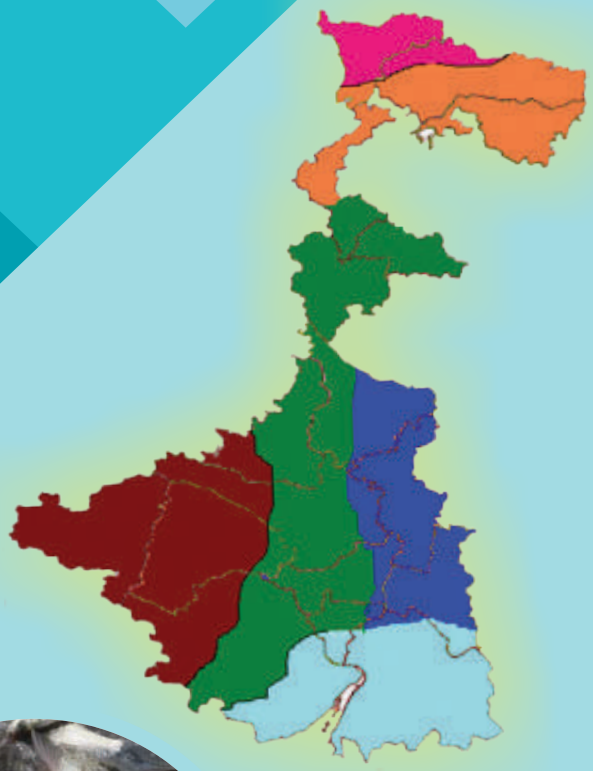
DOUBLING FARMERS' INCOME BY 2022
IN West Bengal



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Doubling Farmers' Income by 2022 in West Bengal

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Doubling Farmers' Income by 2022 in West Bengal

Dedicated

To
The Farmers, Scientists, Extension Personals and Policy Makers

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MESSAGE

Agricultural sector has been striving for raising agricultural output and improving food security. This has resulted into increase of food production to make India self-sufficient in food grain production at aggregate level and also a net food exporting country. Now it is being realized the need to raise farmers' income and thus Government is keen to implement a time-bound programme of doubling farmers' income.

However, to make this plan a reality, concerted efforts need to be taken up involving all the stakeholders. In this respect, bringing out a strategy document for West Bengal tor Doubling Farmers' Income by 2022 is a welcome initiative. ICAR-ATARI, Kolkata in collaboration with all the State Agricultural Universities, ICAR Institutes and State Development Departments has finalized this strategy document including both on and off farm enterprises, The document details the prospects in different agro-ecological zones and related solutions for achieving the targets. III addition, a good number of success stories has made the document more realistic and achievable.

I appreciate the hard work put forth by ICAR-ATARI, Kolkata in synthesizing the possibilities existing in the state and developing a plan of action for increasing the income of the farmers of West Bengal by 2022.

Dated: 10.05.2018

(A.K. Singh)

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No. 94 - ASL

February 28,2018

MESSAGE

Agriculture is an important socio-economic pillar of Indian economy. Strategy for development of agriculture sector in India has so long focused primarily on raising agricultural production, productivity and improving food and nutritional security. Farmers are the key players for bringing about any significant change in agriculture in the country. While the country achieved a commendable position in food production, farmers' income still remains low and highly vulnerable in relation to income of those working in the non-farm sectors. On the other hand, in spite of the best ever food grain and horticulture production, India is still one among the top impoverished nations of the world apart from less addressed issues of food safety. This issue is worrisome in the global scenario of climate change, shrinking available resources and demand of raising food production further significantly to meet the energy and nutritional requirements of the ever-growing populace of our Motherland. In this backdrop, the goal set to double farmers' income by 2022 is praise worthy for promoting farmers' welfare, reducing agrarian crisis and bringing parity between income of farmers and those working in non-agricultura! Professions.

The members of the State Coordination Committee (SCC) for Doubling Farmers' Income by 2022 in West Bengal have taken necessary initiative for preparing this strategy document within the stipulated time-span. I strongly believe this Strategy Document for Doubling Farmers' Income in West Bengal could help all the stakeholders of West Bengal for planning their course of action to achieve the goal in an organized manner, provided necessary budgetary requirements are addressed component-wise in parallel.

I congratulate this initiative as an important step.

(Sanjeev Chopra)

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PREFACE

Doubling farmers' income by 2022 is central agenda to promote farmer's welfare in the entire country. Thus, the publication of 'Doubling Farmers' Income by 2022 in West Bengal' is an attempt to document agro-ecological situations of the State, potentials for development of agriculture and allied sectors and strategy for scaling up result-oriented technologies in favour of augmenting farmers' income.

Agriculture is a predominant source of occupation in West Bengal with about 70% of people engaged in agriculture and allied sectors. Over the years, technological advances have been taken place in agriculture and allied sectors enabling the State self- sufficient in food grain production, especially rice. West Bengal is the largest producer of vegetables and jute, second largest producer of potato and third largest producer of egg and meat in the country. The State is a major producer of fruits and flowers. West Bengal is one of the leading State of India in the fisheries sector which is playing a vital role in employment and income generation in rural areas of the State. However, the farmers are still suffered from getting quality seeds, fertilizers in time, assured irrigation, storage facilities, minimum support price (MSP) for selling agriculture produces. Lack of adequate scientific post-harvest storage facilities both for perishable and nonperishable agriculture produce is one of the problems associated with the agriculture production which results in 10-30% post harvest losses/ wastage every year prior to reaching the consumer in West Bengal. Therefore, it is necessary to develop an integrated approach right from production to post harvest management and processing for increasing the farmers' income.

The contents of this document are aimed at exposing the present status of agriculture and allied sectors and opening scope for agro-ecological zone specific and district specific sustainable development in view of doubling the farmers' income by March 2022 in West Bengal. Efforts have been made to use the updated data in the document. Many success stories on farmer centric technological modules covering different districts have been included so that the stakeholders can be benefited to scale up different technological modules. The editors have included befitting pictures in this document most of which have been photographed by the staff of KVKs of different districts in West Bengal.

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

(S. S. Singh)

Place: Kolkata
Date: 17.05.2018

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The editors like to acknowledge the views and suggestions for doubling the farmers' income in West Bengal made by the members of State Coordination Committee (ICAR vide office order F. No. 5-4/2017-Cdn (Tech) dated 6th March, 2017). Our sincere thanks and gratitude are due to the Vice-Chancellors of State Agriculture Universities, the Directors and Scientists of different ICAR institutes situated in West Bengal, the Directors and officers of various State and District line departments including Agriculture, Horticulture, Animal Husbandry and Fisheries for their generous sharing of valuable thoughts and suggestions.

This is an opportunity to put on record the enormous appreciation to all the Heads and Subject Matter Specialists of KVKs located in different districts of West Bengal for their needful information on agro-climate situations of the district, production status of various crops including animals and fishery sectors at district level, technology interventions for realizing success at the farmers' field.

The authors highly appreciate the farmers of different districts of West Bengal for their vital information and data portrayed in success stories.

In the course of preparing the present plan document, the authors have received enormous help and supports from different organizations and individuals. It is a great pleasure to acknowledge all who helped directly or indirectly to get ready this strategy document. Special thanks are due to all the staff of ICAR-ATARI Kolkata for their help and support during the preparation of this strategy document for doubling farmers' income by 2022 in West Bengal.

Sincere thanks are also extended to the staff of Saraswaty Press Ltd., Kolkata for their cooperation to bring out this publication in time.

Place: Kolkata

Date: 17.05.2018 **Editors**

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Introduction

DOUBLING FARMERS' INCOME BY 2022 IN WEST BENGAL

1. Introduction

Indian Agriculture plays a vital role in the country's economy. Farming is the most important enterprise in our country and farmers are an integral part of our country. Over 58% of rural households depend on agriculture as their principal means of livelihood in India. So far the strategy for development of agriculture sector in India has focused primarily on raising agricultural output and improving food security. Agriculture, along with livestock, fisheries and forestry, is one of the largest contributors to the Gross Domestic Product (GDP). As per the 2nd advanced estimates by the Central Statistics Office (CSO), the share of agriculture and allied sectors (including livestock, forestry and fishery) was 17.3 per cent of the Gross Value Added (GVA) during 2016-17 at 2011-12 base price. During the period of last 50 years from 1965 to 2015, since the occurrence of green revolution, India's food production multiplied 3.7 times while the population multiplied by 2.55 times. During the green revolution the population was around 400- 500 million; now it is 1,300 million and it is predicted to be 3 billion by 2030. The net result has been a 45% increase in per person food production, which has made India not only food self-sufficient at aggregate level, but also an exporting country (NITI Policy Paper No. 1/ 2017 of National Institution for Transforming India (NITI), GoI, New Delhi). While the country achieved commendable position in food production, farming itself turned non-profitable overtime due to rising costs and uneconomical holdings. Farmers' income remains low in relation to income of those working in the non-farm sector. Low level of absolute income as well as deteriorating disparity between income of a farmer and non-agricultural worker constitute an important reason for the emergence of agrarian distress and farmers' unrest in the country. The low and highly fluctuating farm income is causing detrimental effect on the interest in farming community and is also forcing more and more cultivators, particularly young generation, to leave farming. This can cause serious adverse effect on the future of agriculture in the country. In this background, the goal set to double farmers' income by 2022 is central to promote farmer's welfare, reduce agrarian crisis and bring parity between income of farmers and those working in non-agricultural professions. Hence, the paradigm has changed from food security to income security for the farmers.

The per capita income of the people involved in agriculture is almost one third of an average Indian. Further, within the agriculture sector, the inequitable distribution of landholdings (85 per cent of small/ marginal farmers cultivating in 45 per cent of area) makes the small and marginal farms the poverty hotspot of the country. Hence, every effort to inclusive growth has to address the income enhancement in agriculture and those weak, within the sector. The Government of India (GoI) announcement of doubling farmers' income by 2022, having a direct impact on almost half of the population, comes as an endorsement of the above strategy, aiming for a sense of income security to farmers in a time bound manner to reduce agrarian distress and promote farmers' welfare.

The subject has attracted a lot of attention, generating thoughts and debates on policy, strategy and implementation to achieve the goal. There are hardly any data sources that can give income estimates for farmers. The major source of information on income of farmers based on large sample

survey is Situation Assessment Survey (SAS) by National Sample Survey Office (NSSO) conducted during 2002-03 for the first time and repeated during 2012-13. Average household income from agriculture grew annually at 11.75 per cent in India which is Rs. 25,380 during 2002-03 to Rs. 77,112 during 2012-13 in abstract term. That is, it doubled in about 6 years. However, when measured in real terms (after neutralising the effect of inflation), the income growth was 5.24 per cent and doubling of income would take 14 years at this rate. Large farmers took less number of years to double their incomes compared to small and marginal farmers. And, one must note that 85% of the operational holdings in the country are marginal and small. The growth rates in income of farm households across major States of the country varied from 6.71 per cent in West Bengal to 17.48 per cent in Haryana. Income doubling time is 8 to 11 years for States like West Bengal, Assam, Bihar and Jharkhand. Doubling real income of the farmers till 2022- 23 over the base year of 2015- 16, requires annual growth of 10.41 per cent in farmers' income. This implies that the on-going and previously achieved rate of growth in farm income has to be sharply accelerated.

Some economists suggested that if anything is to be doubled by the year 2022- 23, it will require an annual growth rate of 10.41 per cent. During the past 22 years, between 1993- 94 and 2015- 16, farmers' income in nominal terms increased 9.18 times. Farm income increased at different rates in different periods depending upon the growth rate in output, increase in wage bill, and changes in prices received by the farmers relative to the changes in consumer price index for agricultural labour. According to NITI Policy Paper No. 1/ 2017 of National Institution for Transforming India (NITI), GoI, New Delhi, it is documented that if inflation in agricultural prices is high, farmers' income in nominal terms will double in a much shorter period. In the last 30 years, farmers' income at nominal prices almost doubled in five years twice, one during 1987- 88 to 1992- 93 and then during 2004- 05 to 2009- 10. Inflation in agricultural prices also leads to increase in real farm income if agricultural prices received by the farmers increase at a faster rate relative to the prices paid by the farmers, i.e. when terms of trade for agriculture improves. In a situation where non-agricultural prices do not rise, or rise at a very small rate, the growth in farmers' income at real prices to be almost the same as in nominal prices. Anyway, the government's intension seems to be to double the income of the farmers from farming in real terms.

Doubling real income of the farmers till 2022- 23 over the base year of 2015- 16, requires annual growth of 10.41 per cent in farmers' income. This implies that the on-going and previously achieved rate of growth in farm income has to be sharply accelerated. Therefore, strong measures will be needed to harness all possible sources of growth in farmers' income within as well as outside agriculture sector. According to NITI Policy Paper No. 1/ 2017 of National Institution for Transforming India (NITI),GoI, New Delhi, the major sources need to be increased by 2022 within agriculture sector are:

(I) Increase in productivity of crops by 4.1 per cent each year,

(ii) Increase in productivity of livestock by 6.0 per cent each year

(iii) Improvement in efficiency of input use, or saving in cost of production by 3.0 percent each year

(iv) Increase in cropping intensity by 1.3 per cent each year,

(v) Diversification towards high value crops by 5.17 per cent each year.

The increase of sources outside agriculture includes:

(i) Shifting of cultivators from farm to non- farm occupations by 2.4 per cent each year,

(ii) Improvement in terms of trade for farmers or better price realisation by 17.0 per cent each year.

Doubling farmers' income by 2022 is quite challenging, but it is obvious that some needful and results oriented strategies could make a road map to achieve the target of doubling the farmers income by March 2022. According to NITI Policy Paper No. 1/ 2017 of National Institution for Transforming India (NITI), GoI, New Delhi, it is suggested to undertake the whole programme focusing the following **three broad strategies**:

(i) Strategy I: Development initiatives including infrastructure

(ii) Strategy II: Technology generation and dissemination,

(iii) Strategy III: Policies and reforms in agriculture.

West Bengal is one of the most important states of Eastern India. Agriculture has been the way of life and continues to be the single most important livelihood of the rural masses in West Bengal. The cultivators and agricultural labourers constitute about 70% of the state population indicating agriculture as a predominant source of occupation in the State. However, the farmers are still challenged with getting quality seeds, fertilizers in time, assured irrigation, minimum support price (MSP) for selling agriculture produces apart from various natural calamities like drought, untimely rain, cyclone, flood etc. Recently, Government policies in the form of demonetization, GST etc have brought new challenge in agriculture and allied sectors to cope up with the changing market system. So, all the stakeholders of agriculture and allied sectors in West Bengal need to put steps forward in a very strategic manner and work in a holistic manner with a mission mode for development of agriculture and allied sector to fulfill the vision of '**Doubling Farmers' Income by 2022 in West Bengal'.**

Table 1: Average monthly income (Rs.) per agricultural household for the agricultural 20l2 year July-June 2013 for StateslUTs

State/UTs	Income From Wages	Net Receipt From Cultivation	Net Receipt From Farming of Animals	Net Receipt From Non-Farm Business	Total Income
Andhra Pradesh	2482	2022	1075	400	5979
Arunachal Pradesh	2076	6647	1310	836	10869
Assam	1430	4211	799	255	6695
Bihar	1323	1715	279	240	3558
Chhattisgarh	1848	3347	-19	1	5177
Gujarat	2683	2933	1930	380	7926
Haryana	3491	7867	2645	431	14434
Himachal Pradesh	4030	2876	1047	824	8777
Jammu & Kashmir	7336	3063	801	1483	12683
Jharkhand	1839	1451	1193	238	4721
Karnataka	2677	4930	600	625	8832
Kerala	5254	3531	575	2529	11888
Madhya Pradesh	1332	4016	732	129	6210
Maharashtra	2156	3856	539	834	7386
Manipur	3815	2924	1563	540	8842
Meghalaya	3776	6472	657	887	11792
Mizoram	3655	4561	864	19	9099
Nagaland	5393	3212	1384	59	10048
Odisha	1716	1407	1314	539	4976
Punjab	4779	10862	1658	760	18059
Rajasthan	2534	3188	967	710	7350
Sikkim	3113	1696	980	1009	6798
Tamil Nadu	2902	1917	1100	1061	6980
Telangana	1450	4227	374	260	6311
Tripura	2185	2772	311	162	5429
Uttarakhand	1069	2531	848	253	4701
Uttar Pradesh	1150	2855	543	376	4923
West Bengal	2126	979	225	650	3980
Group of Uts	5179	1864	213	1312	8568
All-India	2071	3081	763	512	6426

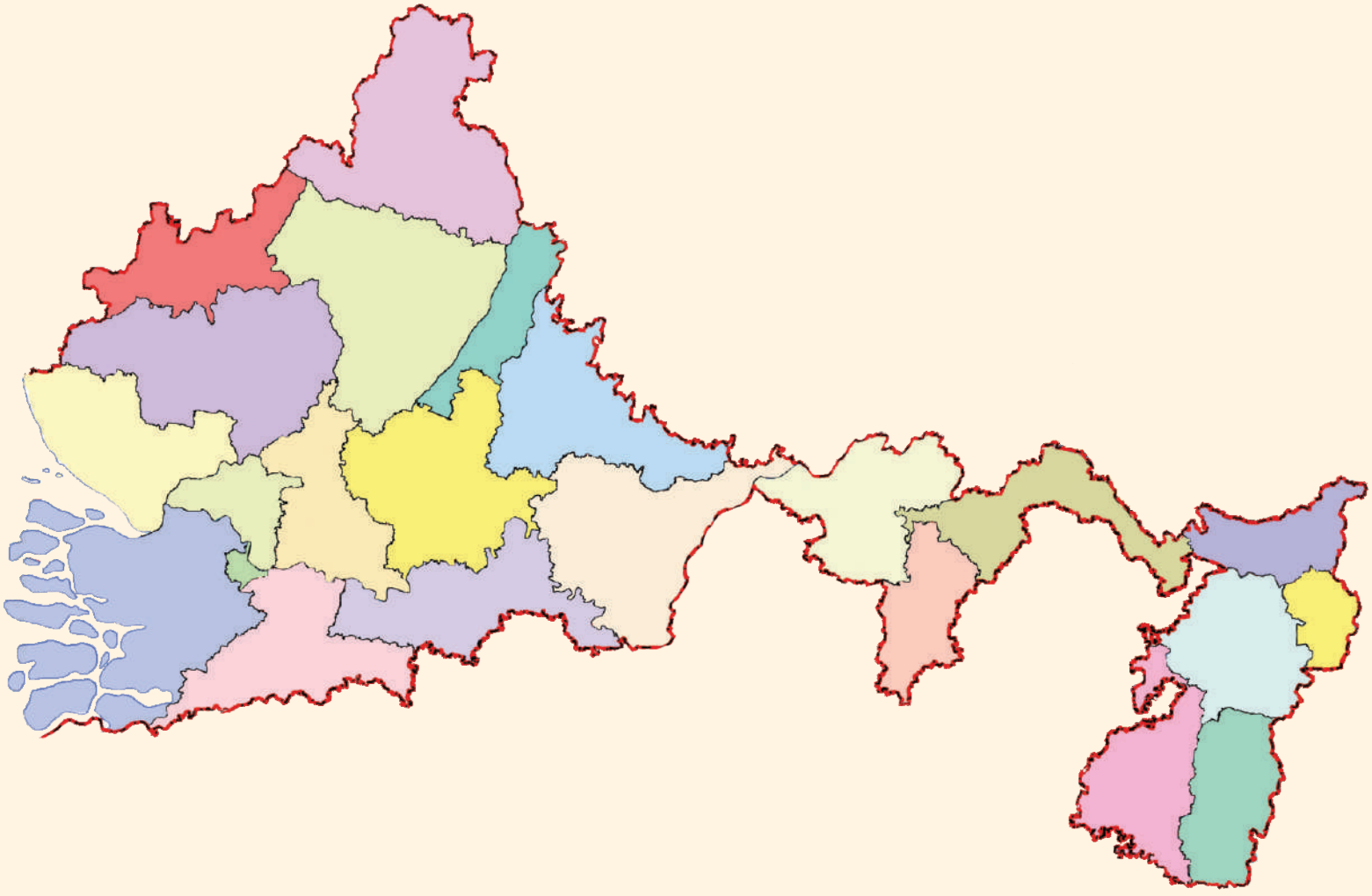
Source : NSSO (2014)

Table 2: Targeted Farmers' Income

The DFI Committee has estimated the extent to which farm's income (income from crop agriculture, livestock, non-farm business and wages and salaries) would rise between the years 2015-16 to 2022-23. These are shown in the following Table, both in real terms and in nominal terms assuming the inflation to be 5 per cent per annum during the period 2015-16 to 2022-23.

