfall and intermediate drought like situation which affects the growth stage of crops.

Technological Intervention and KVK Support

Mardanpur village in Chatra block of Chatra district has been adopted under National Innovation of Climate Resilient agriculture project (NICRA) by KVK Chatra in the year 2012. After adoption of the village, participatory rural appraisal (PRA) was conducted by a multidisciplinary team of KVK scientists. During PRA, it was revealed that a majority of the farmers were facing the problem of low productivity in rice due to several factors like not availability of drought tolerant varieties, imbalanced use to nutrients, moisture stress in growth stage and incidence of pests and diseases. After farmers participatory planning, it was decided to demonstrate such varieties of 90-100 days duration and having 10-15 days dry spell tolerant capacity along with balance dose of nutrients. The KVK earlier had conducted on form trails on three varieties *i.e. Anjali, Bandana* and *Abhishek* in which *Anjali* and *Bandana* were found to be best performing in drought like situation in the district. Keeping this in view, intervention was planned with *Anjali* and *Bandana* in the adopted village. Prior to implementing intervention, the selected farmers were imparted training at KVK chatra. Community level seedling was raised where water bodies were available and 21 days old seedlings were transplanted at the spacing of 25 cm x 15 cm @ 1 and 2 seedlings per hill. Half dose of nitrogen and full dose of phosphorus and potash were applied at the time of transplanting. The rest dose of nitrogen was applied in two split dose at 25 and 20 days after transplanting. Initially, farmers were not ready to prepare 2.5” x 0.75" bund before onset of monsoon for rain water management. After persuasion through exposure visit to KVK farm, the farmers agreed to prepare bund around the field, one weeding was done by cono-weeder after 20-30 days after transplanting. The crop stand was so attractive in spite of 10 days 2 dry spell during growth stage. Farmers from nearby village after visiting the demonstration sites, enquired about the varieties and other management practices.

Benefits (Economical and Social)

Generally farmers of the district grow long duration, more water requirement variety like *MTU1010* which intermedatory suffers from drought and thus yield reduces upto 30-50%. But after introduction of short duration rice variety like *Anjali* and *Bandana*, this issue was mitigated and income of the farmers increased upto 80-100%.

Adoption, Spread, Up Scaling of Technology

Anjali and *Bandana* varieties have been included in participatory seed production programme of the

district. In the year 2016-17 and 2017-18, the participatory seed production programme fulfiled 30% seed requirement of the district. Sri Birendra Kumar, Village - Unta, Block- Chatra (Jharkhand) has played important role for participatory seed production programme. His constant efforts have been recognised by honouring him by the Hon`ble Governor of Jharkhand. Nowadays, these varieties have been included in seed distribution programme of the government of Jharkhand on subsidiary basis. These varieties have already been spraded in 10,000 ha area of the district.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	Long duration variety 130-145 with ($N_{80}P_{30}K_0$)	*Anjali, Bandana* ($N_{80}P_{30}K_0$)
Yield of Product (q / ha)	17	26
Fixed Cost (Rs. / ha)	1,700	1,700
Recurring Cost (Rs. / ha)	19,000	19,000
Gross Income (Rs. / ha)	30,600	46,800
Net Profit (Rs. / ha)	9,900	26,100
BC Ratio	1.47	2.26
Marketing	Local market	Government agency
Dissemination of knowledge in the locality	-	-
Knowledge gain based on 1- 5 scale*	2.0	4.5
Feeling of economic security based on 1- 5 scale*	2.5	5.0
Ability to understand and solve problems based on 1- 5 scale*	2.5	5.0
Self image in community based on 1- 5 scale*	2.0	4.5
Self confidence based on 1- 5 scale*	2.0	5.0

* 1- 5 scale indicates 1 = lowest and 5 = highest

Cultivation of *Sahbhagi Dhan* for Yield Advantage in Rainfall Deficit Situation

Deokaran, Mandhata Singh, V. Dwivedi, Bhanu Pratap Singh and Vikash Kumar
Krishi Vigyan Kendra, Distt. Buxar, Bihar

Agro-ecology and Farming Situation

Buxar district is rainfed plain area. The average annual rainfall of 2014 to 2016 is 721.63 mm with erratic rain fall pattern. The deficit rainfall in July for consecutive last three years has affected the timely transplanting of rice in the village Kukurha of Buxar. Farmers prefer long duration (140-155 days) cultivars viz *BPT 5204* and *MTU 7029* which are sowing in June and transplanting in July. However, due to deficit rainfall situation in July, farmers wait for transplanting till August. This results in low productivity and affects the timely sowing of succeeding *rabi* crop on the same land leading to low average yield.

Technological Intervention and KVK Support

With the help of Technology Demonstration component of NICRA project, KVK, Buxar demonstrated stress/ drought tolerant and short duration (110-115 days) var. *Sahbhagi Dhan* that could withstand up to 2 week of exposure to dry spell in rainfed area and found highly resistant to leaf blast and moderately resistant to brown spot and sheath blight of the project village. The average yield was slightly lower compared to long duration varieties due to early maturation. However, short duration varieties serve as best options for drought proofing in rainfed rice cultivation as they provide a significant yield advantage in drought seasons over the traditional long duration varities.

Benefits

The average yield (38.5 q/ha) was 6.35% higher than 114 days varieties. Gross return Rs 59,675/- per ha was found in demonstration plot and Rs 56,110/- per ha was in farmer practice. The system Rice-wheat and Rice -lentil average yield were found 76.75 q/ha and 63 q/ha, respectively.

Adoption, Spread and Up Scaling of Technology

Drought tolerant variety was extended in 66 hectare area in the NICRA adopted village Kukurha and its adjourning villages Yadav Dera, Surondha and Gheuriya. *Sahbhagi Dhan* has been up scaled in 185 ha area in 2015 and 225 ha area in 2016 through transplanting and direct seeded in Buxar district by State Agriculture Department and ATMA in various projects like BGREI, NFSM and PMKSY. This variety has also been adopted as a contingent crop in low land area in four week delay monsoon situation.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	*MTU 7029*	*Sahbhagi Dhan*
Yield of Product (q / ha)	36.20	38.5
Fixed Cost (Rs. / ha)	7,550	7,550
Recurring Cost (Rs. / ha)	18,225	16,325
Gross Income (Rs. / ha)	56,110	59,675
Net Profit (Rs. / ha)	30,335	35,800
BC Ratio	2.17	2.49
Marketing	Itahri and Buxar	Itahri and Buxar
Dissemination of knowledge in the locality	Yes	Yes
Knowledge gain based on 1- 5 scale*	3	4
Feeling of economic security based on 1- 5 scale*	2	4
Ability to understand and solve problems based on 1- 5 scale*	-	4
Self image in community based on 1- 5 scale*	-	3
Self confidence based on 1- 5 scale*	1	3

* 1- 5 scale indicates 1 = lowest and 5 = highest

Seed Production of *Sahbhagi* Dhan in Mid Land Situation for Economical Benefits

S. Bhusan and Ravi Shanker
Krishi Vigyan Kendra, Dist. Godda, Jharkhand

Agro-ecology and Farming Situation

Godda falls under central north eastern plateau agro climatic zone. The characteristics of the zone is humid to sub humid tropical monsoon type of climate, the average annual rainfall is 1250 mm. During last 5 years it has been observed and recorded that the distribution pattern of rainfall is erratic. Rainfed farming is a traditional practice followed by the farmers of this Agro Ecological Situation. Farmers were unaware about the recommended variety of rice for upland and mid land. They were keeping the land fallow or cultivating the rice variety *MTU - 7029*. Due to erratic rainfall and long duration character of this variety the yield recorded was low and in many years the crop became failure due to lack of irrigation.

Technological Intervention and KVK Support

With the help of NICRA Project, the KVK Scientists introduced the rice variety *Sahbhagi Dhan* in the Bhelwa (Pauriahaat block) village for mid land. This variety is drought tolerant and suitable for rainfed upland and medium low land. The duration of the variety is 110 - 115 days and the yield potential is 40 - 45 q/ha. This variety is also resistant against leaf blast, brown spot and sheath blight. During the year 2015- 16, rice variety *Sahbhagi* was cultivated only in small area of 10 ha. The foundation seed of the variety was provided by the GVT - KVK, Godda. All the agronomical practices were followed by the farmers. Farmers were satisfied with the result. During next year *i.e.* 2016- 17, farmers of the village became ready for the seed production. Beej gram, Bhelwa (Seed Village Bhelwa) was constituted and about 60 farmers became member. Each farmer has grown the seed of rice (Variety: *Sahbhagi*). The total area under rice seed production was 50 ha. Raw seeds were processed in Seed Processing machine of KVK, Godda. Processed seed were sent to Seed Testing laboratory, Ranchi for testing of seeds as per seed norms. The total production was about 1700 q. After keeping for own purpose, they sold seeds @ Rs. 1600/q to the Govt. of Jharkhand through DAO. Beside the village Bhelwa, the nearby villages like Draupad, Dande, *etc.* have come forward in seed production.

Benefits

Farmers got benefit for double crops or double income in the same piece of land and they utilized the rice-fallow area. Quality seed was available in the villages.

Adoption, Spread and Up Scaling of Technology

The farmers of the area are adopting the rice variety *Sahbhagi Dhan* very fast. The varieties become popular in the neighbouring area of village Bhelwa *i.e.* Draupad, Garhi, Padampur, Gunghasa, Gauripur *etc.* covering 250 ha area. The farmers of the village Bhelwa have made Seed bank. The seed bank sells the seed of rice. In near future, more seed village has to be formed and transformed it into FPO.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	Rice variety *MTU - 7029* in midland	Rice variety *Sahbhagi Dhan* in midland
Yield of Product (q / ha)	32	43
Fixed Cost (Rs. / ha)	-	-
Recurring Cost (Rs. / ha)	36,900	37,700
Gross Income (Rs. / ha)	38,400	68,800
Net Profit (Rs. / ha)	1,500	31,100
BC Ratio	1.04	1.82
Marketing	Local	Seed purchased by GoJ
Dissemination of knowledge in the locality	-	Through demonstration, Field day, farmers to farmers contact
Knowledge gain based on 1- 5 scale*	1	4
Feeling of economic security based on 1- 5 scale*	2	4
Ability to understand and solve problems based on 1- 5 scale*	2	3
Self image in community based on 1- 5 scale*	1	5
Self confidence based on 1- 5 scale*	2	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Cultivation of Rice var. *Swarna Sub-1* for Yield Advantage and Economical Benefit in Low Land Flood Prone Areas

Ram Eshwar Prasad, Sachchidanand Prasad, Manohar Panjikar and Kinkar Kumar
Krishi Vigyan Kendra, Sitamarhi, Distt. Sitamarhi, Bihar

Agro-ecology and Farming Situation

District Sitamarhi comes under Agro climatic zone I and it is situated in north western part of the state. The annual average rainfall of this district is 1210 mm. The entire district is flood prone which normally comes in the month of June and continues till October. The soil of the district is calcareous, light to clay in texture with low to moderately high organic matter content. The principal crops of the district are rice, wheat, maize, pulses, oilseed, tobacco, sugarcane, vegetable and spices with number of crop rotation.

