Success Stories of Support Services

Agriculture Development Through Farmers Participatory Approach

Case Studies on Agriculture Support Services (ASS)

WBADMIP-2017
(West Bengal Accelerated Development of Minor Irrigation Project)
A World Bank supported project
Water Resources Investigation & Development Department
Government of West Bengal

Case Study: Mr. Paritosh Mandi

Village: Susnia Jamthole, Block: Chhatna, District: Bankura [Crop year 2015-16]

Prepared by:

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Mr. Paritosh Mandi grown cauliflower and happy for harvest

Mr. Paritosh Mandi is a 46 year old living in Susunia Jamthole village, Chhatna block, Bankura district, West Bengal. His education level is grade 10 (*Madhyamik* – secondary school certificate). He belongs to Schedule Tribe (ST) community. There are eight members in his family and among them two are adult males, three are adult females, one is minor male and two are minor females. All of them are fully depended on agricultural livelihood and become involve to work for agricultural activities at their level-best. In general they face serious difficulties to maintain household food security. He considered himself as a small farmer owned 4.05 ha and out of which 3.24 ha is cultivable and rest is homestead, gardens and cultivable waste land (tar or very highland). Only 1.21 ha is under the newly created Surface Flow Minor Irrigation Scheme (SFMIS pond 1.56 ha) by the support of the West Bengal Accelerated Development of Minor Irrigation Project (WBADMIP).

In this village, most of the farmers are resource poor ST with small operating farm landholding size. Traditional rainfed agricultural practices and lack of new crop technologies were the major limiting factors to increase farm productivity and family income. Another limiting factor was lack of water and irrigation facility during the rabi and pre-kharif seasons to grow high yielding crops. In this area, environmental changes mainly occurred due to heavy rainfall within a short period of time (make flash flood) and scanty rainfall for a long period of time (droughty condition) are found critical challenges to cultivate crops and save crops from natural calamity. The villagers accepted all types of vulnerabilities as are adversity related to agriculture development and somewhat they become frustrated to maintain

livelihood of their family members. Commonly all adults and minors family members regularly support their agricultural activities as family labour for cost saving income. Peoples in this village found that there is a very little scope of alternate employment in their locality and were waiting for opportunities during the last decade.

Traditionally farmers in this village grow only one rice crop (called *Amon* paddy) during the Kharif season (also called rainy / wet season) and land remain fallow rest of the year that used as pasture. Thus, this area known as *amon* paddy single cropped area. In general, farmers in this village did not have much opportunity of other crop cultivation during the rabi and pre-kharif seasons in addition to other income generation activities (IGAs). In most of the years, this rice crop is damaged due to drought and floods that result lower or no yield which respectively is not enough for household food security and adequate income of the household. They lived with silent famine & hunger and played a push factor role of daily, seasonal and long-term migration to work in non-farm sector. Farmers in this village were not well aware of modern technological practices for other crops cultivation to diversify agricultural practices and mitigate risk for their farm income. Therefore they were knowledge poor about modern farming and not cultivated crops during the rabi and pre-kharif seasons due to lack of irrigation facilities. This situation was prevailed for a long period until WBADMIP constructed new irrigation facility, make available modern cropping technologies and provided technical support to the farmers.

Transforming agricultural landuse from single / mono culture rainfed crop to double and multiple irrigated cropping patterns for value added agriculture and rural employment appreciating by the farm households.

The command area is about 20 ha of SFMIS created by WBADMIP in Susunia Jamthole village. A Water User Association (WUA) has been formed by 27 farmers to use water facility and adopt irrigated agricultural crops, horticultural crops and aquaculture practices round the year. Out of total command area, 15.5 ha (almost 78%) is cultivable area available to adopt irrigated cropping practices during the rabi (winter) and pre-kharif (pre-monsoon) seasons. Besides *amon* paddy cultivation farmers were able to grow various rabi crops and fish culture in SFMIS in the year (CY) 2015-16 and produced adequate amount of different foods which was not in practice before the ADMI Project. Fish production makes happy to their whole community. It is clearly indicates that the project have a significant positive impact on agriculture and fishery for the well-being of the people.

In the case of Mr. Paritosh, the project team found that he is an active and hard working progressive farmer in the village. The project group decided to install gravity based drip irrigation system for 1000 square meters in the field of Mr. Paritosh and promoted hybrid cauliflower cultivation during the rabi season through improve agricultural practices which increased household consumption and farm income. The project provided him trayPoly tunnel nursery, quality hybrid seed of cauliflower, trained for good agricultural practices (GAP) with package of practices (PoP) that resulted to a good harvest. Mr. Paritosh has produced 5,250 kg of

Overall farm productivity of cauliflower found very appreciative. Land productivity was 32.43 t/ha, per unit cost of production was INR 0.44 and return from investment was INR 1:2.27. Per day return was over INR 567.

cauliflower from 40 decimal of land and generated gross return INR 52,200 and net earning was INR 29,203 during the CY2015-16. It was a newly introduced crop to this area that shows off others' interest. The following table shows his package of practices (PoP) for cauliflower, cost of cultivation and value of products.

Package of Practices (PoP) for Cauliflower cultivation (40 decimal) by Mr. Paritosh Mandi			
SL.	**Package of Practices**	**Quantity / Values**	**Cost (Rs.)**
Crop establishment			
1	Seed variety	Lucky – 40 gm	1,400.00
2	Number of plants	6000	*na*
3	Labour charge for planting	2 * 120	240.00
4	Date of plantation	12/12/2015	*na*
5	Survival rate of plants	5400	*na*
Application of chemical fertilizers (kg)			
1	Urea	2.4 Kg * 12	28.80
2	12:61:0	1Kg * 160	160.00
3	$CaNO_2$	2 Kg * 100	200.00
4	0:60	2 Kg * 45	90.00
5	Mixed fertilizer NPK (19:19:19)	400 gm * 150/Kg	60.00
6	Boron	1 Kg * 325	325.00
7	Micronutrients	500 ml * 250	250.00
8	$MgSO_4$	2 Kg * 40	80.00
Application of organic fertilizers (kg)			
1	Neem Cake	100 Kg * 12.5	1,250.00
2	Mackmi	25 Kg * 57	1,425.00
3	Cow Dung	800 Kg * 2.5	2,000.00
Application of pesticides and cost			
1	Bio Control (Crop Guard)	100 ml * 400	400.00
2	Organic (Fungicide)	1 Lt * 482	482.00
Weeding and Irrigation			
1	Weeding number of times and cost	3 times * 10 Labours * 120	3,600.00
2	Number of times irrigated and cost	15 times * 100	1,500.00
Additional labour, packaging, transportation, etc.		Additional cost	9,006.00
Harvesting			
1	Number of times harvested	5 days * 100	500.00
2	Quantity harvested & market value	5250 Kg (5400 pieces)	52,200.00
3	Date & pieces of first harvest	07/03/2016	*950 (17.6%)*
4	Date & pieces of second harvest	10/03/2016	*1230 (22.8%)*
5	Date & pieces of third harvest	13/03/2016	*1580 (29.3%)*
6	Date & pieces of fourth harvest	15/03/2016	*980 (18.1%)*
7	Date & pieces of fifth & last harvest	18/03/2016	*660 (12.2%)*
8	Harvest loss quantity and value	*nil*	*nil*
Source: Mr. Paritosh Mandi, WUA member, Susunia Jamthole SFMIS Water User Association and Agri-Horti Specialist, DPMU, Bankura.			

Mr. Paritosh also cultivated other agricultural and horticultural crops during the rabi and pre-kharif seasons by the support of WBADMIP team. Being a hard working farmer he followed sincerely all necessary crop management practices that time to time suggested by the WBADMIP team. His improved knowledge and hard work gave him better return from crop cultivation and enhanced food security. Using all available opportunities, Mr. Paritosh cultivated almost a hectare (ha) land for agricultural and horticultural crops in a year covering Kharif, Rabi and Pre-kharif seasons that shows increase in cropping intensity (two to three crops in a parcel) and agricultural diversity.

Mr. Paritosh has also cultivated few other crops during the rabi and pre-kharif seasons and further added to net family income of about INR 17,813 (shown in Table below). Altogether, he has generated surplus net family income of about INR 128,467 in a year including share of fishery. He informed to the project team that there was a drought condition for amon crop during the Kharif season where he applied supplementary irrigation from the SFMIS and harvested a very good *amon* paddy (more than 3.5 t/ha) and cost of cultivation was very low. He is also a member of Fishery Farmer Interest Group (FFIG) comprised by 16 members of WUA and earned a satisfactory amount (INR 12,000) which supported by the WBADMIP. Altogether, Mr. Paritosh is now very happy, increased family consumption and distributing horticultural products and fish to his community.

Season	Name of the crop	Cultivated area (acre)	Family consumption (Kg)	Total Production (Kg)	Average Price (INR/Kg)	Cost of cultivation (INR)*	Gross Income (INR)	Net Income (INR)
Kharif	Paddy	5.00	2,920	7,200	13.60	28,469	97,920	69,451
Rabi	Cauliflower	0.40	45	5,250	9.94	22,997	52,200	29,203
	Cabbage	0.10	40	1,360	5.00	3,462	6,800	3,338
	Mustard	1.00	*Sold*	475	45.00	14,040	21,375	7,335
Pre-kharif	Cowpea	0.07	15	220	10.00	500	2,200	1,700
	Pumpkin	0.05	70	110	7.00	330	770	440
	Cucumber	0.05	15	200	9.00	350	1,800	1,450
	Ridge Gourd	0.12	15	500	8.00	450	4,000	3,550
Total of field crops		**6.67**	**3,120**	**15,315**	**NA**	**70,598**	**187,065**	**116,467**
Fish	Share out of 16	0.24	75	125	120.00	3,000	15,000	12,000
Total crops and fishery			**3,195**	**15,440**	**NA**	**73,598**	**202,065**	**128,467**

*The cost of cultivation did not include family inputs and labour and therefore net returns include cost savings income.
NA = not applicable, ha = 2.471 acre, INR = Indian rupee, Kg = Kilogram.

In fact, Mr. Paritosh along-with two others from different WUAs was introduced to Kharagpur wholesale market (about 140 km from his village) to sell their cauliflower where they learnt the selling and good price negotiation skills, etc. which is important for commercial agriculture. He sold almost 70% of his cauliflower to the Kharagpur market. Beaming with confidence, Mr. Paritosh has planned to increase more area under cultivation of various crops during the rabi and pre-kharif seasons for further enhancing his farm income. His success has provoked interest of many other fellow WUA farmers and neighbors in the villages to start vegetables cultivation. He is regularly helping them to grow more crops and increase cropping intensity that contributing to agricultural diversity, increase farm income, enhance food security and reduce poverty. It has been found that village women and children are very happy to enjoy new food crops and increasing consumption in their regular food habits which improving nutritional diet than exists at pre-project situation. The villagers also get share of new produce due to their social customs of ST community to taste and make them happy. Thus the project is making social impact and contributing to the community too.

The village farmers were typically reliant on subsistence cropping pattern and now moving towards commercial agriculture after the ADMI Project. Living with social and economic poverty was obscured due to single amon cropping in kharif (rainy/wet) season, lack of irrigation to grow crops in rabi to pre-kharif seasons and lack of access to marketing infrastructure. Finally, it can be articulated that Mr. Paritosh should be considered as a progressive farmer in this WUA farmer group and he can be a model farmer for others. There is a need to continue regular technical support from the WBADMIP to enhance the capacity of WUA members for their capacity building, technology transfer & validation, up-scaling and sustainability of the project activities. The WUA members need support for their financial inclusion to enhance agricultural, social and human development.

References:

1. Personal communication with Mr. Paritosh Mandi, WUA member, Susnia Jamthole SFMIS WUA, Chhatna, Bankura, for agricultural practices.
2. Dr. Manik Lal Bose (Consultant – The World Bank), Focus Group Discussion with WUA members, Susnia Jamthole SFMIS WUA, Chhatna, Bankura.
3. Agri-Horti Specialists, DPMU and SO staff of WBADMIP, Bankura district, project information.
4. Personal communication with Mr. Biri Singh, Consultant, Marketing expert – The World Bank, market information.

Abbreviation and Glossary:

CY	crop year
FFIG	Fishery Farmer Interest Group
GAP	good agricultural practices
Ha	hectare (2.471 acre)
IGAs	income generation activities
INR	Indian rupee
Kg	Kilogram
NA	not applicable,
PoP	package of practices
SFMIS	Surface Flow Minor Irrigation Scheme
ST	Schedule Tribe
t/ha	tonne per hectare
WBADMIP	West Bengal Accelerated Development of Minor Irrigation Project
WUA	Water User Association

Kharif season:	**Kharif crops cultivated during rainy / wet / monsoon season mostly in rainfed condition.**
Rabi season:	**Rabi crops cultivated during winter / dry season mostly in irrigated condition.**
Pre-Kharif season:	**Pre-Kharif crops cultivated during summer / pre-monsoon season mostly in rainfed and partially irrigated condition.**
***Amon* rice**	**Paddy crop grown in Kharif season.**
Technology	**Agricultural knowledge and practices includes seeds, inputs and all other package of practices (PoP)**

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From Nothing to Prosperity: A Case of Newly Introduced Green Gram to Mr. Bidhan Mandal in Bankura

Hurukbedia Kelai Mini-RLI WUA, Hurukbedia village, Chhatna block, Bankura district

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Mr. Bidhan Mandal is a 40 year old living in Hurukbedia Kelai village, Chhatna Block, Bankura District, West Bengal. His education level is grade 10 (*Madhyamik* – secondary school certificate). He belongs to Other Backward Cast (OBC) community. There are five members in his family and among them two are adult males, one is adult female, two is minor males. All of them are fully depended on agricultural livelihood and fully involved in agricultural activities. He has six cows and they are regularly giving milk, cow dung that helps to increase farm fertility and also used as draft animal to prepare land for farming. His annual average family income is about INR 56 thousands from crops, livestock and fishery sectors which is about a half US dollar per capita per day. It shows, his family belongs to ultra poor group. In general Mr. Mandal has faced serious difficulties to maintain household food security. He considered himself as a small farmer owned only 1 ha and out of which 0.90 ha is cultivated area. He took two bighas of land in lease arrangement and his all cultivable area are belongs to the command area of the irrigation scheme constructed by the West Bengal Accelerated Development of Minor Irrigation project (WBADMIP – in short ADMI Project).

In Hurukbedia Kelai village, most of the farmers are resource poor SC and OBC with small operating farmholding size. Traditional rainfed agricultural practices and lack of new crop technologies were the major limiting factors to increase farm productivity and family income. Another limiting factor was lack of water and irrigation facility during the rabi and pre-kharif seasons to grow high yielding crops. In this area, environmental changes mainly occurred due to heavy rainfall within a short period of time (make flash flood) and scanty rainfall for a long period of time (droughty condition) are found critical challenges to adopt modern agricultural technologies. They difficulties to cultivate rabi crops and to save crops from natural calamity. The villagers accepted all types of vulnerabilities as are adversity related to agriculture development and most of them face difficulties to maintain livelihood depending on their limited resources. Commonly all adults and minors family members regularly support their agricultural activities as family labour for cost saving income. Peoples in this village found that there is a very little scope of alternative employment opportunity in their locality and were waiting for opportunities during the last decade.

Traditionally farmers in this village grow only one rice crop (called *Amon* paddy) during the Kharif season (also called rainy / wet season) and land remain fallow rest of the year that used as pasture. Thus, this area known as *amon* paddy single cropped area. In general, farmers in this village did not have much opportunity to cultivate other crops during the rabi and pre-kharif seasons due to lack of irrigation facilities. In most of the years, kharif rice crop invariably damaged due to drought and flash floods that result lower or no yield. The amount of rice produced is not enough for maintaining household food security and adequate income for the household. They lived with silent famine and hunger that played a push factor role of daily, seasonal and long-term migration to work in non-farm sector. Farmers in this village were not well aware of modern technological practices to cultivate high yielding crops and to diversify agricultural practices to mitigate risk for their farm income. Therefore they were knowledge poor about modern farming and not cultivated crops during the rabi and pre-kharif seasons due to lack of water in and around their cultivable land. This situation was prevailed for a long period until the ADMI Project constructed an irrigation facility in their locality, in addition to make availability of modern cropping technologies and provided technical support to the farmers. Now, farmers are adopting a number of new technologies during the Rabi and Kharif seasons by the help of ADMI Project in Bankura district.