States/ UTs	Base Year: 2015-16 Prices			Terminal Year: 2022-23 At 2015-16			Terminal Year: 2022-23 At Current Prices		
	Farm	Non-Farm	Total	Farm	Non-Farm	Total	Farm	Non-Farm	Total
Andhra Pradesh	54,135	49,957	1,04,092	97,010	69,202	1,66,212	1,36,503	97,374	2,33,876
Arunachal Pradesh	1,24,461	51,691	176,152	225,14	970,369	295,518	316,808	99,016	415,824
Assam	1,28,574	43,350	1,71,924	2,43,776	51,122	2,94,898	3,43,017	71,934	4,14,951
Bihar	26,116	19,201	45,317	46,695	24,567	71,262	65,704	34,568	100,273
Chhattis-garh	46,172	24,892	71,064	95,115	36,059	1,31,174	1,33,837	50,738	1,84,575
Goa	41,581	76,829	1,18,410	84,742	81,801	1,66,543	1,19,240	1,15,103	2,34,343
Gujarat	72,969	45,074	1,18,043	1,38,642	63,895	2,02,536	1,95,083	89,906	2,84,989
Haryana	1,36,622	50,603	1,87,225	2,54,117	60,535	3,14,652	3,57,568	85,179	4,42,747
Himachal Pradesh	51,933	62,943	1,14,876	96,959	73,757	1,70,716	1,36,431	1,03,784	2,40,215
lammu& Kashmir	53,391	1,18,825	1,72,216	1,02,992	1,23,405	2,26,396	1,44,920	1,73,643	3,18,562
Iharkhand	49,060	35,760	84,820	94,146	54,639	1,48,785	1,32,473	76,883	2,09,355
Karnataka	97,547	56,852	1,54,399	1,87,875	71,557	2,59,432	2,64,359	1,00,688	3,65,047
Kerala	54,452	1,01,336	1,55,788	98,013	1,26,764	2,24,777	1,37,915	1,78,369	3,16,284
Madhya Pradesh	89,434	27,354	1,16,788	1,85,039	45,960	2,30,999	2,60,368	64,671	3,25,039
Mahara-shtra	60,885	39,148	1,00,033	1,11238	52,071	1,63,309	1,56,523	73,269	2,29,792
Manipur	61,973	60,916	122,889	108,515	70,729	179,243	152,691	99,522	252,213
Mezhalava	1,09,707	70,677	1,80,384	2,03,506	91,328	2,94,834	2,86,354	1,28,508	4,14,861
Mizoram	76,612	51,882	1,28,494	1,54,987	72,376	2,27,363	2,18,082	1,01,840	3,19,922
Nazaland	58,666	78,473	1,37,139	1,04,308	1,03,255	2,07,563	1,46,772	1,45,290	2,92,062
Odisha	34,463	28,822	63,285	70,511	34,116	1,04,627	99,216	48,005	1,47,221
Punjab	1,60,683	70,222	2,30,905	2,87,623	75,910	3,63,533	4,04,714	1,06,813	5,11,527
Raiasthan	52,270	40,644	92,914	97,693	56,494	1,54,187	1,37,464	79,493	2,16,957
Sikkim	49,129	71,504	1,20,633	88,039	1,14,811	2,02,850	1,23,879	1,61,551	2,85,430
Tamil Nadu	57,511	76,057	1,33,568	1,15,138	1,02,538	2,17,676	1,62,010	1,44,282	3,06,292
Telangana	63,492	22,799	86,291	1,11,238	31,916	1,43,153	1,56,522	44,909	2,01,431
Tripura	54,642	24,320	78,962	1,12,672	38,724	1,51,396	1,58,541	54,489	2,13,030
Uttar Pradesh	56,785	22,188	78,973	99,146	25,758	1,24,904	1,39,508	36,245	1,75,753
Uttarakhand	18,862	42,971	61,833	33,084	48,011	81,095	46,552	67,556	1,14,108
West Bengal	24,441	54,267	78,708	42,626	67,883	1,10,509	59,979	95,519	155,497
Andaman & Nicobar	57,417	94,895	1,52,312	1,22,184	1,22,844	2,45,028	1,71,926	1,72,853	3,44,779
Chandigarh	31,571	3,06,791	3,38,362	55,975	3,83,772	4,39,747	78,762	5,40,006	6,18,768
Dadra & Nagar Haveli	8,806	1,00,196	1,09,002	17,216	1,25,337	1,42,553	24,224	1,76,362	2,00,587
Daman & Diu	24,665	84,402	1,09,067	48,097	1,05,580	1,53,677	67,677	1,48,562	2,16,239
Delhi	13,204	2,62,822	2,76,026	29,352	3,28,770	3,58,122	41,301	4,62,613	5,03,914
Lakshadweep	66,496	1,73,899	2,40,395	1,15,172	2,17,534	3,32,705	1,62,058	3,06,092	4,68,150
Puducherrv	62,431	41,221	1,03,652	1,30,980	65,181	1,96,161	1,84,302	91,716	2,76,019
All India	58,246	38,457	96,703	1,08,045	48,108	1,56,154	1,52,031	67,693	2,19,724

Source: DFI Committee, DACFW



State Profile

2. State Profile

2.1. Agro-ecologies in the State

West Bengal (21° 25' 24" and 27°13' 15" north latitudes and 85°48' 20" and 89°53' 04" east longitudes) is predominantly an agrarian State, comprising of only 2.7% of India's geographical area. West Bengal is located in Eastern India stretching from the Himalayas in the North to the Bay of Bengal in the South. It has an area of 88,752 sq km. It is bordered by Bangladesh in the East, and Nepal and Bhutan in the North; it shares borders with five Indian States: Odisha, Jharkhand, Bihar, Sikkim, and Assam. West Bengal is perhaps the only State blessed with mountains, forests, water bodies, plains and the sea. In the North are the majestic Himalayas which act as natural border. The centre is an extension of India's fertile Gangetic plain. In the South, there is the magnificent Sunderbans- literally the beautiful forest. Beyond that, further South, is the wide expanse of the Bay of Bengal. The capital is Kolkata, steeped in culture and with a vibrant intellectual milieu. It is one of the world's largest populated cities and is well connected with the rest of the world by road, rail, air and sea.

The physiographic setting of the State comes under three agro climatic regions. These three broad regions are Eastern Himalayan Region (Zone II), Lower Gangetic Plain Region (Zone III) and Eastern Plateau & Hilly Region (Zone VIII). Three broad regions are further stratified into six agro-climatic sub regions. Salient features of these sub regions are as follows:

2.1.1. Zone II: Eastern Himalayan Region

2.1.1.1. Northern Hill sub region

It covers Darjeeling and newly established Kalimpong district. Soils are mainly brown forest soil, acidic in nature (pH 3.5-5.0). Annual rainfall varies from 2500-3500 mm. High humidity, less sunshine hours, poor soil depth and quality limit crop productivity. Pre-monsoon showers commences from March. Darjeeling district at a glance is depicted in Annexure 1.

Due to high slopes of the hill region of the northern part of the State with high rainfall and cooler temperature round the year, this area is almost covered with forests, plantation and orchard crops. Only one third area of this region is being cultivated with crops. The crop productivity is poor due to high slopes, high rainfall and erosion, shallow and acidic nature of the soils. The region offers good scope for extension of cultivation of mandarin orange, large cardamom, ginger, summer vegetables, peach, plum etc., adopting a sustainable approach.

2.1.1.2. Teri and Teesta sub region

It covers Jalpaiguri, Coochbehar and Uttar Dinajpur districts. Soils are mostly sandy to sandy loams, porous, low in base content, poor in available nutrients; strongly acidic (pH 4.2 to 6.2). Rainfall varies from 2000-3200 mm. High water table, low water holding capacity, high humidity, less sunshine hours during the monsoon months and marginality of lands in some parts limit crop productivity. Chronically deficient in micronutrients, like boron, molybdenum and zinc, in particular. Jalpaiguri, Coochbehar and Uttar Dinajpur districts at a glance is depicted in Annexure 1.

Rice, jute and tobacco are the major kharif crops of this region, while in winter a number of winter vegetable crops, potato and a few pulses and oilseed crops are being grown with poor productivity. This agro-climatic region is also suitable for extension of cultivation of wheat, potato, groundnut, superfine and scented rice, high value spices like black pepper, cinnamon, ginger, turmeric, garlic etc. Cultivation of medicinal and aromatic plants and allied sectors like animal husbandry and fisheries are other potential areas for further development. Small and marginal farmers of North Bengal also have tradition for large scale cultivation of winter vegetables. As a matter of fact, there are good prospects for agro-processing units for primary processing of vegetables, fruits and spices and at the same time bringing them in a semi-processed condition or secondary processed material with backward linkages to small rural centers.

2.1.2. Zone III: Lower Gangetic Region

2.1.2.1. Old Alluvial sub region

It comprises Dakshin Dinajpur and Malda districts. Soils are lighter in higher situations and heavier in lower situations, mildly acidic to neutral in reaction (pH 5.2 to 7.0); fairly fertile over most of the sub region; rainfall 1500-2000 mm in upper and 1300-1500 m in lower parts, considerable area is flood prone.

This region has great promise for large scale cultivation of a variety of winter and rainy season vegetables as well as flowers. Mango and litchi are the prosperous fruit crops of this region.

2.1.2.2. Gangetic New Alluvial sub region

It covers East Medinipur, Burdwan, Hooghly, Howrah, Murshidabad, Nadia, North Parganas. Soils are deep, mostly neutral in reaction (pH 5.5 to 7.0) and fertile; rainfall 1350- 1450 mm; most productive area of the State. West Bengal has by far the largest alluvial land, being 35 lakh ha in the country of which 22 lakh ha comes under Gangetic New Alluvial soil regions. These are endowed with neutral to near neutral, deep and fertile soils with high water holding capacity. The areas have advantage of river valley irrigation as well as ground water potentials.

A wide range of wet and dry season field crops, vegetables, fruits and spices are being grown with around 200% cropping intensity. This region has great promise for large scale cultivation of a variety of winter and rainy season vegetables as well as flowers. Mango, litchi, guava and banana are the prosperous fruit crops of this region.

2.1.2.3. Costal Saline sub region

This zone covers South Parganas district. Soils are mostly heavy clay containing higher salts of sodium, magnesium, potassium with organic matter at different stages of decomposition, mostly neutral soils (pH 6.5 to 7.5). Electrical conductivity varies from 3.0 to 18.0 dsm^{-1}, rainfall 1600-1800 mm; salinity and water congestion limit good crop productivity.

The Southern most areas of West Bengal in the district of South 24-Parganas are low lying and level part of the deltas of the river system of the Ganga on the Northern coast of the Bay of Bengal. The rice fields are classified as medium low and low lands which are inundated by floods and rain water with poor drainage. Water stagnates throughout the monsoon period to a level of 30 to 60

cm. The vast tracts of coastal saline soils occur on the fringes of Bay of Bengal. Underground water table is present at a shallow depth with high salt content. Salts are raised to the surface during the dry periods of the year rendering it unfit for cultivation of many crops needed by the local people. These areas extend to 8.4 lakh ha. Only 4% of the cultivated area is irrigated with sweet water. The region is, therefore, a mono-cropped area with 4.2 lakh ha being cultivated area in the wet season and the rest six to seven months during winter and summer remain generally fallow. Howover, a few enthusiastic farmers in the less saline areas have adopted commercial cultivation of chilli and watermelon adjacent to their homestead. Possibilities of extension of sunflower, groundnut and cotton cultivation providing saline water irrigation, have been reported. During the kharif season, this tract receives about 1600 mm rains between June to October. This amount of water is far in excess of that required for kharif crops. The proven technique of storing the excess rain water in 1/5th excavated land of the total cultivated land of a farmer and raising the adjacent embankment and crop field is strongly suggested for large scale adoption. This technique would surely bring in prosperity with the cultivation of fruits and vegetables on pond embankment and diverse field crops both in kharif and rabi seasons on the raised fields and pisci-culture amongst the small and marginal farming communities of this agro climatic region.

2.1.3. Zone VII : Eastern Plateau and Hill Region

2.1.3.1. Undulating Red and Laterite sub region

The region covers Bankura, Birbhum, Purulia and West Medinipur. Soils shallow modulated gravely, coarse textured, highly drained with low water holding capacity. Upland soils are highly susceptible to erosion; acidic in reaction (pH 5.5 to 6.2), poor available nutrients; low moisture holding capacity and poor nutrient status limit crop productivity. Rainfall varies from 1100 to 1400mm which is spread over only three months, mid June to mid September.

In the Western belt of West Bengal there exists a vast tract relatively arid where the lands are lateritic and undulating. Such lands represent about one third of the cultivated area in the districts of Purulia, Bankura, Birbhum and parts of West Medinipur. Uplands of varying sizes, from a few hectares to a few square kilometers, are interspersed with terraced rice fields in the depressions and on the slopes. The bottom terraces where moderate yields of rice are obtained generally belong to a few comparatively better-off farmers. The majority of the inhabitants of this region are predominantly tribal and other backward communities. They have largely depended on these marginal uplands where they attempt to grow some hardy varieties of poor yielding rice, certain small millets, a minor pulse-horse gram and a minor oilseed-niger; to eke out a living. Except in the year of good rainfall, the yields are very poor, hardly compensating for the labour and other inputs. The nutritional status is poor partly due to leaching losses on account of high soil porosity.

2.2. Land use and cropping pattern

Agriculture is the leading economic sector in West Bengal. Years after independence, food production remained stagnant, and the Indian green revolution bypassed the State. However, there has been a significant increase in food production since 1980s, and the State now has a surplus of grains. A major agricultural producer, West Bengal is the 6th biggest contributor to India's net domestic product.

Agricultural land of the State is 56.82 lakh ha. The gross cropped area is 97.52 lakh ha, while the net cropped area is 52.96 lakh ha with a cropping intensity of 184 per cent. Cropping pattern in the State is dominated by food crops which account for about 78 percent of the area under principal crops.

The State is rich in human resources with 70% of its population engaged in agriculture. There are 733 lakh farm families of whom 90 per cent of the cultivators being small and marginal farmers (less than 1 ha land holding). Large holdings (above 10 ha) are almost absent. Small and marginal farming communities hold 84% of the State's agricultural lands as against 69.8 percent at all India level. Incidentally, this is the second highest in the country after Kerala. Thus, agriculture in the State is small farmer centric. The average size of land holding is only 0.77 ha. The per capita cultivable land holding is highly fragmented. This has resulted in uneconomic holding size to sustain a farmer's family.

2.2.1. Food Crops

Cropping pattern in the State is dominated by food crops which account for about 78 percent of the area under principal crops.

2.2.1.1. Rice

Rice is the State's principal food crop which is cultivated in 58.48 lakh hectares (production of 1628 lakh MT) followed by cereals (all combined) in 63.49 lakh hectares. Rice is mainly produced during kharif season in West Bengal, as well as in boro season and in aus season to some extent. Rice varieties mainly grown in West Bengal are high yielding varieties (HYV) and some tall indica cultivars, especially adapted to different agro-ecological conditions. More than 90 percent of areas under rice have been covered with high yielding varieties. There is potential to grow scented rice in West Bengal. There are some short and medium grained traditional aromatic rice varieties in different agro-climatic zones of the State. Some of this promising scented rice cultivars are Gobindabhog, Tulaipanji, Kalonunia, Radhunipagal, Kataribhog, etc.

2.2.1.2. Pulses

Pulses are an important group of crops in West Bengal. Pulses are cultivated on the marginal and sub marginal land, predominantly under non-irrigated conditions. The trend of commercialization of agriculture has further aggravated the status of pulses in the farming system. However, there is a huge gap between the requirement and production of pulses in West Bengal. West Bengal shares 0.78% of pulse area and contributes 3% of pulse production in India. About 60% of pulse area in West Bengal is covered by Lentil and Kalai and rest by other pulse crops. Important pulse growing districts are Murshidabad, Nadia, Birbhum and Malda. Major biotic stresses in West Bengal are wilt, root rot and BGM. These biotic stresses reduce the productivity of the crop by 30-50%. Other important constraints are terminal moisture and heat stress, non-

availability of quality seeds of improved varieties, non-adoption of improved production technologies, inadequate and imbalanced use of fertilizer, delayed sowing, poor plant population due to low seed rates and weed infestation. High labour requirement at several critical stages like weeding at the vegetative stage or multiple plucking in Mungbean, Urdbean, Field pea during harvesting due to non-synchronous maturity increases the production cost. Due to lack of small processing units or milling facility, farmers do not get sufficient return from the production of their small land holdings.

2.2.1.3. Oilseeds

Oilseeds are grown approximately in 0.79 million ha in West Bengal. Oilseed cultivation in West Bengal is predominantly dependent on rainfall and this leads to a higher magnitude of instability in production of oilseeds. Among nine oilseed crops, mostly Rapeseed and Mustard (445.0 thousand ha.), Sesame (228.2 thousand ha.) and Groundnut (89.0 thousand ha.) are grown in West Bengal. Area under oilseeds crop has been increased from 770.9 thousand ha during 2013-14 to 782 thousand ha in 2016-17. The crop wise area, production and yield of oilseeds in the State during 2013-14 to 2016-17 are given below:

Table 3: Area (in '000 ha), Production (in '000 tones) and Yield (in kg/ha) of different oilseeds during 2014-15 to 2016-17 in West Bengal

Crop	Unit	2014-15	2015-16	2016-17
Groundnut	Area	77.4	84.2	89.0
	Production	179.9	189.9	201.9
	Yield	2324	2255	2269
Sesame	Area	224.5	227.4	228.2
	Production	213.6	214.0	215.7
	Yield	952	941	945
Sunflower	Area	15.0	12.0	8.5
	Production	22.0	17.0	12.0
	Yield	1467	1417	1412
Rapeseed & Mustard	Area	448.6	457.83	445.0
	Production	479.7	499.0	485.0
	Yield	1069	1090	1090

2.2.1.4. Jute

Jute and mesta are the two important fibre crops in India next to cotton. In trade and industry, both the crops together are known as raw jute. Jute shares to the tune of only 0.5 per cent to the total cropped area in the country. Traditionally, West Bengal has been the highest producer of jute and produces nearly 70% of the country's raw jute fibers. Jute is cultivated by small and marginal farmers. Thus, the investment capacity is poor. Technically, there is poor adoption of technology,

imbalance fertilizer application, poor plant protection measure in jute cultivation. There is shortage of improved variety seed. Jute cultivation is labour intensive for weeding, thinning, extraction of fiber cutting / soaking, stripping, washing and drying. Murshidabad is the leading district for cultivation of jute in 26.95% of total jute grown area in the State followed by Nadia (21.07% of total jute grown area), Coochbehar (12.88% of total jute grown area), North 24 Parganas (8.92% of total jute grown area) and Uttar Dinajpur (8.01% of total jute grown area). Production of raw jute has been improved over the years.

Table 4: Area (in '000 ha), Production (in '000 bales) and Yield (in kg/ha) of Jute during 2013-14 to 2015-16 in West Bengal

State	2013-14			2014-15			2015-16		
	A	P	Y	A	P	Y	A	P	Y
West Bengal	566.4	8771.8	2788	567.2	8343	2647	544.7	7667.1	2534

2.2.1.5. Potato

Potato is the third most important food crop in the world after rice and wheat. India and China together contribute 1/3rd of global potato production. Potato production in West Bengal has witnessed a five -fold increase in the last 40 years. The State is second largest producer of potato with high yield (19.73 t/ha) second only to Uttar Pradesh (22.8 t/ha) and produces 30% of the total potato in the country. Potato is cultivated in 4.12 lakh ha in West Bengal. Potato is the most important cash crop grown in rabi season in the State. Hooghly, Medinipur West, Bardwan and Jalpaiguri are the most important districts producing potatoes and contribute about 62% of the total potato production of West Bengal. The importance of potato cultivation has increased day by day and the farmers have shifted from traditional rice -based cropping system to high value cash crops like potato in the rabi season. Per hectare yield in potato is higher in the State than all India level.

2.2.1.6. Horticulture

India is the world's second largest fruits and vegetables producer next to China. Indian horticulture achieved a growth rate of 7% during 2004-05 to 2014-15. While the area increased by 2.7%, the productivity increased by 37% that has resulted in daily per capita availability of about 200g of fruits and 400g of vegetables. The horticulture sector in West Bengal is wide ranging and produces considerable amounts of vegetables, fruits and nuts, spices, medicinal plants, aromatic plants etc. under different agro-climatic conditions. West Bengal is the highest vegetable growing State in India, covering an area of about 9.39 lakh hectares with an annual production of 162.89 lakh tones including potato having the productivity of 19.34 t/ha. About 14.68% of the sown land is under vegetable crops, the highest in the country. The Central Government has so far sanctioned one Agri-Export Zones (AEZ) for vegetables in West Bengal covering three districts viz., Nadia,

Murshidabad and North 24 Parganas. This covers a major part of the Gangetic alluvium with high cropping intensity resulting in round the year availability of a number of vegetable crops. The State, at present, is the leading producer of brinjal (23%), cabbage (24%), cauliflower (22%) and okra (14%). West Bengal is also producing non-traditional vegetables like broccoli, gherkin, baby corn, brussel sprout, celery etc. Obviously large pool of skilled and enthusiastic small and marginal farmers are mainly responsible to bring about revolution in vegetable production in the state.

It is also the leading producer of pineapple, litchi, mango and loose flowers. The production of major fruits in the State like mango, banana, papaya has been increasing steadily over the last few years. Among fruits, while mango occupies the largest area (about 42% of the total area under fruit crops), the state contributes 22.88% and 10% of national pineapple and litchi production, respectively, and thus ranks 1st and 2nd in production at the national level for these two crops, respectively. Malda, Murshidabad, North 24 Parganas, Nadia and Darjeeling are some of the major fruit growing districts in the State. India is the largest producer, consumer and exporter of spices and spice products. The total area under different spice crops in the State is 22 lakh ha with an annual production of 2.999 lakh MT. The major spices crops include chillies, ginger, turmeric, coriander and large cardamom. The important districts for cultivation of spices crops include Coochbehar, Nadia, North and South 24 Parganas, West Midnapore, Jalpaiguri and Darjeeling.

2.2.1.7. Animal Resources

One of the pillars of the State's rural economy is animal husbandry. Animals are the source of food, fibre, power, skin, bones and manure. The livestock industry in India contributes about 4% to GDP. West Bengal livestock sector contributes 3.89 % of the State Domestic Product (SDP) and nearly 20.34% of its agricultural production. The Gross value of output from the livestock sector at current price is Rs. 329.4 billion. The State is rich with 16.52 million cattle which is 7th in India, 11.5 million goat population which is 1st in India and 52.84 million poultry population which is 7th in India. All livestock and poultry are indigenous and low-productive except Black Bengal Goat, Garole sheep and Ghungroo pig. The world famous, superior Black Bengal goat and the Garole variety of sheep are highly priced for the excellent quality of their meat and skin with high fecundity. Beside this, the State possesses about 0.65 million of pig including the famous indigenous pig breed named as 'Ghungroo'. Buffalo population has a negative trend in WB. The State has a meager number of buffaloes (0.6 million). The sector is largely unorganized.