Technological Intervention and KVK Support

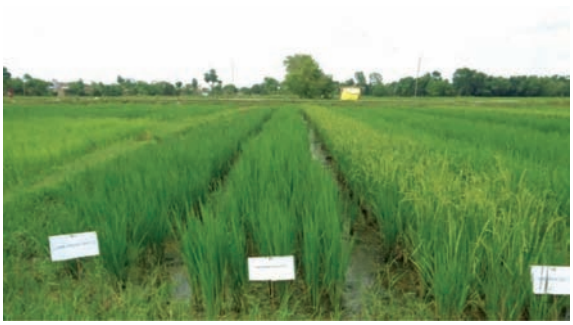
Agriculture in the district is prone to natural calamity, whereas 40% areas of the district are affected by the recurrent flood. Due to water logged condition in the district, selection of specific cultivar of rice was needed for sustaining in this flood prone situation. In order to further tap the potential of these varieties under different flood prone environments, Best Management Practices (BMPs) including time of seeding / transplanting and method of crop establishment need to be standardized. In order to further tap the potential of improved stress tolerant varieties for submergence, On Farm Trial was conducted by KVK, Sitamarhi and variety *Swarna Sub-1* was found most suitable in all locations. After screening variety *Swarna Sub-1,* it was demonstrated under FLD programme organized by KVK, Sitamarhi in the flood prone area of the district and then the variety was popularized in farming community by celebration of Kisan Gosthis, Field day *etc.*

Benefits

Yield of the var. *Swarn Sub -1* to the tune of 44 q / ha was found maximum as compared to other varieties. Other varieties like *Shambah Masoori Sub -1* and *IR-64-1* gave yields of 36 and 35 q / ha, respectively. Among all the submergence tolerant varieties, *Swarna Sub-1* got most popularity in farming community due to highly tolerant capacity under submerge condition (15-17 days) and highest productivity.

Adoption, Spread, Up Scaling of Technology

Varieties *Swarna Sub-1* has been considered by the farmers as the best suitable variety in the submergence prone agro-ecological situation of the district. Approx 30,000 Farmers are using this technology.



Economic and Socio-Psycho Impact

Impact factor	Before adoption	After Adoption
Farmers Practice	Only local variety Katma used	1) *Swarna Sub-1* 2) *I.R.- 64 Sub-1* 3) *Shambha Mansoori Sub-1*
Yield of product (q / ha)	20	1) *Swarna Sub-1*- 44 2) *I.R.- 64 Sub-1*- 35 3) *Shambha Mansoori Sub-1*- 36 q / ha
Fixed Cast (Rs. / ha)	2,600	2,600
Recurring Cost (Rs. / ha)	20,000	24,5000
Gross Income (Rs. / ha)	30,000	1) *Swarna Sub-1*- Rs. 66,000 / ha 2) *I.R.- 64 Sub-1*- Rs. 52,000 / ha 3) *Shambha Mansoori Sub-1*- Rs. 54,000 / ha
Net Profit (Rs. / ha)	7,400	1) *Swarna Sub-1*- Rs. 38,900 / ha 2) *I.R.- 64 Sub-1*- Rs. 25,400 / ha 3) *Shambha Mansoori Sub-1*- Rs. 26,900 / ha
BC Ratio	1.32	1) *Swarna Sub-1*- 2.43 2) *I.R.- 64 Sub-1*- 1.93 3) *Shambha Mansoori Sub-1*- 1.99
Marketing (Rs. / q)	1500	1500
Dissemination of Knowledge	Lack of knowledge regarding high yield varieties for flood condition	Farmers have appropriate knowledge and practices of high yielding favorable var. for flood situation
Knowledge gain based on 1-5 scale*	1	5
Feeling of economic security based on 1-5* scale	1	5
Ability to understand and solve problems based on 1-5scale*	2	5
Self image in community based 1-5 scale*	2	4
Self confidence on 1-5 scale*	1	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Enhancement of Income through Relay Cropping of Vegetables with Rice Crop in Deficient and Untimely Rainfall Conditions

Anupama Kumari and Surendra Prasad
Krishi Vigyan Kendra, Manjhi, Distt. Saran, Bihar

Agro-ecology and Farming Situation

Saran is a rainfed, drought affected area of Bihar. In the last 15 years, Saran district has experienced deficient and untimely rainfall, late monsoon which resulted into delayed transplanting of old age seedlings (40-45 days) and thus poor crop yield. In order to address this problem, relay cropping of vegetables crops with rice has been started for good yield and higher economic returns.

Technology Intervention and KVK Support

Sri Narwadeshwar Giri has evolved relay cropping system of vegetable with rice and alternative to rice- wheat cropping system in the district. Due to climate change he was not getting profit in above said cropping system. Every year he was in loss due to sporadic rainfall and prolong dry spell. With the help of KVK Scientists, this vegetable + rice based system has been précised in 2 ha. He is growing vegetable after short duration rice (Rice-Brinjal-Tomato-Cucumber). Sowing of brinjal in nursery is done on 15th August and transplanted in main field by 15th September at 6 ft. x 3 ft. distance on permanent beds. Seedlings of tomato are raised in a separate nursery in last week of November and transplanting is done in between the rows of brinjal at a distance of 4 feet. Cucumber and long melon are sown directly in between the plants of tomato at a distance of 2 feet by 25th February. After incorporation of Sesbania, short duration rice is taken in the field after puddling.

Benefits

Relay cropping of vegetables with rice provides cash flow round the year as compared to rice-wheat based cropping system which is not certain to get return due to climate variability. The system is sustainable and profitable. The combination of vegetables and cereal provides all need of farmers and provide higher return with the highest net profit of Rs. 3.25 lakh/ha. Utility of this innovation is very true in the climate change perspective. Due to short fall and untimely rainfall in *kharif* and *rabi* season, this practice is suitable to provide higher return along with the own need of rice round the year.

Adoption, Spread and Up Scaling of Technology

Farmers of surrounding area are now adopting this innovation and they are earning more income than the previous cropping system of rice-wheat. For up scaling of this technology, farmers are getting training and making field visit to the field of Sri Narwadeswar Giri. From 2 ha of land of Sri Narwadeswar Giri, this technology has been up scaled in 10 ha of land with the adoption of other farmers in the village Affaur and near by village. Future projection is to spread this technology with mulching of vegetables using rice starw and plastic for increasing the soil health and minimizing the effect of sporadic rainfall with conserving the moisture in the climatic change condition.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	Rice-wheat cropping system	Relay cropping of vegetables after short duration rice
Yield of Product (q / ha)	Rice-21 Wheat-18	Cucumber- Brinjal- Tomato-
Recurring Cost (Rs. / ha)	31,167	1,23,000
Gross Income (Rs. / ha)	63,800	4,48,000
Net Profit (Rs. / ha)	32,633	3,25,000
BC Ratio (Rs. / ha)	2.04	3.64
Marketing	Local market	Mandi
Dissemination of knowledge in the locality	No	Yes
Knowledge gain based on 1- 5 scale*	0	5
Feeling of economic security based on 1- 5 scale*	2	4
Ability to understand and solve problems based on 1- 5 scale*	1	5
Self image in community based on 1- 5 scale*	2	5
Self confidence based on 1- 5 scale*	1	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Diversification of Rice-Wheat Cropping System through Climate Resilient Mustard Variety for Augmenting Income

Anupama Kumari and Surendra Prasad
Krishi Vigyan Kendra, Manjhi, Distt. Saran, Bihar

Agro-ecology and Farming Situation

Continuous Rice cultivation has led to deterioration in soil quality, receeding ground water table, declination in productivity as well as environmental problem. Scientific intercropping for intensifying and diversifying the prevelant rice-wheat cropping system with rice- mustard- moong cropping system has been found better for assured return under the resources available.

Technological Intervention and KVK Support

Rajendra Suphalam is the variety of mustard which is suitable in both rainfed and irrigated condition. Due to climate change, there is always uncertainty of drought and floods. If there is drought then it can be sown timely and if floods then it can be sown in late condition. During prolonged cold in North Bihar, only *R. Suphalam* is survived and all other rapeseed and mustard varieties start drying from top of the plant ultimately affect the yield.

Benefits

In the last 15 years, Saran district has experienced deficient and untimely rainfall, late onset of monsoon due to which in rice-wheat cropping system is not economically beneficial for the farmers. With the diversification of cropping system, rice with mustard var. *R. Suphalam* has resulted higher income as compared to the previous income from rice-wheat cropping system. Now, the farmers can take green gram, cereals, oil seeds and pulses for crop diversification and it is widely acceptable.

Adoption, Spread, Up Scaling of Technology

Most of the farmers are adopting rice- mustard- moong cropping system. Due to more yield and adaptive capacity to climatic vulnerability, the demand of *R. suphlam* is more. A future projection is to sowing of mustard (*R. Suphalam*) with zero tillage machine as line crop will increase yield with 20-30%.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	Rice-wheat cropping system	Rice-mustard-moong
Yield of Product (q/ha)	Rice-28 Wheat-26	Rice-36 Mustard-18 Moong-10
Recurring Cost (Rs./ha)	58,127	68,076
Gross Income (Rs./ha)	7,97,806	1,43,240
Net Profit (Rs./ha)	21,563	75,164
BC Ratio	1.37	2.10
Marketing	Local market	Mandi
Dissemination of knowledge in the locality	No	Yes
Knowledge gain based on 1- 5 scale*	0	4
Feeling of economic security based on 1- 5 scale*	1	3
Ability to understand and solve problems based on 1- 5 scale*	1	5
Self image in community based on 1- 5 scale*	2	5
Self confidence based on 1- 5 scale*	1	3

* 1- 5 scale indicates 1 = lowest and 5 = highest

Income Generation through Cultivation of High Yielding Variety Brinjal

Kalpana Sinha, Sayed Abid Imam and Jaywant Kumar
Krishi Vigyan Kendra, Distt. Nawad, Bihar

Agro-ecology and Farming Situation

Nawada district comes in South Bihar Alluvial plane zone -III. This district is drought Prone and the agriculture is mainly rainfed type. Soil of the district is sandy, sandy lome, clay and clay lome. The Soil is deficient in micro nutrients like Boron, Zinc and Iron. 80-85% farmers of the district are small and marginal. Although average rainfall of the district is 1037 mm. Dry spell during *Kharif* and *Rabi* season is evident, since last 10 years. The farmers of the NICRA Villages under KVK Nawada are mostly cultivating cereal pulses and vegetables. Since last 10 years, climatic vulnerability has led to decrease in production of the cops and increase in disease and pest infestation.