The command area of MINI RLI created by WBADMIP in Hurukbedia kelai village is about 40 ha. A total of 69 farmers are assigned to use water facility and adopt irrigated agriculture, horticulture and aquaculture practices round the year by forming Water User Association (WUA). Out of total command area, 37.27 ha is cultivated area that adopted irrigated cropping practice during the rabi (winter) season in crop year (CY) 2016-17 and produced an adequate amount of different foods. It clearly indicates that the project have a significant positive impact on agriculture and fishery development to improve well-being of the people.

In the case of Mr. Mandal, the project team found that he is an active and hard working farmer in the village. The ADMI Project group decided to promote Green Gram cultivation in his land during the Pre-Khariff season through improve agricultural practices which has increased household consumption and farm income. The project provided him seeds, fertilizer & Rhizobium and trained him for good agricultural practices (GAP) with standard package of practices (PoP) that resulted to a good harvest. Mr. Mandal has produced 180 kg of Green Gram from 33 decimal of land and generated gross return INR 12,600 and his net earning was INR 5,299 during the Pre-Khariff season in crop year (CY) 2016-17. It was a newly introduced crop to this area that creates interest of other farmers. Though the earning was not too much but still they prefer it because getting an additional food which was not possible before the irrigation facility. They is much better than nothing which giving them better opportunity for self-employment and to generate cost savings income. The following table shows his package of practices (PoP) for Green Gram cultivation and market value of products.

Cost and Return of Green Gram production during Pre-Kharif season, 2016-2017

SL.	Package of Practices	Quantity / Values	Cost (Rs.)
Crop establishment			
1	Seed variety	SML-666	1,200.00
2	Date of Sowing	27/02/2016	*na*
3	Land preparation (draft / power tiller)	Hour: 3* cost 360.	1,080.00
Application of chemical fertilizers (kg)			
1	10 :26:26	10 Kg	270.00
2	Rizobium	1200 gms	192.00
3	D.A.P	1 Kg	27.00
Application of organic fertilizers (kg)			
1	Cow Dung	800Kg	2,000.00
Application of pesticides, IPM and cost			
1	Organic (Fungicide)	1 Lt * 482	482.00
Weeding and Irrigation			
1	Weeding number of times and cost	1 times * 05 Labours * 150	750.00
2	Number of times irrigated and cost	02 times * 400	800.00
Harvesting		5 days * 500	500.00
Total cost of cultivation			**7,301.00**
Production (Kg) and Gross Income (INR)		**180 KgX 70**	**12,600.00**
Net Income (INR)			**5,299.00**

Source: Mr. Bidhan Mandal, member Hurukbedia Kelai Mini-RLI WUA, Hurukbedia village, Chhatna block, Bankura district, Dr.Sudip Bhui, Agri & Water management Expert, DPMU Bankura District.

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Shifting More Seedlings to Single Seedling Transplantation of Paddy Cultivation for Better Return: An Impact of SRI Method

Component: Promotion of livelihood through Improved Agricultural Practices

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SRI Method of Paddy Farming:

System of Rice Intensification (SRI) method argued to avoid more plants together and go for young single plant transplantation of paddy seedlings that reduce cost of cultivation and return higher yield than planting bunch planting in conventional method. It argued that many plants in one place and close plantation seriously confront competition of balance nutrients intake for plants' growth. This competition strongly makes impact on plants' survivability, health, reproduction capacity and thereby reduces output. It is known that plant population have different genetic characterise that strongly influence growth and yield. Some plants face initial problem after sowing or planting caused by insects or disease; some plants' roots just do not develop well due to lack of soil minerals and nutrients intake; some are just weak due to various other reasons.

According to SRI-India (http://www.sri-india.net/html/aboutsri.html), "System of Rice Intensification (SRI) emerged in the 1980's as a synthesis of locally advantageous rice production practices encountered in Madagascar by Fr Henri de Laulanie, a Jesuit Priest who had been working there since 1961. But, it is Dr. Norman Uphoff from Cornell International Institute for Food and Agriculture, Ithaca, USA, who had brought this method to the notice of outside world in the late 1990s. Today SRI is being adopted in many states in India and the response from farmers has been overwhelming seeing the benefits of the method, notwithstanding the constraints.

SRI is a combination of several practices those include changes in nursery management, time of transplanting, water and weed management. Its different way of cultivating rice crop though the fundamental practices remain more or less same like in the conventional method; it just emphasizes altering of certain agronomic practices of the conventional way of rice cultivation. All these new practices are together known as System of Rice Intensification (SRI). SRI is not a fixed package of technical specifications, but a system of production with four main components, *viz*., soil fertility management, planting method, weed control and water (irrigation) management. Several field practices have been developed around these components. Of them, the key cultural practices followed in most cases are:

- Preparing high-quality land
- Preferring compost or farmyard manure to synthetic fertilizers
- Developing nutrient-rich and un-flooded nurseries
- Using young seedlings for early transplantation
- Ensuring wider spacing between seedlings
- Transplanting the seedlings singly
- Frequent inter-cultivation with weeder
- Managing water carefully so that the plants' root zones moisten, but are not continuously submerged

Rice grown under SRI has larger root system, profuse and strong tillers with big panicles and well-filled spikelets with higher grain weight. The rice plants develop about 30 – 80 tillers and the yields

are reported to be higher. The secret behind this is that rice plants do best when young seedlings are transplanted carefully at wider spacing (seedlings should be planted at precise spacing, usually 25 X 25 cm2, about 16 plants per square meter); their roots grow larger on soil that is kept well aerated with abundant and diverse soil microorganisms."

Diffusion of SRI Technology by ADMI Project:

Farmers learned good agricultural practices (GAP) through training on SRI method from ADMI Project in Birbhum. Its vegetative growth is high and healthy that propagates more number of tillers during the pre-growth stage as it grows without much competition with other plants in a row. Currently more number of farmers from WUA and outside WUA villages is adopting this method to grow Kharif and Boro paddy for higher return compared to their conventional method. The above mentioned issues have been discussed thoroughly in successive sections.

In 2014, the farmers of Talpukur village in Rajnagar block of Birbhum district first time heard about the term SRI after collaboration with agriculture team of West Bengal Accelerated Development of Minor Irrigation Project (ADMI Project). The farmers were from Talpukur Udyog Pump Dug Well cluster-II Water Users Association (WUA). Initially it was very difficult to convince them of accepting SRI method of paddy cultivation. It was found that repeated meeting, awareness programme and motivational session were not enough to initiate the process. After several meetings, few of them came forward with a lot of enthusiasm but maintained reservation and were looking for someone to take the risk. Finally, agriculture team of District Project Management Unit (DPMU) identified a lead farmer Mr. Madan Ghosh who willingly came forward to take risk and accepted a SRI Demonstration Centre (DC) from the project and followed all instructions of DPMU staff, Birbhum.

Mr. Madan Ghosh allocated one acre land for the SRI DC after through training, frequent interaction and handholding support of DPMU staffs. Interestingly, the DC plot became an attraction of other

farmers of the villages in Rajnagar block. The farmers of the village closely observed the technological input, age of seedling, single seedling transplanting, line transplanting, fertilizer application, plant protection, irrigation system, weeding, growth of plant tillers, health of plants, panicles, rice grain and production etc., and realized the difference of their traditional method of paddy cultivation. During the cultivation period, a farmers' field day was conducted by the DPMU and invited farmers of project and adjacent villages to replicate method of SRI paddy cultivation and disseminate knowledge. The farmers from Jharkhand state also visited the DC plot and noticed the changes and benefit. It could be said that a strong will power and hard work of Mr. Ghosh make remarkable differences from traditional method to SRI method of paddy cultivation that motivated other farmers to come forward.

The Achievement Compared to Pre-Project Situation:

The ADMI Project achievement of SRI technology dissemination started from one acre DC plot of Mr. Madan Gosh and his will power through receiving regular support from the DPMU staffs, Birbhum. The crop cutting of the SRI DC shows that about 10.5 quintals of paddy produced per bigha (almost 7.9 tonne per hectare) which is 4.5 quintal higher (75% addition) compared to their traditional cultivation method. Net earning of Mr. Madan was about INR 9,200 from one bigha which is equivalent to 69,000 per hectare. It has not only increased his household food security rather he sold a sizeable amount of paddy to the market. Remarkably, after knowing this fact many farmers of the Talpukur WUA had shown interest of this method of paddy cultivation. The following table shows cost & return of one bigha land from SRI practice.

Package of Practices (PoP) for SRI Amon Paddy Cultivation in 33 decimal by Mr. Madan Ghosh			
SL.	**Package of Practices**	**Quantity / Values**	**Cost (Rs.)**
Crop establishment			
1	Seed variety	Rajendra masuri	60.00
	Seed bed preparation(1 bigha)	1 labour &F.Y.M	200.00
3	Labour charge for planting (own+hired)	3 * 150	450.00
4	Date of plantation	02/08/2016	*na*
6	Land preparation (animal or mechanical)	Hour:…01* cost 900.00	*900.00*
Application of chemical fertilizers (kg)			
1	Urea	25kg	125.00
2	10:26:26	15 kg	360.00
3	MOP	6 kg	144.00
6	Boron	100 gm	60.00
Application of organic fertilizers (kg)			
3	Cow Dung	One tractor 1 tonne	800.00
Application of pesticides, IPM and cost			
3	Plant protection and IPM method	pesticide	200.00
Weeding and Irrigation			
1	Weeding number of times and cost	1 time * 2 labour *150	300.00
2	Number of times irrigated and cost	1	200.00
Additional labour, packaging, transportation & commission cost (Field to home)		1 tractor	400.00
Harvesting			
1	Harvesting and threshing labour cost	1*9*150	1,350.00
2	Quantity harvested & market value	1050 kg @ 13.00	13,650.00
3	Paddy straw harvest & Market value	40 pon*25	1,000.00
Investment and Return			
1	Total investment	total	5,449.00
2	Gross return	total	14,650.00
3	Net return	total	9,201.00
Source: Madan Ghosh, Talpukur village, Rajnagar block, Birbhum district and DPMU, Birbhum district.			

Intensifying SRI Technology Adoption:

In 2015, the Talpukur WUA makes a resolution with the leadership of Mr. Madan that they will motivate other farmers of the WUA in their block to start practicing SRI method of paddy cultivation during the next kharif season. They organised a meeting just before the kharif season of 2015 and found 40 famers are agreed to cultivate kharif paddy following SRI method. Mr. Madan took the responsibility of acting as a master trainer of all. He provides handholding support to other farmers of his mouza. This initiative takes a lead to increase 70 bighas of SRI paddy cultivation in Talpukur mouza in Kharif 2015. All the farmers produced more or less 9 to 10.5 quintals

per bigha that gave them an additional net return from paddy from INR 4,000 to 6,000 variably compared to their conventional practice.

In 2016, farmers of Talpukur mouza encouragingly continued this practice and more farmers started adopting. Interestingly, many farmers from two other villages outside the mouza also adopted SRI system of cultivation. It was reported by the Talpukur WUA that altogether about 85 farmers of Talpukur and Ruhida mouzas have adopted SRI method in Kharif 2016 that reach upto 200 bighas of land. In addition, 17 farmers from a tribal mouza Madarpur under the Rajnagar Block also adopted SRI method and already started cultivation of kharif paddy in 40 bighas.

Voice of the Farmers about their Benefit:

Farmers mentioned that they are getting following benefits through practicing SRI method:-

- Getting healthy seedling through scientific bed preparation.
- Early transplanting which leads better growth.
- Use of single seedling reduces quantity of seeds and cost of cultivation.
- Distance planting protecting disease and pest infestation.
- Easy weeding technique for better growth.
- Required less irrigation reducing cost of cultivation.
- Almost doubling production by reducing cost of cultivation than traditional method.
- Finally, increasing farm income, food security and reducing poverty.

The ADMI Project feels success of their efforts and proud of introducing SRI technology to the farmers. It is assumed that this technological adoption will not only sustainable, it will extensively increase coverage of more land both in Kharif and Rabi seasons for *amon* and *boro* paddy cultivation respectively.

Source of information:

1. Mr. Madan Ghosh, Talpukur Udyog WUA, Rajnagar block, Birbhum district.
2. DPMU, Birbhum district, ADMI Project.

Acknowledgement:

We are grateful to the West Bengal Accelerated Development of Minor Irrigation Project and the World Bank.

Case Study: Mr. Shyam Sundar Dey – Broccoli & Sweet Pea Grower

Village: Balichak, Block: Amta-1, District: Howrah
[Crop year 2016-17]

Prepared by:
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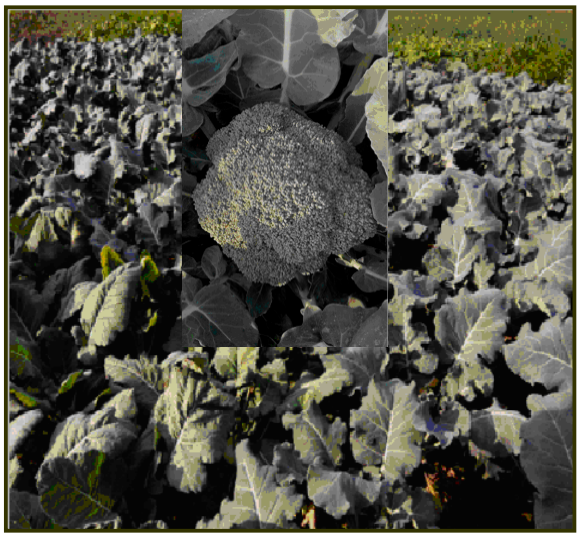
April, 2017

Mr. Shyam Sundar Dey is a 46 year old living in Balichak village, Amta-1 block, Howrah district, West Bengal. His education qualification is Higher Secondary Pass. There are five members in his family and among them two are adult males, two are adult females, one is minor female (daughter). His Daughter is currently studying in Class-VII. All of them are fully depended on agricultural livelihood and agricultural activities are their main occupation. Before implementation of the West Bengal Accelerated Development of Minor Irrigation Project (ADMI Project) and involving with new crops cultivation following modern technologies, they were highly vulnerable to maintain their household food security. They were habituated living with poverty due lack of other income opportunities. He is a small farmer owned a total 1.13 ha and out of which 1.06 ha is cultivable and rest is homestead, gardens with his house.

Initially, before the implementation of the ADMI Project there was a serious problem of irrigation for agricultural production system. Traditionally farmers in this village grow only one rice crop (called

Amon paddy) during the Kharif season and land remain fallow rest of the year that used as pasture. Thus, this area known as *amon* paddy single cropped area. In general, farmers in this village did not have much opportunity to grow other crop cultivation during the rabi and pre-kharif seasons due to lack of irrigation. Also the village people do not have much opportunity for other income generation activities (IGAs). After the implementation of the ADMIP Project, they got the scope to cultivate different types of vegetables and agricultural crops with new technologies and package of practices in irrigated system. They were very happy to water for which they were waiting for long. During the last year, DPMU Howrah has conducted an experimental DC on Broccoli and Sweet Pea on 2 bigha of land of Shyam Sundar Dey.

In case of broccoli, he cultivated it with modernized agricultural practices as per as the information given to him. At that time he got a yield of about 10 Quintal per bigha. That influenced and motivated the other farmers of that area to cultivate Broccoli. Thus this year more than 5 bighas of land are under Broccoli cultivation in this Rabi Season. Mr. Shyam Sundar Dey is one of them and this time also he was rewarded with an excellent yield. Details are given here under. He earned net INR 41,850 from cultivation of one Bigha of land broccoli. The details culture practice and cost of cultivation is given below:



Crop: Broccoli
Cultivated Area: 33 Decimal, No. of Plants: 4000
Date of Sowing: 01/11/2016 and Date of Harvesting: 07/01/2017 to 20/01/2017 (7 days Interval)

Cost of Cultivation:

Sl.No.	Package of Practices	Cost (INR)
1	Field Preparation (with seed bed & Boundary	700
2	Crop Establishment	8,000
3	Organic &chemical fertilizers &pest Management	3,150
4	Irrigation and Labour	4,500
5	Packaging and Transport	1,800
	Total cost of cultivation	**18,150**

Gross Income: Rs. 60,000 and Net Profit: Rs. 41,850.
Price: Average Rs. 15 per Piece.