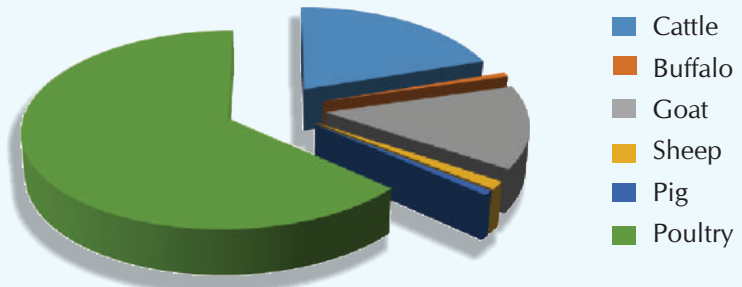


Fig. 1: Livestock and poultry population (in million) in West Bengal (Cattle- 16.52 m, Buffalo- 0.60 m, Goat- 131 m, Sheep- 1.08 m, Pig- 0.65 m and Poultry birds- 52.84 m)

In national perspective, the State is ranked third in egg and meat production and eleventh in milk production. The number of livestock population is large in the State, but the availability of livestock products is below the Indian Council of Medical Research (ICMR) norms. Despite significant increase in production of various livestock products during the past three decades, the State still faces a number of challenges in augmenting productivity of livestock and poultry birds for bridging the ever increasing demand – supply gap. The annual shortfall is about 36 million tonnes of milk, 4644 million numbers of egg and 378 thousand tons of meat.

Table 5: Per capita availability (PCA) of milk and egg

Sl. No.	Product	West Bengal	India	Highest PCA State	Position of WB in India	Position of WB in Eastern India
1	Milk (gm/day/head)	145	351	961(Punjab)	18th	4th
2	Egg (No/year/head)	58	66	261 (Andra Pradesh)	9th	1st

(Annual Report 2016-17 of Animal Resource Development Department 2016-17, GoWB and Annual Report 2016-17 of Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture & Farmers Welfare, GoI)

In 2016, milk production is estimated 5182.5 thousand tons in West Bengal. Only 2% of total milk production is being marketed by organised sector. Supply of milk from organised sector throughout the state is nearly 3 million litres per day, while the State requires 16.9 million litres of milk daily. So there is a massive shortfall, which is met mostly by the unorganised sector.

In 2016, egg production is estimated 618 crores in West Bengal. Still, the requirement of eggs in West Bengal is about 250 lakh eggs per day, while State produces about 165-170 lakh eggs per day and about 80 lakh eggs on an average per day have to be brought from other States, mainly Andhra Pradesh. The organised layer poultry contributes only 16% of total eggs in the State. About 50% of the eggs are produced by indigenous chicken. Backyard ducks contribute about 34% of the total eggs produced in the State.

West Bengal is the third largest producer of meat in the country. But that still translates to just 67% of the per capita requirement of the State. Presently (year- 2016), per capita meat availability in West Bengal is recorded 7.1 kg/year/head, which is accounting 706 thousand tons of meat as against 7020 thousand tons of meat production in India. Chicken is the most consumed meat in West Bengal and in India, because it is cheaper than other meats and is subject to fewer religious prohibitions or cultural taboos.

Table 6: Percentage share of meat production during 2015-16

Sl. No.	Species	West Bengal	India	Position in India
1	Poultry	46%	46%	7th in India
2	Buffalo	3%	23%	10th in India
3	Goat	40%	13%	1st in India
4	Pig	6%	6%	3rd in India
5	Sheep	3%	7%	6th in India
6	Cattle	2%	5%	7th in India
	Total	100%	100%	

Availability of feed and fodder is a serious constraint. There is a rise in demand for feed and fodder, especially due to increasing crossbred population. The availability of fodder is only 248 MT/ year (40%) as against the fodder requirement of around 615 MT/ year. The fodder land is only 1.08% in West Bengal. The area under permanent pastures and other grazing land is less than 0.1 per cent of the total reporting area.

2.2.1.8. Fisheries

Next to rice, fish is the staple diet of Bengal's population and therefore, fish production is one of the key areas, where the State government puts a substantial part of its resources to maintain as well as enhance its productivity. The significant aspect is that the State is no longer a fish deficit State. The State has 7.45% of total water resources of our country contributing 16.71 MT (2015-16) of fish and shell fish to the national fish basket.

Table 7: Inland fishery resources of West Bengal

S/N	Type of fishery	Total potential resource (lakh ha)	Under culture (lakh ha)	Percentage of resource area under culture
1.	Ponds / Tanks	2.88	2.61	90.62
2.	Beels & Boars	0.42	0.21	531
3.	Reservoir	0.28	0.13	
4.	a) River b) Canal	1.64 0.80	- -	- -
5.	Sewage fed fishery	0.04	0.04	100.00
6.	Brackish water fishery	0.62	0.59	98.33

(Source: Annual Report 2015-16 of Dept. of Fisheries, Govt. of West Bengal)

West Bengal is one of the leading States in the fisheries sector of India, contributing 16.12% of countries fish. Its share of the all India fish seed production is 38%. In the inland sector, about 23% of all India fish production comes from West Bengal. In order to increase the fish production/productivity, the Fish Farmers' Development Agency of this State has been playing a vital role and putting sustained efforts on development of Pond Fisheries, Jhora Fisheries and Ornamental Fisheries. West Bengal has exploited about 75% of its inland and 30% of its brackish water resources for fish production for which it has been able to bag "National Productivity Award" for last consecutive 17 years. The fisheries sector contributes around 2.35% (2014-15) to the State Domestic Product (SDP) at constant price and more than 2.4 million fishermen are engaged in fisheries activities. Fisheries sector is playing a significant role in employment generation, poverty alleviation and socio-economic upliftment in rural areas of the State. A total of 89616 employments (or 21507909 no of man days approx.) have been generated (unit: man year = 240 days) during 2015-16.

Table 8: Total fish production of West Bengal

Year	Fish production (in lakh metric tons)	Seed Production (in million numbers)
2011-12	1472.05	13846
2012-13	1490.02	15002
2013-14	1580.65	15890
2014-15	1617.32	-

2.3. Natural resource endowments

- West Bengal is bestowed with favourable agro-climate and abundance of natural resources for diversified agriculture production.
- Highly productive soils with predominance of fertile alluviums which are responsive to different inputs and management practices for agricultural production.
- The climate and physiography of the State supports a huge diversity of life forms. The State has more than 7000 species of described flora including bacteria, algae, fungi, bryophytes, pteridophytes and angiosperms and more than 10,000 species of described fauna. As of 2013, recorded forest area in the State is 16,805 sq km, which is 18.93% of the State's geographical area.
- West Bengal is endowed with 7.5 per cent of the water resource of the country. About 60% of the water resource is available in the North, while South Bengal has 40% of the resources. The replenishable ground water resources including natural discharge is 34.20 bcm of which 31% is in north Bengal and 69% in South Bengal. The net annual water resource generated from rainfall in West Bengal amounts to 51.02 bcm. The State receives 598.56 bcm of trans boundary water from neighbouring States. The Ganga carries 525 bcm of water from its large catchment covering 26% of the Indian geographical area.
- West Bengal is a major producer of food grains- especially rice. There is huge potential for the cultivation of rice, pulses, potato and jute.

- All the agro-climatic regions, particularly, the hills and terrain regions have possibility of multi-tier cropping systems which can enhance the returns per unit area of land and time, generating employment potential and providing food and nutritional security.
- Strong production base for horticulture crops especially fruits and vegetables with scope for further development, processing and value addition.
- Excellent potential for production of high value cut flowers like dendrobium/cymbidium orchids, liliums, gladiolus, anthurium in the Darjeeling hills, marigold, gerbera, rose in the Plains.
- There is huge livestock and poultry population. The world famous, superior Black Bengal goat and the Garole variety of sheep are highly prized for high fecundity and the excellent quality of meat and skin.
- The State has vast resources in the form of rivers, flood plain wetlands, estuaries, reservoirs, creeks and canals etc. The State has 7.45% of total water resources of our country. Existence of several water bodies including riverine areas, beel, boar, canal and tanks with a total water spread area is 2.76 lakh ha conducive for irrigation and fish production. More than 900 big water bodies (Govt.) available which are most suitable for big size carp fish production/aqua farming as well as developing Fish Tourism (a kind of Eco-Tourism).
- The State has 2.10 lakh ha of impounded brackish water resources (highest in country) of which only 0.48 lakh ha have been developed signifying the opportunity for further development. Major producer and supplier of fish seed in the country (65% of country's seed is sourced from West Bengal) due to availability of good quality of spawn/ seed from natural as well as commercial hatcheries.

2.4. Important development indicators

- Adoption of location specific cropping sequences, crop diversification with less water intensive and remunerative crops like pulses and oil seeds and vegetables, intercropping practices are the important development indicators for the enhancement of cropping intensity from 184 % to 200 -250 % in all sorts of land in West Bengal.
- Creation of soil testing infrastructure facilities at district level for comprehensive soil analysis and introduction of soil health cards indicate soil health management and augmentation of crop productivity.
- Establishment of seed hub and promotion of seed villages for production of certified seed lead to ensure availability of quality seeds at the villages.
- West Bengal ranks first in area and production of rice in India. It accounts for 12.61% of area and contributes about 14% of total rice production in the country. West Bengal shares 0.78% of pulse area and contributes 3% of pulse production in India. There is a huge scope for increasing the rice fallow area for pulse production in West Bengal. The total available area under rice fallow is 8.53 lakh ha. The present area under pulses is 2.19 lakh ha and additional pulses area covered under rice fallow is only 0.96 lakh ha. The availability of high yielding varieties with efficient plant type for different situations can provide 3-2.0 tons/ ha stable seed yield to compete with other crops.

- West Bengal has been the highest producer of jute and produces nearly 70% of the country's raw jute fibers. Raw jute being bio-degradable and annually renewable source, it is considered as an environment- friendly crop.
- The State is second largest producer of potato with high yield (19.73 t/ha) second only to Uttar Pradesh (22.8 t/ha) and produces 30% of the total potato in the country.
- West Bengal (WB) is the highest vegetable producing State in India, eighth largest producer of fruits and sixth in the area of floriculture. The State has immense potential for development in horticulture sector both through horizontal (area expansion) and vertical integration (productivity improvement).
- The Mission for Integrated Development of Horticulture (MIDH) scheme, through its area extension programme has planted new orchards on 3,79,146 hectare lands during 2014-15 to 2016-17.
- Creation of Agri-Export Zones (AEZ) has brought about a paradigm shift in the approach from "production oriented" to "market driven" vegetable farming in West Bengal.
- Darjeeling mandarin orange is famous for its sweetness and quality. There is huge scope for the cultivation of large cardamom, ginger, strawberry, kiwi fruits in hill areas of West Bengal.
- The special variety of mango produced in Malda district is exported across the world and thus there is tremendous scope for the promotion of various mango cultivars like Fazli, Ashwina, Gopalbhog, Langra, Lakshanbhog, Himsagar, Amrapalli and Guti.
- Initiatives for the establishment of more and more custom hiring centres for making available of laser land leveler, tractors, power tillers, rice transplanter, reapers, threshers, sprayers, power sprayers, power weeder, grass cutters, fruit pluckers, mini trucks to the farmers on a cooperative mode. Mechanization options that allow direct sowing, minimum/reduced tillage, land levelling, retention of crop residues will result in sustainable economic growth. The outstanding success of no-till and conservation agriculture practices is a good example of the approach.
- The Murshidabad Silk for making saris and scarves is world famous, indicating the huge scope for the promotion of sericulture in Murshidabad and adjacent districts in the State.
- The State is ranked third in egg and meat production and eleventh in milk production. Notwithstanding, there is a demand-supply gap. About 70% of marketed milk is contributed by the households having one or two milch animals. Diversification towards dairy is one of the most promising options to enhance farmers' income.
- The State doesn't have recognised breed of cattle or buffalo, however, the indigenous cattle produce around 60% of the milk in the State. Since there is only 22% crossbred/ up-graded cattle and the rest 78% cattle are indigenous and low-productive in West Bengal, there is a scope for breed improvement through the production of superior quality bulls, production of superior quality semen and AI programme.

- Strong consumption base with huge localized demand for dairy, poultry, meat and fish and proximity to major consuming centers is widening market opportunities.
- In Indian perspective, the largest amount of goat meat is produced by the State. West Bengal is blessed with the world famous meat type, prolific Black Bengal goat and Garole sheep. A mission mode programme needs to be undertaken for the promotion of profitable goat/ sheep farming among the smallholder farmers.There is an excellent scope for commercial venture of poultry farming including processing and value addition.
- 'Ghungroo' has recently been recognized as an indigenous pig breed of West Bengal. Pig farming with Ghungroo pigs has already been recognized as a profitable enterprise at the farmers' field.
- Piggery and backyard poultry farming as supplementary livelihood activities among marginal/ landless rural poor/ tribal habitations have already been undertaken to meet the increasing local demand.
- The State is one of the leading producers of fresh water fish and the largest producer of fish seeds in the country. West Bengal has the highest consumer of fish and fishery products in the country. The State has ever increasing demand and assured market of fish both in domestic and export market. The major commodity in export is shrimp. The State has emerged as the fourth largest State in the country's total exports despite having a small coastline of 150 km. West Bengal (Kolkata) is the Gateway for seven North Eastern and three Eastern States thereby better scope for business promotion in fish feed production, fish processing, value addition and also export to EU and Japan.
- Existence of active and functional Fisherman's Cooperative Societies, Fish Production Groups and a large number of Self Help Groups (SHG) all over the State are contributing well for the growth of the fishery sector.
- Integrated fish farming with agriculture, horticulture, dairy, goattery, poultry and piggery offers immense scope for development in the State.
- There is a strong extension mechanism with focus on active involvement of informal channels for technology dissemination through Farmers' Clubs promoted by KVKs, NABARD, farmers' SHGs and pro-active NGOs.

Infrastructure for Agriculture and Government Programmes

3. Infrastructure for Agriculture and Government Programmes

- Infrastructure development is a key growth driver. This needs to be done under support from Government as well as through private initiatives.
- Well developed irrigation infrastructure is facilitating higher cropping intensity with potential for further development especially of ground water resources. Total irrigation potential of the State is 67.43 lakh ha. Main source of irrigation is open/tube wells. The gross irrigation potential so far has been created through major, medium and minor irrigation in 55.01 lakh ha land till the end of March 2009. There is a scope to control soil erosion in upper catchment area and remove silt (dredging) from the main river bed for increasing the irrigation potential through surface water. The trend in irrigation development indicates that there is predominance of area underground water irrigation in the districts of Nadia, Murshidabad and 24 Parganas (North), whereas districts of Bardwan, Birbhum and Bankura show predominance of surface water irrigated areas.
- Farm power available in the State is 35 kW/ha. By and large, the farmers have adopted the mechanized ploughing and for this purpose they have relied mostly on the custom hiring of tractors. Though 33% of farmers have bullocks and ploughs, they mainly use bullocks for transportation of the crops. Only 10% farmers have their own tractors and power tillers; 40% of the farmers have diesel pump-sets and 24% farmers have their own electric pump-sets for irrigating their land. In some villages irrigation is provided solely by government operated mini deep-tube wells. In other cases the farmers mostly depend on privately owned shallow tube-well for irrigating their agricultural land. The sprayer and thresher are most extensively used and also owned more frequently by the farmers. Therefore, there is vast scope of mechanization in every nook and corner in the field of agriculture. There has been increase in purchase and use of power tillers in West Bengal.
- With the objective of providing water to every field, Pradhan Mantri Krishi Sinchai Yojana (PMKSY) has been launched on July 1, 2015 to provide end to end solution in irrigation supply chain, water resources, network distribution as well as farm level application. PMKSY, not only focuses on resource building for assured irrigation, but also on the water conservation through rain water harvesting for protected irrigation.
- Water harvesting structures (10 % of a farming unit), mini deep tube well (can irrigate 5 ha of land), percolation tank, farm pond, check dam in streams available in villages, roof water harvesting in hill area, solar energy operated pump, water pump procurement and distribution have been done utilizing fund from MNREGA and RKVY.
- Rural infrastructure development programs like making land shaping structures for rain water harvesting in Govt. and private lands, excavation of new ponds and water reservoirs, desilting of beels and rivers, renovation of ponds have been taken up.
- Micro irrigation system has been identified to be the best means of giving water to the plants where water use efficiency is maximum. The modern irrigation systems like drip irrigation and sprinkle irrigation have been developed which are being popularized in the farmer's fields.

National level Programme like Pradhan Mantri Krishi Sinchai Yojana (PMKSY) is being implemented, which ensures 'More Crop Per Drop' through micro irrigation,requisite government support is being provided to encourage the farmers.

- Mini rice mill, oil and dal mill have been installed at the gram panchayat level and facility of milling has been made available to the farmers.
- There are at present 378 licensed fruits and vegetable processing units in the State, however, the actual capacity utilization is still less than 40%.
- In West Bengal, about 65% of fluid milk in WB is supplied to sweet shops where milk is sold through middleman, thus the farmers are exploited. Only 2% of total milk production is being marketed by organized sector. Dairy Infrastructure Development Fund is established with Rs. 8,000 crore for the revival of old Schemes of Dairy Processing and Infrastructure.
- Conservation and breeding of high value farm animals should be given priority in the State. Rashtriya Gokul Mission has been launched for the first time in the country to develop and conserve indigenous breeds of cattle in a scientific and holistic manner. In addition, two Kamdhenu Breeding Centres are being set up, one each in Andhra Pradesh and Madhya Pradesh for the conservation of indigenous breeds on a national level.
- The Paschim Banga Go Sampad Bikash Sanstha (PBGSBS) is involved in production of high quality milch cows as well as bulls with high genetic potential.
- Meat processing in the State is expected to grow as the Government of India is encouraging setting up of modern abattoirs by giving capital grant subsidy. One abattoir under the Kolkata Municipal Corporation has already come up and two more are under consideration in Kolkata. Five more in various municipalities have been given in-principle approval by the Ministry of Food Processing Industries and some of them are thinking of opening 100% export oriented units under PPP mode, opening up huge investment slots for interested entrepreneurs.
- Six Mega Food Parks are in operation in various parts of the State and some are very specialized, like the one at Chakgaria, where all units are involved in fish processing. The parks at Malda, Howrah and Murshidabad are also coming up.There are tremendous opportunities and huge potential of food processing to be tapped in West Bengal.
- There is a strong network of State line departments in the entire State.
- The State Government has already undertaken breed improvement programme in the entire State by door-step delivery of AI services through strong net work of Prani Bandhus and calf rearing scheme.
- The State Government has been extending Veterinary care services both at institutional level and by organizing health camps, deworming programmes, vaccination programmes, and fertility camps etc.
- Under the National Mission on Bovine Productivity, an allocation of Rs. 825 crore has been made for providing animal health card - Nakul Sawasthya Patra to the farmer owning milch cattle with unique 12 digit ID tags.

- Under the National Livestock Mission started in 2014-15, sustainable development of the livestock sector for the purpose of enhancing breed productivity of small ruminants, assistance to the small scale poultry sector through back yard poultry and improving availability of quality food and fodder has been initiated.

- Presence of two State Agriculture University, one State Animal and Fishery Science University, some ICAR Research Institutes like CIFRI, Research Centres of CRIJAF, NIRJAFT, CSSRI, CISH, NDRI, IVRI, CIFA, CIBA and CIFE in the State, are the boon for the technocrats and farmers.

- The use of Information and Communication Technologies (ICTs) for agricultural extension is increasing to address the information needs of the farmers. ICT based agri-extension portal, a dynamic platform is being used massively to disseminate crop, livestock and fishery related solution to the farmers at farm-gate level. The Government has launched many websites, portals, phone services, mobile apps and agriculture Short Message Services (SMS). ICAR has already attempted some pioneering models like mKISAN Portal, KVK Portal, KRISHI Portal etc. Mobile Apps for farmers has also been developed by ICAR. Through Kisan Suvidha App, farmers are getting information on weather conditions, input dealers, market price, plant protection along with appropriate advisories.

- A novel approach initiated from the part of the Government is the registration of farmers for building up a database. An online registration provides a unique identity number for the registered farmers and coupling with a permanent identity proof so that a smart-card can be issued to them. The database, thus, formed becomes the part of the planning process, whereby the first hand information on all aspects like the crop profile, land use capability, extent of land that can be put for additional production etc., can be received. Many a times the farmers become unaware of the developmental programmes of the Government. In this context, the registered farmers would get SMS relating to the programmes and they can apply online.

- Crop insurance is must to avoid economic loss out of crop failure due to climate related disastrous. A new scheme 'Pradhan Mantri Fasal Bima Yojana' (PMFBY) from Kharif 2016 has been launched across the country overcoming the inherent deficiencies of Crop Insurance Scheme. The Government is taking effective and substantial measures to reduce the risk of agriculture sector through Restructured Weather Based Crop Insurance Scheme (RWBCIS) so that farmers feel secure even during the occurrence of natural calamities.

- Marketing forms a key issue in any agrarian development. The farmers need to be linked with the market intelligence (e – choupals), which provides information on what to grow, where to grow, how to grow, when to grow, where to sell, at what price to sell etc. An e-pashudhan haat portal has also been launched by the Central Govt. since November, 2016 to link the breeders of indigenous breeds and farmers, under which so far 43 million semen doses have been sold. Detailed information of more than 17000 cow and buffalo is also made available on this portal, so that an interested farmers could purchase them transparently.

Productivity Gaps and Major Constraints

4. Productivity Gaps and Major Constraints

- The State is rich in human resources with 70% of its population engaged in agriculture. There are 733 lakh farm families of whom 90 per cent is small and marginal farmers (less than 1 ha land holding). Large holdings (above 10 ha) are almost absent. Small and marginal farming communities hold 84% of the State's agricultural lands as against 69.8 percent at all India level. Incidentally, this is the second highest in the country after Kerala. Thus, agriculture in the State is small farmer centric. The average size of land holding is only 0.77 ha. The per capita cultivable land holding is highly fragmented. This has resulted in uneconomic holding size to sustain a farmer's family.
- Agriculture is the leading economic sector in West Bengal. There has been a significant increase in food production since the 1980s, and the State now has a surplus of grains. Cropping pattern in the State is dominated by food crops which account for about 78 percent of the area under principal crops, in particular, rice. Per hectare yield in rice is higher in the State over all India level.