Techological Intervention and KVK Support

An educated farmer, Sri Indradev Rajvanshi of village Vidyasagar, Block - Kawakol, District - Nawada, Bihar, was struggling to fulfil his own and the family demands. He came in contact with the scientist of KVK Nawada, and was advised to focus on cultivation of vegetable in his locality. He started cultivation of Brinjal with high yielding variety (HYV) *Swarna pratibha* in 10 Khatha (0.37 acre) of land under supervision and guidance of KVK Scientist. During cultivation, he faced problem of heavy infestation of shoot borer in brinjal. Then he used a natural extract of tobacco for controlling the short borer infestation.

Benefits

The production of brinjal was increased and he gets higher yield from same field of land compare to old verity. Sri Indradev Rajvanshi is now getting 30q of brinjal (*swarna pratibha*) and earning Rs. 30,330/- per season. Earlier he was getting 10q of brinjal and earning Rs. 5000/- per season. The BC ratio from cultivation of high yielding variety has been found to be better than the previous practice. The application of mixture (1 L cow urine + 1 L water + 250 gm extract of tobacco) of extract of tobacco and cow urine has led to reduction in shoot borer infestation with increased yield.

Adoption, Spread and Up scaling of Technoloogy

The Rural unemployed youth are being motivated by Sri Indradev Rajvanshi by seeing his success. The youth are taking advice from him about cultivation practices of the HYV brinjal. Sri Indradev Rajvanshi becomes the role model for the unemployed youth. The youth are featuring to sale their produce in a cooperative market by making their cooperative groups.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	Local variety	*Swarn Pratibha*
Yield Of Production (q)	10	30
Fixed Cost (Rs./ha)	5,000	5,000
Recurring Cost (Rs./ha)	6,000	12,670
Gross Income (Rs./ha)	16,000	48,000
Net Profit (Rs./ha)	5,000	30,330
BC Ratio	1.45	2.71
Marketing	Own village	Local market
Dissemination of Knowledge in the locality	-	7
Knowledge gain based on 1-5 scale*	1	3
Feeling of economic security based on 1-5 scale*	1	4
Ability to understand and solve problems based on 1-5 scale*	2	4
Self image in community based on 1-5 scale*	3	5
Self confidence based on 1-5 scale*	3	4

*1-5 scale indicates 1 = lowest and 5 = highest

Rain Water Harvesting Structures for Sustainable Livelihood

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Krishi Vigyan Kendra, Distt. Buxar, Bihar

Agro-ecology, Farming Situation

Buxar district in Bihar is rainfed plain area. The dry spell has lasted for three consecutive years in the district. Drought situation has resulted in depleting groundwater levels up to 8-9 feet in off monsoon season at Kukurha village, Block Itarhi of Buxar. The average annual rainfall of last six years was 721.63 mm with erratic rain fall pattern. So the crops are mostly dependent on monsoon. Climatic vulnerability is expected to affect the crops and thus the marginal farmers and make their livelihoods even more precarious. Small scale water harvesting structures at individual farms level enable to reuse of harvested water during critical periods of nursery, growth stages, or providing water for pre sowing irrigation to *rabi* crops. Water is a precious natural resource when drought condition prevails.

Technological Intervention and KVK Support

A demonstration was carried out at farmers' field under NICRA activities in the year 2011-12 and 2012-13 to provide life saving irrigation to the crops and livestock under drought condition by conserving runoff water and recharging ground water. There were six rain water harvesting structures (RWHS) encompassing a total area of 0.457 ha with the depth of 1.5m to 1.6 m. Rain water harvesting structures were excavated and the reshaping cost was @ Rs 151/ m^3 at farmer's field. During monsoon season, the runoff water from catchment area of 6.25 ha filled the pond with a total volume of 7714300 L water which provided irrigation to 77.14 ha land with 1 cm^3 water in rice/ vegetable fields and pre sowing irrigation for wheat cultivation. It recharged the ground water level by 2- 4 ft. Six nos of RWHS of 10-15 % of farm area were excavated in 2016-17 at Surondha and Gheoria village of Kukurha. Total 131 lakh L water was harvested during monsoon season.

Benefits

Total 26.25 ha area has been irrigated for rice and 13 ha for *rabi* crops. Fish farming and duck production hav been started by using these water harvesting structures. The farmers provide feeds *viz*, rice bran and mustard oil cake to fish and soaked rice to ducks. In a small sized (27m X 27m X1.65 m) pond with 750 fingerlings and 21 ducks, the farmers could reap a net income of Rs. 49,500/ per annum from fish and Rs. 1,655/ - from ducks in six months. The multifarious use of water increases the productivity and economic benefit from a small land holding.

Adoption, Spread and Up Scaling of Technology

Rain water harvesting and recycling for supplemental irrigation technology have been up scaled through MGNREGA and Soil Conservation department of Buxar.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	-	16 Rain WHS
Yield of Product rice (q/ha)	28.75	39.35
Yield of Product Wheat (q/ha)	22.80	36.25
Yield of Product Fish (Kg)	-	415
Fixed Cost (3 years)	21580 Land rent	170858 Land rent+ cost of RWHS
Recurring Cost of 3 years (Rs.) (input for crop +fingerlings+ ducks+ feeding)	75,675	75,850
Gross Income of 3 years (from crop, fish and ducks) (Rs.)	2,43,127	6,50,441
Net Profit (Rs.)	1,69,572	2,51,108
BC Ratio	2.40	2.63
Marketing	Itarhi and Buxar	Itarhi and Buxar
Dissemination of knowledge in the locality	Yes	Yes
Knowledge gain based on 1- 5 scale*	2	4
Feeling of economic security based on 1- 5 scale*	1	4
Ability to understand and solve problems based on 1- 5 scale*	-	5
Self image in community based on 1- 5 scale*	-	3
Self confidence based on 1- 5 scale*	1	3

* 1- 5 scale indicates 1 = lowest and 5 = highest

Ensuring Irrigation for Cultivation of Multiple Crops through Sand Bag Check Dam (Bora Bandi)

Sanjay Kumar, Atal Bihari Tiwari and Rajan Kumar
Krishi Vigyan Kendra, Distt. Gumla, Jharkhand

Agro-ecology and Farming Situation

The cluster of villages consisting of Gunia, Jargatoli, Burhu, Balagada and Kuhipat hamlets in Ghaghra block of Gumla district, Jharkhand, represents around 500 households and the villages are dominated by Oraon tribes who cultivate just one crop of rice during *kharif*. Besides, they also cultivate ragi or maize with little or no inputs. The tribes generally broadcast rice and do not apply any nutrients and also do not bother for weeding their plots. Hence, the rice yields are only 1500 kg/ha. Although this area receives about 1200 mm rainfall annually, there is a high degree of variation in the spatial and temporal distribution of rainfall rendering the farming community vulnerable. There is no water storage/ harvesting infrastructure in the villages.

Technological Intervention and KVK Support

The scientists of KVK, Gumla floated an idea before the villagers for making availability of water in *Mahasaria* rivulet by arresting its flow with the help of a sand bag check dam under NICRA project. The idea was readily accepted by the villagers and they came forward to contribute their labour (*shram daan*) to lay a sand bag check dam, popularly called as "Bora Bandi" across the rivulet. The engineers assessed the peak flow and gave a rough estimate about the width and height of the check dam. Nearly 500 villagers gathered on the banks of *Mahasaria* and started filling nearly 600 empty cement sacks (procured by paying Rs.2 each by KVK) with sand. While one group of people filled sand and closed the bags by tightly securing them with strings, the other group of people began laying them one above the other across the flow of water. The bags were arranged in two rows with about a meter's gap in between in which sand was filled and trampled for the required strength. As the villagers raised the height of the check dam by placing sand bags row by row, the water level rose along with it without much delay. This was indeed spectacular and the fruit of collective labour was realized instantly. A 100 m long, 3 m wide and 2 m tall check dam was ready retaining a large amount of water behind it. Following that, by the end of December, 2011, eight more sand bag check dams were built across *Mahasaria*. This was perhaps one of the quickest adoptions of a water harvesting option over a geographical area in the state of Jharkhand.

Benefits

It may be noted that this intervention did not require high investments but just an innovative idea of reducing the flow of the rivulet and extending the availability of water beyond *kharif* season. It also showed the farmers, development workers and the state administration as to how vast stretches of land left fallow for want of water could be brought under cultivation during *Rabi* and *summer*. It also revived the collective spirit of villagers that could make a difference to their livelihood. Although it is not a sophisticated technology, it is indeed a community based approach that can give hope to many

communities suffering from water scarcity and thus lack of livelihood opportunities. This is an example of how a small idea can go a long way in contributing towards increasing cropping intensity and food security. Quickly this initiative has left the broad impact and farmers have succeeded to cultivate the wheat crop in more than 1000 ha areas across the Gumla, Lohardaga, Sindega, latehar and Khunti districts. Bora Bandh initiative not only prepared the land ready for double or multiple crops but enhanced and recharged the water table, which was undergone 7-8 ft in hot summer. After the intervention it has come to 3-4 ft. Through this successful intervention, KVK has been praised by The State Level awards in Water conservation area by Dainik Jagran Samman and honored by Hon'ble Agriculture Minister, Govt. of Jharkhand. KVK has also succeeded in capturing the zonal level award under NICRA project.