In the case of Sweet Pea, he was cultivated sweet pea in 1 bigha of land in the previous year and received a yield of about 13 Quintal. Many farmers get influenced from it and they are also started cultivating this crop over 4 bighas of land. A total of eight farmers were cultivating sweet pea with this newly introduced modern technologies and package of practices. They followed line sowing method with proper spacing and applied optimum amount of chemical fertilizers according to the instruction given by the ADMI Project. In this year Mr. Shyam Sundar Dey has cultivated sweet pea in 1 Bigha of land and got a yield of 15 quintals which is about two quintals more than the previous year. He earned net INR 16,650 from cultivation of one Bigha of land by Sweet Pea. The details culture practice and cost of cultivation is given below:

Crop: Sweet Pea.
Cultivated Area: 33 Decimal,
Date of Sowing: 28/11/2016. & Harvesting date: 17/01/2017 to 27/02/2017 (2 to 3 days Interval)

Cost of Cultivation:

Sl.No.	Package of Practices	Cost (INR)
1	Field Preparation (with seed bed & Boundary	600
2	Crop Establishment	1,000
3	Organic &chemical fertilizers &pest Management	1,850
4	Irrigation and Labour	3,900
5	Packaging and Transport	1,000
	Total cost of cultivation	**7,350**

Gross Income: Rs. 24,000, and Net Profit: Rs. 16,650.
Price: Rs. 15 to Rs. 20 per KG.

Case Study: Mr. Subal Bajani – Sunflower and Okra Grower

Village: Boral, Block: Shyampur-1, District: Howrah

[Crop year 2016-17]

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April, 2017

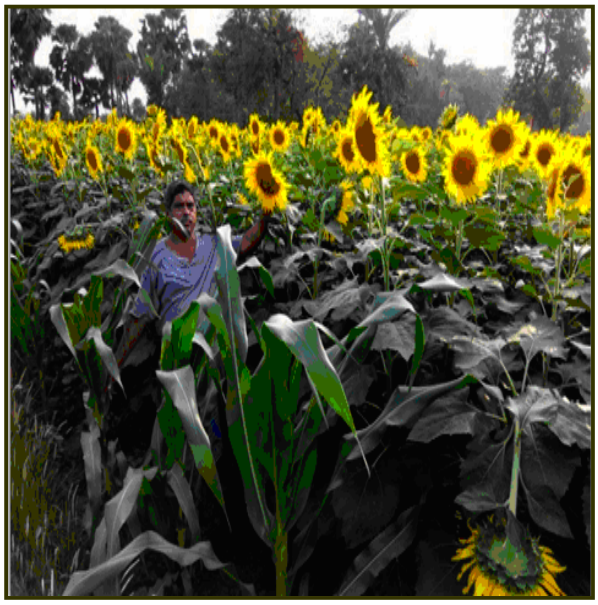
Mr. Subal Bajani is a 50 year old living in Boral village, Shyampur-1 block, Howrah district, West Bengal. His education qualification is 8th standard Pass. There are three members in his family and among them he and his wife and a son. The education qualification of his son is class 12 passed (higher Secondary). All of them are fully depended on agricultural livelihood and on their agricultural activities and apart from that his son is partially involved in a business. Before the implementation of the project they use to face serious issues to maintain their household food security. He is a small farmer owned 0.33 ha and out of which 0.26 ha is cultivable and rest is homestead, gardens with his house.

Before the implementation of the West Bengal Accelerated Development of Minor Irrigation Project (WBADMIP) there was a serious problem of water scarcity. Traditionally farmers in this village grow only one rice crop (called *Amon* paddy) during the Kharif season and land remain fallow rest of the year that used as pasture. Thus, this area known as *amon* paddy single cropped area. In general, farmers in this village did not have much opportunity of other crop cultivation during the rabi and pre-kharif seasons in addition to other income generation activities (IGAs). After the implementation of the project they got the scope to cultivate different types of vegetables and agricultural crops with new technologies and package of practices under irrigated ecosystem.

Cultivation of Sunflower and Okra:

DPMU Howrah has conducted an experimental DC on Sunflower and Okra on 3 bighas and 1 bigha of land of Mr. Subal Bajani respectively in the last year. A total of five farmers were cultivated sunflower on 3 Bighas of land and two farmers cultivated Okra on 1 bigha of land.

In case of Sunflower (PAC-361), previously he cultivated it with modernized agricultural practices as per as the information given to him. At that time he got a yield of about two quintals per bigha. That influenced and motivated the other farmers of that area to cultivate Sunflower (PAC-361). This year 48 numbers of farmers were cultivating more than 50 Bighas of land are under sunflower cultivation in this Rabi Season. Mr. Subal Bajani is one of them and his plot produce an excellent yield of about three quintals sunflower oilseeds per bigha and his net earning was INR 10,000 from one Bigha of land. Details are given below:



Crop: Sunflower (PAC-361)
Cultivated Area: 33 Decimal, No. of Plants: 1000
Date of Sowing: 25/12/2015 and Date of Harvesting: 05/04/2016
Cost of Cultivation:

Sl.No.	Package of Practices	Cost
1	Field Preparation (with seed bed & Boundary	500
2	Crop Establishment	1,000
3	Organic &chemical fertilizers &pest Management	1,000
4	Irrigation and Labour	2,000
5	Packaging and Transport	500
	Total cost of cultivation	5,000

Gross Income: 15,000 and Net Profit: Rs. 10, 000.
Price: 45 - 50 Rupees per Kg of oilseeds.

In the case of Okra (SVOK0001), Mr. Subal Bajani had also cultivated okra in 1 bigha of land in the last year and received a yield of about ten quintals. Many farmers get influenced from it and they are also started cultivating the same crop over 5 bighas of land in this year. A total of ten farmers were cultivating okra in 5 Bighas of land with new modern technologies and package of practices. They followed the method of line sowing, proper spacing, optimum usage of chemical fertilizers that they learnt during the training conducted by the ADMI Project.In this year Mr. Subal Bajani has cultivated Okra in 24 Decimal of land and got a yield of about 14 quintals. His net earning of this crop was about INR 16,526. The details practice and cost of cultivation is given below:

Crop: Okra (SVOK0001),
Cultivated Area: 24 Decimal, No. of Plants: 7200
Date of Sowing: 25/11/2016; Date of Harvesting: 10/01/2017 to 15/03/2017 (2 to 3 days Interval)
Cost of Cultivation:

Sl.No.	Package of Practices	Cost (INR)
1	Field Preparation (with seed bed & Boundary	650
2	Crop Establishment	2,000
3	Organic &chemical fertilizers &pest Management	2,000
4	Irrigation and Labour	3,524
5	Packaging and Transport	500
	Total cost of cultivation	8,674

Gross Income: 25,200 and Net Profit: 16,526.
Price: 15 to 20 Rupees per Kg.

Sources of information: Mr. Subal Bajani, Farmer, and DPMU, Howrah district.

Impact of Irrigation on Household Income Through Adopting Multiple Cropping Pattern: A Case of Mr. Ganesh Barman

Salbari Barmanpara WUA, Matiali block, Jalpaiguri district

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April, 2017

Salbari is a small village of Matiali block in Jalpaiguri District. The village is situated at the foothills of Matiali hill area. Neora River passes through the village. To farmers, agriculture is not that highly remunerative due to low productivity in rainfed agricultural practices. The soil is sandy loam and water holding capacity of the soil is very low. Rain water is not enough to hold soil moisture which is very requirement of many field crops. Thus, the farmers mainly cultivated only kharif paddy during the rainy season. In a small scale, farmers of the village use to grow some leafy vegetable, coriander and few other crops for their domestic consumption during the Rabi season mainly is kitchen gardening area. In some part of the village farmers grow jute ad jute stick is important to them for

various reasons. Due to lack of agricultural activities after the kharif paddy, many families and their members are involved in pebble collection from the Neora River for cash. Therefore they neglect agriculture which does not give opportunity of regular cash earning.

In such a situation, the West Bengal Accelerated Development of Minor Irrigation Project (WBADMIP – in short ADMI Project) and setup district level office and deployed staff to support directly to the farmers. The ADMI Project had organised various awareness programmes at the village and few people came forward and agreed to work in a group for cultivation round the year. They identified 10 hectares of land and initiated a proposal for minor irrigation structure in their field. A group of engineers from WBADMIP visited the village and decided to create two solar operated Pump dug well (SOPDW) for the selected 10 hectares.

It is found that these 10 hectares of land is with only 17 farmers. They formed a Water User's Association (WUA) namely, SalbarI Barman Para WUA. After installation of the scheme they started rabi crop cultivation in the month of July 2015 after hand over the project. Before the project, there was very small area under rabi crops to support the needs of their families. Since 2015 area under rabi crops gradually started increasing. Nearly about 5 hectares land out of 10 hectares came under Rabi crops in the year 2016. Main crops were Tomato, Brinjal, cauliflower, cabbage, mustard and a local variety of Potato cultivated during this year. Some of the farmers are doing well to adopt agricultural technologies during the rabi season and Mr. Ganesh is one of them.

Ganesh Barman is a 30 years old farmer. His education level is fourth standard. He own 4 bighas of land and he also cultivate 8 bighas that own by his father and brothers. In total he is cultivating 12 bighas of land. He has two bulls cow which he use for ploughing and two cows with two calves. He has also 5 goats which gives him some additional income.

Before the scheme he used to cultivate kharif paddy and produced on an average 40 quintals and the value of product would be hardly Rs. 48,000 per annum. He grown Swarna variety paddy in low land and Mayuri variety paddy in upland during the kharif season. He used to cultivate some vegetables in kitchen garden that indicates his past experience of agricultural practices.

He is growing kharif paddy as because of land preparation animal power and family labour is available in the family, keep paddy seeds for next year and thus he do not need much cash to continue with paddy cultivation. As he grow paddy for household food security with less cost he will

not abandon cultivation of amon paddy. Although the scheme has been handed over in July 2015 but there is no significant change in kharif paddy cultivation as it is totally rainfed crop and require very limited cost for cultivation.

After the irrigation scheme he allocated land for rabi crops to adopt irrigated agricultural practices. The Change in income he found in Rabi 2016 only. Just he cultivated Rabi crops in only one season in the year 2016 due to availability of solar operated irrigation facility. Mr. Ganesh grown multiple rabi crops in this year to exploit the irrigation opportunity standing on his cultivable land area. He cultivated brinjal, tomato, cauliflower, and various leafy vegetables make additional benefit by about 39 thousands. The following table shows aggregated costs and value of products for various crops cultivated by Mr. Ganesh during the last rabi season.

Crop	Area in bigha	Total expenditure	Yield in Kg/Bigha	Value of product (INR)
Brinjal	1.0	5,000	3,600	18.000
Tomato	1.0	7,000	4.000	20.000
Cauliflower	0.5	2,500	6.000	15.000
Leafy veg.	0.5	500	Na	1.000
Total	**3.0**	**15,000**		**54.000**

In case of product marketing, Mr. Ganesh was not getting proper price of Tomato as he was not aware about gradation of tomato. He has to sale tomato in distress rate in local market at INR 2 to 3 per kg which was not supporting the cost of cultivation. He went to Malbazar wholesale market and talked with the merchants from where he came to know that the product needs to be sorted and graded according to their quality. Then he started grading of tomato. He started grading into three categories which are 1) completely green, 2) yellowish, and 3) completely red & ready for

consumption. The price of red one is high, yellow is always at least one rupee low and green one does not have any sale value at the Malbazar wholesale market.

After learning that marketing knowledge, he started plucking tomato, grading them into three grades and sent to market in Malbazar and Matiali only red one and kept the yellow one for next day and applies ethylene to make it red. He also applies ethylene to make red the green one and send them to market for higher income.

Presently, Mr. Ganesh is very happy as he has increased his cash capital, operating cash at hand and some saving at bank. This year he is planning to increase land at least 10 bighas for next Rabi crops cultivation. He tells people that he is very happy by getting training, technical assistance, and agri-implements to improve agricultural knowledge and practices that provided by the ADMI Project.

Acknowledgement:

We are grateful to Mr. Ganesh Barman for providing his personal information and data on his agricultural activities. We are indebted to ADMI Project for giving us opportunity to conduct this case study.

Transfiguring Daily labour to Commercial Grower of Local Red Potato (*Lal Pakhri-Bogula*)

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April, 2017

Mr. Narayan Barman is 50 years old, illiterate and a known daily wage labour. He is living with his wife and two adult sons. Altogether, he has four adult members in his family and everybody works in the vegetable field. He has two cows and two goats. Besides working as day labour at farm fields he and his family members collect pebbles from Neora River. He has only 1.25 bighas of land close to the pump house of the ADMI Project. Half of his land is homestead and half is used for kitchen garden. He used to grow spinach, coriander, bottle gourd and some other types of leafy vegetables. His main constraint was availability of irrigation water. Practically, he was practicing crop cultivation in rainfed condition and in critical situation was irrigating crops from well water by traditional method (called bucket). All the products he was growing were mainly for family consumption and rarely sold very small amount in the local market. He became a member of WUA after the installation of irrigation scheme by the ADMI Project.

Mr. Narayan Barman was growing local potato (called Lal Pakhri-Bogula) during the last few years in Rabi season, but its yield response was very poor due to lack of adequate irrigation. This year he took lease of 0.75 bighas land from Mr. Naresh Barman living and that land parcel is very close to the irrigation structure and use to remain fallow after kharif paddy cultivation. Mr. Barman kept 50 kilos of local variety of potato (Lal Pakhri-Bogula) seeds at his home to cultivate in the lease land under the scheme.

Total cost of red potato cultivation was INR 7,100. He produced about one tonne of potato and sold an price per kg INR 15.00. His net earning was about INR 7,900 from the local potato during the last Rabi season.

<u>Reason for cultivation local variety of potato as mentioned by Mr. Narayan</u>

- It is non perishable
- No need for cold storage
- Low fertiliser consumption
- Seed is available at Maynaguri block which is very close to the place
- Ready market at Malbazar, Matilai and Maynaguri
- Huge demand at local market.

He is very happy and planning take at least 5 bighas of land within command area in next Rabi. He also cultivates brinjal, cauliflower, different variety of potato, tomato and different types of leafy vegetables. Practically he is a professional vegetables grower.

Bitter-Gourd is Not Bitter to Mr. Manirul Haque: An Impact of Technology Adoption on Productivity and Farm Income

Component: Promotion of livelihood through Improved Horticultural Practices

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April 2017

Mr. Minarul Haque is a 41 year old living in Khanda Sarkara village in Amdanga block, North-24 Parganas district, West Bengal. He studied up to class nine. He belongs to minority community (called Muslim). There are five members in his family and he is the only adult male and one adult female with two minor males and one minor female. His family is fully dependent on agricultural livelihood and working very hard for agricultural activities round the year. In general his family face serious difficulties to maintain household food security. He considered himself as a small farmer owing 1.25 ha, out of which only 0.85 ha (2.1 acre) is cultivable and rest is homestead, gardens and cultivable waste land. His total cultivated land (0.85 ha) is under the newly created medium deep tube-well (MDTW) minor irrigation scheme installed by the West Bengal Accelerated Development of Minor Irrigation Project (WBADMIP in short called ADMI Project). Mr. Monirul Haque became a member of Water User Association of MDTW scheme, Khanda Sarkara village, Amdanga block, North-24 Parganas district.

The Village Farmers and Agriculture Situation:

Most of the farmers in Khanda Sarkara village are economically and resource poor. In general, farmers' practiced traditional rainfed agricultural practices. Lack of irrigation facility and modern agricultural technologies were the major limiting factors of high-yielding rabi and pre-kharif crops cultivation to increase farm productivity and family income. Another limiting factor is unpredictable environmental changes which mainly occurred due to heavy rainfall within a short period of time and makes flooding and water logging as well as drought in recent years. These are found critical challenges to cultivate crops and save crops from natural calamities. These vulnerabilities to climatic hazards and traditional agricultural practices are critically limiting agricultural development. The farmers' are dependent on agriculture were facing chronic poverty and face hardship to maintain livelihood and food security.

Commonly minor family members (called child labour) regularly support their families to survive with agricultural activities for cost saving income. People in this village found very little scope of alternative employment in their locality and struggling with agricultural development during the last decade.