Table 9 : Production/ productivity of various crops in West Bengal (2016- 17)

Crop	Production (Million tons)		Productivity (Kg/ hactare)	
	India	WB	India	WB
Rice	105.5	14.35	2418.7	2596.0
Pulses	16.47	0.21	652	800
Rapeseed & Mustard	6.80	4.85	1184	1090.0
Sesame	2.15	0.68	436	945
Jute	99.4 lakh bales	76.67 lakh bales	2457	2534
Potato	43.77	8.43	20515	19730
Vegetables	167.05	26.354	17000	17340

- West Bengal contributes 3% of pulse production in India. The early vigour and duration of local varieties of pulse crops are generally slow and long, respectively, thus, the farmers are reluctant to grow pulses in their fields. The availability of high yielding varieties with efficient plant type for different situations can provide 2-3 tons/ ha stable seed yield to compete with other crops. Major biotic stresses in West Bengal are wilt, root rot and BGM. These biotic stresses reduce the productivity of the crop by 30-50%. Other important constraints are terminal moisture and heat stress, non-availability of quality seeds of improved varieties, non-adoption of improved production technologies, inadequate and imbalanced use of fertilizer, delayed sowing, poor plant population due to low seed rates and weed infestation.
- West Bengal contributes 3.04% oilseeds production in India. The oilseed economy of West Bengal faces challenge on technological and policy fronts. A major concern is that domestic prices of oilseeds and vegetable oils are too un-remunerative to attract farmers for intensive oilseeds cultivation. Another concern for oilseed cultivators in particular is the lack of availability of quality seed material of improved cultivars. Inadequate and imbalanced crop nutrition, the slow pace in bridging the yield gap and lack of adoption of the appropriate

agronomic practices and available technologies are some of the key issues related to the production of oilseed crops. Though the State has a surplus production of rice and potato, a huge gap exists between the requirement and production of pulses and oilseeds.

- West Bengal has been the highest producer of jute and produces nearly 70% of the country's raw jute fibers. With its insignificant coverage, it plays a predominant role in the country's economy by generating employment, using in the textile as well as paper industries, improving soil fertility, earning foreign exchange etc. Jute is cultivated by small and marginal farmers. Thus, the investment capacity is poor. Technically, there is poor adoption of technology, imbalance fertilizer application, and poor plant protection measure in jute cultivation. There is shortage of improved variety seed. Jute cultivation is labour intensive for weeding, thinning, extraction of fiber cutting / soaking, stripping, washing and drying.
- Potato production in West Bengal has witnessed a five-fold increase in the last 40 years. The State is second largest producer of potato. However, the State is totally dependent on other States like Punjab for meeting the seed potato requirements. Absence of exclusive cold storage facilities for seed potato is affecting seed quality and viability. Potato in West Bengal is grown mainly by small and marginal farmers who face problems of getting remunerative market price, sufficient credit/bank loans and cold storage facilities.
- The horticulture sector in West Bengal is wide ranging and produces considerable amounts of vegetables, fruits and nuts, spices, medicinal plants, aromatic plants, mushroom etc. under different agro-climatic conditions. The State has immense potential for development in horticulture sector both through horizontal (area expansion) and vertical integration (productivity improvement). Despite the impressive achievements, low productivity of vegetables in the State is a challenge and matter of concern. The phenomenon of climate change and aberrant weather conditions are major issues to be tackled with new innovations in crop improvement and production systems. Apart from these, the challenges are many, namely, need for new plant genotypes for diversified end uses, degradation of soil health, production deficit and gluts, lack of infrastructure in commodity value-chain, retail chains and farmer producer companies, and export promotion.
- There is only 22% crossbred/ up-graded cattle and the rest 78% cattle are indigenous and low-productive in West Bengal.
- Average milk yield of dairy animals available in West Bengal is below than the national average.

Table 10: Average yield of milk in kg per day per animal

Sl. No.	Species	West Bengal	India
1	Crossbred cattle	5.56	7.33
2	Indigenous cattle	1.91	3.41
3	Buffalo	5.05	5.76
4	Goat	0.14	0.45

(Annual Report 2016-17 of Animal Resource Development Department 2016-17, GoWB and Annual Report 2016-17 of Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture & Farmers Welfare, GoI)

- Lack of adequate scientific post-harvest storage facilities both for perishable and nonperishable agriculture produce is one of the problems associated with the agriculture production in the State. The storage capacity is considered to be grossly inadequate. Similar situation prevails in respect of cold storage facilities for perishable horticulture produce.
- The annual post-harvest fruit and vegetable losses in West Bengal, result into 12 lakh metric-ton shortfall as far as cold storage capacity is concerned. Though 90 per cent cold storage facilities of the State is for potato crop and located in the potato growing regions, still it falls far below the requirement. At present 20-25 % of horticultural produce is wasted prior to reaching the consumer in the State and during the periods of rains losses of produce increased further.
- There are many climate-related problems that people in West Bengal are already facing, such as diminishing water resources and frequent natural disasters, which are likely to be further aggravated by the impending changes in the climate. In the present situation, a heavy rainfall lead to flood and a deficient rainfall could lead to drought. The paradox of flood and drought occur simultaneously almost every year, making agriculture highly vulnerable and unstable in many districts of the State. In every summer many parts of Purulia, Bankura, Paschim Medinipur, and Birbhum suffer water shortage. About 42% of the State area is flood prone and is manifested across the State by various modes. The devastating impact of natural calamities experienced in the recent past – Cyclone Aila in West Bengal, is perhaps are the warning signals of what is imminent in the future on account of climate change. With over 70% of Indian agriculture being rain fed and totally dependent on vagaries of monsoon and an equal percent of population depending agriculture for subsistence, the consequences of climate change could be to say the least, disastrous. There may be adverse impact of sea-level rise on coastal agriculture and settlements in the State. There is a direct impact on human health due to the increase in vector and water-borne diseases such as malaria.
- The Temperature Humidity Index (THI) relates animal stress with temperature and humidity. Livestock animals are comfortable at THI between 65 and 72, under mild stress when THI is between 72 to 78 and under severe stress when it is above 80. The livestock in West Bengal is already experiencing medium to high stress levels. Increase in temperature levels in the future may make the entire West Bengal region with THI $>$ 80. Livestock and poultry birds are likely to suffer from heat stress impacting their productivity. Crossbreds are more sensitive to rise in THI than indigenous varieties. Rising temperatures negatively impact growth and time to attain puberty of livestock species. There is normally a decrease in milk production for animals under heat stress. This decrease can be either transitory or longer term depending on the length and severity of heat stress. These decreases in milk production can range from 10 to $>$25%. An average adult cow or buffalo producing 10-15 lit milk per day requires about 40-45 lit/day as drinking water on hot days and about 40-60 lit for other related work thus requiring a minimum of 100 lit/ day/ animal. An organized animal farm following standard management practices and disposal of animal wastes requires additional water about 50-100 lit/day/animal. Any loss in water availability will certainly lead to decline in milk productivity.
- Production cost of an egg in WB is about 4/- whereas, eggs supplied from AP cost about 3.5 to 3.8 per egg. This is due to high feed cost. Due to unavailability of feed ingredients like

maize, fish meal etc., the cost of poultry feed is much higher than Andhra Pradesh and other poultry farming developed States. Most agri-developed districts in the State are high humid zone which is not suitable for layer farming. It is not possible to make the state self-sufficient in respect of egg production unless special attention is paid for the establishment of big organized commercial layer farms.

- Major poultry companies have vertically integrated operations which comprise approximately 60-70 percent of the total chicken production. Entire market is controlled by middleman. Thus, base level farmers are exploited.
- The State is a fodder deficit State. There are certain limitations such as non-availability of land for fodder cultivation and acute shortage of availability of quality fodder seeds in the State are responsible for the shortfall of fodder production. The two main feed ingredients viz., maize and soybean are required to be imported from other States, as the production of maize and soybean in West Bengal is meagre.
- The following tables show the requirement of Fingerling, Fry, Spawn, Brooder as well as Feed in the State.

Table 11: Estimation of culture based fisheries requirements in reservoirs of West Bengal

Reservoir	Total Area (In ha)	Available Area (60%) (In ha)	Yield potential In tons*	Stocking rate Fingerling /ha	Fingerling requirement (million no.)	Expected production in tons (@50% survival) Expected fish growth = 0.5kg/fish	Expected production in kg/ha
Small	15470	9282	4641	1000	9.2	2300	247
Medium	1060	636	72.6	500	0.3	7.5	124
Large	11520	6912	693	300	2.0	50	75
Total	**28050**	**16830**	**5404.8**	**1800**	**13**	**2357.5**	

Yield potential: *500 kg/ha for small, 200 kg/ha for medium and 100 kg/ha for large

Table 12: Requirement for fisheries development in reservoir

Resources	Total fingerling requirement	Fry requirement @ 40% survival	Spawn requirement	Brooder requirement (Kg)		Total brooder requirement
				Female	Male	
	In million numbers					
Cage (Pangas)	80.22	114.6	286.5	1685	1685	3370
Reservoir	13	16.42	41.0	241	241	482

Table 13: Requirement of feed for various culture operations

Purpose	Feed required (tonnes)
Cage feed	95500
Brooder feed	168
Nursery feed	9
Rearing feed	1400
Total	**97077**

- Nursery @ 210 kg/million spawn (20 days)
- Rearing; (individual weight gain 10g, FCR-3)
- Brooder pond (one year maintenance)

- The problem again is the lack of organized infrastructure in terms of automated and hygienic processing units. With its tropical climate and proximity to ports, Bengal has the potential to develop into one of the largest develop into one of the largest producers of processed fish, value added fish and meat products in the country.
- Hilsa is mostly available in the eastern part of Bay of Bengal, especially in West Bengal and Bangladesh coastal water and in the rivers and estuaries of the region. A trend on hilsa catch and import from across the border is given here to understand the dwindling nature of this important fishery vis-a-vis its demand in the market. The visible decline in hilsa catch in the estuarine and riverine stretch of Hooghly-Matla system is a matter of serious concern for the State. Indiscriminate capture of juveniles is further causing damage to already disturbed fishery.

Potential for Development of Horticulture, Livestock, Fisheries, Agro-forestry and Post-harvest Processing etc.

5. Potential for Development of Horticulture, Livestock, Fisheries, Agro-forestry and Post-harvest processing etc.

5.1. Potential for Development of Horticulture

- It is essential to put a system of recognition of nurseries in place to facilitate, promote and monitor production and trade of quality planting materials of conventional vegetable crops/ fruit plants. Thus, it is necessary to strengthen the infrastructure facilities of public sector stakeholders like NSC, SFCI, State Seed Production agencies, SAUs, KVKs etc. to ensure the availability of quality planting materials among the vegetable growers.
- Fruits, vegetables and even spices can give relatively higher profit than cereals and pulses. To increase additional production of vegetables and to make vegetables available round the year, there is a need to encourage cultivation of high value/ off season vegetables in protected structure.
- Short or medium range programme on vegetable based cropping systems; ploy house or low plastic tunnel cultivation of high value vegetables like coriander leaf (early autumn), coloured capsicum, cherry tomato, okra, gherkin, broccoli, red cabbage, savoy cabbage, lettuce, celery etc. (autumn-winter) will bring perceptible change/ improvement in production of different vegetables. Advanced concept of protected cultivation of high value and high quality vegetables need to be promoted on a large scale.
- Production of high-value commodities can suit the needs and resource endowments of the farmers having small land holdings. These commodities can give higher, regular and quick size returns to the smallholder farmers. Introduction of some new vegetable crops such as baby corn, sweet corn, cherry tomato, lettuce, celery, leek, teasle gourd, etc. have the potential to widen the demand of vegetables and increase income of the farmers.
- The farmers may be motivated for cultivation of high-value fruits like strawberry to fetch more income.
- Flowers which can fetch good ensured market value should be targeted. Rose, gladiolus, jasmine, marigold, tuberose and also orchids are the important flowers. Export market of these crops should be explored. Quality certification is to be imposed and ensured. Accessing quality seeds and plant materials, adopting improved management practices and strengthening supply chains through appropriate institutional arrangements are the key challenges in exploring the potential of horticultural commodities. With a view to create entrepreneurship in the state, there is enough scope for cultivation of flowers in open field.
- Micro/ precision irrigation should be used in fruits like mango, litchi, guava, papaya and vegetables like potato, tomato, cauliflower, cabbage etc.
- Promotion of horticulture as a sustainable activity for the small and marginal farmers in wastelands in the Watershed Development Programmes may be undertaken.
- Nursery being a highly viable activity, there exist very good scope for promotion of private nurseries for production of perennial horticultural crops especially in districts like Malda, Murshidabad. The programme can be dovetailed with the programme of NHB or NHM in consultation with the Department concerned for the benefit of prospective entrepreneurs.

- Protected nursery raising technology under low plastic tunnel or poly house through plug plant production is highly suitable and can be established as a small scale industry in major vegetable growing areas of the State by progressive farmers especially in peri-urban areas. By this way the vegetable growers will get disease-free healthy and off-season nursery as per their requirement and it can generate extra employment in urban and peri-urban areas. Similarly, grafting vegetable seedlings of a susceptible scion onto a resistant rootstock can quickly provide resistance against soil-borne diseases such as bacterial wilt, Fusarium wilt and rootstock vigor, thus enabling production of high value vegetable crops in areas under predominant soil–borne pathogens. Mass-scale production of grafted seedlings could generate more employment opportunities among rural youth of the State.
- Large-scale awareness programmes on pre- and post-harvest management systems of vegetable/ fruit crops among rural educated youth will help in entrepreneurship development.
- Kitchen gardening with local crop varieties may be promoted.
- Specific perennial horticultural crops may be grown in the cultivable wastelands owned by the tribal families.

5.2. Potential for Development of Livestock

- The main plank of livestock development would be on availability of quality animals. The State doesn't have recognised breed of cattle or buffalo, however, the indigenous cattle produce around 60% of the milk in the State. Since there is only 22% crossbred/ up-graded cattle and the rest 78% cattle are indigenous and low-productive in West Bengal, breed improvement through the production of superior quality bulls, production of superior quality semen and AI programme should be undertaken in a mission mode in the State. Even at 30 lakh AI per annum, the coverage will be around 25%.
- Diversification towards dairy is one of the most promising options to enhance farmers' income. About 70% of marketed milk is contributed by the households having one or two milch animals. In this context, the role of Co-operative Milk Producers Federation is important in transforming agriculture towards dairy sector. The members of the Dairy Co-operative are always able to fetch better profit as compared to their counter parts not associated with Co-operatives.
- National Dairy Plan is being implemented by NDDB to produce High Genetic Merit (HGM) cattle and buffalo bulls, fodder development programme etc.
- Buffalo population has a negative trend in West Bengal. As in cattle, tremendous opportunities exist for scientific buffalo farming with good quality buffaloes and processing of buffalo meat for both the domestic and international markets.
- West Bengal is blessed with the world famous meat type, prolific Black Bengal goat and Garole sheep. The conservation of these high valued animal genetic resources adopting a definite breeding policy is urgently required. A mission mode programme on production of superior quality bucks/ rams and their distribution in a community as well as exchange/ withdrawal of old bucks/ rams needs to be undertaken for the promotion of profitable goat/ sheep farming among the smallholder farmers.
- Ghungroo' has recently been recognized as an indigenous pig breed of West Bengal. Though good quality 'Ghungroo' piglets are produced at Institutional/ Govt. Farms, still there is huge

demand of 'Ghungroo' piglets at the farmers' field. Hence, 'Ghungroo' piglets production programme should be undertaken by the farmers to utilize opportunity and fetch more income out of selling piglets at remunerative rate.

- Animal breed/ variety improvement programme needs to be undertaken on Black Bengal goats, Garole, Bonpala and Chottonagpuri sheep, Ghoongroo pigs in specific district/ breeding tract in the state.
- Feed is the most important single item that accounts for more than 70% to 75% of the recurring cost of a farm. Production of main ingredients for feed, particularly maize, is insignificant in West Bengal. Another important ingredient is soya bean which is not grown in the State. Farmers, especially in North Bengal, may be encouraged to grow maize in more land to meet the demand.
- Feeding of balanced ration along with mineral mixture can increase milk production by 10% over traditional feeding system in all categories of dairy animals. If homemade balanced feed is fed, there is chance of reduction of 20% cost of production.
- The production of milk and meat could be increased upto 15-20% by following immunization programme in time, controlling parasitic attack through deworming and supplementing the mineral mixture.
- High density feed block and azolla cultivation at the side of the house or under the tree as an alternate source of rich nutrition should be popularized massively to meet the fodder crisis.
- Other than straw, initiatives should be taken to utilize residues of pulse/ oilseeds crops as fodders, as well as conserve the fodders for the lean period.
- Infertility and repeat breeding problem of dairy animals need to be addressed properly using new treatment protocols like Ovysynch protocol, Heatsynch protocol etc.
- An effective management of diseases caused by new strain of bacteria and virus needs to be followed to increase production.
- To control and contain the existing epidemic diseases, the government and its concerned departments need to prepare long term strategies to ensure that 100 percent population of the livestock get regularly vaccinated.
- Animal shed is essential for alleviating heat stress in livestock. It is necessary to provide low-cost, improved animal shelter with proper dimensions, sufficient light and ventilation for protecting the valuable animals from rain, sunlight and cold and keeping the animals stress free.
- Insurance of domestic animals, such as poultry birds, cattle, goat and pig is essential to avoid economic loss at the time of disease outbreak in villages.
- Livestock management is an important area to keep the animals healthy and productive. Hands on training may be undertaken on different aspects of cleaning and sanitation in and around the livestock shed and there is a scope to take such programme in the light of 'Swachh Bharat Abhiyan' throughout the year for the welfare of the livestock as well as the livestock owners. Capacity building on fodder production and conservation technology needs to be organized.

- Pig farming could be the best option for the tribal farmers to augment income for livelihood.
- Backyard poultry farming and goat rearing programme may be undertaken for women farmers.

5.3. Potential for Development of Fisheries

- Fish has a great socio-cultural importance for the people of Bengal. The fish farming in West Bengal is one of the most profitable ventures and fish always commands higher prices in the market. People have strong affinity for fish culture and have support of strong traditional knowledge base of the fisher folk and fish farmer and scientific inputs in various aspects of fisheries management. The State has ever increasing demand and assured market of fish both in domestic and export market.
- Quality fish fingerlings are important for augmenting productivity of fishes. In this context, it is to be mentioned that West Bengal is the largest producer of fish seeds in the country. There is ample opportunity for fish seed production to meet the increasing demand and thus fetching money.
- Diversification of freshwater aquaculture involving high value species such as Magur, Koi, Pabda, Tangra, Pangasius etc, may be undertaken.
- More thrust needs to be given to the development of seasonal water bodies to undertake air breathing fish culture and raising of advanced fingerlings. Formulation of short duration carp culture scheme involving stunted fish fingerling for flood prone zones may be popularised.
- Ornamental fish farming is an attractive option for earning money easily.
- Collection of larval/juvenile stages of fish and shell fish, though, catering livelihood of local populace, is jeopardizing their very survival in the nature which may lead to their extinction and may pose a threat to the livelihood in the long run. Considering its international importance and heritage site of UNESCO, a research centre dedicated to the sustainable aquaculture/ fisheries development vis-a-vis livelihood security and maintenance of biodiversity may be established. Awareness programmes on conservation of hilsa for fishermen is urgently needed.
- Hilsa Conservation and Research Centre (HCRC, set up at Diamond Harbour) need to be strengthened in taking up hilsa conservation programme. Replication of Bangladesh model on hilsa conservation by stopping fishing of jatkas and brooders may be undertaken.
- The concept of organic farming is relatively new in commercial agriculture sector in the State as is elsewhere. However there are specific pockets especially in the hill district of Darjeeling where tea, selected fruits and vegetables, medicinal plants and spices (ginger and large cardamom) are being cultivated under organic farming conditions. A few NGOs like Ramkrishna Mission KVK in South 24 Parganas are promoting the concept of organic farming through farmers' awareness programmes. One of the major constraints associated with promotion of Organic Farming in the State is absence of any Accreditation/ Certification Agency based in West Bengal. This is an issue to be addressed to especially by institutions like BCKV/ IIT Kharagpur.
- Educating the people about the importance of river in fisheries perspective and conservation of biodiversity through government sponsored mass awareness programmes.

- Adequate awareness needs to be created among all private hatcheries to follow appropriate breeding protocol to arrest possible inbreeding.
- The selected youths may be trained to provide farm based extension services relating to fish breeding, fish seed raising, soil-water testing, fish disease diagnostic and other technical services akin to Prani Bandhu in the Animal Resource Development Department and Krishi Bandhu in the Agriculture Department of the State.

5.4. Potential for Development of Agro-forestry

- As of 2013, recorded forest area in the State is 16,805 sq km, which is 18.93% of the State's geographical area.
- Tuber crops like colocasia, elephant foot yam and spices like turmeric, ginger may be brought under forest villages.
- Bay leaf, citrus in forest villages as diversified crop may be developed.
- To combat fodder shortage, fodder development needs to have an additional impetus from the government by promoting agro forestry.