Adoption, Spread and Up Scaling of Technology

The success of the check dam idea "Bora - Bandi" spread fastly across the district as the Print and electronic media flash this idea. Jharkhand Government has taken an initiative to replicate this model in all the districts of Jharkhand. Consequently, Minor Irrigation Division, Gumla invited tender notice for construction of works for series of a check dam worth of Rs. 3 crores 94 lakhs within the stipulated period of one year. By seeing the rigorous effort of KVK, Deputy Commissioner has been pleased enough to sanction Rs 89 lakh for implementing MESO project in Dumri block of Gumla district. This model has been extended to make 70 no. of Bora Bandh in 2016 and ensure the irrigation in 3500 acres of land during *Rabi* and *Summer* crop. The major objective of the project is to ensure the irrigation water for crop production and area expansion under *Rabi* and *summer* season crops. The innovative irrigation idea "Sand bag Check Dam" may find resonance in other villages through convergence in coming year and create more than 1000 ha land under assured irrigation. This technology has registered more than double or triple fold increase in production and productivity of the crop in the district. The purpose is to create employment opportunities in the villages to generate addition income and check migration.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice (Wheat, Mustard & Summer Vegetables)	1-5 ha	150-200 ha
Yield of Product		
Wheat	1-2 ha	160-180 ha
Mustard	< 1 ha	25-30 ha
Potato	< 2-3 ha	15-20 ha
Summer Rice	1-2 ha	10-15 ha
Summer Vegetable	< 1 ha	3-5 ha
Fixed Cost	8000-10000	22000-40000
Recurring Cost (Rs / q)	10000-45000	20000-70000
Gross Income (Rs. / ha)		
Wheat	12000-15000	30000-35000
Mustard	6000-8000	25000-30000
Potato	50000-60000	90000-120000
Pea	40000-50000	75000-85000
Summer Vegetable (Okra)	45000-55000	80000-90000
Summer Rice	12000-15000	25000-30000
Net Profit (Rs. / ha)		
Wheat	8000-10000	15000-18000
Mustard	8000-10000	22000-25000
Potato	25000-30000	55000-60000
Pea	20000-25000	45000-50000
Summer Vegetable (Okra)	25000-30000	50000-55000
Summer Rice	7000-9000	15000-20000
BC Ratio		
Wheat	1.2	1.66
Mustard	1.5	2.08
Potato	1.42	2.0
Pea	2.22	2.14
Summer Vegetable (Okra)	1.8	2.28
Summer Rice	1.5	2.08
Marketing	Local	Local
Dissemination of knowledge in the locality	-	-
Knowledge gain based on 1- 5 scale*	02	04
Feeling of economic security based on 1- 5 scale*	02	04
Ability to understand and solve problems based on 1- 5 scale*	01	04
Self image in community based on 1- 5 scale*	01	03
Self confidence based on 1- 5 scale*	01	03

* 1- 5 scale indicates 1 = lowest and 5 = highest

Augmenting Farm Income through Diversification in Farming under Climate Change Scenario

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Krishi Vigyan Kendra, Seed Multiplication Farm, Mussi, Makhdumpur, Distt. Jehanabad, Bihar

Agro-ecology and Farming Situation

Jehanabad district of Bihar comes under NARP Zone - III B. The soils of Jehanabad district are classified as old alluvial. Climate of the area is humid-hot. Rice-wheat is major cropping system in village Sakrorha in Jehanabad district. Sri Sant Kumar Sinha is an educated farmer of village Sakrorha with about 12 years of farming experience. He has 5 acre of cultivable land. Initially he started farming on traditional knowledge of farming system but due to his innovative nature he thought to adopt an enterprise other than agriculture.

Technological Intervention and KVK Support

With the help of the KVK Scientists, Sri Sant Kumar Sinha has started animal husbandry, poultry farming and duck farming besides farming. For poultry farming, he is using poultry housing structure specially designed by KVK which can withstand heat and temperature. He does farming purely on the basis of market demand. Initially, he started dairy farming with indigenous breed of cows and buffalo, but the income was low because of low milk production. Gradually, he has replaced all cattle with crossbred. He is now supplying milk to dairy cooperative running in the village. He is a member of Dugdh Utpadak Sahayog Samiti, Sakrorha. The daily milk production is 40 kg per day. Besides growing crops in both *Rabi* and *Kharif* season, he has started growing different types of fodder crops throughout the year. He has a nutrition garden. Guava, papaya, mango, elephantfootyam *etc.* are present at his nutrition garden. Besides nutrition garden, he has a vermicompost unit and using cow dung in this unit. The dependency on chemical fertilizer has been reduced. He is also involved in agro-forestry (like tick wood, sesamum). He uses tiller for quality field preparation and Zero tillage machine for wheat sowing keeping in view with resource conservation like saving of water, seed, fertilizer and labour.

Benefits

The annual gross income of Sri Sant Kumar Sinha is approx Rs. 3,93,640/- from all sources including livestock farming. Sri Sant Kumar Sinha has increased his income after diversification in farming.

Adoption, Spread, Up Scaling of Technology and Future Projection

The farmers of neighboring villages are now following Sri Sant Kumar Sinha for dairy farming as well as poultry farming along with crop production to increase income. It has been observed that the small and marginal farmers are more interested to adopt this diversified farming system.

Economic and Socio-Psycho Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	Traditional Farming	Animal husbandry and Scientific farming
Yield of Product (q/ha)	Rice @ 36 wheat@34.4 lentil @ 10.5 mustard @ 9	Rice@43 wheat @41.6 lentil @ 15 mustard @14.6 linseed @ 8 elephant footyam, poultry farming, dairy farming
Fixed Cost	-	-
Recurring Cost (Rs.)	1,10,000	1,55,000
Gross Income (Rs.)	2,15,000	3,93,640
Net Profit (Rs.)	1,05,000	2,38,640
BC Ratio	1.95	2.53
Marketing	Local Market	Local Market
Dissemination of knowledge in the locality	-	Yes
Knowledge gain based on 1- 5 scale*	1	5
Feeling of economic security based on 1- 5 scale*	1	4
Ability to understand and solve problems based on 1- 5 scale*	1	4
Self image in community based on 1- 5 scale*	2	4
Self confidence based on 1- 5 scale*	2	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Secondary Agriculture

Vermi Compost Production and Income Generation

Pravin Kumar Dwivedi, Shashi Bhushan Kumar Shashi, Nilesh Kumar and Sachidanand Singh
Krishi Vigyan Kendra, SCADA, PO. Ara, Distt. Bhojpur, Bihar

Agro-ecology and Farming Situation

Mr. Jitendra Kumar Singh, MBA, living in village- Baruna, Bihiya, Bhojpur, is a 32 years old farmer having 0.8 ha land in rainfed area with insufficient crop production to support his family. Earlier, he worked in Private sector dealing with organic fertilizers for 4 years. This gave him an idea to start his own enterprise in production of vermicompost.

Technological Intervention and KVK Support

During 2014, he came in contact with KVK, SCADA, Bhojpur and he approached KVK for proper technological support. Thus, training and proper technological support were provided to Shri Jitendra Kumar Singh for vermicompost production. Finally, the unit was established with his own earned money and support from friend and relatives. Shri Jitendra Kumar Singh has made 43 pits. He is now producing 200q in one cycle of 60 days. For running his unit, he is collecting water hyacinth from local water bodies and purchasing cow dung around 22-24 tractor trailer @ Rs.2200/ trailer.

Economic and Socio-Psycho Impact

Impact Factor	Before Adoption	After Adoption
Farmer Practice (In case Vermicompost production)	-	Vermicompost production for marketing
Yield of Product	-	100 MT
Fixed Cost (Rs.)	-	100
Recurring Cost (Rs. per annum)	-	4,20,000
Gross Income (Rs. per annum)	-	6,00,000
Net Profit (Rs. per annum)	-	1,80,000
BC Ratio	-	1.42
Marketing	-	Farmers and Tea Gardens
Dissemination of knowledge in the locality		
Knowledge gain based on 1- 5 scale*	2	5
Feeling of economic security based on 1- 5 scale*	2	5
Ability to understand and solve problems based on 1- 5 scale*	3	4
Self image in community based on 1- 5 scale*	2	5
Self confidence based on 1- 5 scale*	3	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Shri Jitendra Kumar Singh is producing 200q (400 Bag X 50 Kg) in one cycle (60 days) from 43 pits. His net return per cycle is Rs. 55,000- 60,000/- after meeting all liabilities and making input payments. He already sold worms of Rs. 16,000/- also. On an average he is taking 5 cycles of production in one year and producing 100 MT vermicompost annually. The success of Shri Jitendra Kumar Singh has convinced PNB personals, who have sanctioned Rs. 5.0 lakh loan and Rs. 4.0 lakh current credit and within nine months he repaid Rs 2.25 lakhs to Bank.

Adoption, Spread, Up Scaling of Technology and Future Projection

The vermicompost production technology has spread to more than 5 villages involving more than 50 farmers who are also producing vermicompost.

Promotion of Kusumi Lac on Ber in Upland Area for Remunerative Income Source, Utilization of Natural Resource, Employment Generation and Environment Protection

Kiran Kumari and A. Mishra
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Agro-ecology and Farming Situation

Saraikela-Kharsawan has been carved out of erstwhile West Singhbhum district in the year 2001. It has a geographical area of 2,81,545 ha. The district forms part of the Southern fringe of the Chotanagpur Plateau and is highly upland tract. There are hills alternating with plains, steep mountains, deep forests on the mountain slopes. It has got 8 blocks of which 4 blocks, namely Rajnagar, Kuchai, Ichagarh and Nimdih are mainly known for agriculture practices and remaining Gamharia, Kharsawan, Chandiland and Saraikela blocks are taking care of industrial development together with agricultural products processing and ancillary units. The district has extreme hot summer and pleasant cold season. The average annual rainfall is about 1277 mm of which 80% precipitates during the south west monsoon.

Gravel upland rice undergoes climatic stress every year and thus it is necessary to find out a viable option for the utilization of the available resource. Both palash and ber tree are available in plenty in the district and around bund of upland; however their economic use is very limited since many years. Few families cultivate lac traditionally. A major number of palash as well as ber tree available on upland are not utilized for lac. The lack of institutional support at local level is a major constraint to scale up this enterprise. Although different species of lac host tree are available, poor technical knowledge for its utilization leads to scarcity of brood lac at local level. Hence, farmers take only rice crop.

Lac production may be a viable option, as palash as well as ber trees are available on upland area in the district. Lac is the hardened resin, secreted by the tiny lac insect belonging to a coccid group. The widely known Indian Lac insect is *Laccifer lacca*. Lac insect settles on the twigs of certain host trees, suck the plant sap and grow and then secret lac resin from their bodies. Since the insects are closely spaced on the twigs, the resin forms continuous encrustations over the twigs of the host trees. Basically two strains of lac insects are grown in the district i.e. rangeeni on *Butea monos perma* (palash) and *Zizyphus mauritiana* (ber) and kusmi on ber and *Schlerichera oleos*a (kusum) tree. So, ber tree plays important role in production of brood lac as it can play as an alternate host for rangini as well as kusumi. Ber plants are of low height, so its pruning is somewhat easy. If the locally available lac hosts could be utilized for cultivation of lac, it would not only increase the production of lac in the district and add to the income of the farmers. It also helps to prevent indiscriminate use of ber trees for fuel and timber purposes.