Traditionally farmers in this village grow single rice crop (Amon Paddy) during the Kharif season (also called rainy / wet season) and land remains fallow rest of the year. Thus, this area known as Kharif Paddy cropped area. Farmers in this village did not have much opportunity to grow crops during the rabi and pre-kharif seasons. This area also did not have much opportunity of other income generation activities (IGAs). In most of the years, amon crop damaged due to floods that result lower or no yield which respectively make farmers vulnerable to maintain food security and reduce household income to remain in poverty cycle. Many adult people worked as wage labour in farm and non-farm sectors and sometimes migrated elsewhere in the district to search for work. Farmers in this village were not well aware about modern technological practices for crops other than amon paddy cultivation to diversify agricultural practices in rabi and pre-kharif seasons to diversify agricultural income and reduce vulnerability of food security. This situation was prevailed for a long period until WBADMIP constructed new irrigation facility and technical support for adoption of modern cropping technologies to grow crops during rabi and pre-kharif seasons.

The Scheme of Irrigation and Technology Adoption:

The designed command area of MDTW is about 20ha created by WBADMIP in Khanda Sarkara village. There are 166 farmer members with the scheme to use water facility and adopt irrigated agriculture crops, horticultural crops and improve knowledge of aquaculture practices. Out of total command area 16.5 ha (almost 82.5%) is cultivable area available to adopt irrigated cropping practices during the rabi (winter) and pre-kharif seasons. Besides Kharif paddy farmers were able to grow various rabi and pre-kharif crops in crop year (CY) 2016-17. In the CY 2016-2017, adequate amount of different food crops were produced which was not in practice before implementation of the ADMI Project. Several outcomes of the project through adopting new crops and modern technology practices clearly indicates that the project have a significant positive impact on agriculture and well-being of the farmers.

In this case of Mr. Monirul Haque, the project team found that he is an active and hard working progressive farmer in the village. He was motivated to grow bitter-gourd in 0.33 decimal of land during the pre-kharif season. He received training and other necessary support to grow bitter-gourd (a health food product) and was able to generate a gross return is about INR 22,000 and net earning (include cost savings income) was INR 10,810 from this crop during the pre-kharif season in CY 2016-17. Following table shows cost and returns from bitter-gourd cultivation by Mr. Haque.

Package of Practices (PoP) for Bitter Gourd cultivation (0.33 decimal) by Mr. Haque

Package of Practices	Quantity / Values	Cost (Rs.)
Crop establishment:		
Seed variety	Magna-2 300gm (3000 plants)	2,000
Labour charge for planting (own+hired)	2 * 200	400
Land preparation (draft power / power tiller)	Hour: 2 * cost 500	1,000
Fertilizer application:		
Urea	15Kg * 7	105
10:26:26	30Kg * 23	690
15:15:0	25 Kg * 19	475
Mixed fertilizer NPK (19:19:19)	100 gm * 170/Kg	170
Micronutrients(DHANZYME GOLD)	500 ml * 250	250
FYM	500 Kg * 2	1,000
Cow Dung	80Kg * 2.5	200
Pest control:	Inorganic	300
Weed control:	3 times * 10 Labours * 200	2,000
Irrigation application:	8 times * 100	800
Harvesting labour cost	10 times 9 days * 200	1,800
Total cost including family labour		11,190
Quantity harvested & Gross market value	1000 Kg	22,000
Net return from investment	Including cost-savings income	10,810

Source: Mr. Minarul Haque, Khanda Sarkara village, Amdanga block, North-24 Parganas district,

Mr. Monirul Haque cultivated some other agricultural and horticultural crops during the rabi and pre-kharif seasons by the support of WBADMIP team (see the following table). Being a hard working farmer he followed sincerely all necessary crop management practices that time to time suggested by the WBADMIP team. His improves knowledge and hard work gave him better return from crop cultivation and enhanced food security. Now he is forgetting bitter experience in the past and dreaming better trade-off in the future. Using all available opportunities, Mr. Haque's gross cropped area was more than a hectare (ha) by increasing irrigated land through cultivating agricultural and horticultural crops in a year covering three seasons (Kharif, Rabi and Prekharif) seasons that shows an increase in cropping intensity by about 180% and agricultural diversity.

Mr. Haque was able to increase his farm income more than a lakh in a year. His net family income from the crop sector is about INR 122 thousands per annum. According to him, he has generated surplus family income including fishery and forgetting about feeling poor. He informed to the project team that there was a drought condition for amon crop during the Kharif season where he applied supplementary irrigation from the MDTW and harvested a very good *amon* paddy (more than 4.0 t/ha). He reported that cost of cultivation has substantially reduced due to the availability of irrigation scheme under the WUA. Altogether, Mr. Haque is now very happy man and become a successful farmer through increasing farm productivity and family income.

Various crops cultivation by Mr. Haque during Kharif, Rabi and Pre-Kharif seasons in 2016-17

Season	Name of crop	Cultivated area (acre)	Production (kg)	Average price (INR/KG)	Cost of cultivation (INR)	Gross income (INR)	Net income (INR)
Kharif	Paddy	1.00	1,600	13	15,000	20,800	5,800
Rabi	Cauliflower	0.10	1,000	7	4,000	7,000	3,000
	Cabbage	0.10	800	8	3,000	6,400	3,400
	Mustard	0.15	1,500	35	3,000	52,500	49,500
	Brinjal	0.15	7,000	6	22,000	42,000	20,000
	Potato	0.15	5,000	6	30,000	30,000	0
	Onion	0.33	2,500	20	25,000	50,000	25,000
Pre-kharif	Sesame	1.50	300	30	5,000	9,000	4,000
	Bitter-Gourd	0.33	1,000	22	11,190	22,000	10,810
Total field crops		3.81			118,190	239,700	121,510
Fish	Share		200	120	3,000	24,000	21,000

Source: Mr. Minarul Haque, Khanda Sarkara village, Amdanga block, North-24 Parganas district,
*The cost of cultivation includes family inputs and labour and therefore net returns include cost savings income.
NA = not applicable, ha = 2.471 acre, INR = Indian rupee, Kg = Kilo

In fact, Mr. Haque with two other farmers from different WUAs was introduced to Kolkata Kola wholesale market to sell their bitter gourd which is about 35 km from his village. He sold almost 70% of his bitter gourd to the Sealdah (Kolkata) market. Beaming with confidence, Mr. Haque has planned to increase more area under cultivation of various crops early during the rabi and pre-kharif seasons for further increasing his farm income. His success has provoked interest of many other members of WUA in the villages to start vegetables cultivation. He is regularly helping them to grow more crops and increase cropping intensity that contributing to agricultural diversity, increase farm income, enhance food security and reduce poverty. It has been found that village women and children are very happy to enjoy new food crops and increasing consumption in their regular food habits which improving nutritional diet compared to that of pre-project situation. Thus the project is making social impact and contributing to the community too.

References:

1. Personal communication with Mr. Monirul Haque, WUA member, Khanda Sarkara MDTW WUA, Amdanga, North-24 Parganas, for agricultural practices.
2. Agri-Horti Specialists, DPMU and SO staff of WBADMIP, North-24 Parganas district, project information.
3. Personal communication with community worker Mr. Chanchal Benerjee & Mr. Mrinal Kanti Mondal for Market information.

Acknowledgement: We are grateful to the farmer for providing information and thankful to the West Bengal ADMI Project & the World Bank.

A Gift of Bloom to Mr. Ali Ahamed Mandal: The Case of Inspiration to Venture Broccoli Technology

Component: Promotion of livelihood through Improved Horticultural Practices

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Mr. Ali Ahamed Mandal is a 58 year old farmer living in Durlavpur Village, Amdanga block, North-24 Parganas District, West Bengal. His education level is Class-VIII standard. There are three members in his family and among them two are adult males and one is adult female. All of them are fully involved agricultural activities for their livelihood and food production. Mr. Mandal is a resource poor farmer owned about a hectare land for living and farming. He has only 0.772 ha cultivable land and considered as small farm-holding. In general they face serious difficulties to maintain household food security and a below poverty level family. His total cultivable land (0.772 ha) is in the command area under the newly created Medium Deep Tube-Well (MDTW) scheme by created by the West Bengal Accelerated Development of Minor Irrigation Project (WBADMIP – refer as ADMI Project).

The Village Farmers and Agriculture Situation:

Farm households in Durlavpur village are economically and resource poor and marginal or small farm holdings. In general, farmers' practiced traditional rainfed agricultural practices. Lack of irrigation facility and modern agricultural technologies were the major limiting factors of high-yielding rabi and pre-kharif crops cultivation to increase farm productivity and family income. The adversities related to environmental changes are mainly due to heavy rainfall within a short period of time that makes flooding and water logging as well as drought in recent years. These are found critical challenges to cultivate crops and save crops from natural calamities. Usually farmers in this village never get expected yield of crops due to various reasons related to technological practices. These vulnerabilities to climatic hazards and traditional agricultural practices are critically limited agriculture development. Thus, farmers' dependent on agriculture were facing chronic poverty and very hard for them to maintain livelihood and food security.

Commonly both male and female family members regularly support their families to survive with agricultural activities for cost saving income. People in this village found very little scope of alternative employment in their locality and struggling with agricultural development during the last decade.

Traditionally farmers in this village grow single rice crop (Amon Paddy) during the Kharif season (also called rainy / wet season) and land remains fallow rest of the year. Thus, this area known as Kharif Paddy cropped area. Farmers in this village did not have much opportunity to grow crops during the rabi and pre-kharif seasons. This area also did not have much opportunity of other income generation activities (IGAs). In most of the years, amon crop damaged due to floods that result lower or no yield which respectively make farmers vulnerable to maintain food security and reduce household income to remain in poverty cycle. Many adult people worked as wage labour in farm and non-farm sectors and sometimes migrated elsewhere in the district to search for work. Farmers in this village were not well aware about modern technological practices for crops other than amon paddy cultivation to diversify agricultural practices in rabi and pre-kharif seasons to diversify agricultural income and reduce vulnerability of food security. This situation was prevailed for a long period until WBADMIP constructed new irrigation facility and technical support for adoption of modern cropping technologies to grow crops during rabi and pre-kharif seasons.

The Scheme of Irrigation and Technology Adoption:

The designed command area of MDTW is about 20ha created by WBADMIP in Durlovpur village. There are 94 farmer members with the scheme to use water facility and adopt irrigated agriculture crops, horticultural crops and improve knowledge of aquaculture practices. Out of total command area 15.5 ha (almost 77.5%) is cultivable area available to adopt irrigated cropping practices during the rabi (winter) and pre-kharif seasons. Besides Kharif paddy farmers were able to grow various rabi and pre-kharif crops in crop year (CY) 2016-17. In the CY 2016-2017, adequate amount of different food crops were produced which was not in practice before implementation of the ADMI Project. Several outcomes of the project through adopting new crops and modern technology practices clearly indicates that the project have a significant positive impact on agriculture and well-being of the farmers.

Broccoli is one of the most valuable vegetable crops cultivated in Rabi season in Durlovpur village. It is a such vegetable called as “crown of jewel nutrition” because of its richness in dietary fibre, vitamins, antioxidants, photochemical and minerals like calcium, magnesium, iron, manganese, zinc and phosphorous. Being a shallow rooted crop, broccoli is highly deepened on applied inputs and irrigation to produce optimum size for higher productivity. Shortage of soil moisture and nutrients in growth stage of this crop drastically reduce productivity.

The ADMI Project team identified Mr. Ali Ahamed Mandal to grow broccoli in his 0.33 decimal of land. He was very keen to listen and follow training and suggestion that provided by the project team time to time. He produced very good quality broccoli and generated gross return INF 56,002 and net earning was INR 38,882 (including cost savings income) during the CY2016-17. It was newly introduced crop to this area and gave good return according to farmer which attracted other farmers in the village. Many farmers are interest to grow broccoli in the next cropping season.

Package of Practices (PoP) for Broccoli cultivation (0.33 decimal) by Mr. A.A. Mandal

Package of Practices	Quantity / Values	Cost (Rs.)
Crop establishment		
Seed variety	Lucky 70gm (6540 plants)	3,850
Labour charge for planting (own+hired)	2 * 200	400
Land preparation (draft power/power tiller)	Hour: 2* cost Rs.500	1,000
Fertilizers application		
Urea	15Kg * 7	105
Mixed fertilizer 10:26:26	30Kg * 23	690
Mixed fertilizer 15:15:00	25 Kg * 19	475
Mixed fertilizer NPK (19:19:19)	100 gm * 170/Kg	170
So4	30kg*12	360
boron	2.5*325	813
Zn so4	5kg*40	200
Micronutrients(DHANZYME GOLD)	500 ml * 250	250
FYM	500 Kg * 2	1,000
Cow Dung	80Kg * 2.5	200
Pest control:	Inorganic	1,800
Weeding and crop management	3 times * 10 Labours * 200	2,000
Irrigation application	8 times * 100	800
Harvesting practice	15 days * 200	3,000
Total cost (including family labour)	**Total cost**	**17,113**
Quantity harvested &Gross market value	6540 pieces@avg Rs.8.00	56,002
Net return from investment		38,890

Source: Mr. A.A. Mandal, Durlovpur village, Amdanga block, North-24 Parganas district,

Mr. Mandal has cultivated other agricultural and horticultural crops during the kharif, rabi and pre-kharif seasons by the support of WBADMIP team. Being a hard working farmer he followed sincerely all necessary crop management practices that time to time suggested by the WBADMIP team. His improved knowledge and hard work gave him better return from crop cultivation and enhanced household food security. Using all available opportunities, Mr. Mondal cultivates almost one hectare (ha) in CY2016-17 covering all three cropping seasons that shows increase in cropping intensity and agricultural diversity.

It was found that multiple cropping pattern of Mr. Mandal has increased his family income and adequate for the family. He also sold harvested production in to the market and earned cash for the family use and for the next crop cultivation. During the CY2016-17, his net earning from agriculture sector was about INR 53,680 (except broccoli). Altogether, he has generated surplus net family income of about INR 92,570 (including broccoli) in a year . He informed to the project team that there was a drought condition for amon crop during the Kharif season where he applied supplementary irrigation from the MDTW and harvested a good *amon* paddy. Now one can find Mr. Mondal is a happy farmer who has increased family income and consumption within a year and wish to continue all practices he learned from the ADMI Project.

Crops cultivation by Mr. A.A. Mandal during Kharif, Rabi & Pre-Kharif seasons in 2016-17

Season	Name of crop	Cultivated area (acre)	Total production (kg)	Average price (INR/kg)	Cost of cultivation (INR)	Gross income (INR)	Net income (INR)
Kharif	Paddy	1.00	1,800	13	15,000	23,400	8,400
Rabi	Cauliflower	0.10	1,000	7	4,000	7,000	3,000
	Cabbage (piece)	0.10	800	8	3,000	6,400	3,400
	Mustard	0.15	150	35	3,000	5,250	2,250
	Brinjal	0.15	1,500	6	5,280	9,000	3,720
	Onion	0.33	3,500	15	23,500	52,500	29,000
Pre-Kharif	Bitter Gourd	0.10	800	22	13,690	17,600	3,910
Total of field crops		1.93			67,470	121,150	53,680

Source: Mr. A.A. Mandal, Durlovpur village, Amdanga block, North-24 Parganas district,
*The cost of cultivation includes family inputs & labour and therefore net returns include cost savings income.
NA = not applicable, ha = 2.471 acre, INR = Indian rupee, Kg = Kilogram

In fact, Mr. Mandal was introduced to Coley wholesale market in Kolkata (about 35 km from his village) to sell his broccoli where he learnt selling and good price negotiation skills although did not received very good price. He found that this market experience helped him significantly to grow commercial crops. He sold almost 70% of his broccoli to the Coley market. Presently confidence of Mr. Mandal is so high that he independently started landuse planning to increase more production and enhance farm income. His success has provoked interest of many other fellow farmers in the village and taking suggestions from him.

Reference:

1. Personal communication with Mr.Ali Ahamed Mondal, Durlavpur village, Amdanga block, North-24 Parganas.
2. Agri-Horti Specialists, DPMU and SO staff of WBADMIP, North-24 Parganas district.
3. Personal communication with community worker Mr. Chanchal Banerjee & Mrinal K. Mondal, ADMI Project.

Acknowledgement: We are grateful to the farmer for providing information and thankful to the West Bengal ADMI Project & the World Bank.