5.5. Potential for Development of Post-harvest processing

- Being a surplus production State for both perishable and non perishable agricultural commodities, adequate storage infrastructure is of paramount importance. The wide gap in the available storage infrastructure vis-a-vis the requirement, offers an opportunity for both public and private sector investment in creating storage infrastructures for agricultural produce in the State. Storage infrastructures, especially cold storage units and storage facilities for grains, have tremendous commercial prospects in the State. There is a severe lack of cold storage facility in North Bengal.
- Most of the food grains are being processed and has enormous potential to improve their processing efficiency. At present, rice milling installed capacity is inadequate. Maize processing is insignificant despite high demand for starch, corn oil, corn flakes and poultry feed. Existing fruits and vegetable processing units are engaged in the manufacturing of fruit juices, fruit pulps, squashes, jam/jelly, fruit beverages, pickles, tomato sauces/puree/paste, etc. However, most of the agro-processing units are unorganized. It is essential to develop necessary infrastructure in this sector including setting up of R&D laboratories.
- Value addition to the farm produces could be the boon for the additional income of the farmers. Enhancing income of farmers through value addition, product diversification and entrepreneurship development must be the trust areas. In consideration of increased level of production of fruits and vegetables, it is necessary to encourage setting up of some processing facilities at private sector with more initiative from the Industry and Commerce Department, besides encouraging cottage level processing by the individual/ SHG.
- Processing and value-addition through development of products like flakes, granules, powder, chips, french fry from potato; sauce, ketchup, paste, puree from tomato; pickles from mixed vegetables, dehydration of cabbage, cauliflower, onion etc. for meeting demands in domestic and export markets thus saving from gluts and generate more employment opportunities among rural women and youth.
- One of the reasons for the food processing industries based on horticultural produce not being very viable in our country is non-utilization of the valuable waste accumulated during

handling and processing. The huge quantity of fruit and vegetable waste generated in the packing station and fruit processing factories can also be gainfully utilized for making value added products, thereby reducing the price of processed products and fully utilize the nutritive value of the crop. Waste part also may be utilized for preparing compost or fish, poultry and cattle feed.

- In West Bengal, only 2% of total milk production is being marketed by organized sector. So, there is a massive shortfall, which is met mostly by the unorganized sector. Investors have a wonderful opportunity to establish industries on processing and marketing of liquid milk and milk products in potential areas by way of procuring milk from the potential milk producing areas of the State. The scope is enormous since consumer preferences, in tune with global trends, are moving towards value added milk products. These include ice cream, flavoured yoghurt, processed cheese and cheese powder, flavoured milk butter and cream. Bengali sweets hold a special place in the hearts of all worldwide. The scope is to harness this creative pool into an organized industry that will take on the world.
- With its tropical climate and proximity to ports, Bengal has the potential to develop into one of the largest producers of processed fish, value added fish and meat products in the country. Excellent investment opportunities are there for setting up large scale fish and meat processing units and by products.
- Bengal has a vibrant leather industry which produces a wide variety of footwear and leather accessories. The industry requires larger and assured supplies of environmentally processed hides. The bones too can be processed to meet various industrial needs including livestock feed companies.

Role of Technology

6. Role of Technology

6.1. Strategy and action plan for enhancing production, cost reduction, quality improvement, generating additional income

6.1.1. Availability of quality certified seeds/ planting materials

- Being an agrarian State with relatively high level of cropping intensity and diversified crop production, the production and productivity has a direct correlation with the availability of quality seed which forms the critical production input. It is well documented that improved seed quality alone can increase 20% crop yield. The most important component in increasing crop production and productivity resulting in increase in farmers' income is 'quality seed'.
- At present approximately 50% of seed requirement in the State is being sourced from other parts of the country. The diverse agro climatic conditions in the State offer good scope for seed production of different crops. Production of certified seeds should be sectorized based on best suitable area for production of seed of a particular crop and knowledge of seed producer, instead of trying to produce seeds of all crops throughout the State.
- There is need of providing supports to the farmers for region specific, short duration varieties of paddy, drought and disease resistant varieties of paddy, location specific varieties of fine quality rice, location specific scented rice varieties, different pulse varieties with early vigor and profuse branching and short duration and high Harvest Index input. There is need of developing some rice varieties resistant to arsenic for some districts like North 24 Parganas, Nadia etc.
- Production of certified seeds should be de-centralized. Emphasis needs to be given on decentralized production through "seed village concept" with active involvement of progressive farmers, farmers' clubs, PACs/ societies. Active involvement of KVKs both in production as well as extending technical support to farmers/ other agencies is needed.
- The State is emphasizing for self sufficiency in quality seed production. Production of certified seed should be continued in the Government Farms as well as in farmer's field with proper seed testing, seed processing, and storage facilities. The concept of quality seed is complex one. Evaluation of physical and genetic purity, germination capability, moisture, seed health etc. as per prescribed standard of I.S.T.A (International Seed Testing Association) is considered as hallmark of judging the quality of seed). Seeds and planting material certification arrangements of the state is running through state seed certification agency. Seed certification wing has to be strengthened by means of laboratory support and HR support. Accredited seed testing laboratories should come up in both private sector and/ or PPP mode to cope up with the tight time schedule and demand for quality.
- There is a need for standardization of location specific potato seed production technologies in the State to ensure timely availability of quality seed on long term basis.
- Training needs to be imparted to generate awareness among the farmers about the benefit of using quality seed/ planting materials.

6.1.2. Soil health and nutrient management

- The soil is home to a large proportion of the world's biodiversity. In a balanced soil, plants grow in an active and steady environment. The mineral content of the soil and its healthful structure are important for their well-being, but it is the life in the earth that powers its cycles and provides its fertility. Soil health depends on the physical and biological properties of soil. The

content of soil organic matter (SOM)/ organic carbon is the crucial indicator. The soil health can be deteriorated because of poor organic carbon content, land degradation, soil erosion, increase or decrease of soil pH etc. The impressive growth of consumption of fertilizer in India as well as West Bengal in the post-green revolution period ensured increase in food grain production. But because of imbalances in use of chemical fertilizers and non-use of organic manure and bio-fertilizers, the adverse effect on soil fertility has been noticed. Restoration of soil fertility is the need of the hour all over the world, especially in the context of food security.

- Even though different soils have some properties that cannot be changed, such as texture, soil quality can be improved by implementing good management strategies. A good management strategy includes the use of nutrient plans by which nutrients to the soil at the required level can be very effectively added.
- Soil testing and issue of 'Soil Health Card' to all farmers has to be done to take stock of the soil health status at a regular interval. Scheme like 'Swasth Dhara- Khet Hara' has been launched to maintain the soil health fertility where in Soil Health Cards are being issued to the farmers.
- Based upon soil test results (pH of lands), chemical fertilizers have to be used and necessary liming programme should be taken.
- Balanced and optimum use of fertilizers will be promoted together with use of organic manures and bio-fertilizers to optimize the efficiency of nutrient use.
- The concept of INM practices in rice, pulse, oilseeds production needs to be popularized.
- Use of organic manure in the soil would be the effective step in maintaining the health of the soil. Composting, vermicomposting, use of Farm Yard Manure, use of green manure crops, green leaf manuring etc., would be promoted as part of it. The availability of these types of natural organic manures is to be assured by employing effective mechanisms and logistic networks so that the organic content of the soil is increased to the level ideal for shifting towards 'Organic Farming' without affecting the returns.
- Amelioration of acidic soils through soil ameliorants to be undertaken and side by side acid tolerant crops are also to be included in the cropping system approach, where amelioration would not be profitable.
- Adequate and timely supply of fertilizers at reasonable rate to farmers shall be the endeavour of the Government.
- Farmers should be convinced for growing green manure crop and planting organic matter supplying trees on their lands.
- Training on skill development is to be imparted for vermicompost preparation from manures of cattle, pigs, poultry and goat along with various sorts of crop/ vegetables residue.

6.1.3. Technologies for conservation and management of natural resources

- A database of the soils as well as water resources of West Bengal State is required to make available to the farming community indicating the different characteristics of the soils. Water resources and the crops suited for them with the corrective measures are needed for introducing alternate crops. Farmers should get these details at their fingertip through the web and facilitated by Agricultural officer who is the grass root functionary of the system. The database on soils, water resources and the crops suited for the area along with technological modules should be at Panchayat level and treated as baseline for any agricultural development programmes.

- Effective use of land and water is fundamental to growth and sustainable development. Soil and water conservation, agriculture development and allied activities like animal husbandry, pisciculture etc, will be carried out in an integrated manner with a full involvement and participation of the farmers.
- Water budgeting could be defined as 'an estimate of harvest of water resources and its utilization for a set period of time'. The requirement of water in a watershed is assessed scientifically and a plan is to be made. The water available from rains, irrigation requirement, water holding capacity of the soil, irrigation frequency, method of irrigation, crop duration etc., should be taken into account and a water budget is to be formulated with the help of irrigation engineers, NGOs, farmers and Agricultural Officers. This would not only help to regulate the water use but also in improving the per unit productivity per drop of the available water.
- The programmes should aim at improving water, soil, biomass and other natural resources which would help the rural livelihoods and institutionalizing and scaling up participatory approaches and processes in natural resource management with a focus on livelihoods.
- It is important to preserve and promote traditional varieties of crops.
- Low water intensive, location specific crops and cropping sequences under command areas are to be identified and promoted.
- Intervention is needed for increasing productivity of land by mixed cropping, cover cropping, crop rotation, conservation tillage, leveling and mulching.
- Promotion of pulses (rabi, summer & kharif) and Dhaincha in cropping system should be incorporated for better soil health.
- On farm production of bio fertilizer should be encouraged in a big way.
- Different types of plant protection chemicals are being used by the farming community in West Bengal. These plant protection chemicals severely affect the bio resources available in soil and water. Pesticide residues are being found increasingly in our farm produces posing a threat to human health. Use of chemical pesticide needs to be declined. Use of bio-pesticide and botanical pesticide is being emphasized.
- The programme needs to be designed to suit the specific local conditions of the State and to help re-orient its development in conformity with environmental perspectives so as to make the development sustainable.
- Awareness, training and capacity building of the farmers are to be organized on use and management of natural resources.

6.1.4. Utilization of rice fallow area

- There is a huge scope for increasing the rice fallow area for pulse production in West Bengal. As per the estimates of the Department of Agriculture, Government of West Bengal, the total available area under rice fallow is 8.53 lakh ha. The present area under pulses is 2.19 lakh ha and additional pulses area covered under rice fallow is only 0.96 lakh ha during 2016-17. Pulses in rice fallow may also be promoted in the districts like Birbhum, West Medinipur, Bankura and Purulia.

- It is to be mentioned that under National Food Security Mission (NFSM) more than 60% of the budget has been allocated for pulse production.
- A very/ super early pulse crop (lentil/ green gram) should be sandwiched between early/ medium kharif paddy and boro paddy in the cropping sequence.
- Location specific 2nd crop (pulse/ oilseed/ maize) should be selected in the rice fallow area so as to cover entire 8 lakh ha of rice fallow in West Bengal. It may be grown as paira crop or as sole crop sown by zero/ minimal tillage method.
- Where late kharif paddy is in practice or where high residual moisture is retained up to the end of November, sunflower/ summer green gram can be a good alternative to cover the fallow.

6.1.5. Integrated Farming System (IFS) approach

- For the small and marginal farmers of the State, IFS approach involving integration of crops + goat + poultry for irrigated midland situation may be promoted to augment the farmers' income.
- For the small and marginal farmers of the State, IFS approach involving integration of crops + cattle + fish + duck for lowland situation may be promoted to augment the farmers' income.
- IFS model needs to be promoted involving synergic blending of crops, horticulture, dairy, fisheries, poultry, etc. which is a viable option to provide regular income and at site employment to small land holder, decreasing cultivation cost through multiple use of resources.
- Integrated fish farming, especially poultry/duck/pig/dairy/paddy-cum-pisciculture with horticulture and seasonal vegetables on the embankments may be encouraged. This will encourage organic fish farming and simultaneously utilize a number of organic wastes including domestic sewage thus enabling eco-restoration.
- Production of vermin compost needs to be integrated with the production of bio gas and the use of its slurry in the agricultural field.
- In-situ crop residue incorporation should be encouraged.

6.1.6. Crop diversification

- Adaptation of rice based profitable crop sequence; preferably including one leguminous pulse crop can be an additional source of income. Cereal or other crops in the prevailing rice-wheat cropping systems may be replaced with high yielding varieties of pulses. Short duration varieties of pulses as catch crop may be included. Cultivation of pulses in the irrigated area in rabi season may be increased. The cropping intensity by incorporating short duration forage crops in rice based cropping sequence (e.g. rice-grass pea-vegetables) may be improved. Pigeonpea may be cultivated on bunds.
- Crop diversification such as pulses, oilseeds, potato, vegetables, tuber crops may be brought under massive programme.
- Cultivation of grass pea (Lathyrus) as dual purposes (green forage + pulse seed production) to utilize residual moisture and nutrients may be undertaken, particularly in Western part and Coastal/ Saline areas of West Bengal.

- Inter-cropping with the growing of two or more crops simultaneously in the same field may be encouraged. Generally, individual crop yield slightly less when intercropped, but total productivity is higher than in monoculture. Enhancement of cropping intensity uniformly from 184 % to 200 -250 % in all sorts of land and training to the farmers for accepting the need of intercropping in various area should be organized.
- In North Bengal, nearly 68341 ha fallow land might be a good resource to initiate desired crop diversification programme.

6.1.7. Reduction of cost of production

- Increase in use of farm power through farm mechanization should be targeted. Promotion of use of Power tillers, Power weeders, Paddy threshers, Wheat threshers, Maize Sheller, Wheel Hand hoe, Manual/ power operated Wheat/Paddy reapers may reduce the cost of production.
- Use of small farm tools will reduce the cost of production.
- Use of recommended seed rate, spacing and depth will reduce the cost of cultivation.
- Need based application of agricultural inputs is essential to reduce the cost of cultivation.
- Promotion of mulching to maintain moisture and to reduce intercultural operation cost.
- In house production and use of organic manure/ compost/ vermin compost need to be promoted.
- Promotion of tillers and other garden tools can reduce drudgery.
- In house production and use of low cost animal feed may reduce the cost of production of milk, meat and eggs.

6.1.8. New and innovative technologies for crop husbandry practices

- Water saving technologies under irrigated rice (boro/ aus crops) like System of Rice Intensification (SRI) where feasible may be introduced. The technology has the potential to reduce the irrigation requirements by 30%.
- Cultivation of rice following SARP technology may be undertaken.
- There are some short and medium grained traditional aromatic rice varieties in different agro-climatic zones of the State. Some of this promising scented rice cultivar are Gobindabhog, Tulaipanji, Kalonunia, Radhunipagal, Kataribhog, etc. The State Agriculture Department may make a plan for promotion of these potential aromatic rice varieties.
- Development of multiple disease and pest resistant varieties for all major pulses is urgently needed.
- Zero tillage technique of sowing of a number of crops including rice may be undertaken.
- There is need of district-wise technology policy for minimizing the yield variation and thus increasing the overall jute productivity in the state. Value addition of jute, recycling of jute waste e.g. use of jute stick for charcoal may give extra return to the farmers. An acceptable retting technology, involving minimum use of water and keeping the jute sticks intact need to be developed.
- Integrated pest and disease management practices in different crops through popularization of different kinds of traps, botanical pesticides, bio-agent and other natural enemies along with balanced and optimum use of pesticides should be undertaken.

- Integrated weed management practices by popularizing cultivation of crops in rows and use of small implements wherever possible, mechanical weeding and need based use of herbicides should be undertaken.
- Various research studies have shown that water saving, electricity saving, irrigation efficiencies and yield of crops using drip irrigation are substantially higher than crops irrigated by the conventional flood irrigation method. Steps may have to be taken to promote and propagate drip irrigation system as an effective measure for conservation of water in the dry and water scarce tracts of Purulia, parts of Birbhum, Paschim Medinipur and Bankura districts.
- Water harvesting in 10%/ 20% model field ponds and utilizing it as life saving irrigation may be beneficial.
- "Ail" [bund] cultivation following land shaping may be popularized.
- Multitier cropping system needs to be popularized to augment farm income.
- Promotion of gender friendly mechanization for reduction of drudgery in farm women (Nail weeder, ground nut decorticator, maize sheller, fertilizer broad caster, Chaff cutter)

6.1.9. Application of climate resilient technologies to address climate change challenges

- Climate Change resilience can be built in through assessing vulnerability of a cluster of villages/ sub-region to climate change, stabilisation and management of the natural resource base with an ecosystems-based approach.
- Bio diversity within the species and among the species must be restored. Diversification among enterprises and diversification of varieties will have an important role to play in the coming times to mitigate the adverse impact of climate change.
- There is a need of integrating a package of climate smart agriculture practices into ongoing programmes such as weather-based locally specific agro-advisories, contingent crop planning, promotion of low-external input technology, agricultural diversification towards enhanced climate resilience, water budgeting, and livelihood diversification.
- Resource Conservation Technologies (RCTs) need to be promoted for farming such as "no tillage" as it saves water, labour and energy, helps early sowing, improves soil organic C, reduces soil compaction, increases fertilizer use efficiency, and reduces soil erosion.
- Development and cultivation of climate resilient crops need to be promoted.
- Protected cultivation may be one option.
- Crop insurance is must to avoid economic loss out of crop failure due to climate related disaster.

6.1.10. Generation of additional income

- Some non-farm activities such as bee keeping, sericulture, mushroom production, carpentry, tailoring, etc in order to uplift the financial status of the farming community need to be undertaken among the vast farming community.
- There is need to promote women SHGs for preparation of home-made low cost weaning food for malnourished children at home and making marketing network for the same.

- Promotion of young girls, unemployed women for handmade jute handicraft at their surplus time and marketing them.
- Processing of fruits and vegetables may be advocated.

6.1.11. Strengthen capacity of the farmers through skill training

- Skill development training on crop husbandry, livestock rearing, fisheries, home science and other areas would benefit the farmers for farming in a better way and thus bring a change in more income generation.

6.1.12. Development of agro-ecological zone specific, district specific and farmer centric technological modules

6.1.12.1. Zone II: Eastern Himalayan Region

6.1.12.1.1. Northern Hill sub region

6.1.12.1.1.1. Darjeeling District

- Need based technology should be provided for rice-maize based cropping system.
- There is need for the promotion of Darjeeling mandarin orange, peach, pear, plum and pineapple, strawberry, kiwi fruits by proper nutrient management as well as disease management.
- Rejuvenation of old mandarin orchards with intercropping of large cardamom is suggested.
- Technological backup should be there for the cultivation of large cardamom, ginger and turmeric which are the main cash crop of the region.
- Availability of quality planting materials of fruits (pineapple, strawberry, lime etc.) and flowers (rose, gladiolus, gerbera, anthurium and orchids) need to be ensured.
- Promotion of agro forestry plantation in wasteland for improvement of organic carbon in the soil.
- Cultivation of broom stick may be promoted.
- Dried preservation of mustard leaf, rai sag, soybean and radish and radish leaf needs to be undertaken. Promotion of hill specific farm implements to minimize manual labour is required.
- Making of wall decorative/ craft using locally available dried flowers and other materials may be encouraged.

6.1.12.1.2. Teri and Teesta sub region

6.1.12.1.2.1. Jalpaiguri District

- This district has rich bio-diversity in both flora and fauna and has immense natural beauty.
- Promotion is required for huge cultivation of local scented rice namely *Kalo Nunia* and its marketing in the entire State.
- There is a need to promote soil amendments in reclamation of problematic and degraded soil in *Terai zone*.
- Promotion is required for organic cultivation of local scented rice and high value crops.

- There is a need to promote areca nut based cropping model (Areca nut + Citrus + Black pepper), (Areca nut + Vegetables + Black pepper), (Areca nut + Turmeric /ginger + Black pepper).
- It is required to practice vegetable based multitier cropping model (cucurbitaceous vegetables + leafy vegetables + turmeric/ ginger).
- Acid tolerant crop (pineapple) may be included in the cropping system.
- Promotion of different Integrated Farming System modules such as:
  a) Crop based- (Crops + Composting + Dairy + Goat farming / backyard poultry)
  b) Pond based-(Fish + Vegetables + Duck), (Crops + Fish + Vegetables + Duck),
  c) Livestock based-(Mini dairy + Composting + Protected cultivation + Fodder production).
- Bay leaf, citrus, tuber crop like colocasia, EFY and spices like turmeric, ginger may be brought under forest villages.
- Conservation and propagation of high value local Ghungroo breed of pig need to be undertaken among the farmers in general and tribal farmers particular.
- There is a scope for agro forestry.

6.1.12.1.2.2. Uttar Dinajpur District

- It is one of the most backward districts of India. The Dinajpur region has traditionally been known for cultivating a large variety of indigenous aromatic rice strains, of which the *Tulaipanji* variety is native to the Raiganj region and has got geographical indicator. Promotion is required for huge production of such local scented rice and its marketing in the entire State.
- Replacement of old and traditional varieties with high yielding varieties in grains, pulses, oilseed and also horticultural crops.
- Promotion of different Integrated Farming System modules such as:Crops + Livestock + Backyard Poultry + Mushroom cultivation + Honey Bee + Fodder production + Vegetable cultivation.
- Crop losses are a frequent feature during the season of rains, because of the location of large parts of the district along the active floodplains of the rivers Mahananda and Nagar. Adequate technological back up needs to be extended to help the farmers overcome the crop losses due to flood. Technology is needed for protected cultivation of crops.
- Conservation and propagation of high value local Ghungroo breed of pig need to be undertaken among the farmers in general and tribal farmers in particular.

6.1.12.1.2.3. Coochbehar District

- Promotion of suitable mixed cropping (jute + amaranthus, lentil + mustard), inter cropping (potato + maize, elephant foot yam + amaranthus) is suggested.
- Integration of crops + goat + poultry for irrigated medium land is suitable.
- Integration of crops + cattle + fish + duck for low land situation is suggested. Integration of vegetables + fruits + cattle + fish + duck + poultry for pond based land is recommended.
- Promotion of agro-forestry system in uncultivable wasteland and unfertile fallow land is suggested.

- There is good prospect for dairy farming with crossbred or up-graded breed of cattle with high genetic potential
- Cultivation of perennial fodder crops in selected fallow land, ails or bunds is needed.
- There is a need for conservation and breeding of high value fish species.