Technological Intervention and KVK Support

There is abundance of lac host plants in district Saraikela-Kharsawan. On an average there are 10-15 lac host plants per family. Traditionally, the villagers inoculate lac on Palash Plant and Ber plant of Rangini strain, but there is high mortality due to climatic stress during growth period. KVK introduced Kusumi Lac on Ber plants. Its growth period is not much affected by climatic stress (high temperature) during May-June. It has a good combination with Kusum tree as an alternate host and so brood lac production becomes easy. The price of Kusumi lac is higher in local market than Rangini.

Economic and Socio-Psycho Impact

Impact Factor	Before Adoption	After Adoption
Farmers' Practice	Only rangini lac	Both rangini and kusumi lac cultivation
Yield of Product (kg / plant)	2-4	10-12
Fixed Cost	-	-
Recurring Cost (Rs. / plant)	600.00	650.00
Gross Income (Rs. / plant)	800.00	2400.00
Net Profit (Rs. / plant)	200.00	1750.00
BC Ratio	1.33	3.69
Marketing		
Dissemination of knowledge in the locality	-	More than 3000 farmers adopted this technology
Knowledge gain based on 1- 5 scale*	-	4
Feeling of economic security based on 1- 5 scale*	-	5
Ability to understand and solve problems based on 1- 5 scale*	-	5
Self image in community based on 1- 5 scale*	-	5
Self confidence based on 1- 5 scale*	-	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Lac cultivation on ber has been found to be more productive, sustainable and remunerative. Since there are abundant lac host trees and most of them are on bund and on upland, this resource becomes productive. Through this intervention, it has changed the economic situation of villages. The upland which was otherwise not under production has come under economic production. The productivity of upland has been increased in rice based farming system. It has not only provided the additional income to the farmers, but also it has brought greenery in the village as felling of tree has already been checked. Planting of ber tree on paddy bund would be a great step for economic development in the district. A climatic resilient combination of crop and forest product would help in utilization of locally available resource, employment generation, poverty alleviation, environmental protection and livelihood support especially for small and marginal farmers.

Adoption, Spread and Up Scaling of Technology

Lac production has been revived in the district. The farmers are adopting lac production as a new and income generating enterprise. The Farmers Club under supervision of KVK in collaboration with TSRDS, a CSR of Tata Steel, has started a small lac processing unit in the village.

Enhancement of Farmers' Income by Pest Management in Lac on Ber (*Ziziphus mauritiana*)

Atal Bihari Tiwari and Sanjay Kumar
Krishi Vigyan Kendra, Gumla, Vikas Bharti Bishunpur, Jharkhand

Agro-ecology and Farming Situation

Gumla district is a tribal district and geographical area of the district is 531393.13 ha, which is 6.67% of the total area of Jharkhand. The topography of the district is undulating and rugged geographically. The district is predominant by tribal population and about 29% area is under forest. Total rainfall during the period is 1100 mm and rainfall during monsoon is 900 mm.

The tribal farmers mainly depend on rainfed agriculture and forest based minor produce for their livelihood. Lac farming is an important source of income to the marginal, small and large farm family having very low investment and labour cost. Lac host plant is naturally available in the district. The analysis of primary data of lac growing farmers, yield is very low in growing blocks Kamdara, Sisai, Palkot, Bishunpur, Raidih and Jari. In each block, data were collected randomly from 5 farmers and identified their major problems like insufficient and quality brood lac, lack of knowledge about lac cultivation, lack of storage facility, lack of market and minimum support price (MSP) and insect death due to climate vulnerabilities. The loss due to pest is ranging from 30 to 40% annually.

Technological Intervention and KVK Support

On farm trial was conducted among 20 lac growers to overcome the pest problem in village Garha of Kamdara block. Treatment schedule was made and accordingly host plant (Ber) was treated with Carbendazim @ 0.5 gm/lit 7 days before inoculation of brood lac and three spray at 30, 60 and 90 days after inoculation. After treatment, it was observed that the incidence of disease caused by *Pythium* and *Aspergillus* sp. was completely eradicated and good quality of lac yield was safely harvested.

Particulars	Yield of lac (kg/ha/100 ber plants)
Untrained lac growers/Traditional lac growers	410
Trained growers	678-700

Benefits

With the scientific method of lac cultivation, the farmer's earning from lac has been increased tremendously. About 220 farmers are motivated for scientific lac cultivation and net income is increased from Rs. 61,400/- (by traditional method) to 1,29,900/- (by scientific method) per annum per hectare. Social parameters like living status, housing and communication facilities like bike and mobiles have been improved.

Economic and Social Impact

Impact Factor	Before Adoption	After Adoption
Farmer Yield (kg/ha/100 ber plant)	410	Lac- 400 Brood lac- 278
Yield of Product	Lac	Brood lac and Lac
Fixed Cost (Rs./ha)	10,000	10,000
Recurring Cost (Rs./ha)	31,000	41,500
Gross Income (Rs./ha)	92,400	88,000 (by lac)
		83,400 (by brood lac)
		Total 1,71,400
Net Profit (Rs./ha)	61,400	1,29,900
BC Ratio	2.98	4.07
Marketing	Local market	Brood lac local farmers and Lac through LAMPS
Dissemination of knowledge in the locality	-	60- 65%
Knowledge gain based on 1- 5 scale*	2	4
Feeling of economic security based on 1- 5 scale*	2	5
Ability to understand and solve problems based on 1- 5 scale*	2	4
Self image in community based on 1- 5 scale*	3	5
Self confidence based on 1- 5 scale*	3	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Adoption, Spread, Up Scaling of Technology and Future Projection

Scientific lac cultivation by pest management has been adopted by more than 220 farmers of Kamdara block. Pest management technology (scientific lac cultivation) is being spread by FLDs, Field days, Kisan gosthi, Advisory services and Training. The income of tribal farmers is on the way of double income.

Bee Keeping and Income Generation

Shobha Rani and Wajid Hasan
Krishi Vigyan Kendra, Seed Multiplication Farm, Mussi, Makhdumpur, Jahanabad, Bihar

Agro-ecology and Farming Situation

Sri.Vinay Kumar is a small farmer of Mananpur village, Block- Modanganj of Jehanabad disrict. Mananpur village, Block- Modanganj of Jehanabad disrict is having rice-wheat cropping system under rainfed situation. Sri.Vinay Kumar is having 1 acre of land and 2 cows. He was facing financial scarceness with small piece of land due to bigger family size.

Technological Intervention and KVK Support

Sri Vinay Kumar is a hard working man showing keen interest in bee keeping for income generation. He received training on sustainable bee keeping from KVK Jehanabad and started bee keeping as small enterprise from 2013 initially with 20 bee boxes. In the starting phase, his bee boxes were affected by plume moth, mite, lizards and yellow wasp. Gradually, by taking technical advice from KVK Jehanabad, Sri. Vinay Kumar took action against these problems to protect his bees. Some bee boxes were affected with swarming and absconding, he collected those bees from trees and again introduced in bee boxes. In 2015-16, he extracted 200 kg honey and sold it in local market @ Rs. 250/ kg. The total income from bee keeping was 50,000 during 2015-16. Then, he has has increased his bee boxes from 20 to 30 in his apiary.

Economic and Social Impact

Impact Factor	Before Adoption	After Adoption
Farmer Practice	Crop production and dairying	Bee keeping along with crop production and dairying
Yield of Product		
Fixed Cost	-	-
Recurring Cost (Rs./year)	70,000	85,000
Gross Income (Rs./year)	2,00,000	3,15,000
Net Profit (Rs./year)	1,30,000	2,30,000
B:C Ratio	2.85	3.70
Marketing		Local Market
Dissemination of knowledge in the locality		
Knowledge gain based on 1- 5 scale*	1	4
Feeling of economic security based on 1- 5 scale*	1	3
Ability to understand and solve problems based on 1- 5 scale*	1	3
Self image in community based on 1- 5 scale*	2	4
Self confidence based on 1- 5 scale*	2	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

After adopting bee keeping, the annual net income of Sri. Vinay Kumar has been increased from Rs. 1,30,000/- to Rs. 2,30,000/-. He is now happy and running his family well.

Adoption, Spread, Up Scaling of Technology and Future Projection

Sri. Vinay Kumar regularly shares his knowledge and experience with other farmers.

Honey Production and Marketing through FPO: A Success in Ranchi

Ajeet Kumar Singh and Anjali Chandra
Divyayan KVK, Ramakrishna Mission Ashrama, Morabadi, Ranchi, Jharkhand

Agro-ecology and Farming Situation

Agro ecological condition of Ranchi district is quite different from plain areas. It is a part of Hazaribagh and Ranchi plateau region. It is primarily having rainfed agriculture and crop production largely depends on monsoon. More than 60 percent population is rural based. About 82 percent of households have holdings less than two hectares with the average holding size being 1.18 ha. Ranchi is one of the richest district in term of natural resources particularly abundance of forest and flora. Besides the availability of different species of trees and plants in this area, niger, an important oil seed crop, is cultivated in a larger area in the tribal belt and thus niger is a huge source of pollen and nectar for bees. Farmers are already engaged in bee keeping. However, such practice is in unscientific and indigenous method. Due to the lack of scientific know how and skill, farmers fail to exploit the huge potentiality that exists in the area. This is a wonderful source of subsidiary income and complementary to the crop production as well.

Technological Intervention and KVK Support

Divyayan KVK, Ramakrishna Mission Ashrama, Ranchi trained the tribal farmers of Ranchi and surrounding districts in the field of apiary or honey bee rearing as one of the most suitable livelihood activity. Popularization of keeping Italian bee after refinement of technology by increasing number of combs from 3 to 5 per frame has motivated the tribal farmers to take up bee keeping as successful enterprise in the district as well as in state. After several years of KVK efforts in this area a fair number of bee-keepers have been developed as small entrepreneur. Initially, they started marketing of their product through KVK sale counter. Gradually, the bee-keepers produced so much of product that it was not possible for the KVK to market their product. Then, it was the need for organizing the bee-keepers of the district under farmer's producer organization (FPO). Progressive bee keepers came forward first. Thus, Farmer's Producer Organization (FPO) of honey producers, named "Vivekanand Madhu Utpadak Swawlambi Sahakari Samiti Limited", Ranchi has been formed for the first time in the State. Under guidance of KVK, FPO was linked with NABARD for financial support. Now, the bee keepers are used to sell their products to FPO and get guaranteed income without any hustle. Even after formation of FPO, KVK is providing technical support and guidance for successful venture of FPO.