Reducing Cost of Cultivation and Increasing Productivity of Rice: A Case of SRI Method Adopted by Mr. Nilkamal Mondal

Mandapghat-IV Chaitannya Smriti RLI-WUA, Hanskhali block, Nadia district

Crop year: Rabi-2016 (Summer Boro Rice)

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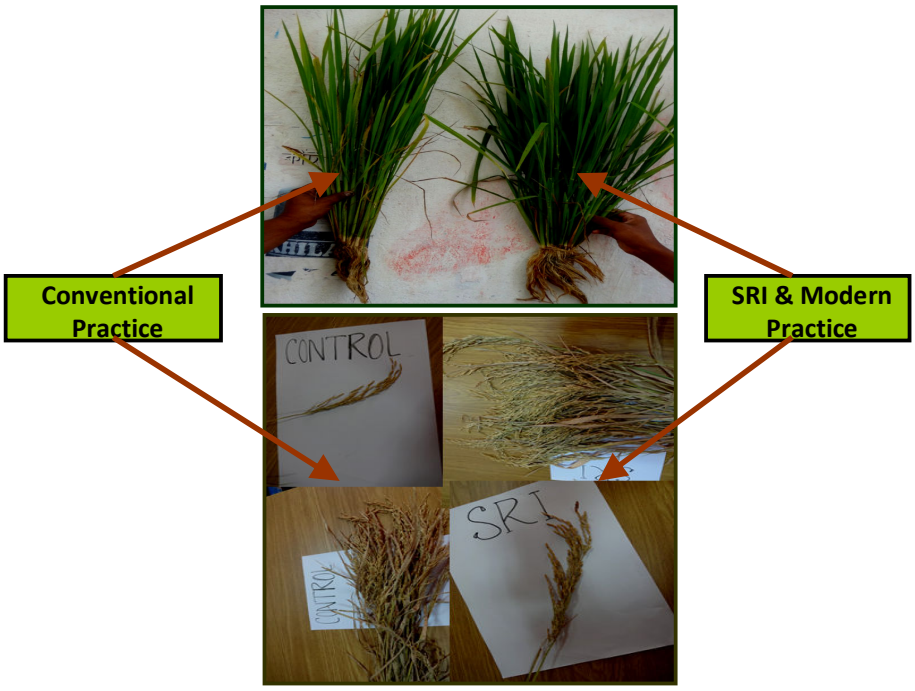

The climate of this region is fall in humid tropic. Top soil texture of this area is clay loam. The summer is very hot and winter is moderate and May is generally the hottest month of the year. The average temperature ranges from 25.4^{O}C to 39.6^{O}C to during the summer season and 8.5^{O}C to 23.7^{O}C during the winter season. Monsoon ceases during the month of October and cool period started during the month of November. The annual average rainfall of this region is about 1500mm and normal monsoon breaks in the first week of June. Though water resources in this area are generally satisfactory and 90% of these resources are tapped form the ground water source through deep and shallow tube wells. However, due to faulty crop planning and lack of scientific water management approach, a significant portion of agricultural area is identified as gray zone from hydrological point of view. Even many tube wells are becoming dry due to over exploitation of

ground water from the lower depths of confined aquifers. Rice is the only major crop that can be grown in a large extent during the *kharif* season due to environmental constraints which is less profitable because of high input and labour costs. Summer rice gave satisfactory yield which require more input costs but farmgate price can be seen not profitable considering unit cost of production.

Most of the farmers in this area grow high-yielding variety (HYV) of rice both in kharif and summer seasons. Rice is the pre-dominant staple food crop in the area cultivated in both kharif and summer seasons. The kharif (rainy) season HYV rice (*amon* paddy) gave an average yield 2.5-3.5 tons/ha. The rice grown as summer rice (*boro* paddy) to get higher yield is an intensive rice culture using higher amount of inputs and labour cost. The average yield of summer rice is about 4-5 tons/ha which is better than the kharif rice in terms of production volume. Presently, the cost of rice cultivation and profitability did not match with the sale price due to exorbitant input cost hike and distress sale after the harvest. Farmers knows that rice growing became non-profitable venture but they can not avoid it because of staple food, land utilization in rainy season and ensuring household food security from their own resources. Most of the farmers are following rice farming practices based on the knowledge acquired during the green revolution era through agriculture extension services conducted by the government sector. It becomes conventional to the new generation of farmers.

The on-farm programme on System of Rice Intensification (SRI).method was carried out in Mandapghat village under river lift irrigation (RLI) system established by the West Bengal Accelerated Development of Minor Irrigation Project (WBADMIP – in short ADMI Project) in Hanskhali Block of Nadia district during the summer season in the year 2016. It could be mentioned that the SRI method of rice cultivation is a proven technology to shift farmer from traditional way of crop establishment to improve method to save water to growing rice, higher number of tillers, less labour requirement, easy to weed control and higher yield than conventional method. The philosophy of SRI method is to break yield frontier and achieve higher productivity of land, labour and capital that articulate together more income from per drop of water.

The ADMI Project has organized a Water User Association (WUA) for the Mandapghat IV Chitannya Smriti RLI to use water for irrigation particularly in rabi season to adopt various agriculture and horticulture crops technologies to increase productivity, cropping intensity and agricultural diversity. There are 69 WUA members associated with this RIL as beneficiaries and more than 50% are belongs to schedule caste (SC) group. The command area of the RLI is 20 ha with an establishment of 9 sprouts and approximately 2.2 ha covered by each sprout. The farmers received six exposure visits

and 10 lead farmers meeting. After implementation of project, jute found predominant pre-kharif crop and sesame, rice during kharif, and crops like wheat, lentil, vegetables, onion, etc grown during the winter/rabi season. All these are considered based on farmers' participatory system for crop diversification. Altogether about 15-20% variably increased in average yield of various crops which increased cropping intensity by about 90% over the pre-project situation. The market interventions of the produce were done through arranging buyer-sellers meet. A regular market is available within access of 5 km distant.

Before the implementation of RLI, the farmers in this area was primarily following rainfed single crop of kharif rice due to high cost of water from the private owner of irrigation facilities. In the summer season, dearth of water limited to grow crops and the land either remain fallow or practicing rainfed system of agriculture. Summer season rice (*Boro*) was grown adopting traditional method in some small pockets that become non-profitable proposition. Therefore, ADMI Project selected this area, to facilitate farmers for adopting new cropping technologies under the irrigation scheme with an intention to increase farm productivity, farm income and diversification of agricultural practices. The SRI method is one of the technologies of the project transferring to the farmers through a number of approaches. First the project started introducing SRI method of rice cultivation in this area during the summer season to the selected beneficiary farmers of this WUA with the following **objectives**:

1. To reduce the cost of cultivation by reducing seeds and other inputs use;
2. To increase yield and water productivity;
3. To increase farm income of the farmer and food security;

Agriculture support services (ASS) and SRI technology adoption:

The critical inputs were supplied from the project in terms of seed and fertilizers along the methods of growing rice according to SRI to encourage farmers for technology adoption.

Mr. Nilkamal Mondal shown his keen interest and contacted with ADMI Project personnel being a beneficiary member of the WUA in RLI command area for SRI intervention. He was given 1 kg of hybrid rice (cv*Arize*6444) variety to grow summer rice (boro paddy) under SRI method with water and fertilizer saving technologies in 2016. The **seed bed** was prepared in December 19th in 2015 and followed a single plant

transplanting method using 13-14 days old seedling in soft puddled soils without standing water. The transplantation followed in line allowing **spacing** of 25 cm x 25 cm from plant to plant by row and column. The recommended dose 40:20:20 kg (N, P_2O_5 and K_2O) fertilizer was applied during land preparation. The water and fertilizer along with organic manures (FYM @ 5 tons/ha) were applied as per recommendation which is almost less than half as compared to traditional crop establishment method. The control plots with traditional method was kept separately with recommended doses of fertilizer as well standing water allowed up to flowering at the depth of 5±2 cm depth.

The farmer found that higher length of spacing and single seedling, the cost of rice cultivation including seed and fertilizer was severely cut down from the beginning. Unlike traditional rice, the crop under SRI was irrigated as and when required basis, just up to soil saturation (field capacity), no standing water was allowed. Thus the number of irrigation required up to 30 with total water requirement only of 60 cm wherein as compared to number of irrigation required for conventional planting up to 15 with total water requirement of 120 cm even under alternate wetting and drying basis. Accordingly 50% of water cost along with 50% cost of fertilizer application was saved under the SRI method along with cost reduction for seed requirement.

The single plat turn out with 60-75 **tillers** and 90% of it found effective tillers under SRI whereas traditionally rice gave maximum of 25 tillers per 3-4 plants. The survivable rate of plant was found 98%. The length of **panicle**, number of grain per panicle, straw yield and test weight were observed more under SRI method than that of conventional method. The crop harvested at 130 days maturity a little earlier than traditionally grown rice. The crop yield was estimated 9.05 tons/ha under SRI as compared to 6.03 ton/ha in traditional method, thereby increased yield almost 3 tons/ha (added 50%) as compared to

conventional method. Total cost of inputs and labours was required for 1 bigha of land was (7.5 bighas = 1 ha) rice cultivation was INR10,245 in conventional method as compared to INR 9,668 under SRI which shows about 6% reduction in cost of cultivation. Considering a same price of rice (Rs. 14/kg) the total value of production was INR 16,800 (Rs. 19,000 including price of straw) under SRI method and INR 12,600 (Rs. 14,600 including price of straw) in conventional method. After deducting the operational cost of cultivation, the net income from SRI method was INR 9,332 and it was INR 4,355 for conventional method, which shows doubling the profit using SRI method. Therefore, Mr. Nilkamal earned net INR 46,660 from his 5 bighas rice cropping in SRI method.

Cost and Return of SRI and Conventional Paddy Cultivation at Mandapghat by Mr. Nilkamal Mondal (an estimate of 1 Bigha for Rice Variety ARIZE-6444)

Package & practices	SRI Method		Conventional Method	
	Quantity/Rate	Cost (Rs.)	Quantity/Rate	Cost (Rs.)
Cost of Seed and management	1 Kg. @ Rs. 350/-	350	6 Kg.	2100
Labour for planting	6 labour @ RS. 300/-	1800	4 persons @ RS. 300/-	1200
Application of fertilizers				
Urea @Rs.8.16/Kg.	30Kg.	245	45Kg.	370
SSP @Rs.6.00/Kg	42Kg	250	52Kg.	312
MOP @Rs.19.00/Kg	12Kg.	220	14Kg.	260
Seed Treatment	DM-45(5gm)	3	DM-45(5gm)	3
Organic fertilizers & pesticides				
Vermi-compost	3- Cart @ Rs. 900/-	2700	2- Cart @ Rs. 900/-	1800
Weeding & Irrigation				
Weeding labour & cost	6 Labour @ 150/-	900	4 Labour @ 150/-	600
Irrigation times & cost	20 times(60cm)	1200	12 times(120cm)	2000
Harvesting				
Harvesting cost	5 labour @Rs. 200/-	1000	4 labour @Rs. 200/-	800
Threshing & other cost	5 labour @Rs. 200/-	1000	4 labour @Rs. 200/-	800
Total cost of production		9668		10245
Quantity & Gross value	1200 Kg. @ 1400/Qtl.	16,800	900 Kg. @ 1400/Qtl.	12,600
Quantity of straw & value		2,200		2,000
Gross income from investment (INR)		19,000		14,600
Net income from investment (INR)		8,600		4,355

Case Study on Cucumber Cultivation by Maheswar Rajwar: An Intervention of ADMI Project

Village: Jurgurudihi, Block: Kashipur, District: Purulia

Component: Promotion of livelihood through Improved Horticulture Practices

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Jurguridihi is a village in Kashipur block of Purulia district. It is a schedule caste (SC) dominated area where 29% schedule tribe (ST) population are living. They are known as indigenous people enjoy various socio-cultural traditions in their community. Nearly all people live in earthen houses with tally or straw roof and earthen wall and the settlement are commonly found at the road side very close to one and another family. Timbers, bamboo and other gardens are common around their homestead area and there are also separate orchard areas. Most of the households rearing livestock for farming and native poultry birds in a small scale for family consumption. Jurguridihi is a socio-economically back ward village and most of them are marginal and small farmers. In general, farmers mainly grow single *amon* paddy as their staple food crop. Thus farming is not the means of commercial earning but only for survival. People were used to strive with poverty and they are used to believe that it is their fate and livelihood.

It is the traditional practice in the villages of Purulia to cultivate rainfed paddy in the Kharif (rainy / monsoon) season for household food security and rest of the year land remain fallow that used for pasturing. This area faces a dilemma of drought-prone and flood-prone environment that cause damage of field crops almost every year. These adverse climates restrict them to take risk of improving agricultural diversity. Farmers' in many villages did not have opportunity to grow other crops during the rabi and pre-kharif seasons due to scarcity of water. In view of that the Accelerated Development of Minor Irrigation Project (ADMI Project) of West Bengal developed irrigation facilities in this village during 2015 to help farmer of preventing crop damage due to drought and grow more crops during the rabi and pre-kharif seasons.

In general, people's involvement in scientific and commercial cultivation is not commonly known in many distance villages of Purulia district. However, there are farmers who can take the challenge to involve scientific cultivation where water is not a limiting factor. Mr. **Maheswar Rajwar** is one of them who set an example through his practice and hard work as well as actively motivated other farmers in the ADMI Project command area of irrigation facility.

Mr. Maheswar Rajwar is a 50 years old man and belongs to SC community. His education level is grade ten (Madhyamik). He has six family members and among them four adult males and two females. The family is totally dependent on agricultural livelihood. His three sons are studying in collage. Mr. Rajwar owned 18 bigha of total land and out of which 14 bigha is cultivable. He has 3.5 bigha under the ADMI Project irrigation scheme.

In 2015, a check dam (CD) has been created on a small river named Beko by the ADMI Project in Jurguridihi village to facilitate crop cultivation in 2016. The command area of this irrigation facility is 40 hectare (ha). A Water Users Association (WUA) was formed by 59 farmers to use water facilities and adopt modern scientific agricultural and horticultural practices. It has also given them opportunity of aquaculture round the year.

Besides, saving Kharif paddy (amon) from the drought, farmers of WUA started cultivation of rabi and Pre kharif crops using CD irrigation facility. Presently they believe-in that livelihood and food security can be sustainable through crops cultivation and self-employment in the field. They started experiencing positive impact of the project assistance and return from their hard work. The WUA members of the Fish Farmer Interested Group (FFIG) are also pleased to adopt modern aquaculture

practices that given them opportunity to increase fish consumption and good return from investment.

The community development of support organization (SO) and agriculture support services (ASS) team of the ADMI Project successfully motivated and trained farmers to change their knowledge, attitude and practices (KAP) in favour of scientific and commercial agriculture. Improving their knowledge from traditional to modern agriculture practices, the farmers started adopting and spreading technologies that are suitable according to their agro-climatic conditions.

In the case of Mr. Maheswar Rajwar, he was identified as a progressive farmer by the project team. He was found very assertive to increase farm productivity and agricultural income and interested to take challenging work and successfully set an example in the Jurguridhi village. The project group decided to install poly tunnel in the field of Rajwar for cabbage nursery. He was also promoted by high yielding verity of different agricultural and horticultural seeds with improved agricultural practices that increased his household consumption and farm income. He was very successful to grow cucumber in his two acre of land. The overall activities of Mr. Rajwar were regularly supported by different training and exposure visits.