6.1.12.2. Zone III: Lower Gangetic Region

6.1.12.2.1. Old Alluvial sub region

6.1.12.2.1.1. Dakshin Dinajpur District

- Promotion of different Integrated Farming System modules such as:
  a) In Medium to Up land: Jute / Mesta - Rice - Mustard/Wheat, Fishery, Livestock, Poultry
  b) In Medium to Low land: Fallow - Rice - Rice, Fishery.
  c) In Medium land: Jute - Rice - Vegetable / Potato, Fishery.
  d) In Upland: Vegetable - Vegetable - Vegetable, Fishery, Livestock, Poultry.
  e) In Lowland: Fallow - Rice - Fallow, Fishery.
- Promotion of cultivation of fibre crops like jute is suggested.
- Plantation of quick growing crop like custard apple, drumstick, fig, biel and other economically viable plants in waste land is recommended.
- Promotion of ghungroo pig in farmers in general and tribal farmers in particular is needed.

6.1.12.2.1.2. Malda District

- Mango, jute and silk are the most notable products of this district.
- The special variety of mango produced in this region, popularly known by the name of the district, is exported across the world and thus it is suggested to promote various mango cultivars like Fazli, Ashwina, Gopalbhog, Langra, Lakshanbhog, Himsagar, Amrapalli and Guti.
- Rejuvenation of age old Mango orchard and plantation of new orchard with export quality varieties of mango and litchi are required.
- Establishment of new orchard with high density planting is recommended.
- Improve technique of harvesting i.e. use of mango harvester to reduce the loss due to damage during harvesting of the fruits is required.
- Proper grading and packaging of mango need to be promoted.
- There is a need of intercropping of pulses, turmeric, ginger, elephant foot yam, etc under shady and partial shady condition.
- Promotion of cultivation of fibre crops like jute and also jute based processing facilities are required.
- Integration of adequate cropping system with inclusion of cereals, pulses, horticultural crops like, guava, banana, citrus, papaya and fodder crops is required.
- While 4.03 per cent cropped area of the district is drought prone, 7.55 per cent has been earmarked to be flood prone area. Alternative option is required in drought prone area of the district. Adequate technological back up needs to be extended to help the farmers and overcome the crop losses due to flood.
- Dairy farming needs to be promoted.

6.1.12.2.2. Gangetic New Alluvial sub region

6.1.12.2.2.1. East Medinipur District

- Development and promotion of area specific and resource specific IFS model for maximizing profit and reducing risk of mono-cropping are suggested.

- There is a scope for increasing productivity of oilseed through cultivation of sunflower and groundnut.
- The district has a long coastline of 65.5 km along its southern and south eastern boundary. Thus, there is a tremendous scope for fish farming.
- There is huge potentiality to develop composite fish culture, fish based farming system with vegetable in bank and orchard in pond side area.
- The district has a 899 hectare forest cover. The farmers need to be motivated for agro forestry.
- Normally floods occur in 21 of the 25 Blocks in the district. Adequate technological back up needs to be extended to help the farmers and overcome the crop losses due to flood.

6.1.12.2.2.2. Bardwan District

- The district of West Bengal leads the table in the country so far as rice production is concerned and among its' districts Bardwan is on top which is why the district is known as the 'Rice bowl of India'. Proper care and management need to be extended to the farmers for the production of short duration, high yielding rice varieties.
- Short duration, high yielding oilseed and pulse crops to be taken up in rice fallow areas with assured irrigation.
- Integrated farming system needs to be scaled up.
- There is a huge prospect of dairying in the district.

6.1.12.2.2.3. Hooghly District

- With highly fertile alluvial soils, well developed irrigation infrastructure, the district can safely be called as an agriculturally advanced district. The following cropping system needs to be promoted.
  a) Rice- Rice- Jute
  b) Rice- Potato- Sesame
  c) Rice-Vegetables- Rice
  d) Rice- Potato- Rice + Livestock and Fisheries
- The district is well known for jute cultivation, jute industry, and jute trade hub in the state. Need based technological back up for jute cultivation needs to be extended to the farmers.
- Potato is one of the cash crops in the district. Emphasis should be given for potato seed production in the district.
- There is a good scope for vegetables production, particularly onion. Adoption of improved package of practices for increasing onion productivity and dissemination of improved seed production technology of onion are recommended.
- There is scope for livestock farming and fisheries in the district.

6.1.12.2.2.4. Howrah District

- Diversification in rice based farming system is required.
- Howrah district has huge low lying areas where cultivation of paddy is the only option. That area can be brought under land shaping programme by formation heaps for planting of fruit crops where crop diversification can be possible.
- Cultivation of Swarna Sub-I under waterlogged condition is suggested. Sowing of short duration paddy variety like IET- 4786, IET- 4094 etc. in seed bed for flood affected areas of Howrah district is also recommended.

- Short duration, high yielding oilseed and pulse crops to be taken up in rice fallow areas with assured irrigation.
- Ground nut varieties TAG-24, TG-51 may be introduced as an alternative crop in Summer.
- Integrated farming system needs to be scaled up.
- Production of flowers may be undertaken in the farming system.
- Poultry and duck farming may be promoted for the farmers belonging to SC, ST and backward classes.
- There is a huge prospect of dairying in the district.

6.1.12.2.2.5. Murshidabad District

- The economics of the district is based on agriculture, handicrafts and sericulture. The Murshidabad Silk for making saris and scarves, is world famous.
- Crop diversification needs to be promoted from low value crop to high value crop in rice based farming system.
- Promotion of different Integrated Farming System modules such as:
  a) Cereals/Vegetables/fruits/Pulses/Spices/Medicinal plants + Dairy + Fishery + Backyard Poultry + Duckery + Biogas unit + Composting unit.
  b) Cultivation of vegetables at pond bunds + Composite fish culture + Goatery/ Backyard poultry/ Duckery.
  c) Fodder production + Mini dairy + Composting + Vegetables.
- Technological inputs are needed for the promotion of jute, wheat, pulses, oilseeds, vegetables and mangoes.
- Promotion of green gram intercropping with jute to increase per unit land productivity and profitability is required.
- Fodder production is in practice in the district. It is necessary to promote the cultivation of green fodders rich in digestible proteins viz. rice bean, cowpea and berseem as well as napier and dinanath as fast growing grass for lean season.
- Murshidabad district is known for the breeding tract of pure Black Bengal goats. The conservation and propagation of pure Black Bengal goats should be a thrust area of work.
- There is a good scope for dairying and poultry farming in the district.

6.1.12.2.2.6. Nadia District

- Crop diversification to high value crops in rice based farming system needs to be promoted.
- Agriculture and Horticulture-based farming system is encouraged.
- Adoption of pulse based cropping system is suggested.
- Nadia district is known for vegetable growing district. Promotion of off season vegetable cultivation like summer cauliflower, cabbage, leafy vegetables like spinach, coriander, radish, winter gourds, ladies finger etc is suggested.
- There is scope for promotion of protected cultivation of capsicum, strawberry, gerbera, orchid etc.

- Promotion of integration of horticultural crops like mango, litchi, guava, banana, citrus, papaya with of vegetables like gourds, turmeric, ginger, chilli etc as intercrop is recommended.
- Dairy based farming system needs to be promoted, is recommended.
- There is good scope for goat and poultry farming in the district.

6.1.12.2.2.7. North Parganas District

- Crop diversification to high value crops in rice based farming system needs to be promoted.
- Agriculture and Horticulture-based farming system is encouraged.
- Promotion of off season vegetable cultivation like french bean, pea, kharif onion, bottle gourd, summer cauliflower, cabbage, leafy vegetables like spinach, coriander, radish, winter gourds, ladies finger etc is suggested.
- Promotion of cultivation of flower crops like tuberose, chrysanthemum, rose, gladiolus, foliage plant etc is suggested.
- There is need for promotion of integration of horticultural crops like mango, litchi, guava, banana, citrus, papaya with vegetables like gourds, turmeric, ginger, chilli etc as intercrop.
- Integration with livestock, fishery (composite fish culture) and horticultural crops is recommended.
- Adoption of land shaping model for coastal area is suggested.
- Dairy based farming system needs to be promoted.
- There is good scope for goat and poultry farming in the district.

6.1.12.2.3. Costal Saline sub region

6.1.12.2.3.1. South Parganas District

- Nimpith KVK developed land shaping and rain water harvesting technology for augmenting production per unit area by converting mono-cropped low lying areas into multi-cropped and assured irrigation throughout the year.
- There is a scope for cultivation of sunflower and cotton.
- Pisciculture is the major economical support of this district. Promotion in multiple cropping through paddy cum fish + vegetable in ails during kharif + vegetable in land embankment is recommended.
- Diversification in vegetable farming through land embankment cultivation is promoted.
- Creation of vegetable cultivable areas through reclamation of saline soils is recommended.
- Distillation of derelict water bodies and proper utilization of water bodies through culture of air-breathing fish species are suggested.
- Promotion of integrated fish cum duck cum vegetables cultivation is suggested.
- Optimization of profitability by stocking at least 30 different freshwater fish species in carp ponds is advocated.
- Triple cropping in a year through promotion of mono-sex tilapia and climbing perch farming in shallow water bodies is recommended.
- Promotion of backyard hatcheries of high demand fish like carps, catfish, etc. to enhance

farmers' income is promising option.

- There is a prospect of culture of high value species like freshwater giant prawn, sea bass , feather back, indigenous catfish, butter fish, climbing perch, etc. in mono culture or poly-culture systems.
- Promotion of commercially profitable brackish water fish and prawn species like sea bass, mullets, shrimps, crabs etc is required.
- Bee keeping may be promoted.
- There is enough scope for goat and poultry farming in the district.

6.1.12.3. Zone VII: Eastern Plateau and Hill Region

6.1.12.3.1. Undulating Red and Laterite sub region

6.1.12.3.1.1. Bankura District

- Intermittent gaps of precipitation and moisture stress during the monsoon gives rise to serious setback in production during the kharif, which is the main stay of agriculture in the district.
- Integration of adequate cropping system with inclusion of cereals, pulses, oilseeds and forage is suggested.
- It is recommended to promote integration of horticultural crops like mango, guava, citrus, papaya with intercrop of vegetables like turmeric, ginger, chilli, elephant foot yam etc.
- Plantation of different economically important minor fruit plants, such as bael, amla, custard apple etc and vegetable crops like drumstick, green papaya etc in wasteland should be undertaken.
- Promotion of different Integrated Farming System modules such as:
  a) Crop based backyard poultry - goat rearing/ seasonal fish farming,
  b) Crop based - dairy husbandry - goat rearing,
  c) Crop based backyard pig rearing and backyard poultry rearing / goat rearing,
  d) Crop based backyard poultry rearing and goat rearing
- Drought constitutes a major hazard in the district. Promotion of sericulture, apiculture, poultry, and mushroom production will harness the potential of improved technology in farming occupation.

6.1.12.3.1.2. Birbhum District

- Birbhum District is often called as "the land of red soil". Major crops produced in the district include rice, legumes, wheat, maize, potatoes and sugar cane.
- The following farming systems may be promoted.
  a) In Upland- Paddy, red gram, fruit crops.
  b) In Medium land- Paddy, mustard, potato, sugarcane, sesame, black gram, vegetables and fruit crops.
  c) In Lowland- Paddy, sugarcane, wheat, potato and vegetables.
- It is suggested to promote commercial cultivation of demand specific medicinal plants like kaempheria etc in rainfed area.
- Production of cotton, lac and sericulture should be promoted.

- In waste land, tree plantation with year-round drumstick, hybrid amloki, hybrid ber, different perennial cereal and legume fodder crops may be promoted.
- Promotion of different Integrated Farming System modules such as:
- Integration of fishery with inclusion of pulses and vegetable,
- Integration of duck and poultry farming with fish based farming system,
- Integration of fruit trees with fish and poultry based farming system.
- Birbhum is a major centre of cottage industries. Thus, some notable cottage industries like cotton and locally harvested tussar silk, jute works, batik, kantha stitch, pottery and terracotta, solapith, woodcarving, bamboo and cane craft, metal works and tribal crafts should be promoted.
- Promotion of rural tourism in different tourist spot of the district is suggested.

6.1.12.3.1.3. Purulia District

- Due to the rough weather and soil, Purulia lags behind in agricultural arena from the other districts of West Bengal. However, cultivation of silk and lac are the main agricultural products. Hence, cultivation of lac and sericulture should be the priority area of development.
- Kharif rice based cropping system should be followed with the cultivation of suitable pulses/ oilseeds.
- Digging of trenches for high percolation of water, construction and regular maintenance of check dams in the district are required.
- Storage of rain water in monsoon season by pond lining is suggested.
- Development of orchards in waste land may be promoted.
- Promotion of effective use of mulch, sprinkler and drip irrigation in the existing orchards as well as vegetable cultivation is required.
- Conservation of Black Bengal Goat and Aseel breed of poultry in context to Purulia district is required for maintaining the bio-diversity as well as the income generation programme.
- Pig farming among the tribal people may be promising option.
- To promote the income generation among the rural youth through, broiler poultry as well as duck farming and mushroom production may be high remunerative option.
- Tourism is another source of income for this district. Promotion of rural tourism in different tourist spot of the district is suggested.

6.1.12.3.1.4. West Medinipur District

- Rice based cropping system should be followed with the cultivation of suitable pulses/ oilseeds.
- Construction of watershed structures and artificial structure to maximize water percolation rate in marginal and denudated areas are suggested.
- Cultivation of Swarna Sub-I under waterlogged condition is suggested. Sowing of short duration paddy variety like IET- 4786, IET- 4094 etc. in seed bed for flood affected areas of West Medinipur district is also recommended.

- Ground nut varieties TAG-24, TG-51 may be introduced as an alternative crop in Summer.
- Integrated farming system needs to be scaled up.
- Wasteland development through orchard development eg mango, cashewnut, musambi etc.
- Afforestation with agroforestry and cultivation of fodder plants are suggested.
- Fisheries and duck farming may be promoted.
- West Medinipur district is subject to both flood and drought. Adequate technological back up needs to be extended to help the farmers overcome the crop losses due to flood as well as drought. Promotion of sericulture, apiculture and mushroom production will harness the potential of improved technology in farming occupation.

6.2. Potential contribution to farmers' income and strategy for scaling out these technologies (Technology information/packages validated/successfully demonstrated as examples to be replicated in different agro-ecologies)

6.2.1. Zone II: Eastern Himalayan Region

6.2.1.1. Northern Hill sub region

(Darjeeling)

Success Story - 1

Mandarin Orange Cultivation-A valuable and profitable source of income

Back ground:

Darjeeling is world famous for its Mandarin orange. Though there are four different types of mandarin found in India namely Darjeeling Mandarin, Khasi mandarin, Coorg mandarin and Nagpur mandarin but the mandarin found in Darjeeling is known particularly for its peculiar taste . Fruit of Darjeeling mandarin are oval in shape, average diameter of 5.5 to 8 cm, average weight 76-150g, number of juice sac 8 to 12 and rich in juice content. Apart from table purpose we can prepare marmalade, juice and squash from its fruit. Mandarin is a perennial crop which starts its bearing at the age of four but its economical yield is reached only at the age of six for 15-20 years. According to WBSMB 2007-08, the total area under mandarin in Darjeeling district is 3680 ha with the production of 35980 tones. The major threat with the mandarin cultivation in Darjeeling district is the decline in yield, it is due to the combination of malady - poor nutrition, very old age of the tree, water stagnation, improper cultural practices and disease and pest attack. The soil of Darjeeling District is deficit in phosphorus, potassium (in some areas) and various other micronutrients. Farmers of our district use only FYM as a source of nutrition and are unaware about the use of balanced fertilizers and micronutrient.

The Farmer and technological interventions:

Mrs Anita Sharma, Age 40 years, Female, W/o Sri Ekunath Sharma of village Bong busty, P.O. Kalimpong, P.S. Kalimpong, Dist.-Kalimpong is one of the trainees for mandarin cultivation at KVK, Darjeeling. A homemaker turn agriculturist, she has an experience in crop cultivation for

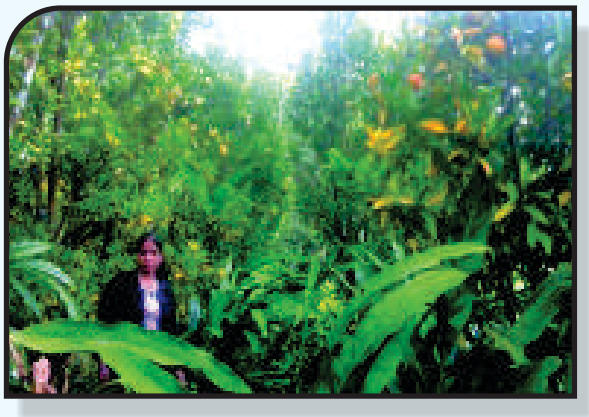
A FLD programme on Nutritional Management of Darjeeling Mandarin with the application of N:P:K@ 300:250:300 g/tree, Boron 50g, Zinc 250g, vermicompost12.5 kg, pig manure 6.25kg along with FYM 25 KG per tree was conducted by the KVK. The said dose was applied in two split doses - one-third in the month of Feb-March and the rest two-third in the month of Sept-October. Manures and fertilizers were applied in the ring six inches deep, with the application of the said manures and fertilizers. Mrs Anita Sharma noticed the change in the health of trees, change in yield, net return and the cost benefit ratio.

Table 14 : Economic analysis of mandarin crop per hectare

Type of cultivation	Yield (q/ha)	Cost of cultivation/ha	Gross income/ha	Net income/ha	BC ratio
Farmers Practice	180	1,05,900/-	2,66,700/-	1,60,800/-	2:5
After nutrient Application	370	1,84,100/-	5,48,000/-	3,63,900/-	2:9

FLD CONDUCTED BY KVK

FIELD VISIT BY KVK SCIENTIST



HAPPY FARMER

Success Story – 2

Higher income generation through management of blight disease in large cardamom

Background:

Mr. B. B. Thapa, a progressive farmer from Sangsey village, Kalimpong is having about one acre of land under large cardamom cultivation. Varlengey is the major cultivar grown by him which was about six years old. Most of the cardamom plantations were not having adequate shade trees and were hugely affected by blight disease, *Colletotrichum gleosporioides*. Once attacked by the fungus, usually during the onset of monsoon, the cardamom leaves and pseudostem develop grey and brown patches that dry out giving a burnt appearance. He was having a huge loss due to infestation of blight disease. It was the general picture in the field.

After intervention of KVK:

Through trainings and Frontline demonstration, the farmers were made aware about the importance of using Bordeaux mixture against blight disease in Cardamom field. Frontline demonstration with 1% Bordeaux mixture for the management of blight disease was conducted in the same village selecting Mr. Thapa as one of the clients for the demonstration. Mr. Thapa seriously took the advice and requested for technical support from KVK for further up-gradation of his knowledge in disease and nutrient management. He applied this technology in his field and has observed reduction of blight disease upto 40% thereby increase his annual production upto 27% and increases in income upto 67%.

Mr. Thapa was delighted; he again started earning from his cardamom plantation after 2015-16 onwards. The table below shows the earning from the respective orchard.

Table 15 : Monetary return from large cardamom cultivation

Year	Area (acre)	Yield (kg/acre)	Cost of cultivation	Gross return	Net return	BC ratio
2014-15	1.0	86	23,068	90,300	67,232	3.91
2015-16	1.0	103	24,146	1,08,150	84,004	4.48
2016-17	1.0	109	24,155	1,36,250	1,12,095	5.64

Impact and up scaling:

The performance of application of 1% Bordeaux mixture for blight disease management play a positive role in the production of large cardamom at Darjeeling district. It further revealed that use of improved technology recorded the highest yield of 109.0 kg/acre and BC ratio was 5.64. As massage of his success is spreading to whole village, more farmers are showing interest towards adopting this technology.

6.2.1.2. Teri and Teesta sub region

(Jalpaiguri, Uttar Dinajpur and Coochbehar)

Success Story – 3

Livelihood development through diversified farming in Jalpaiguri

Background:

Mr. Arup Bhattacharya, 45 years old, an energetic and informative small farmer having 2.7 acre of cultivated land residing at Sobhabari, PO-Pandapara-Kalibari, in Jalpaiguri district of West Bengal. Mr. Bhattacharya visited KVK, Jalpaiguri and interacted with the scientists and became interested in diversified farming system and adopting modern technologies in his farm after leaving Mumbai based private sector.

After intervention of KVK:

After taking training from KVK, Jalpaiguri, he has been engaged in diversified farming system for last 18 years along with his family members. First 10 years, he was engaged in small cattle unit and cultivation of field crops and some common vegetables. Then, he has interested in dairy farming with cattle, buffalo, goat and sheep with innovative technologies. To get better market he has started paneer making in his house and supplied to the district retail centre at early morning by his motorbike. He has installed a Bio-gas plant on his farm and the bio-gas is consuming for cooking purposes and saving more than Rs. 6,000 annually. Family members are also interested in farm intensification through azolla unit for cattle and goat feed. He has also engaged in vermin compost production unit on his farm. Besides selling, vermicompost and slurry of Bio-gas plant are utilized for nutritional garden, arecanut plantation and azolla unit. By doing so, he has increased his annual income from Rs. 69,600 to Rs. 2, 86,850.00.