Economic and Social Impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	Conventional	Bee-keeping with organized marketing
Yield of Product	Individual sale	12 tons honey marketed through FPO till date
Recurring Cost	Individual level	4 lakhs per cycle
Gross Income (Approx.)	Individual level	3 to 4 lakhs per cycle
Net Profit	Individual level	2.25 lakhs per cycle
Marketing	Individual level	Organized marketing brand as "Jharkhand Madhu"
Dissemination of knowledge in the locality		About 4000 farmers are aware about bee-keeping technologies and about functioning of FPO
Knowledge gain based on 1- 5 scale*	2	4
Feeling of economic security based on 1- 5 scale*	2	4
Ability to understand and solve problems based on 1- 5 scale*	1	5
Self image in community based on 1- 5 scale*	1	5
Self confidence based on 1- 5 scale*	2	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Bee keeping becomes very popular as successful enterprise in the District as well as in the State. After KVK intervention, large scale adoption of technology led to formation of Farmer's Producer Organization (FPO) of honey producers, named "Vivekanand Madhu Utpadak Swawlambi Sahakari Samiti Limited", Ranchi for the first time in the State. Currently Vivekanand Madhu Utpadak Swawlambi Sahakari Samiti Limited, Ranchi has 380 farmers from Ranchi district. The FPO covers 86 clusters for honey growing farmers. FPO members collects Karnaj, litchi, Surguja, Mustard, Vantulsi, Mangrosa, Ber, Multiflora favour of honey. FPO has currently 1.55 lakh of equity shares. The FPO has 11 board of directors registered under Cooperative society act of Jharkhand and FPO has hired one professional Chief Executive Officer to run their organisation from outside market. FPO deals in purchase of raw honey, channelization of apiary related accessories to their members whatever they required on affordable price. Capacity building in the field of apiary business i.e. advance honeybee rearing technology, market their products etc. The patronage system and dividends are the system of benefits sharing among the members farmers. Vivekanand Madhu Utpadak Swawlambi Sahakari Samiti Limited, Ranchi sold their products under the brand name of JHARKHAND MADHU in the pack of 1 kg, 500 grams, 250 grams with FSSAI license. Formation of FPO resulted in boosting farmer's income up to 30 percent.

Adoption, Spread, Up Scaling of Technology and Future Projection

The practice of bee keeping is widespread in Jharkhand. As forest trees like Karanj, Eucalyptus etc. are present in plenty in this area. Farmers are now motivated for mango and litchi plantation. Mustard is also being grown in large area after intervention of KVK through FLD and OFT programmes. Besides the ex-trainees, other farmers of the nearby villages have started bee keeping as an enterprise. Sri Sahabir Mahto of village Khakra P.O. Baraudi of Burmu block is one such young man having 3.75 acres of land. He is a good farmer in his locality. By seeing the achievements of fellow villagers who got trained from Divyayan KVK, Sri Sahabir Mahto became inspired to undergo training at Divyayan KVK. Thereafter, he took training and subsequently started bee keeping along with crop husbandry. Initially he started with 2 Italian Bee colonies assisted by Divyayan KVK under CAPART Project. At present, he possesses 85 bee colonies. He sells 40 colonies @ Rs. 1500/- each i.e. Rs. 60,000/- yearly and earns Rs. 1.25 to 1.50 lakhs from the sale of honey.

The number of bee boxes sold by the KVK so far is 2178, colony distributed 1317 and quantity of honey sold 1546.88 quintals. Presence of resource for bee keeping and continuous efforts of KVK by it's long duration training programmes and holding of farmers bee-keeping work flourished in the area and is adopted by more than 4000 farmers, who are rearing about 6000 colonies and about 500 tons of honey is being produced in the district every year. Some of our best farmers are earning more than Rs. 10.0 to 15.0 lakhs per year through bee keeping. It is the main income generation activity of this area.

Mushroom Production: A Way to Change Livelihood

Kalpana Sinha and Sayed Abid Imam
Krishi Vigyan Kendra, Sarvodya Ashram, PO Sokhodeora, Distt. Nawadah, Bihar

Agro-ecology and Farming Situation

Nawada district comes under South Bihar Alluvial plain zone- III. This district is drought prone and the agriculture is mainly rainfed. Soil of the district is sandy, sandy loam, clay and clay-loam. The soil is deficient in micro nutrients like boron, zinc and iron. Eighty to eighty-five percent farmers of the district are small and marginal. Although average rainfall of the district is 1037 mm, dry spell during kharif season is evident since last 10 years. The farmers of the area mostly cultivate cereals, pulses and oilseeds, though their earning remains between Rs. 55,000 to Rs. 65,000 per annum by which it is quite difficult for them to get sustainability in production. To move towards sustainability, holistic approach in adopting various agricultural technologies is very essential.

Technological intervention and KVK support

Sri Manoj Kumar of Derma village is an educated farmer. In year 2007, he completed B.Sc. (Hons.). His father was having hundred bigha land, but according to him, farming of paddy, wheat and pulses by traditional method was costing more. Besides farming, he was producing mushroom at lesser extent and found that it was not so beneficial. The income was insufficient to meet his expenses. Then, he came in contact with the scientist of Krishi Vigyan Kendra, Nawada and enquired about scientific agriculture and allied activities to raise income. He was suggested to start scientific production of mushroom along with production of spawn and making of compost for button mushroom, and production of organic manure from bio-degradable waste of mushroom to increase his income. The idea suggested appealed him. During 2010, he decided to cultivate mushroom as an enterprise with the technical guidance of KVK. But, in the beginning, he faced lots of problems in selling the mushroom as people of the district were not aware about the mushroom due to poor marketing linkage. Sri Manoj Kumar explored the market and the farmers of Lucknow and Delhi who were producing mushroom in an organized market. In his mushroom unit, he produced oyster mushroom, button and milky mushroom. He established a spawn unit to produce and sell spawn in the district and the adjacent areas. Today, it is quite different situation! He is now earning approx. Rs. 80,000-Rs. 90,000/- per month.

Socio-economic impact

Impact factor	Before Adoption	After Adoption
Farmers' Practice	Mushroom Production (Oyster mushroom)	Mushroom production button, milky and oyster mushroom
Yield of product (kg)	1650	15000
Fixed cost (Rs.)	50,000	1,56,170
Recurring cost (Rs.)	19,520	5,63,076
Gross income (Rs.)	1,32,000	15,00,000
Net profit (Rs.)	62,480	7,80,754
BC ratio	1.89	2.08
Marketing	Local market	Nearby local market, Lucknow and Delhi
Dissemination of knowledge in the locality	-	100
Knowledge gain based on 1- 5 scale*	1	4
Feeling of economic security based on 1- 5 scale*	1	4
Ability to understand and solve problems based on 1- 5 scale*	2	4
Self image in community based on 1- 5 scale*	2	4
Self confidence based on 1- 5 scale*	2	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

By adopting the scientific production of mushroom of oyster, button and milky mushroom, the annual production of mushroom is 15000 kg and the annual income of Sri Manoj Kumar has raised to Rs.15,00,000/- by selling mushroom and spawn within the district and outside of state. He also sells dry mushroom to Lucknow. Sri Manoj Kumar has increased his annual net income from Rs. 62,480/- to Rs. 7,80,000/-. He is now popular among the mushroom grower in Nawada and adjacent districts. He is also providing training to the rural unemployed youths and encouraging them to engage in mushroom production.

Adoption, spread, up scaling of technology and future projection

Sri Manoj Kumar has become a role model to the mushroom growers of the area. Number of mushroom production units in Nawada district is increasing day by day. More than 250 units of mushroom production (oyster, milky and button) are running in the district. People of the area are now purchasing and using mushroom in their diet and fulfilling their nutritional security. A farmer- producer group of mushroom grower has also been started.

Mushroom Cultivation As A Source of Livelihood Income, Creating Employment and Checking Migration

Sanjay Kumar and Nisha Tiwari
Krishi Vigyan Kendra, Vikas Bharati, Bishunpur, Distt. Gumla, Jharkhand

Agro-ecology andfarmingsituation

In Gumla district of Jharkhand, farmers are having small and marginal land holdings and cultivating kharif crops only. Very few farmers are growing rabi crops due to poor irrigation facility. As the area is dominated by mono-cropping system in general, seasonal migration of farm women is a big problem in this area. To create employment and check migration, an intervention on mushroom cultivation is being promoted.

Technological intervention and KVK support

Sri Amarjeet Kujur is a young graduate farmer living in Helta village of Bishunpur block. After completion of graduation, he was in search of job and one day he came to KVK for skill training information. He was quite interested in doing training. In 2016- 17, he took admission in ASCI skill training of 200 h on mushroom production. All necessary aspects of mushroom production enterprise like compost preparation, mushroom cultivation, spawning, favourable condition, marketing strategies etc. were taught in the training. He thought that mushroom cultivation was an additional source of income. So, he started mushroom production very soon.

Socio-economic impact

Impact factor	Before Adoption	After Adoption
Farmers' Practice	Selling mushroom grown in forest in rainy season + growing paddy	Cultivating oyster mushroom + Paddy + Compost
Yield of Product	10- 20 kg mushroom	5- 6 quintal mushroom
Fixed Cost (Rs.)	-	5,000
Recurring Cost (Rs.)	-	25,000
Gross Income (Rs.)	-	65,000
Net Profit (Rs.)	-	40,000
BC Ratio	-	2.6
Marketing	Sale in local market of Bishunpur	Extends its sale from Bishunpur to Ghaghra, Gumla and SHGs producing mushroom pickle
Dissemination of knowledge in the locality	lack of knowledge	Dissemination this technology in his village among 25 farmers and in Gumla also
Knowledge gain based on 1- 5 scale*	1	3
Feeling of economic security based on 1- 5 scale*	2	4
Ability to understand and solve problems based on 1- 5 scale*	2	4
Self image in community based on 1- 5 scale*	2	4
Self confidence based on 1- 5 scale*	2	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Sri Amarjeet Kujur has now become a model among youths of his village. Achieving his goal in establishing mushroom enterprise, he is quite satisfied with low-cost input and is getting good income. Around 125 farmers of the nearby localities were motivated from Sri Kujur to practice this lucrative venture for earning handsome money with least investment.