Mr. Rajwar produced 5,000 kg of cucumber from 1 bigha of land under command area during the rabi season due to availability of water for irrigation. Not only that from adjacent command area he cultivates the same crop of 5 bigha of land with 25,000 kg. The gross return from 5 bigha cucumber production was Rs. 210,000 and net return was Rs. 109,410. Not only that, Mr. Rajwar has exported cucumber to the neighbouring state for better earning. His example of cultivation and profitability make interested to other farmers to grow economically viable cultivation of cucumber. The following table shows his package of practices (PoP) for cucumber cultivation and value of production:

Package of Practices (PoP) for Cucumber cultivation (0.33 acre) by Mr. Meheswer Rajwar			
SL.	**Package of Practices**	**Quantity / Values**	**Cost (Rs.)**
Crop establishment			
1	Seed variety	Malini – 900 gm	1,665.00
2	Number of plants	2700	*na*
3	Labour charge for planting (own+hired)	5 * 120	600.00
4	Date of plantation	10/12/2016	*na*
5	Survival rate of plants	2600	*na*
6	Land preparation (draft power / power tiller)(Animal & Mechanical)	Hour: 30 munit. cost.250, Animal ploughing.cost.300	*250.00* *900.00*
Application of chemical fertilizers (kg)			
1	Urea	10 Kg * 8	80.00
2	10:26:26	10Kg * 25	250.00
3	M. O. P.	5Kg*30	150.00
5	Boron	1 Kg * 325	325.00
6	Micronutrients	500 ml * 250	250.00
Application of organic fertilizers (kg)			
3	Cow Dung	500. Kg *1	500.00
Application of pesticides, IPM and cost			
2	Organic (Fungicide)	Al pesticides cost	1,800.00
Weeding and Irrigation			
1	Weeding number of times and cost	1 times * 6 Labours * 120	720.00
2	Number of times irrigated and cost	12 times * 300	3,600.00
Additional labour, packaging, transportation & commission cost		Total cost	4,800.00
Harvesting			
1	No. of times harvested & labour cost	6 days * 200	1,200.00
2	Quantity harvested & market value	5,000 Kg (Rs.7.5/kg)	36,700.00
3	Date of first harvest & quantity	7.3.2017	500 (10)
4	Date of second harvest & quantity	12.3.2017	800 (16)
5	Date of third harvest & quantity	17.3.2017	1500 (30)
6	Date of fourth harvest & quantity	25.3.2017	1500 (30)
7	Date of fifth harvest & quantity	29.3.2017	700 (14)
Labour used for farm operation (ex. Planting)			
	Number of family labour days used	(male:3, female: 0)	
	Number of hired labour days used	(male:.12, female:9.)	Wage rate/day: 120
. Source: Personal communication, **Mr Meheswer Rajwar. WUAmember, Jurudiha CD Water User Association.**			

Overall, Mr. Rajwar has cultivated amon paddy and brinjal in Kharif season; cabbage, cauliflower, mustard and Moong, Cucumber in Rabi season; and watermelon in Pre-Kharif season. He achieved cropping intensity by almost 171% which is much better than the normal practice of single amon rice

cultivation. This is the benefit he has received within a year from the ADMI Project. He is very serious and sincere farmer and therefore the ADMI Project team was able to make success of improved cultivation practice through him. Remarkably, the second son of Mr. Rajwar is educated and takes active participation in farming with his father.

Table-2: Cropping pattern of **Meheswer Rajwar during 2016-17**

Season	Name of crop	Seed variety	Cultivated area (acre)	Family consum-ption (Kg)	Produc-tion (Kg)	Average Price (INR/Kg)	Cost of cultivation (INR)*	Gross Income (INR)	Net Income (INR)
Kharif	Paddy	SAHABHAGI	2.66	900	32000	12	28000	38400	10400
	Brinjal	VNR-218	2.00	30	3200	10	30000	32000	2000
Rabi	Cauliflower	Rainqueen	0.16	20	10000	10	6000	10000	4000
	Cabbage	BC-76	0.16	40	12000	6	6000	7200	1200
	Mustard	B-9	0.66	*100*	380	45	8000	17100	9100
	Moong	Sona moong	0.33	*20*	200	40	2300	8000	5700
	Cucumber	MALINI	1.66	*50*	25000	7	83825	175000	91175
Pre-Kharif	Water melon	Shinyboy	0.33	50	3000	5	4200	15000	10800
Total of field crops			7.96	*1210*	85780	NA	168325	302700	134375

*The cost of cultivation did not include family inputs and labour and therefore net returns include cost savings income.
NA = not applicable, ha = 2.471 acre, INR = Indian rupee, Kg = Kilogram.

Watermelon field of Mr. Meheswer Rajwar. He mentioned that his dream come true to become a commercial farmer and now he believed that his land resources and agricultural practice making him rich due to ADMI Project assistance.

Source of information:

1. **Mr Meheswer Rajwar. WUAmember, Jurudiha CD Water User Association, Purulia.**
2. **DPMU, Purulia district, ADMI Project.**

Acknowledgement:

We are grateful to the West Bengal Accelerated Development of Minor Irrigation Project and the World Bank.

Case Study: Aquaculture intervention by WB-ADMI Project
Village: Majramura, Block: Kashipur, District: Purulia

Component: Strengthening livelihood through composite fish farming

Prepared by:
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March 2017

Kapistha-Majramura Check Dam (CD) Water User Association formed in 2014 and Fish Farmer Interest Group (FFIG) formed in 2015

Majramura village in Kashipur block, Purulia is a home of many schedule tribe (ST) population. Most of them are marginal and small farmers and grow mainly single *amon* paddy during kharif (rainy/wet) season for staple food which is subsistence cropping. Most of the households maintain livestock and native poultry birds in a small scale for family consumption. Gardens are common around homestead area. They are a type of indigenous people enjoy various socio-cultural traditions in their community. Community sharing is in their blood and a major issue among the ST villagers during all types of festivals and ceremonies. In the village, earthen houses with tally or straw roof tops are common settlement of the families to live in. It is a dilemma of drought-prone and flood-prone areas that cause damage of field crops. Besides rice, fish is their favourite food which has very high social values during festivals, particularly during the "*Swarashati Puja*". There is very little scope of non-farm employment opportunities and most of the women work at the field to grow crops.

In general, people's involvement in scientific aquaculture is not commonly known in Purulia district, West Bengal. Involvement of ST farmers in aquaculture production activities is crucial for their socio-

economic upliftment, self-employment, consumption and nutritional intake. The availability of seasonal water ≥6 months retention capacity and/or perennial water bodies in many villages of Purulia district are highly suitable for aquaculture development. However, most of the water bodies belonging to tribal villages have not been utilized before for modern aquaculture practice.

The available abundant water-bodies in the Majramura village are used for traditional fish culture system along with indigenous fish species. There are seven suitable water bodies for aquaculture (both seasonal and perennial) in the village. However, ccomposite carp culture with appropriate technology is unknown to the villagers and the ADMI Project has organized a group of fish farmer interest group (FFIG) and introduced modern aquaculture practices to them. It has been expected that an effective extension programme through capacity building, motivation and adoption of scientific technology would help ST farmers in taking up aquaculture in a sustainable way. It has been also expected that aquaculture practices will increase fish production, consumption and income generation of the people.

Before implementation of aquaculture program in Majramura village, it was found that there are several constraints and obstacles for not adopting aquaculture practices in this village, such are namely, non-availability of desired quality and quantity of fish seeds, absence of organized marketing and most importantly lack of knowledge and technical skills of farmers. All these prevailing factors discouraged them to take aquaculture as an important economic activity for improving their food security and increase household income.

In 2015, the ADMI Project introduced composite carp farming practice by involving 11 FFIG (ten WUA and one non-WUA including two females) members in Majramura village under Kashipur block. Age group of them ranges from 27 to 62 years and education level is from class 4 to 9 except non-WUA member, The FFIG selected one of their village ponds called “Salkar Bundh”. All of them are from poor economic back ground and having access to this community pond. The effective water-body area of Salkar Bundh is about 0.53 ha and found suitable for fish culture. The ADMI Project has selected this Salkar Bundh for demonstrating composite fish farming by involving FFIG members as beneficiaries. The subsequent discussions are highlighting the pre- and post- project scenarios of aquaculture practices in this village.

Traditionally villagers or pond owners grow fish without applying technological practices. They only release fry in the water-body without any management practices and received poor production.

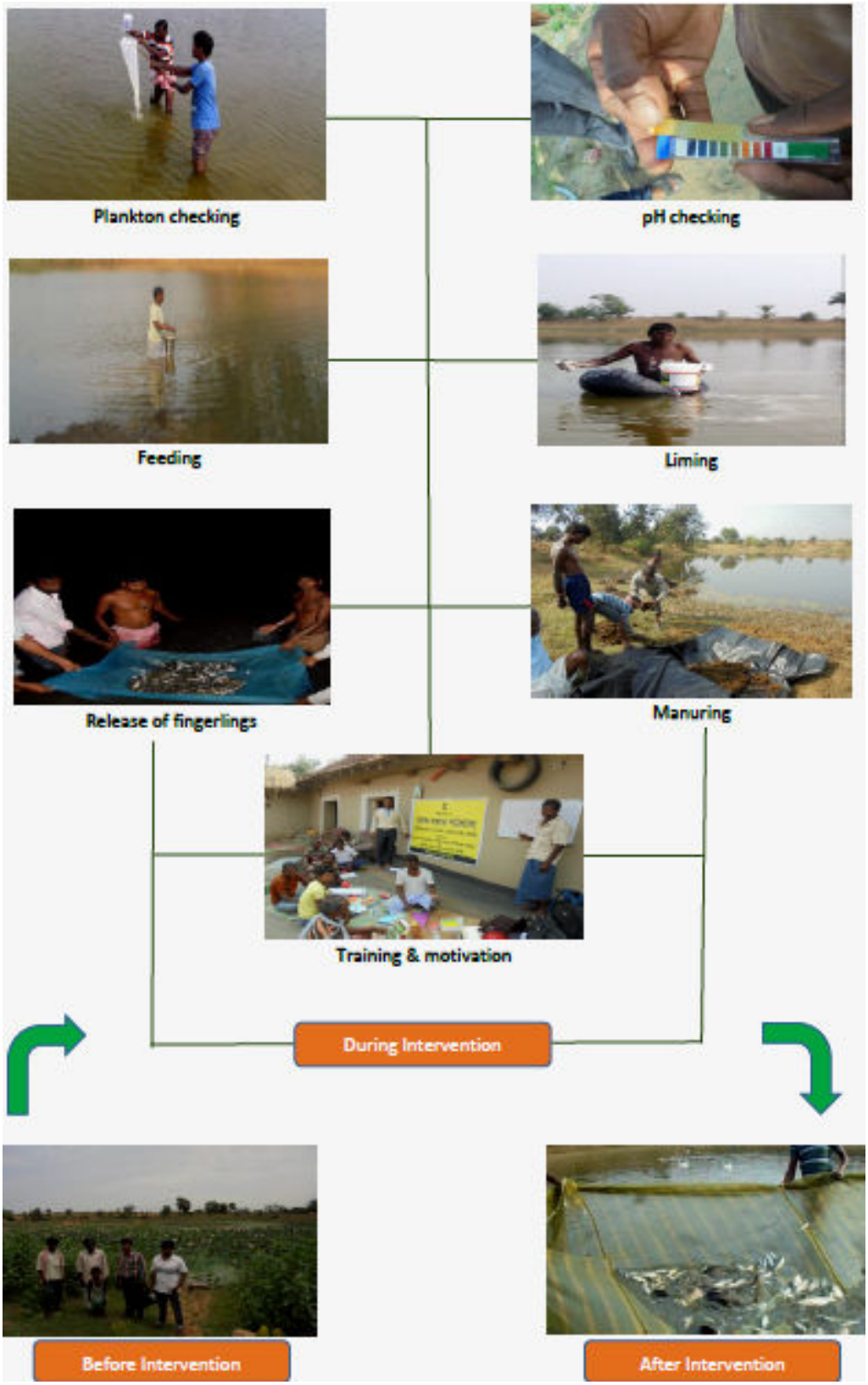
Before the project intervention, the beneficiaries used to stock mixed seeds of Indian Major Carps (IMC also called ICC - Indian Common Carp) spices in unmanaged pond which are namely Rohu, Catla and Mrigala. Considering three years of production, the average catch of fish from the pond was found 185 kg (350 kg ha^{-1}) per annum. Fish seed (fry) of 1.5-2 cm size were stocked at an average density of 1855 units (3500 ha^{-1}) that varied from year to year. There was no other application of any important materials and management practices such as - fertilizer, lime, supplementary feed, water quality management and cleaning, etc. Practically they just release fry in the water-body and gradually start catching fish after two months. It was in fact not a scientific aquaculture management practice, rather a tradition of inherent fish culture that practically gave low productivity and poor return from investment.

After the ADMI Project, hands on training was provided in different aspects of freshwater aquaculture *viz.,* removing aquatic weeds and predatory fishes, pond preparation, liming, stocking, manure application, supplementary feeding, health care of fish and harvesting. The FFIG members received critical inputs and through training-cum demonstration from the fishery specialist of Purulia District Project Management Unit (DPMU), ADMI Project. It was found that farmers do not have adequate operating capital for scientific aquaculture practices. Therefore, efforts were instigated to foster linkage with bank for accessing institutional credit by the FFIG and prompted market linkages for selling fishes to traders and consumers. Moreover, linkages were established with the source of all necessary inputs they need for fish culture practice.

FFIG members were very keen to learn aquaculture practices. The ADMI Project has improved their knowledge base that they did not get before.

Taking into consideration the inherent water quality (by checking pH, transparency and plankton availability) and soil conditions (by checking pH), management practice schedules were prepared for the water body and management was done accordingly. Stocking of advance size fingerlings / yearlings (size ranges from 8-15 cm) was recommended as it grows very fast within 6-7 months period. Use of supplementary feeds, feeding methods, pond fertilization and management strategies were found most important for enhancing production. Critical inputs like fish seed (fry), lime, feed and fertilizers were provided to the groups in order to encourage them to adopt scientific practices. Different steps were followed during intervention along with scheme status before and after adoption of technology introduced by ADMI Project (see diagram 1).

Diagram-1. Status of Salkar Bundh – Before and After intervention



In the pond, fingerlings (10-12 cm) of Rohu, Catla, Mrigala, Silver carp, Grass carp and Common carp spices were stocked at a ratio of 1.5 : 2 : 2 : 1 : 1.5 : 2. Presently, the average stocking density has been given 4,240 fingerlings (8,000 ha^{-1}) which are 288% higher than the traditional practices before. The beneficiaries were taught about post-stocking management of fishes and procedure of using organic manure (cow dung) in pond water. Besides, inorganic fertilizer urea and SSP (Single Super Phosphate) were applied for augmenting phytoplankton production. About 35% crude protein containing pelleted supplementary fish feed was given @ 2-3% of the estimated biomass. Depending on the water quality, adequate amount of lime was applied as per requirement. Periodic sampling through fish catches was carried-out to monitor fish health status and growth. Intermittently pH level checking and availability of plankton (primary productivity indicator) checked and accordingly further liming and fertilization was applied. Fish production level was recorded regularly after each catch from the pond.

Figure-1 shows operating variable cost of aquaculture demonstration practices. It includes various inputs that were applied and other cost of culture and management practices. It was evident that cost of feed (60%) and fingerling (25%) were the most important than other for labour (5.5%), fertilizer (3%), netting and transport (3%), miscellaneous (2%) and lime (1.5%). Total cost of culture fisheries was INR 100,216 (189,087 ha^{-1}) and total value of production was INR 171,005 (322,651 ha^{-1}). Finally, the cost per kg of fish production was INR 67.39.

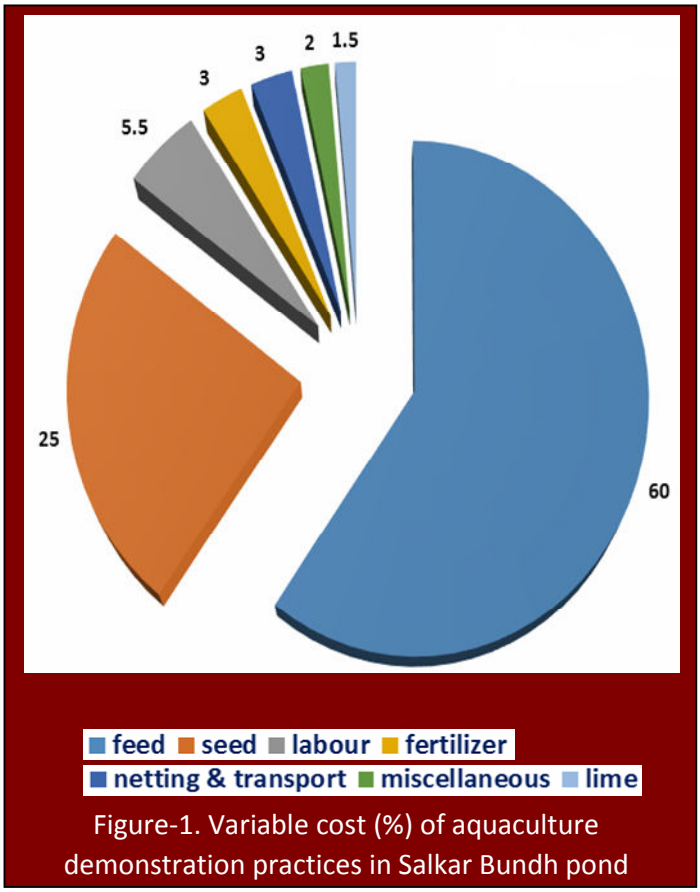


Figure-1. Variable cost (%) of aquaculture demonstration practices in Salkar Bundh pond

Figure-2 shows an estimate of per ha productivity of fish from the demonstrated pond for seven months culture period. The actual production of fish was 1,487 kg from 0.53 ha which would be about 2,805 kg ha^{-1} compared to the pre-adopted production level of 350.00 kg ha^{-1}. Overall incremental productivity has gone up by about 701% as compared to average production of traditional practices before the ADMI Project.