Economic analysis of diversified farming:

Table 16 : Income level before adopting diversified farming:

Crop/ Livestock/ Fish/ Enterprise	Area (acre)/ No. production*	Cost of (Rs. per unit)	Return (Rs. per unit)	Net Income (Rs.per unit)
Rice	2.0	17,500	42,000	24,500
Areca nut	220	9,900	33,000	23,100
Livestock-Cow	4	56,400	72,000	15,600
Livestock-Goat-Sheep	6	4,800	11,200	6,400
Total :	**-**	**88,600**	**1,58,200**	**69,600**

Table 17 : Income level after adopting diversified farming

Crop/ Livestock/ Fish/ Enterprise	Area (acre)/ No. production*	Cost of (Rs. per unit)	Return (Rs. per unit)	Netincome (Rs.per unit)
Crop-Rice/green fodder	1.5 acre	13,500.00	32,800.00	19,300.00
Crop-areca nut	350nos	19,250.00	52,500.00	33,250.00
Livestock-Cow	12	2,84,700.00	4,56,250.00	1,71,550.00
Livestock-Buffalo	5			
Livestock-Goat- Sheep	14	10,950.00	29,200.00	18,250.00
Enterprise-Vermi compost unit	5 chamber	43,800.00	84,000.00	40,200.00
Enterprise-Bio gas unit	2	1,200.00	6,300.00	5,100.00
Enterprise-Paneer Making	****5 kg paneer produced per day from the milk of housed production of Cow – Buffalo**			
Enterprise-Azolla Unit	1	800.00	-	till continuing
Total :		**3,74,200.00**	**6,61,050.00**	**2,86,850.00**

* Includes cost of input, labour and others including marketing and transport of the products.

** The income accumulation of the Livestock – Cow & Buffalo

Success Story – 4

Integrated Pest Management (IPM) of fruit and shoot borer and other pest in brinjal

Background:

West Bengal being the highest producer of brinjal in India (28%) suffers a lot from brinjal fruit and shoot borer causing significant loss in production and net return to the farmers. IPM module for brinjal fruit and shoot borer has been proved to be the best option for higher production and net return to the farmers.

Technology Demonstration:

- Seedling raising under protected condition
- Pheromone trap installation @ 100 nos. $Ha.^{-1}$ at 35 days after transplanting.
- Neem cake @ 15 q ha^{-1} at 30 DAP
- Split application of N(in four split)
- Cut the damage shoot at weekly interval
- Pick up the damage fruit (even small) during harvesting
- Neem oil 10000 ppm sprays @ 2 ml /L at weekly interval from 50 DAP.
- Avoid the continuous planting in the same field or surrounded field, at least minimum two months gap in between uprooting the old plants and planting the new plants

Benefits:

Percentage of shoot infestation was lower (50%) in eco-friendly management than farmer's management and infested fruit was lower (75%) in eco-friendly management than farmer's management though yield was almost same (farmers practice was 30.50 t/ha and eco-friendly management 30.90 t/ha).

Economics:

BC ratio was on an average 1.99 – 2.68 in eco-friendly management practices as compared to 1.22 – 1.38 in farmer's practice.

Impact and up scaling:

- Farmers are practicing this technology in their field.
- Pesticide free brinjal available in the market.
- IPM tools like pheromone trap, neem oil, neem cake etc are readily available in the local market.
- Consumers are preferring the organically produced and pesticide free brinjal even they consume in higher price.

Raising seedlings under nylon net

Removing damaged shoot
at regular interval

Installation of Pheromone
trap at 35 DAT

Inspecting the pheromone trap and
destroying the insect

Rising the height of pheromone trap g″
above canopy with plant growth

Success Story – 5

Large scale adoption of skill oriented market linked technology on low cost weaning food for malnourished children

Background:

"Critical Mass leads to Critical Action" this quote is being proved by the members of Self Help Group of Uttar Dinajpur District of West Bengal. Malnourishment amongst the pre-school children (0-5yrs age group) in Uttar Dinajpur district is alarming. Data of District Project Office, ICDS, Uttar Dinajpur indicates that around 10 percent children enrolled with 3737 numbers of Anganwari centres of the district are severely under weight and defined as **"Red-Children".** The Integrated Child Development Service (ICDS), Uttar Dinajpur project through its 3737 service centre provides different services including **"supplementary nutrition"** to the children.

Technological intervention:

Keeping this alarming situation in view and considering the poor economic condition of a large section of community, Uttar Dinajpur Krishi Vigyan Kendra since its inception has taken rigorous activities for protocol development (Standardization) of various low cost nutritious weaning food utilizing locally available ingredients (wheat, maize buckwheat, green gram, peanut, drumstick leaves etc.) through its mandated activities of On Farm Trials. After rigorous trials through several years, Uttar Dinajpur KrishiVigyan Kendra has been able to develop and standardize several formulations of low cost weaning foods. The calorie measurement and nutritive value of the feed formulations has been tested at CFTRI, Mysore. All the feed formulations passed the criteria on calorie measurement and nutritive value as per national standards.

Up scaling of technology:

After standardization of feed formulation through On Farm Trials, Uttar Dinajpur KVK started wide scale adoption of the technology through training of the SHG members and anganwari workers for capacity building and sensitization, frontline demonstrations, case studies, awareness campaigns, field days etc. Three SHGs after getting trained from KVK, started producing low cost weaning food under direct supervision of KVK and selling it in the name of SHISHU AAHAR in the local Mela, rural haats, KrishiMela, SwanirbharMela, KanyashreeMela, SabalaMela etc. This has resulted into wide spread popularity and preference of the brand name SHISHU AAHAR among the resource poor farmer families.

Wide scale adoption:

Revealing the results of different low cost nutritious weaning food formulations developed by KVK in child health development in different forums and meetings, the Uttar Dinajpur District Administration decided to incorporate the low cost nutritious weaning food developed by Uttar Dinajpur Krishi Vigyan Kendra in a project called "PUSHTI" - An initiative for providing additional nutritional supplements to the malnourished pre-school children through SHG networks of the district. Skill development training on preparation and quality control of low cost nutritional food was imparted to the selected SHG members by the KVK. DRDC was in need to supply 3007

packets of food supplement for the children and 2054 packets for the pregnant mothers in the district per week. DRDC negotiated the matter with 10SHGs one each from ICDS block of the district to produce and supply required numbers of food packets to the concerned ICDS centre of the block. On the other hand, DRDC remitted the fund for the cost of the food packets in the account of the concerned SHGs. The process has been established and running smoothly since October, 2014 to combat malnourishment among children and pregnant mothers.

Economic configuration:

As per data from District project Officer, ICDS, the number of the target Group viz. "severely under weight (0-5 yrs.) children" termed as "Red Children" in ten (10) ICDS Blocks of the district is 3007 numbers. As assumed to provide "Additional Nutritional Supplement" of 500 g per child per week a total quantity of 3007 pkt.x500g i.e. 1503.5 Kg weaning food is required per week. The district administration has fixed the cost of weaning food @ Rupees 60.00 per Kg. Thus, a total revenue of 72,168 Kg x Rs. 60.00 i.e. Rs.43,30,080.00 (Rupees forty three lakh thirty thousand eighty only) is being revolved through the 10 SHGs selected by district administration for preparing and supplying the weaning food supplements for malnourished children. Keeping a profit of 20 percent on the total cost of production an amount of Rs. 8,66,016.00 (Rupees eight lakhs sixty six thousand sixteen only) is being generated to the selected SHGs.

Role of KVK at end term implementation:

As requested by the District Administration, Uttar DinajpurKrishiVigyan Kendra also acted as a resource centre to impart hands on training to the aspiring SHG members of each ICDS Blocks in preparation of low cost weaning food and sensitizing them in keeping hygiene and quality of the weaning food as per specification.

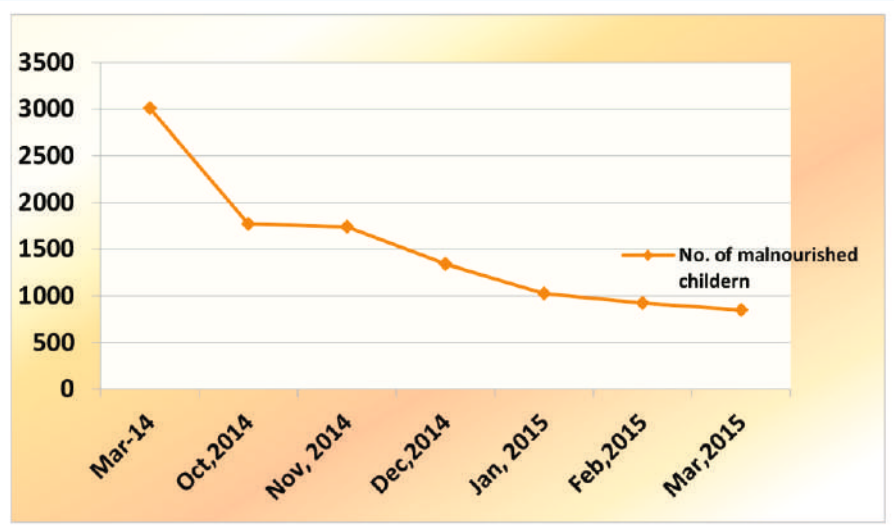


Fig 2. Monthly tracking of severely malnourished children in Uttar Dinajpur District after supplimenting with low cost weaning food developed by KVK

(Source: District ICDS Cell, Uttar Dinajpur, WB)

SHG members engaged in preparing low cost weaning food

Ready Shishu Aahar Packet

Homemade low cost weaning food given to child

Success Story - 6

Vermicomposting: A profitable and sustainable small farm enterprise by SHGs

Background:

Women in rural areas have to do with more than poverty. They also have to deal with their voices silenced, rights denied and opportunities curtailed. KVK seeks out a solution to this state by creating groups of women in villages bonded by a common way of earning their livelihood. Being in a group gives them the collective strength of the group to change their destiny. Indiscriminate use of chemical fertilizers and pesticides has contributed to soil degradation in many rural areas. Vermicomposting is the process of creating an eco-friendly, free from chemicals, natural manure i.e. vermin compost from biodegradable organic wastes. Good quality vermicompost can be prepared easily at home with very little input cost. Recognizing these shortcomings in rural waste management practices and to provide livelihood security to resource poor farm families' nutritional organic manure through the method of vermicomposting was introduced as a small scale enterprise.

Role of KVK:

Aleya Fatema Begum SHG was formed by Uttar Dinajpur KVK in 2008. Members were very active and used to come to KVK for various capacity building trainings. Mentioned SHG has taken 8 days rural youth training on "vermicompost production technology" from Uttar Dinajpur KVK and started a small scale unit within a month of training. After providing training to them, the Uttar Dinajpur Krishi Vigyan Kendra had extended technological as well as economic help in setting up production unit for SHG. The introduction of vermicomposting gave the SHG a new direction.

It is heartening to know that many women from other villages are now involved in producing compost either for use in their fields or to sell it to other farmers.

Economic benefits:

Impact factor	Before Adoption	After Adoption
Crop / Agricultural Practice	No use of vermicompost	Use of Vermicompost in their own field
Yield of crop / product		8qt/ cycle
Sale Value		Rs.9600/-
Input Cost	-	Rs.3500/qt.product
LabourCost		Rs.700/qt.
Any Other Cost		Rs.200/qt.
Net Saving / Net Profit		Rs.5200/cycle

Impact of technology:

Prior to the establishment of vermicomposting units, these women worked on their fields and were involved in domestic chores which did not accrue any economic benefit to them. Vermicomposting significantly enhanced the nutrient profile of animal manure through use of a particular earthworm species, thus adding value to traditional fertilizers. Poor farm women have taken it as venture to not only use it in their fields but also create awareness about this compost among fellow villagers for better soil health. Initially, SHG was producing 2-3 q. Vermicompost per month which was scaled up to 6-8 q per month and group is earning Rupees 6000-8000 per month and also selling vermiworms occasionally. Not only they are earning an income, but they are also developing skill sets. The SHG women are running an entire vermicomposting initiative on their own right from the setting up of the unit, maintaining it daily, packaging and selling the vermicompost. In this manner, they are being exposed to the day to day challenges of operating a business, learning to cope with them. These women also display confidence in handling financial aspects. This new opportunity has helped them support their children's education and other household expenses.

The greatest sense of empowerment that these women are witnessing comes from the increased recognition of their new role in the community at large. Fellow villagers admire these groups of women for being able to run an enterprise like vermicomposting. Even in their own houses, their partners reflect a new found respect for their wives. Such acceptance is helping women break away from their traditional roles and explore newer possibilities.

Success Story - 7

Backyard Azolla cultivation: A community initiative by KVK and farm women of Uttar Dinajpur District of West Bengal

Background:

Women and young girls often spend a great deal of time in collecting the fodder for the animals. The cost involved in purchase of concentrated feeds is prohibitively expensive. Existing feed sources such as farm wastes and dwarf paddy varieties lack essentially the adequate amount of nutrition, in particular protein. Poor rural village families who are already facing food insecurity loose interests in animal raising. Azolla is small fast growing free floating fern which is protein rich green feed for the farm animals.

Role of KVK:

In 2013, KVK, Uttar Dinajpur has first imparted training and then frontline demonstration programme on backyard azolla cultivation involving 10 Self Help Groups in five villages. Radhika Mandal and the members of Preetilata women farmers club of Uttar Dinajpur District also started backyard azolla cultivation. Thereafter, Radhika Mandal came forward to promote azolla at

community level and provide mother culture of azolla to many other fellow women and her relatives after giving training on backyard azolla cultivation. Azolla became the green feed for the domestic animals and the poultry birds.

Economic benefit:

Impact factor	Before Adoption	After Adoption
Agricultural Practice	-	Backyard Azolla cultivation
Yield of azolla		60kg/ 30 sq. meter area/ month
Sale Value @ Rs. 15 per kg		Rs. 900/ month
Input Cost		Rs. 100.00
Labour Cost		Rs. 200.00
Any Other Cost		-
Net Saving / Net Profit		Rs. 600.00/ month

Impact:

Azolla produces abundant biomass with high protein content and it offers cost-effective solutions for fodder security (more than 30-40% cost saving) and significantly reduces costs for concentrate feeds. It has been a significant change in knowledge, attitude and skill level of SHG women practicing azolla cultivation after getting training. Backyard azolla cultivation offers sustainable resources use and management in order to ensure livelihood security. Through farmer to farmer knowledge sharing and proper training, now it has reached to 65 SHGs covering more than 56 villages and 750 farm families in five blocks of the district.




Success Story - 8

Market linked technology of mushroom cultivation for subsidiary income and nutritional security of farm families in Uttar Dinajpur

Background:

Mushroom is a delicious food consumed throughout the world. It is also called the future vegetable which is a guarantee against food insecurity, malnutrition problem and has medicinal value. Mushroom can be a valuable dietary protein with various micronutrients and medicinal properties. The small-scale mushroom production represents an opportunity for farming community interested in an additional income and is an ideal option specifically for those without much land. Mushrooms can be successfully grown without access to much land, and can provide a regular income throughout the year.

Role of KVK:

Uttar Dinajpur Krishi Vigyan Kendra has started working since 2012-13 on popularizing mushroom cultivation. A baseline survey on status of mushroom cultivation in the district indicated that, there were only 2-3 running units, majority of the sample groups were not aware of this cultivation. No knowledge of nutritional and medicinal value of mushrooms was found among majority of them even many of them had fallacies about mushrooms and were not ready to keep it in their regular foods. Uttar Dinajpur KVK has initiated imparting skill development training on mushroom production to the rural youth and SHG members. They were made familiar with fungi life cycles, and the importance of hygiene and sterilization in developing successful growing environment. They were also trained in the post harvest handling and processing aspects as well. Thereafter, the rural youth and SHG members initiated their cultivation on a small scale, in each ones homestead and after gaining confidence they started in a large scale and gradually it turned into the development of 15 commercial mushroom producing entrepreneurs producing on an average 150 kg fresh mushroom per day per unit. Initially each producer used to sale their produce individually in local markets. Seeing the difficulties in individual marketing, KVK intervened into the matter to establish one Producers Organization with the help of NABARD. Meanwhile, KVK initiated the process of collecting fresh mushroom from each entrepreneur and supplying to the Siliguri and Nepal market collectively. Presently an average monthly income by each mushroom grower ranges between Rs. 50,000- 70,000 per month.

Impact of Technology:

Criteria	Before adoption	After adoption
Status of mushroom production in the district	**No. of commercial units:** 5 nos. **Fresh mushroom prodn. :** 50 - 55 q year^{-1}unit^{-1} ❖ Individual growers ❖ Imperfect market linkage ❖ No assured spawn availability ❖ Production restricted to only Oyster mushroom	**No. of commercialunits:** 38 nos. **Fresh mushroom prodn. :** 70 - 100 q year^{-1}unit^{-1} **Activities** ❖ Formation of registered production groups ❖ Capacity building training ❖ Linkage with organized markets ❖ Assured availability of quality spawn through KVK ❖ High value Button mushroom, Milky mushrooms in addition to Oyster one
Criteria	**Before adoption**	**After adoption**
Increased Profitability	**Rs. 0.8 - 0.9 lakhs year^{-1}unit^{-1}** ❖ Insufficient market linkage ❖ No product diversification ❖ No product registration and branding	**Rs. 1.8 - 2.0 lakhs year^{-1}unit^{-1}** **Activities** ❖ Formation, registration and capacity building of processing--cum-marketing groups ❖ Value addition in terms of space, form and time ❖ Product registration, branding and market promotion ❖ Efforts for Provisioning of city based "One Stop Shop"

As a livelihood diversification option, mushroom cultivation has enormous scope to improve food security and income generation, which in turn can help boost rural and peri-urban economic growth. Mushroom production can play an important role in managing farm organic wastes when agricultural and food processing by-products are used as growing media for edible fungi. The spent substrate can then be composted and applied directly back to the soil.

Success Story - 9

Herbal Gulal preparation as an entrepreneurial activity by SHGs in Uttar Dinajpur

Background:

Herbal Gulal preparation is a step towards our health and environmental safety. In the month of January and February 2017, KVK, Uttar Dinajpur have conducted four awareness camps to initiate this programme and made famers aware of biodegradable products and safe chemicals. As the festival of colours Holi was coming so KVK had made benefecaries (SHG) aware and requested them to use eco-holi colours and explained them the process of making Herbal Gulal at their home. Many of them were quite interested and very happy with this step. Few teachers who reside in urban localities have also shown their interest in purchasing the colours if available.

Role of KVK:

KVK has imparted training to 3 Nos. SHGs viz., Mahaprabhu SHG, Dolua and Paglilgacch, Swarnayanti Mahila dal (2 Nos.), Sonapur to start Gulal preparation as entrepreneurial activity. After taking training SHGs have immediately started working on this project with technical support from KVK, Chopra. In the process of making herbal gulals main base ingredient is arrowroot which is coloured with different natural colours extracted from turmeric, petals of marigold flowers, beetroot, leaves of different plants and petals of different flowers etc., to get particular shade. Specific colouring material extract has to be added viz. for yellow colour we need turmeric extract and to get pink colour we need beetroot extract.

Impact:

In the mean time SHGs have given a stall on Herbal Gulals in Technology Week and Krishi Mela 2017 organized by Uttar Dinajpur KVK at Chopra, Uttar Dinajpur. This is the main turning point for them. Delegates as well as the participants have praised their move and till the last day of the mela they sold their whole stock and received orders in their hands for further preparation. They earned profit and got boosted for further task. Preparation of Herbal Gulal as entrepreneurial activity by SHGs is published by 4 nos. Local Papers. Process documentation of Herbal Gulal preparation was done by Doordarshan, Jalpaiguri as well as private channels like News Time, Kolkata TV and CCN.

Success Story - 10

Integrated management of mealy bug in pineapple

Background:

Low production of pineapple due to mealy bug infestation is a severe bottleneck for the pineapple growers. The farmers generally apply Phorate 10 G @ 20 kg ha-1 during planting followed by indiscriminate use of different insecticide like Monocortophos, Endosulfan, Triozophos etc. at different times.

Intervention point: Treatment of planting materials with application of recommended management practices.

Improved practice:

Treating planting materials with Monocrotophos (0.2%) and application of Phorate 10 G @ 15 kg ha-^{1} at 100 DAP and Neem cake @ 15 q/ha at 150 DAP and spray of Neem oil (1500 ppm) 2.5 ml/l at 390 DAP with three times manual weeding.

Impact:

Integrated management options and components include apparently clean planting material and application of need based physical, chemical (mealy bugs and gardener ants), and cultural (clean-weeded plots and rouging) methods. After completion of three years of the experiment with the above management practices, it was observed that average mealy bug population was between 3.8 to 4.2 per plant among the wilted pineapple plant. Wilted plant percentage ranged between 2.4 to 2.6 and yield 41.6 t/ha to 44.8 t/ha compared to farmers practice 9.3 to 13.8, 11.8 to 12.4 and 26.1 to 32.5 in mealy bug population, wilted plant percentage and yield, respectively. It was also noticed that BC ratio was 1.30 in the integrated pest management practices as compared to 1.09 in farmers' practices. Mealy bug population was 59% to 70% lower in integrated pest management (IPM) practice than farmers practice (FP) and wilted plant was 79-80 % lower in IPM than FP. The yield was higher in IPM (38% to 59%) than FP.



Success Story - 11

"Bunch cover in banana" for increasing farmers' income in coochbehar

Background:

Banana is a profitable crop of Coochbehar district. The price of banana remains high round the year. Major problem of banana cultivation is development of scar on fruit by scarring beetle; as a result the fruist fetch less market price. Generally period of infestation of this insect is governed by hot humid weather which is typical characteristics of this district. The rainfall coupled with hot humid condition starts from the month of April and continues up to September.

Role of KVK:

In order to mitigate this problem of banana scarring beetle nearly 0.9 ha of banana field was taken under NICRA Project in the village Khagribari. Banana bunches immediately after emergence was covered with non woven polypropylene skirt bag. After witnessing the grand success of this technology NABARD sponsored one project to disseminate the technology at Dinhata-II block over 5 ha and comprising 39 farmers. Covering the bunches with polypropylene cover stopped 4-5 insecticide spray for controlling scar beetle which in other way decreased environmental pollution and increased fruit quality. Fruits under bunch cover showed very less to nil infestation percentage whereas fruits produced without any bunch cover showed very high percentage of scarring beetle infestation. Moreover the cover itself protected the banana fruits from outside dust, bird droppings, spider net etc. As a result bunches under cover produced good quality fruit having shiny surface and free from any scar and dust particle and fetched higher market price by Rs 35-50 per bunch as compared to bunches without any cover.