Adoption, spread, upscaling of technology and future projection

Now-a-days, Sri Kujur has spreaded this technology among many youths and has linked with KVK, Gumla for mushroom cultivation training. Farmers have already started producing not only oyster variety of mushroom, but also button mushroom, milky white mushroom and maintaining the cycle of production throughout the year.

Adoption of Mushroom Cultivation As A New Enterprise

Chanchila Kumari, Sudhanshu Shekhar, Manish Kumar, Binit Kumar and Rupesh Ranjan
Krishi Vigyan Kendra, Jainagar, Distt. Koderma, Jharkhand

Agro-ecology and Farming Situation

The most important background for mushroom cultivation is to transform low valuable agricultural waste into high level of edible protein, providing work to farm women and rural youth aiming at the promotion of contingent like crop on uncultivable land. The technology is suitable for landless farmers especially farmwomen. However, no one was aware about the package of practices for mushroom cultivation and how much income they could generate by such mushroom cultivation. Thus, KVK Scientists organized one day Kisan Gosthi to sensitize and provide mushroom cultivation related information to the farmers. Initially, the farmers did not show interest in mushroom cultivation due to lack of knowledge, unavailability of market, lack of skill manpower and management. With the passage of time, farmers have shown their interest in mushroom cultivation and adopted it as an enterprise.

Technological intervention and KVK support

KVK Scientists imparted training and demonstrated the technology in the adopted villages. Farmers observed that the mushroom could grow in the paddy straw after cut into the small pieces and sterilized with hot water. KVK Koderma provided the spawn of mushroom to the farmers from KVK Hazaribag and the farmers started mushroom cultivation. At present, 56 farmers and farm women have started mushroom production and they are managing marketing in the nearby locality. Farmers are now profiting Rs. 158/- from a single bag having 1750 gm mushroom.

Socio-economic impact

Impact factor	Before Adoption	After Adoption
Farmers' Practice	No	Yes
Yield of Product (gm)	-	1750
Fixed Cost (Rs./bag)	-	45
Recurring Cost (Rs./bag)	-	40
Gross Income (Rs./bag)	-	243
Net Profit	-	158
BC Ratio	-	2.85
Marketing	Nil	Local market
Dissemination of knowledge in the locality	Nil	Yes
Knowledge gain based on 1- 5 scale*	1	3
Feeling of economic security based on 1- 5 scale*	1	4
Ability to understand and solve problems based on 1- 5 scale*	1	4
Self image in community based on 1- 5 scale	1	3
Self confidence based on 1- 5 scale*	1	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Mushroom production technology has opened a new opportunity to the poor and marginal farmers for getting extra benefits besides their main agricultural practices in Koderma district. The income in comparison to the cost of cultivation is significantly higher indicating uplifting of the livelihood. The input cost of cultivation is comparatively found lower than the cultivation of main crop. The other objective is fulfiled to use the spent compost (substrate) of mushroom by the farmers in their field. Thus, proper management of agricultural by product is successfully achieved. So, the application of inorganic chemicals i.e. urea, DAP, MOP, SSP are reduced. Moreover, the soil health has also been improved.

Adoption, Spread and Up Scaling of Technology

After demonstration of mushroom production technology in adopted village of Koderma district, farmers gradually showed interest in cultivation of other varieties of mushroom like white button mushroom and milky mushroom under suitable climatic conditions. Around 56 potential rural youth, farm women and farmers have adopted mushroom production in nearby villages. To make it popular among more farmers, several Kisan Gosthi and training are being organized by the KVK Scientists in the different villages of Koderma district.

Value Addition of Fruits and Vegetables: A Way Forward for Achieving Prosperity

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Krishi Vigyan Kendra, PO. Saraya, Distt. Muzaffarpur, Bihar

Agro-ecology and Farming Situation

The district Muzaffarpur comes under Indo Gangetic plain and Rice-Wheat cropping system is followed by several farmers of Muzaffarpur district. This Zone is located in the North of the state between $25^0$54" to $26^0$23" N latitude and $84^0$55" to $85^0$45" E longitude. Total geographical area of the district is 3.176 lakh ha and total cultivable area 2.477 lakh ha. Muzaffarpur district is well suited for the production of fruit specially litchi, mango, amla, karaunda etc. The land of the district is also very suitable for vegetable production and farmers introduced one new vegetable crop that is elephant foot yam from last 10 years. But, the main problem arises during glut of their production in main season due to perishable nature of fruits and vegetables. During surplus production, the market price goes down. As there is no storage facility for these locally grown produces, so either their produces are spoiled or they are compelled to sell at minimum rate. To overcome this problem, value addition of fruit and vegetable especially pickle making could provide maximum income to the farmers and the problem of storage or spoilage would be minimized.

Technological Intervention and KVK Support

Value addition is mainly addition of value to the product, which may be in form of preservation or other processing method. Here, preservation of fruit and vegetable is used for value addition. Different preserved products prepared from fruit are fruit juice, nector, RTS, squash, preserve, toffees, pickle chutney, canned fruit, fruit powder, fruit concentrate, jelly, jam, cheese, candy, syrup, dried shreds, etc. Here pickle is selected because it is very popular item in the menu of Indians. Though each and every family knows the main technique of pickle preparation, there is no extra time to prepare pickle at home due to economic and social advancement. So, people depend on market and prefer to purchase pickle of local taste and flavor.

Mrs. Rajkumari Devi had 2 acre of land own and 2 acre of land on lease. However, her family was getting very less income from farming and thus the income was not sufficient to fulfill the basic need of her family. As the raw material of pickle was easily available in the surrounding local markets at low price during glut of season, she decided to start pickle making after taking technical guidance of KVK. Thus, the gross production cost was very low. Mrs. Rajkumari Devi formed Self- Help Group (SHG) involving local ladies for the engagement in this business. So, there was no labor problem. There was drastic improvement in income as market linkage developed. Mrs. Rajkumari Devi displayed her products in local, regional, national and international mela for marketing and gradually the products became very popular among the consumers.

Economic and Socio-Psycho Impact

Name of raw product-Mango	Name of value added product	Mango pickle			
	Additional Ingredients in pickle/kg raw product	Name of ingredient	Quantity	Cost/kg	Total cost
		Mango	1kg	20.00	20.00
		Salt	150gm	10.00	0.15
		Spices as fenugreek seed, turmeric,kalongee, chilli powder, saunf	90gm	100.00	9.00
		Aesofoetida& cloves	5gm	1000.00	5.00
		Mustard oil	350ml	100.00	35.00
		Glacial acetic acid	5ml	500.00	2.50
	Per kg cost of ingredients	Rs. 71.65			
	Cost for 10 kg raw product	Rs. 716.50			
	Labour cost/day	Rs. 300.00			
	Packing cost in ½ kg bottle	Rs. 150.00 (30 bottles@ Rs.5/-)			
	Total cost/ 10 kg of raw product	Rs. 1167.00			
	Total quantity of finished product/kg raw product	1.5 kg after drying loss			
	Total quantity of finished product/10kg raw product	15.00 kg			
	Cost of preparing /kg pickle	Rs. 78.00			
	Selling price	Rs. 160.00			
	Net income	Rs. 82.00			

Name of raw product-Cauliflower, carrot, beet, turnip and pea	Name of value added product	Mix vegetable pickle			
	Additional Ingredients in pickle/kg raw product	Name of ingredient	Quantity	Cost/kg	Total cost
		Cauliflower, carrot, beet, turnip and pea	1kg	08.00	08.00
		Salt	100gm	10.00	0.10
		Spices as mustard, fenugreek seed, saunf, turmeric, chilli powder, pepper, cumin	100gm	200.00	20.00
		cloves	2gm	1000.00	2.00
		Mustard oil	450ml	100.00	45.00
		Glacial acetic acid	8ml	500.00	4.50
	Cost of ingredients	Rs. 79.60			
	Cost for 10 kg raw product	Rs. 796.00			
	Labour cost/day	Rs. 300.00			
	Packing cost in ½ kg bottle	Rs. 150.00 (30 bottles@Rs.5/-)			
	Total cost/10kg of raw product	Rs. 1246.00			
	Total quantity of finished product/kg raw product	1.5 kg after drying loss.			
	Total quantity of finished product/10kg raw product	15.00 kg			
	Total cost of preparing /kg pickle	Rs. 83.00			
	Selling price	Rs. 160.00			
	Net income	Rs. 77.00			
Name of raw product-Amla	Name of value added product	Dried Amla Pachak			
	Additional Ingredients in Amlapachak/kg raw product	Name of ingredient	Quantity	Cost/kg	Total cost
		Amla	1kg	08.00	08.00
		Salt	40gm	10.00	0.04
	Cost of ingredients	8.04			
	Packing cost	Rs. 0.06			
	Cost for 10 kg raw product	Rs. 81.00			
	Labour cost/half day	Rs. 150.00			
	Total cost/10kg of raw product	Rs. 231.00			
	Total quantity of finished product/kg raw product	100 gm			
	Total quantity of finished product/10kg raw product	1.0 kg			
	Total cost of preparing /kg Amlapachak	Rs. 231.00			
	Selling price	Rs. 500.00			
	Net income	Rs. 269.00			

Impact factor	Before Adoption	After Adoption
Farmer Practice	Cultivation of fruit and vegetable as mango, litchi, elephant foot yam and other local vegetable.	Started to prepare pickle from own cultivated fruits, vegetables and collected fruits, vegetables from local market.
Area	2 acre	4 acre (2 acre on lease)
Yield of Product	225 q vegetable and 23 q fruits	73 q pickle of different fruits as mango, litchi, jackfruit, lemon, amla, karaunda, amra, elephant foot yam, red chilli, etc. In adition 495 q raw vegetable and 73 q fruits were also cultivated from their land.
Gross cost	Rs. 75,000.00	Rs. 150000.00
Gross Income	Rs. 2,75,000.00 from vegetable and 46,000 from fruits. Total income = Rs. 3,21,000.00	Rs. 6,41,000.00 from raw fruits and vegetable sell. In addition Rs. 2,40,000.00 from pickle. Total income = Rs. 8,81,000.00
Net Profit	Rs. 2,46,000.00	Rs. 7,31,000.00
BC Ratio	3.28	4.87
Marketing	Selling in local market	Seling of fruits and vegetable in local market. Selling of pickle in different local, regional, national, international mela. As well as online seling at vlebazar.csc.gov.in.
Dissemination of knowledge in the locality	Farmers are adopted to grow fruits and vegetable through seeing by doing only.	Display of product at krishimela, udhyogmela, sarasmela, yantrikaranmela, kisanmela. Lecture and live telecast at Doordarsan, patna, Doordarsan, Gujrat, Doordarsan, Dehradun and Doordarsan, Chandigadh.