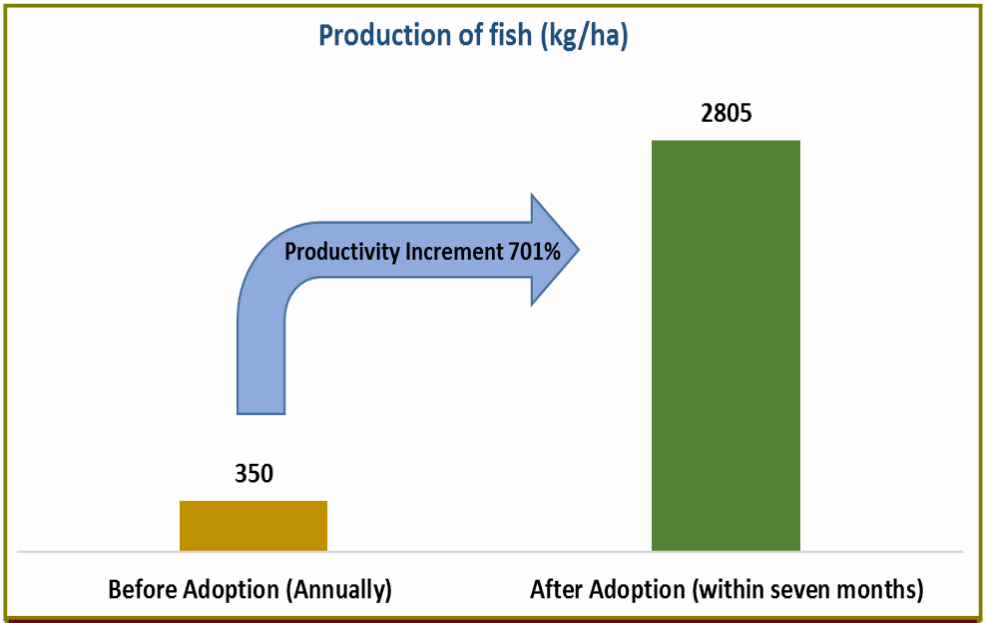


Figure-2. Per hectare fish productivity of Salkar Bundh pond, Before and After the ADMI Project

Information shows that per unit water body produced 28 kg fish, for which cost was INR 1,891 and return was INR 3,227 (net return Rs. 1,336). On the other hand, per unit (kg) production cost was INR 67.39 and return INR 115.00 (net return Rs. 47.61). Therefore the cost-benefit ratio for the water-body and productivity was 1:1.71 that shows almost 70.64% higher return than cost of farming.

Out of total fish production, almost 82% was sold to the villagers and fish buyers and rest 18% was consumed (267 kg) by the FFIG members' families and some of which distributed to the relatives and villagers. Altogether, they sold about 1220 kg and average price per kg was INR 115. Share of their sale proceed was 60% at ***Adra*** wholesale market which is about 10km from the village and rest 40% sold locally. Finally the FFIG members were able to generate almost 70.64% net profit and net earning per member was almost INR 6,500 within seven months.

FFIG members found fish culture is an exciting hard cash earning opportunity. Many WUA members also want to be part of fish culture activities to take benefit.

The FFIG farmers reported that the increase in fish yield has resulted increase in household consumption of quality fish in Majramura village and helped them to improve fish protein intake. There are about 180 households in the village and out of them 32% ate fish from the catches of this

pond. The FFIG members also distributed fish free of cost to 18% household of this village as per their norms of community responsibility to taste of first harvest.

The package of practices (PoP) for composite fish farming demonstration has established high income generating activity to this tribal village. FFIG members are very happy to use this PoP. The FFIG beneficiaries expressed their opinion that the interventions of ADMI Project, Purulia enhanced their level of confidence and interest to grow fish in existing natural pond in Majramura village following the same PoP. They have already captured another three ponds from the village and started culturing fish using new technology of aquaculture. Their positive attitude towards scientific fish farming practices suggested that more tribal farmers, especially women need to give access to the community ponds for fish culture. They want more support from ADMI Project for technology up-scaling and training to enable them of exploiting opportunities for socio-economic benefits from composite fish farming.

Farmers in Majramura village have adopted three more ponds for aquaculture practice and planned to involve women in fish culture. They are interested to increase fish production, consumption and family income in the village.

Observations:

All seven ponds in this village will be adopted by this aquaculture practice. Immediately they need to develop institutional linkage for seeds and inputs and market linkages to sale fish with good price. They need savings of FFIG to maintain water-bodies and to buy inputs for sustainable aquaculture. This project is contributing to improve social capital, making impact on society, increasing local consumption of fish protein, generating employment and increasing income.

Salkar Bundh Pond

Before Project **After Project**

References:

1. **WUA and FFIG, Majramura village, Block: Kashipur, District: Purulia, 2016**
2. **Fishery Specialist, DPMU, Purulia.**
3. **FGD discussion with FFIG members.**

Abbreviations:

DPMU **District Project Management Unit**
FFIG **Fish farmer interest group**
ha **Hectare**
IMC **Indian Major Carps (also called ICC - Indian Common Carps)**
INR **Indian Rupee currency**
Kg **Kilogram**
km **Kilometre**
PoP **Package of practices**
Rs. **Rupees (Indian currency)**
SPMU **State Project Management Unit**
ST **Schedule Tribe**
WUA **Water User Association**
WB-ADMIP **West Bengal Accelerated Development of Minor Irrigation project**

Glossary:

Amon	Local name of kharif paddy grown in rainy / wet season
Kharif	Monsoon season
Swarashati Puja	Pray to Goddess of education and knowledge
Salkar Bundh	Local name of the water body (pond environment)
Village	Small unit of settlement
Tradition(al)	Culture and practice inherited by generation

Acknowledgement:

We are very grateful to all WUA-FFIG members of Majramura village, Kashipur, Purulia for their time, patients and responses during the focus group discussions and their cordial entertainment during the field visit. Our special thanks to all DPMU, Purulia and SPMU professional staffs for their friendly support and coordination in all respects. We are highly indebted to Dr. Anju Gaur and Mr. Raj Ganguly, the World Bank Group for their regular support and guidance to bring success of the ADMI Project.

Fisheries as the Promising Economy in Purulia – A Case Study

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March 2017

Introduction:

Purulia is the extreme western district of West Bengal and acts as a gateway between industrial belts of Jharkhand. Due to it's geographical location, tropical climate, undulated terrain, minimum water retention capacity, low agriculture and fishery productivity, the district still counted as a backward district, characterized by predominance of tribal peoples and poor socio-economic condition of villagers. Fisheries sector have potentiality to contribute significantly to the economy of Purulia district. It has been recognized as a powerful income and employment generator as it stimulates growth of a number of subsidiary industries and is a source of cheap and nutritious food. Most importantly, it is the source of livelihood for a large section of economically backward population of the district. The main challenges facing fisheries development in the district include development of sustainable technologies and creating awareness to peoples to adopt those technologies to get higher yield through aquaculture in both seasonal and perennial water bodies.

Status of Fisheries in Purulia:

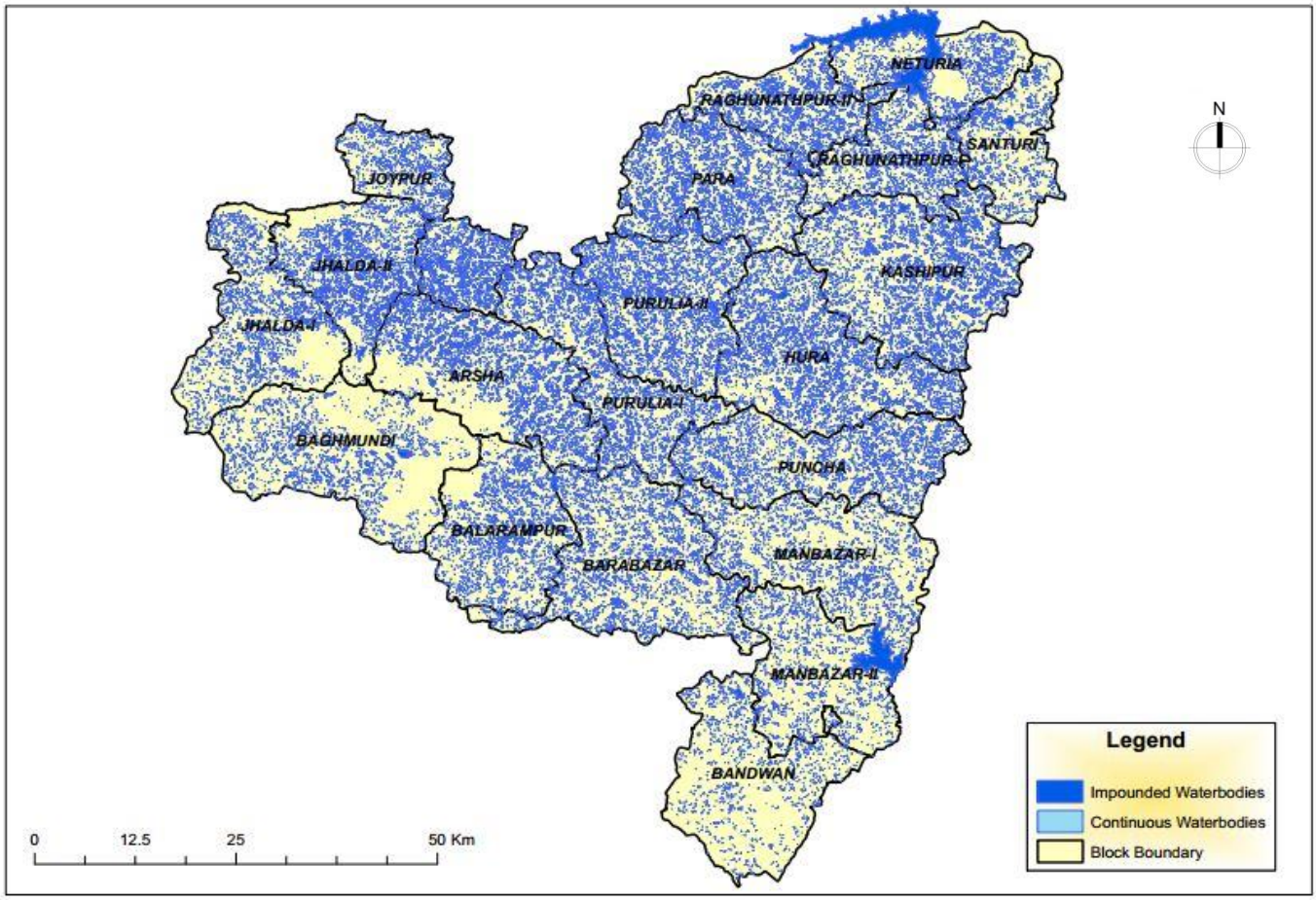

Diagram 1: Total available water bodies at Purulia District

Total geographical area of Purulia district is 6259 sq kms containing 36 Nos. of reservoirs (total water area 8,507.74 ha) and 25,229 Nos. of ponds (total area 18575.69 ha) out of it about 16,214.00 ha area presently available for pisciculture (diagram 1). At present Purulia has total 22 Nos. of functional Fish Production Groups and 230 Nos. of Self Help Groups, engaging 22500 Nos. of fishermen families. District has a demand of about 180 Million of fish seed every year, and only 5 million is its present production status, through 1 Govt. supported and 2 private fish hatcheries. At present annual fish production in the district is about 46,700.00 MT, which is quite lower than its annual demand of 50,000.00 MT (fig 1). Above status indicates that implementation of highly productive sustainable technology is very needful to fulfill demand of both seed and table fish.

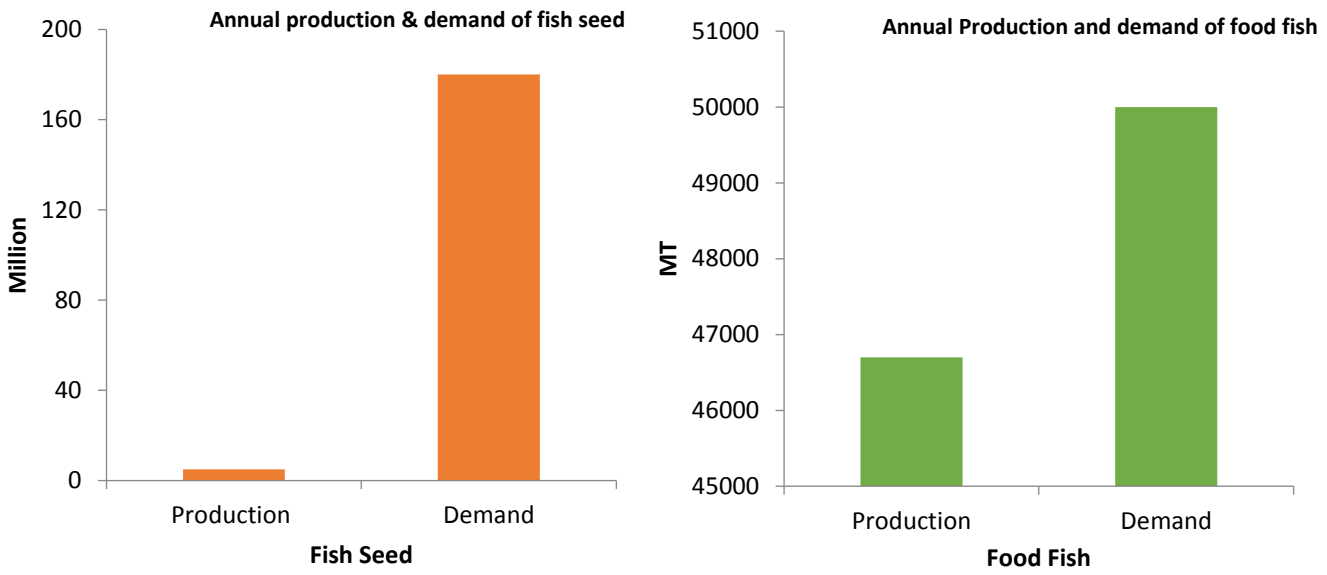

Fig 1: Production and Demand of fish seed and food fish in Purulia District

Approaches taken besides WBADMIP:

Department of Fisheries play a major role in the district for promoting scientific fish farming and involving peoples through some major schemes like Agumentaion of Fish Culture through Development of Socioeconomic Condition of Fishermen, Development of Infrastructure Facilities in Inland Fishing Village, Training Limnological Support, Dwelling House through Gitanjali and Amar Thikana Schemes. Under convergence with Jaldharo Jal Bharo, Rastriya Krishi Vikash Yojona, Agriculture Technology Management Agency and Anandadhra Projects of central and state Governments, Department of Fisheries also promoted aquaculture by infrastructure development, critical inputs supplying, training and motivation. As a line department of WBADMIP, Dept. played crucial role to promote and improve aquaculture practices during training and motivation programmes.

Intervention by WBADMIP:

The present study is based on an intensive fieldwork conducted in WBADMIP polygon areas of four respective blocks of Purulia district, West Bengal during the month of February 2015 to July 2015. After survey and assessment of essential technical parameters (pH, transperancy, dissolve O_2, free CO_2, alkalinity & hardness), twenty different water bodies have been selected on twenty different mouzas, covering a total area of 15.28 Ha. About 209 number of beneficiaries, from twenty different fisheries demonstration sites were selected under Fisheries Interest Group (FIG) on the basis of their interest in fish culture, poor economic back ground and having access to community ponds. Detailed information pertaining to the status of aquaculture, package of practices followed by the farmers and average production level of last three years in pre-adoption phase was collected from the beneficiaries of the adopted ponds. Hands on training was provided in different aspects of freshwater aquaculture *viz.*, removing aquatic weeds and predatory fishes, pond preparation, liming, stocking, manure application, supplementary feeding, health care and harvesting. Critical inputs like fish seed, lime, feed and fertilizers were provided to the groups in order to encourage them to adopt scientific practices. Efforts were initiated to foster linkage with the bankers for extending institutional credit to FIG and also with market for sale of the produce.