Benefits

Now, Smt. Rajkumari Devi is economically very sound. The net income through different type of pickle from mango, litchi, aonla, karaunda, elephant foot yam / jimeekand / ol, jack fruit, red chilly, mushroom, bittergourd and aonlapachak, mix pickle was Rs. 1,59,000.00 in 2014. She has been recognized as Kishan Chachi or Achar Chachi. In this context, she got first, second and first prize in the year 2011, 2012 and 2014, respectively in Kisan Mela organized by RAU, Pusa, Samastipur. Mrs. Rajkumari Devi is now brand ambassador of Bihar to propagate entrepreneurship through pickle making business among women.

Adoption, Spread and Up Scaling of Technology

Smt. Rajkumari Devi is now master trainer at Krishi Vigyan Kendra and resource person in training programme organized by NGOs. She has spreaded the business through the formation of 30 SHGs where she used to provide training related to value addition. She also expanded her business by the name of Anandpur Jyoti SHG. She also shared her experience related to pickle making at different Governmental and Non- Governmental programme so that women can be motivated to earn through value adition. She has started to trade her products online through vlebazar.css.gov.in

Banana Fibre Extraction: An Innovative Enterprise for Income Generation

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Krishi Vigyan Kendra, Hariharpur, Rajauli Hajipur Farm, Distt. Vaishali, Bihar

Agro-ecology and farming situation

Banana cultivation is a major source of income of farmers of Vaishali district. Vaishali is famous for variety of banana like Malbhog, Chinia, Kothia, Alpan etc. Banana cultivation is more popular among farmers due to more return on investment, but there is a problem of disposal of banana stem after harvesting of fruit. Generally farmers offer stem to animals as a feed, but still there is problem for disposal of stem. Stem is waste to the farmer and no income from stem.

Technological intervention and KVK support

Banana is one of the important cash crops of Vaishali district and there is nobody who was interested for its value added product such as marketing of Banana fibre. Shri Nitiesh Kumar aged 23 years, a graduate youth coming from village Kamalpur Singhy, Block-Bidupur cantacted KVK scientists to know about banana fibre production and its utiliazation. After interaction with KVK scientists, Shri Nitiesh Kumar became motivated and he made his mind very clear for production and processing of the banana fibre at his village. Then, he took the training on banana fibre extraction using machine at KVK, Vaishali in the year 2011. Thereafter, he convinced other villagers of his village and formed a group of 25 farmers who were interested in banana fibre production. Thus, all the members of this group were trained at KVK, Vaishali. With the technical supports of KVK, Vaishali, Shri Nitiesh Kumar along with other farmers purchased two machines for the extraction of banana fibre and making various handicrafts.

Socio-economic impact

Impact factor	Before Adoption	After Adoption
Farmer Practice	No commercial use of Banana stem	commercial use of Banana stem
Yield of Product	-	Handicrafts, fibre
Fixed Cost (Rs.)	-	80,000
Recurring Cost (Rs.)	-	60,000
Gross Income (Rs.)	-	3,81,000
Net Profit (Rs.)	-	2,41,000
BC Ratio	-	2.72
Marketing Dissemination of knowledge in the locality	- -	Local as well as Patna Producing in group for marketing
Knowledge gain based on 1- 5 scale*	1	4
Feeling of economic security based on 1- 5 scale*	1	4
Ability to understand and solve problems based on 1- 5 scale*	1	4
Self image in community based on 1- 5 scale*	1	4
Self confidence based on 1- 5 scal	1	5

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Shri Nitiesh Kumar alone is earning more than Rs. 2.00 lakh per year from banna fibre, Rs. 20,000/- per year from handicraft product of banana SAP and Rs. 17,500/- per year from the wastage of the produce by vermi compost. Shri Nitiesh Kumar has made an example of banana fibre processing and utilization in Vaishali district. He is supplying his banana fibre to different textiles and paper industry.

Banana fibre extraction technique has enormous scope for employment and resource generation for unemployed rural youth. It can give lot of employment for farm women for making handicraft items like Ganeshjee, hand purse, tea caster etc.The product made from banana fibre is economical, environmentally safe and biodegradable. So, there is no harm on ecosystem of the nature.

Adoption, Spread and Up Scaling of Technology

Banana fibre extraction technique can give a boost for rural economy. From the waste farmer can make money and variable product in the form of fibre, paper, clothes etc. can be made. This technique can provide social as well as economical security to lesser privileged people of society.

Off- Farm Activity: A Path of Economic Empowerment for Rural Women

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Agro-ecology and farming situation

In the district of Nawada, the rainfed plain area is approx. 40%. Rainfed hilly and forest land is 25% and waste land and unused land is approximately 35%. This is drought prone district and mostly the farmer is small, marginal and landsless. The problem has become worst as land holding size is continuously shrinking. The profit in agriculture is going down day by day. In the same time, unemployment is the major problem of the district and most of the youth are migrating to the cities or other states for earning. The women in the family are facing lot of problems to meet their expenses in time.

Technological intervention and KVK support

Recent approaches to reduce rural poverty among small farm households include increasing opportunities for off-farm work alongside ongoing efforts to improve the agricultural activities and market access. For rural households living at subsistent levels, off-farm work helps to augment farm income, minimize risk and enhance returns. Given the importance of off-farm enterprise for combating poverty, the rural off-farm activities for rural women includes tailoring and stitching handicrafts, making pickles and chutney and other enterprise which require less amount of fund to establish those enterprises. Krisi Vigyan Kendra (KVK), Nawada is making constant efforts to develop skill among rural youth for income generation activities.

Mrs. Seema Kumari and her husband were unemployed educated youth. They have no money to meet the expenses of their family. Mrs. Seema Kumari was depended on her father in law for even small expense. She was unable to provide better education to her children due to scarcity of money. One day in year 2013, she came to KVK, Nawada and explained her difficulties related to economic scarcity. She was intrested to get employment oriented training like tailoring and stiching to generate income for meeting the requirments. She joined in the training programe of KVK and sucessfully completed the training in tailoring and stiching in the year 2013. In the year 2014, she started stiching cloths at her village. Mrs. Seema Kumari started to earn approx. Rs. 35000/- per annum. After few months, she again joined the training programme of KVK to prepare phenyl, surf and blue whitening (blue/ujala) and mushroom production. Therafter, she started to earn money by the preparation of phenyl, surf etc. Now, she is generating income from tailoring, stiching, phenyl, surf and whitening (blue/ujala) and mushroom. Her husband is also supporting her in all the activities.

Socio-economic impact

Impact factor	Before Adoption	After Adoption
Farmer practice	-	Off-farm activities for income generation
Yield of product	-	-
Fixed cost (Rs.)	-	26,875
Recurring cost (Rs.)	-	3,500
Gross income (Rs.)	-	1,05,250
Net profit (Rs.)	-	74,875
BC ratio	-	3.46
Marketing	-	In local market
Dissemination of knowledge in the locality	-	20
Knowledge gain based on 1- 5 scale*	1	3
Feeling of economic security based on 1- 5 scale*	1	2
Ability to understand and solve problems based on 1- 5 scale*	1	2
Self image in community based on 1- 5 scale*	1	2
Self confidence based on 1- 5 scale*	1	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Mrs. Seema Kumari has shown the path of success to other women of the same village and nearby villages through her hard labour. Now, she has become a role model to other woman of the area and 5-10 women go to her house to get training in cutting, stiching and preparation of phenyl, surf and whitening (blue / ujala).

Adoption, Spread and Up Scaling of Technology

Adoption of non-farm activities in Nawada district is high and lots of rural women are coming to KVK, Nawada centre for training. Under the training, guidance and supervision of this centre, the rural women have started different income generating activities. The rural youth who got training from this centre are running tailoring and stitching activities and approx. 120-150 youths have been involved in these off-farm activities and a dozen of women who got training are providing training to others. These rural youths and young rural women are economically supporting their families and hence their self-confidence in this business has increased a lot.

Stitching Work for Self- Help Group: A Way for Earning Income

Pragatika Mishra and Ravi Shanker
Krishi Vigyan Kendra, Godda- Pirpaiti Road (Rautara Chowk), Distt. Godda, Jharkhand

Agro-ecology and Farming Situation

Smt. Parvati Devi, a housewife, is a resident of Badauna of Godda district. Her husband is unemployed. She has 3 children. She is somewhat aware about stitching. She does the repairing and mending work of clothes. She is struggling for running the family.

Technological intervention and KVK support

Smt. Parvati Devi has made contact with Godda KVK to find out the way for improving her livelihood. Accordingly, she was suggested to attend a training programme for skill development in stitching. Smt. Parvati Devi attended a training programme on the stitching/ applique work. She also owns a sewing machine. She has started to prepare various decorative items like bags, wall hanging, letter box etc. She is preparing and selling all decorative items by using different bright coloured cotton cloths and different coloured embroidery thread, mirror, lace etc. Godda KVK is regularly providing technical support.

Socio-economic impact

Impact factor	Before Adoption	After Adoption
Farmers' Practice	Plain stitching	Applique
Yield of product	Nil	90 - 100 letter box/ wall hanging per month
Fixed cost (Rs.)		4,000 for sewing machine and other tools
Recurring cost (Rs./month)		7,500
Gross income (Rs./month)		15,000
Net profit (Rs./month)		7,500
BC ratio		2.0
Marketing		Distant
Dissemination of knowledge in the locality		Through training, by seeing
Knowledge gain based on 1- 5 scale*	1	4
Feeling of economic security based on 1- 5 scale*	1	4
Ability to understand and solve problems based on 1- 5 scale*	2	4
Self image in community based on 1- 5 scale*	2	5
Self confidence based on 1- 5 scale*	1	4

* 1- 5 scale indicates 1 = lowest and 5 = highest

Benefits

Stitching / applique work has brought a remarkable change in the life of Smt. Parvati Devi for economic empowerment. This business could uplift livelihood of poor and marginal farm families. Women could use their time very judiciously and earn money.

Adoption, spread, up scaling of technology and future projection

Smt. Parvati Devi is now role model for such applique work and business in her village. Other farm women of her village have learnt stitching from Smt. Parvati Devi. Now, a group has been formed named, 'Maa Parvati SHG', Badauna. Presently, there are 12 members in the SHG. In the same way, four such groups have been formed in other villages for appliqué works. In near future, Farmers' Producer Organization will be formed with the help of NABARD by adding more numbers of SHG.


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