Taking into consideration the inherent water quality (by checking pH, transparency and plankton availability) and soil conditions (by checking pH), schedules were prepared for the water body and management was done accordingly. Fingerlings (10-12 cm) of Catla, Rohu, Mrigala, Silver carp, Grass carp and Common carp were stocked at the ratio of 2.5 : 1.5 : 1.5 : 1 : 1.5 : 2 (in case of six species culture) & Catla : Rohu : Mrigala stocked at the ratio of 4 : 3 : 3 (in case of three species culture). The average stocking density was 8000 fingerlings ha^{-1}. As post-stocking care of fishes, the beneficiaries were taught about the procedure of using organic manure (cow dung) in the pond. Besides organic manure, inorganic fertilizer *viz.*, urea and SSP (single super phosphate) were used for augmenting phytoplankton production. About 35% crude protein containing pelleted supplementary fish feed was given @ 2-3% of the estimated biomass. Depending on the water quality, lime was applied as per requirement. Periodic sampling was done to monitor fish health status. By checking pH level and availability of plankton (primary productivity indicator) in further liming and fertilization was done. Fish production level was recorded after harvesting the fishes from the pond.

Achievements by WBADMIP:

The average productivity of the selected water bodies before adoption was found 650 - 1400 kg ha^{-1} annually. Prior to adoption, the beneficiaries used to stock mixed seeds of Indian Major Carps (Catla, Rohu & Mrigala). Fish seed of 2-2.5 cm size fry (mostly) were stocked at an average density of 20,000-30,000 ha^{-1} (mostly), other than this there was no application of any other important materials (such as - fertilizer, lime and supplementary feed) were recorded, such unscientific management practice leading to hamper productivity.

After adoption various inputs were applied with variable cost for culture and practice of management, such as, fingerlings (10-12 cm in size), supplementary feed, organic and inorganic fertilizer, lime and essential medicines the mean production level of adopted water bodies have had increased minimum about 1493 kg ha^{-1} and maximum 3472 kg ha^{-1} within six to ten months culture period (depending on water availability and active participation of FIG members). Above mentioned phenomenon is clearly visible in fig 2, where average size of carp fish in an non-adopted water body have reached maximum up to 250 gm after 1 year of culture period where after adoption farmers easily harvested 800gm (average body wt.) of carp fish within 10 months.

Fig 2: Fish Production status without adoption and with adoption by WBADMIP in Purulia

Discussions:

The package of practices demonstrated during the work has established a high economy generating pathway to the members of FIG through composite fish farming. Moreover, linkages were established with the source of all necessary inputs they need for fish culture practice. Stocking of advance size fingerlings / yearlings (size ranges from 8-15 cm) was recommended as it grows very fast within 6-9 months period. Use of supplementary feeds, feeding methods, pond fertilization and management strategies need to be promoted for enhancing production. The beneficiaries expressed that the interventions of WBADMIP, Purulia itself enhanced their level of confidence and fetch interest towards fish culture. With such successful culture practice farmers not only fulfil their internal demand of fish, but also engaging to markets with their harvests, generating a new pathway of economic status development. Besides food fish production internal demand of the districts clearly indicates that fish seed production could be a profitable venture to meet up district level demand and generate economy.

References:

1. WUA and FFIG, District: Purulia, 2016
2. Department of Fisheries, Purulia, 2017
3. Fisheries Specialist, DPMU, Purulia
4. FGD discussion with FFIG members

Acknowledgement:

We are very grateful to all WUA-FFIG members of Purulia District for their time, patients and responses during the focus group discussions and their cordial entertainment during the field visit. Our special thanks to Mr. Subodh Sahana, Executive Engineer, DPMU, Purulia and all other DPMU, Purulia and SPMU professional staffs for their support and coordination in all respects. Our special thanks to Mr. Kamala Kanta Murmu, Assistant Director of Fishery, Purulia for providing important district level data. We are highly indebted to Dr. Anju Gaur and Mr. Raj Ganguly, the World Bank Group for their regular support and guidance to bring success of the ADMI Project.

Transforming Extensive Fish Production System to Semi-Intensive Aquaculture Practices in Uluberia village of Purulia District

Component: Strengthening livelihood through composite fish farming

Prepared by:
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April 2017

Introduction:

There are huge number of perennial and seasonal (minimum of 6 month water retention capacity) water bodies very suitable for aquaculture and can be used as an important source of livelihood in Purulia district. Participation of fish farmers to change their extensive outlook on aquaculture is the primary target of WBADMI Project in Purulia district. Appropriate extension programme through capacity building, motivation and adoption of scientific technology would help farmers in taking up aquaculture in a sustainable way, with adoption of semi-intensive culture practice. However, there are several constraints to increase fish productivity and among them disease is one of the primary constraint of fish growth. Addressing the fish health issues with both pro-active and reactive programmes become a primary requirement for sustaining fish production growth and fish trade.

The present study has undertaken to address major challenges faced by fish farmers in Uluberia village of Kashipur block. The village has 84 households (56 SC and 28 ST) and many of them has own pond and community water-bodies under the Kashipur block which are suitable for fish culture. In this area fish culture promoted by the ADMI Project by giving emphasis on pond preparation for fish habitat, liming for water quality management, pond fertilization, protein-base feed supply with especial consideration on prevention and control of fish disease during aquaculture practice. This study is a case of motivating farmers to adopt semi-intensive aquaculture practice over extensive culture, for healthy fish production and enhancement of productivity.

Pre-Project Scenarios:

Uluberia village under Kashipur block of Purulia district have most feasible nine water bodies for aquaculture (both perennial and seasonal) and among them *Gosai Bundh* (name of the water body) was adopted for demonstrating composite fish farming by WBADMI Project, Purulia. The Gosai Bundh water-body area is about 1.5 ha. Local fishermen culture fish traditionally in this pond. Before the project average fish productivity of the Gosai Bundh was almost 800 kg per ha annually through traditional cultural practice. The beneficiaries used to stock mixed seeds of Indian Major Carps (Catla, Rohu & Mrigala). Mostly fry were stocked on an average density of 25,000 per ha along with some fingerlings. They used to apply organic manure and lime according to their estimate to maintain water quality without proper knowledge. Under such extensive management practice and without proper scientific knowledge fish growth performance was poor and also affected by disease out breaks mortality, which resulted to inferior quality of fish and low productivity.

Post-Project Scenarios:

In 2015, ADMI Project initiated pond aquaculture in Uluberia village. The project organised a ten (10) member fishermen group in Uluberia for Gosai Bundh called Fish Farmer Interest Group (FFIG). The project conducted hands on training covering various aspects to transfer knowledge of freshwater aquaculture. It mainly covered wet and dry pond preparation, optimum time of liming, optimum ratio of stocking, adequate manure application, supplementary protein-based fish feed, disease and health care, optimum growth monitoring and time of harvesting for good return. The FFIG received critical inputs and training-cum demonstration from the project fishery expert of Purulia District Project Management Unit (DPMU) during FY 2015-16. The project has given especial attention to control and management of disease out breaks which is seriously affect fish production in this area.

During the culture period, the fishermen identified that some bottom dwelling fish like Mrigala and Common carp have been reported to show diseases like fin rot and scale disruption. Perhaps, it is due to water pollution and overcrowding stocking of unhealthy fingerlings that leading to parasitic infection on different organs of fish. For such purpose during demonstration some preventive measures against diseases have been taken (Fig 1) from the time of stocking by treating fingerlings with $KMnO_4$ during release in Gosai Bundh. Farmers have strictly followed proper liming at regular intervals and maintaining pH level in between 7.0 – 7.5 during culture period. But the FFIG members have noticed that some fishes are floating on water surface in between 5 – 6 months of culture period. They found symptoms like discoloration of gill with accumulation of excessive slippery materials over it. The fishermen with the help of DPMU personnel properly conducted diagnosis the problem and successfully identified gill infection particularly for Catla fish. The onset of gill disease usually follows a deterioration of environmental conditions associated with overcrowding and increases in toxic metabolic waste products, but for the present phenomenon 1st reason has been found to be justified. It may be an effect of draught as well as utilization of water for irrigation of paddy fields and thereby water level has reduced below the required level of number of fishes that leaded to overcrowding of fish in Gosai Bundh. Immediate action was taken by removing infected fish species, due to

Fig 1a: Treatment with Potassium permanganate during release of fingerling

Fig 1b: Application of Lime during pond preparation

Fig 2a: Salt water (2.5%) treatment for the infected fish

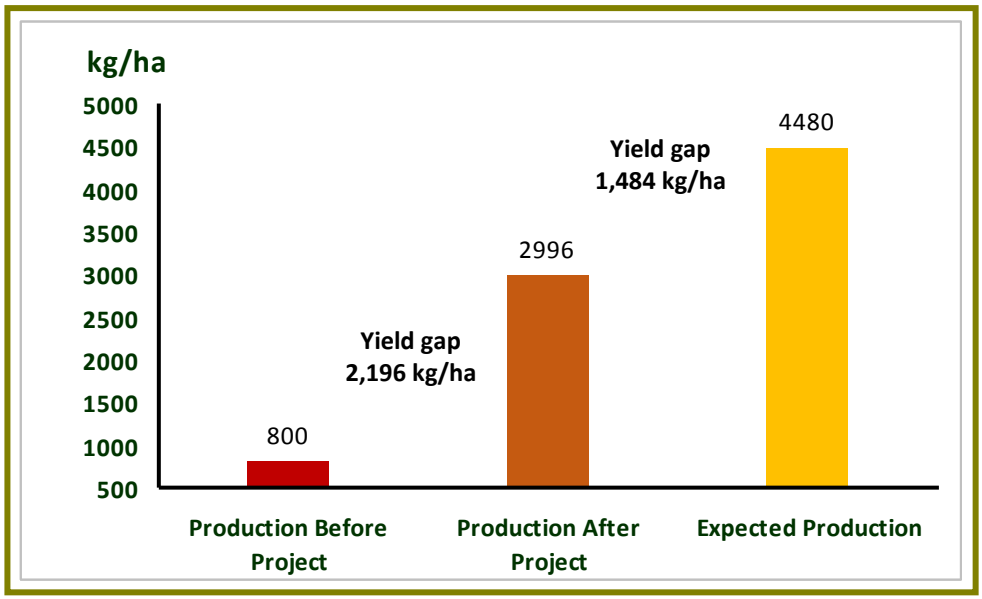
Fig 2b: Gill infection in Catla fish

spread of disease about 158 Kg of fish (mostly infected) have been harvested and sold immediately to rural market and consumed by the fishermen themselves. It reduced biomass as well as the FFIG removed all infected fish from water and during this time about 26 kg of fish was died due to gill infection.

Existing fishes in the water body was treated with 2.5 % of normal salt solution for three days (one time per day), and liming was done after three days of salt treatment as a preventive measure. Surprisingly, within 15 days successful eradication of gill infection was found. Farmers were given instruction to apply lime and fertilize their ponds at regular intervals to maintain optimum water quality, load of fish feed and food organisms. Further, the FFIG members were advised to contact either DPMU personnel and/or fish health experts once any disease signs and any mortality are noticed in the pond to prevent spread of infection.

Achievements:

Under this demonstration programme with a successful combat against disease outbreaks and reduced water level satisfactory outcomes have been obtained after 8 months of culture period. Harvesting was done for about 8 times and total 4494 kg (2996 kg/ha) have been harvested. The achievement was 3.75 times higher compared to the pre-project level of production (800 kg/ha). Disease outbreak and adverse environmental conditions leading to high mortality rate and reduced growth performance were found to be the main reasons for affecting fish growth and reduction in production. However, still over 33% yield gap remain which need to be achieved in future for sustainable production and income growth.



Out of total produce almost 8% fish was self-consumed and distributed to the villagers and relatives. Altogether they have sold rest of the fish (4134 kg) at village and rural *haat* market (6 km distance) as well as to Adra wholesale market (18 km distance). Finally FFIG was able to generate about INR 450,000 which was earned by selling on an average INR 110/kg. Total production cost for this demonstration programme was about INR 283,000 and total worth of production was about INR 494,000 and thus net profit was about INR 211,000. Presently, the FFIG have a significant amount of saving in their bank account.

FFIG still have opportunity to gain more profit by reducing the yield gap. Moreover, the fishermen have found scientific aquaculture as an effective approach to gain productivity and profitability. In 2016-17 FFIG members have adopted additional five more water-bodies and its total effective water area is about 4.5 ha. Out of these five ponds, four are in Uluberia village and one in Rampur village (adjacent to Uluberia) and started semi-intensive aquaculture practices that they learned from the ADMI Project assistance.

Sources of information:

1. FFIG, Uluberia village, Kashipur block, Purulia district.
2. DPMU, Purulia district.

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Plug-Tray to Egg-Tray:
An innovation of indigenous low-cost nursery method to grow healthy saplings

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It is known that a healthy sapling and its survivality without shock is a condition of healthy plant to produce good quality of product. Although it needs favourable environment but always method of practice matter the most. We all know from previous experiences that seedlings grown in Plug-Tray (PT) are always going to give us better and healthy plants resulting to higher and quality production compared to traditional methods of farmers. The West Bengal Accelerated Development of Minor Irrigation project (WBADMIP – in short ADMI Project) introduced PT and coco-peat to grow plant nursery in a control environment using poly tunnel and poly house to cultivate various vegetable crops. Somehow we were unable to provide adequate PT to farmers of all Water User Associations (WUAs) on timely. We were thinking how to satisfy farmers to fulfil their demand for sapling. It came out through our discussion that a best alternative would be of using cavity of normal Egg-Tray (ET) and local soil & compost ingredients of making bed instead of PT and coco-peat.

As we thought, we have collected some ET and took the initiative to test it first before exposed this idea to our farmers. We tried it on an experimental basis in our District Project Management Unit (DPMU) office campus, where we found very positive and encouraging results. We are proud to claim that we have succeeded our mission of innovative thinking to produce sapling through this indigenous innovative approach. After the success, we have selected some farmers from our WUA to implement this innovative idea of using ET instead of PT for seedbed preparation process which found excellent results to grow healthy seedling as good as PT nursery using coco-peat.

Initially we started training our selected lead farmers, our community workers (CW) and community service providers (CSP) about the whole process. We demonstrated the ET seed bed preparation process in the field in presence of farmers and our CWs and CSPs. After providing hands on training to our CW and CSP about the ET seedbed preparation added us with more expert hands for continuous support and monitoring farmers planting ET sapling. Materials used in ET seedbed preparation are ordinary ET for base support, paddy husk ash, compost (cow dung) and for disinfectant purpose *neem* cake dust was used. These above mentioned three components mixed in appropriate quantity. After that seeds are placed in the cavity seedbed if ET. For moistening we used small hand sprayers (1 lit. capacity) so that water falls on the seedbed in foggy spray style.

In the case of Broccoli, the germination rate was about 90% and it was 95% for Capsicum sapling. The survival rate was 98 for Broccoli and 93% in the case of Capsicum. Component used in preparing ET cavity seedbed are:

1. Compost (cow dung) - 70%
2. Paddy husk ash- 28%
3. *Neem* cake dust- 2%

The survival rate was high for certain reason as mentioned below:

- ✓ Use of disinfectant (*neem* cake) while seedbed preparation.
- ✓ Healthy seedling as we can say less root breakage due to untidy seedbed as soil was not used in seedbed.
- ✓ Favourable climatic condition during cropping period.

This result cannot be possible if above mentioned conditions reverses. Luckily we got above mentioned conditions during the cropping period in all the cases from cavity bed preparation of nursery to plant growth in the field.

Records of Innovative ET Demonstration by WUA and non-WUA farmers:

Name of WUA	Block	Name of Farmer	Name of Crop	No of Egg tray used in seedbed	No of Sapling grown
Ramuvita WUA	Goalpokher-I	Yusuf Alam	Broccoli	35	1000
Jharbari Ujjal WUA	Goalpokher-I	Hazra Khatun	Broccoli	20	550
Hatpara WUA	Kaliyaganj	Gopal Roy	Capsicum	10	300
Kunor WUA	Kaliyaganj	Dipal Pramanik	Capsicum	10	300

This ET method is also useful for preparation of nursery for plants like cabbage, cauliflower, Chilli, Bitter Gourd, Ridge Gourd, Cucumber.