Economic benefits:

The economics worked out indicates that banana under bunch cover fetched Rs. 4.62 lac/ha with BCR 2.35 as compared to produce without cover which gave the return of Rs. 3.27 lac/ha with BCR 2.25.

Table 18 : Impact of technology on economic return

Economics of demonstration (Rs./ha)			Economics of farmers' practice (Rs./ha)		
Gross Cost	Gross Return	Net Return	Gross Cost	Gross Return	Net Return
1.95 lac	4.62 lac	2.67 lac	1.42 lac	3.27 lac	1.85 lac

Impact of the innovative technology:

Farmers are showing interest to adopt this new technology in large numbers. One producers' organization has been formed under NABARD to produce quality banana under cover at Bhogdabri. It is expected that more farmers and farmers club will adopt the technology in the years to come.

Uncovered banana with spots

Farmer covering with banana bunch with polythene

Polythene covered banana bunched

Fresh unspotted banana bunch

6.2.2. Zone III: Lower Gangetic Region

6.2.2.1. Old Alluvial sub region

(Dakshin Dinajpur and Malda)

Success Story - 12

Bee keeping: an enterprise for doubling income

Background:

Agriculture is an age old practice in India. At present day agriculture should be sustainable as well as commercial and scientific. Bee-keeping is a need based alternative sustainable agriculture and vertical agriculture practice to fulfill the over growing employment problem of rural youths of India. Considering this, Dakshin Dinajpur Krishi Vigyan Kendra identified bee-keeping as one of the practices by rural youths as an entrepreneurship venture through skill development training. Bee-keeping is a very profitable enterprise. Dakshin Dinajpur District is an agriculture based district. Mustard is cultivated in about 25-30 thousand ha area which is a potential crop for bee-keeping. Besides, fruits and vegetables are also cultivated in considerable area. Thus, this district is potential in bee-keeping.

Role of KVK:

There is a taboo among common people of this district that bee-keeping reduces yield of mustard. Initially, KVK tried hard to persuade the farmers to break the taboo and succeeded in driving out this wrong idea from the mind of a large no. of farmers. Rather, it enhances pollination and increases yield of mustard. Now, many farmers and rural youths are coming forward and opting bee-keeping. KVK has provided about 06 no. of trainings to 152 rural youths during the last 06 years from 2006 to 2011. Apart from training, bee-boxes and bee-hives were given to 06 youths for demonstration on profitability of bee-keeping. During training programmes, the trainees are exposed to hands on practice on different aspects of bee-keeping. As a result of this effort by the KVK, about 24 no. of farmers are maintaining bee-hives in a very small scale mainly for domestic use and they also sale some honey for supporting their family.

Mr. Krishna Karmakar, a 38 years' old rural youth belongs to a very poor and land less family. He has five members in his family. He has no income source. He came in contact with DDKVK, in 2008. The KVK scientist suggested him to take the training on beekeeping. He underwent training on bee-keeping. After completion of training, he was provided with 02 Bee-boxes from KVK and he purchased some colony from his own source. He started his journey in the year 2009-10 and got a profit of Rs. 2,800.00 from 20 boxes. He achieved the confidence and there was no look-back. Now, he is an established entrepreneur with a net annual income of about Rs. 1,79,500.00 with 65 bee-boxes. He is an example for the unemployed youths and landless farmers.

Table 19 : Economic Return of Mr. Krishna Karmakar

Year	No. of Boxes	Yield (Kg)	Rate (Rs.)	Gross Return (Rs.)	Rearing Cost (Rs.)	Net Return (Rs.)	BC ratio
2008-09	20	540	70.00	37800.00	35000.00	2800.00	1.08
2009-10	35	1050	80.00	84000.00	20000.00	64000.00	4.2
2010-11	55	1760	80.00	140000.00	30000.00	110000.00	4.6
2011-12	65	2275	100.00	227500.00	45000.00	182500.00	5.05
2012-13	72	2500	125.00	312500.00	55000.00	257500.00	5.68

Success Story - 13

Low cost manual poultry incubator for hatching of eggs in Dakshin Dinajpur

Background:

Mr. Pulak Sarkar is a very hard working fellow with innovative mindset. He maintains his nine member family with income from one acre of land and a small business of poultry feed, fish feed and chicks etc. He procures about 3000 chicks/month for his business from big business houses like Arambagh Hatcheries, Saguna, Venky's etc. in which cost of chicks and carrying cost etc. becomes very high and accordingly profitability reduces. For this he was thinking of making arrangement of commercial hatching in his house. But the mechanical incubator available in the market is very costly, about Rs. 3-5 lakhs which he could not afford. During this time he attended one training programme on poultry farming organized by the KVK, Dakhin Dinajpur district. He learnt three basic things - hygiene, temperature and humidity control are necessary for hatching. It triggered in his mind for development of wooden incubator. He has developed a low cost manual poultry incubator for hatching of eggs.

Role of KVK:

Considering the high cost and problems of the farmers, the cost effective technology was designed by the innovator farmer's i.e. Mr. Pulak Sarkar. The unique machine can be used by any unemployed rural youth/entrepreneurs with minimum land i.e. 25-50 sq. ft. and cost involvement of Rs. 50-60 thousand under skilled supervision. KVK has trained more than 200 nos. of rural youths and farm women to accept the avenues as an alternative rural employment opportunity. The machine is easily operated by farm women and fetches approx. Rs. 9,000-10,000/cycle with higher economic return.

Impact of the innovative technology:

The machine was successfully demonstrated and installed in innovator's farm, KVK instructional farm and various Blocks of the Dakshin Dinajpur district by Dakshin Dinajpur KVK with RIF fund support of NABARD, Kolkata, W.B. The success of these venture has been documented in various daily (Vernacular) Newspaper, farm Magazine, ICAR-Zonal reports, NABARD Documentary along with display of model in various Krishi Mela, exhibition etc. by Dakshin Dinajpur KVK. Nos. of KVKs within and outside the state of West Bengal has expressed their desire to adopt this innovative practice as small scale entrepreneurship of rural youth in their area. Now, the innovation needs effective market linkage, finer tuning along with propaganda for wider adoption and scalability in near future.

Mr. Pulak Sarkar, showing the egg tray Thermometer fitted on wall of the incubator for measurement of inside temperature

Success Story - 14

Backyard pig farming and doubling income for livelihood in Dakshin Dinajpur

Background:

Pig farming plays a significant role in ensuring livelihood security to the millions of tribal farmers, landless labourers and rural folk. This is one of the most profitable entrepreneurial avenues among different livestock farming and gaining momentum under rural backyard condition. Indigenous piggery practices under backyard or semi-intensive condition is very much popular and this practice prevails since long in rural tribal area of Dakshin Dinajpur district of West Bengal. Among the 08 blocks of Dakshin Dinajpur district, 04 blocks are tribal dominated and they are resource poor, socio economically and educationally backward and mostly belong to marginal and landless category. Their livelihood principally depends on animal husbandry based production system.

Due to lack of scientific know how of improved piggery farming practices, increased disease incidence and overall non profitability, the pig population in the district decreased significantly. As per 2007-08 census, the pig population of the district decreased abruptly (-39.60%) due to its non-remunerative traditional practices, which was also reflected in KVK PRA survey in various adopted villages of the district. The poor productivity of local backyard pig breed is due to poor genetic

makeup of the breed. Simultaneously, exotic commercial pig farming was also quite impossible for the socio-economically backward poor tribal stakeholders. One improved native breed, Ghongroo pig was found in rural tribal area of terrai region of North Bengal having tremendous growth potential and fecundity rate. The breed is very much sustainable in this area and fetches huge profitability considering the backyard condition of the rural tribal area of Bengal. This is a highly prolific breed. In field condition, the fecundity rate of the breed is 12-14 nos of piglet/furrowing and in farm condition it is 15-18 nos./furrowing which is more than double than that of backyard local variety. The growth rate is 70-80 kg in 6-7 months. So, varietal replacement of majority of these low productive backyard varieties by the improved native Ghoongroo pig breed or through crossbreeding with these breed for genetic improvement of productive potentiality are the only scientific and sustainable vis-a-vis profitable entrepreneurial venture for the tribal piggery stakeholders of the area.

Role of KVK:

Dakshin Dinajpur KVK initiated the varietal replacement of low productive backyard piggery by native, prolific Ghoongroo piggery in entrepreneurial venture along with scientific orientation among the rural tribal piggery owner of Dakshin Dinajpur district of West Bengal. Considering the entrepreneurial potentiality of this improved indigenous Pig, KVK started capacity building along with FLD programme on this native variety in various adopted (06) villages of the 03 blocks of the district since 2006-07. In last 6-7 years, 27 nos. of training programmes in 12 batches were conducted with 275 nos. of trainees youths along with 17 nos of demonstration programmes. Among total nos. of trainees 32 nos of farmers set up small units (2 + 1) of piggery as entrepreneurial venture in their backyard household system. During this time span, 68 nos. of piglet distribution in the adjoining area as horizontal spread of technology was done. 17 nos of front line demonstration along with regular awareness cum motivation campaign, monitoring and discussion with farmers were organised to facilitate the farmers for successful development of this pig farming practices. As a result, gradually this farming practice became popular among the tribal farmers of the area and a specific network marketing system was developed for the piggery owners of the area.

Economics of Ghoongroo and local bakyard piggery:

A single unit of Ghoongroo piggery (2 + 1) is quite capable of maintaining the livelihood of a tribal family with the earning of Rs. 90,000/- per year and may bring more than two fold (130%) economic return than local poor productive backyard system.

Table 20 : Comparative economics of Ghoongroo & traditional piggery in farmer's field

Piggery Unit (2 + 1)	Rearing cost per yr. (RS.)	Gross return per yr. (RS.)	BC ratio
Local Backyard Piggery (2 + 1)	Rs.25,000/-	Rs. 65,000/-	2.6
Improved Ghugroo) Piggery (2 + 1)	Rs. 40,000/-	Rs. 1,30,000/-	3.25

Impact of backyard Ghoongroo pig farming:

Some of the successful farming units are - Sri Panchanan Tirky of Gangarampur Block, Sri Amal Tigga of Kasibati village under Tapan block, Sri Subrata Murmu of Gopalganj Village under Kumarganj block of the district. Dept. of ARD of the district have also come forward for large scale dissemination of the technology. Sri Subrata Murmu started his unit (5 + 1) in 2007 and now he is one of the popular profitable entrepreneurs with a unit size of 20 + 5 nos of Ghungroo piggery along leading annual turnover of Rs. 2.0-2.5 lakh. Amal Tigga started his unit in 2008 with a small unit (2 + 1) through KVK demonstration and presently his stock is 10 + 2 no's of Pig, with net return of Rs 90,000/- per annum. Now, he wants to expand his farm in commercial entrepreneurial venture with this Ghungroo pig and for this he needs financial assistance. Now, they are being considered as successful entrepreneurs in the adjoining area as well as district through Ghungroo Pig farming practices.

Tribal farmers rearing Ghoongroo pig in Barsapara and Gopalganj village, Balurghat & Kumarganj block of Dakshin Dinajpur

Success Story - 15

Farmers' participatory low cost magur seed production - A growing enterprise in Dakshin Dinajpur

Background:

The Asian catfish locally known as Magur fish (Clarias batrachus) is an important air- breathing cat fish with good market in West Bengal. Culture of air breathing fishes especially magur can be taken as a profitable, commercially viable enterprise by the rural youth. Despite great potentiality, culture of this species has not yet received due importance.

It is a naturally breeding cat fish and collection of magur seed from water bodies and that too in required numbers and as per demand is practically impossible. Dearth of technological skill is elicited as major constraint to accept this venture. On the other, indiscriminate use of pesticides in the paddy field, the main breeding ground of magur, has caused endangering the species. Further, various anthropogenic activities have resulted to day by day shrinkage of breeding ground.

Role of KVK:

To overcome the problems of magur seed availability, effort was made by the Dakshin Dinajpur KVK to produce magur seed in low cost hatchery in a participatory mode. During 2005-06, it was tried in the hatchery of Sri Bishu Tudu, a fish farmer of Mahala village of Balurghat block and it was proved to be a success. Inspired with the success of the magur seed production in the low cost hatchery at farmers' pond, District Fisheries Department came forward and organized training programmes collaborated with KVK for creating awareness among the youth and KVK went on its effort in simplifying the breeding technique.

A feedback from Sri Bishu Tudu led KVK to further fine-tune the technological package before it was adopted in the hatchery of Md. Ainul Haque, a hatchery owner from Mehendipara village of Harirampur Block in 2006-07. This time hatching percentage improved to a high extent, realizing that amendment suggested by Bishu Tudu was the proven need as it earned greater success. This experience of the KVK in participatory magur breeding in 2005-06 and 2006-07 was very encouraging. However the technique was employed in 2007-08 in young and energetic fellow Hare Krishna Biswas of Kholsi village of Tapan block of Dakshin Dinjapur district with much simplification and its success was much higher than previous two. In the year 2009-10, Swapan Kr. Bhowmik, Balurghat Block achieved a great success in magur seed production. In the year 2011-12, Rafikul Mia, a progressive fish farmer of Panchagram of Gangarampur block produced huge magur seed with improved quality. This simplified technology is now in a way to spread amongst others. In the year (2015-16), 10 youth have started this venture. The KVK is organizing training programmes and field days to popularize and disseminate the technology. A total of 18 nos. of farmers has already established this low cost hatchery and produced magur seed successfully.

Technology Component:

i) Construction of hatching trough: This is the most crucial part of the technology. Circular hatching trough is made of galvanized iron sheet with 80 cm diameter and 30 cm height. The water from drum comes to the trough through pipe and water exists through outlet. A round perforated galvanized iron sheet portion is kept at the middle of the trough. A rectangular hatching ring (35 cm × 25 cm) made of iron to which nylon net is placed within the troughs.

Ii) Breeding technique: The standard breeding technique developed by CIFA was employed with little modification by the KVK. Two to three years' old fishes weighing about 250-300 gm each are used for breeding. Both male and female are given single dose (1.5 mg per fish) of pituitary extract at the same time. The injected male and female are kept in two separate tanks. After 16 hours of injection, the fishes are then ready for stripping. The eggs are released by gently pressing the abdomen towards the vent, collecting them on a stainless steel. The injected male needs to be sacrificed to prepare finally sperm suspension in clean water. The testis is dissected out and cut into small pieces with the help of small scissors and macerated in normal saline water (0.9% NaCl in distilled water) to prepare finally the sperm suspension. The sperm suspension is sprinkled evenly over the eggs followed by clean water addition. Eggs and sperm are allowed to mix by gently moving tray for 4-5 minutes. The fertilized eggs are washed thoroughly and transferred to hatchery.

iii) Operation of the hatching trough: The fertilized eggs are spread on the rectangular net which remains suspended inside the hatching trough at 5 cm depth from the water surface. Normally the larvae took 18–22 hr. of incubation after fertilization to hatch out. The newly hatch larvae retain a large ovoid yolk sac, which gets absorbed in four days. This time they do not take food from outside. The three day old larvae (4th day) was fed with live plankton. On the fourth day the hatchlings are transferred to a rearing tank. After four days, the larvae are transferred to a polythene covered earthen bed (160 cm x 120 cm) surrounded by mud ridge to a height of 20 cm. The water depth in polythene covered earthen tank is maintained at 10 cm. The continuous water supply is to be maintained. After providing feed, water need not be changed within 1 hour. The larvae are fed with live zooplankton for 10-15 days twice to thrice in a day. Plankton are collected from ponds at morning or evening time by a plankton net. The dead zooplankton requires to be removed by siphoning at least twice a day. After 15 days, the magur fry reach to 10-12 mm size. Then the fry is reared in well prepared pond or outdoor cemented tank.

Economic benefits from magur seed production:

Name of the breeder	Name of village	Name of block	Horizontal spread of technology		Production (approx no.)	Benefit cost ratio seed
			No. of farmers received magur	No of viilage covered		
Md. Ainul Haque	Mehendipara	Harirampur	16	8	80,000	2.6
Hare Krishna Biswas	Kholsi	Tapan	30	25	2,20,000	3.1
Swapan Kr. Bhowmik	Balurghat	Balurghat	24	10	3,10,000	2.8
Rafikul Mia	Panchagram	Gangarampur	47	22	4,40,000	2.6
		Total				

Impact :

Participatory magur breeding technology developed by the Dakshin Dinajpur KVK will open the vistas of income generation of the rural youth as well as it may help to provide magur seed to the fish farmers of the district to enable them to take magur culture as an alternative means of self employment. This technology can be replicated in other districts too, making a major breakthrough in fishery sector of the State.

Success Story -16

Production and value addition in Mushroom for augmenting income in Dakshin Dinajpur

Background :

Mushroom is not a traditional food in Dakshin Dinajpur. It occupies a relatively small niche market comprising educated urban households, institute like NGOs, big Mushroom farm, restaurant, BSF cantonment, hospital in Dakshin Dinajpur and others. Mr. Chataru Barman, a rural youth from resource poor marginal family of Baddungi village of Hilli block in Dakshin Dinajpur district worked hard with his parents in the village where they were dependent only on crop cultivation. He was searching for an alternative, profitable enterprise for better income to support his family.

Role of KVK :

The situation started changing when he came in contact with DDKVK, Dakshin Dinajpur during the year 2010-11 and eventually received training in Mushroom cultivation from DDKVK with duration of one week. After successfully completing the training programme and as per the guidance of KVK expert, Mr. Chataru Barman then started Mushroom cultivation of his own through taking spawn from the KVK.

Economic benefits:

Mr Chataru Barman collected the raw Mushroom from producer through Mushroom Marketing group. He travelled to Dakshin Dinajpur KVK in every week to buy spawn and then he sold the spawns to the contact farmers. He is now, earning Rs. 1.0-1.5 lakh in a season by production and

selling his raw mushroom and its various products throughout the district & outside the district. Apart from producing Mushroom, he is supplying spawn and buying Mushroom from producers. Now he provides processed dry Mushroom.

Sl. No	Parameters	Items		
		Raw Mushroom	Dry Mushroom	Pickled Mushroom
I	Yield of crop/ product	7200 kg/yr;	200 kg/yr;	10000 nos bottle
2	Sale Value	Rs. 50/kg;	Rs. 500/kg;Rs.	40/ bottle (200g / bottle)
3	Input Cost	Rs. 30/kg;	Rs. 450/kgRs.	35/ bottle (200g / bottle)
4	Labour Cost	Rs. 95,000.00/yr		
5	Any Other Cost		Nil	
6	Net Savings /Net Profit	Rs.1,09,000.00/yr		

Impact of technology:

Mr. Chataru Barman acting as rural youth entrepreneur-cum- master trainer to create much awareness among other. He has registered his product under small scale industry of West Bengal Govt. vide Registration No. FSS-ACT-2006/22813005001845. Considering his prospect DIC (District Industrial Center) has sanctioned a loan of Rs. 5.00 lakh to setup a Mushroom production and processing unit for up-scaling his enterprise. He has also branded his product in the name of 'Hilli Delhi' as one of the first ever registered farm producers in this region of West Bengal. He has created market outlet for 30 Mushroom farmers, including 25 supported by Dakshin Dinajpur KVK. He sells 150 kg of fresh Mushroom in every week and 5 quintal of dry Mushroom in every year to the local market and outside the District like Malda, Uttar Dinajpur and Darjeeling, Assam. After seeing the success of Mr. Chataru Barman, five (5) farmers in the locality have already started mushroom production and eight (8) rural youth have taken training on mushroom production from Dakshin Dinajpur KVK. He was awarded with Sikrti Award from NABARD in the year 2014.

Success Story - 17

Vegetables based multi-tier horticulture system in Malda

Background:

Farmers generally cultivate seasonal crops. Vagaries of weather many times spoil that scope of earning which aggravates their poverty. When farmers planted single climber crop in bower system made by bamboo structure, there most of the land remain unutilized. The nutrient of different soil layer remains unused. Farmers lack technical knowledge of different cropping systems. In this situation, Multi- tier cropping system opens a new door to earn from round the year as well as there is less risk of complete crop failure. Multitier cropping systems are dynamic interactive practices that better use of the production components such as soil, water, air space, solar radiation and all other inputs on sustainable basis to take full advantage of limited land resources. This technology also minimizes risks of crop yield loss.

Role of KVK:

Malda Krishi Vigyan Kendra popularized this technology at farmers' field of different block in Malda district. At first a structure (about 6ft height) is made by bamboo on which climber crop like cucumber, bottle gourd, bitter gourd, snake gourd, dolichos bean are grown. In this system, the tallest components have foliage of strong light and high evaporative demand and shorter components with foliage requiring shade and / or relatively high humidity. Under the structure, different vegetable crops according to their height can be grown. Under the structure, land should be properly ploughed and prepared plots with irrigation channels. The soil of plots is mixed with fertilizer and manures according to crop requirement. Vegetables which are selected for multi-tier cropping system like leafy vegetables (coriander, spinach, radish, amaranthus) tomato, brinjal, chilli and even elephant foot yam may also be grown. All growing space is used as crop fit together vertically or horizontally (tall, medium & short) and underground (deep-rooted and shallow-rooted plants). Crops can be grown according to market preference and seasons.

Economic benefits:

Area	Cost of cultivation (Rs/bigha)	Gross return (Rs/bigha)	Net return (Rs/bigha)	BC ratio
Farmers who followed the technology	14300.00	45700.00	31400.00	3.19
Farmers practice single crop	5400.00	13800.00	8400.00	2.55

Impact and up scaling: The technology is highly potential because it uses natural resources properly. Farmers are highly interested to adopt this technology because production per unit area of land, time and inputs can be increased with multitier cropping system. It ensures a more evenly distribution of income and employment throughout the year due to harvesting of different crops in different seasons. Women are highly interested to adopt this technology as entrepreneur in their home stead situation. This technology can be replicated for other district or other area also.

Success Story - 18

Resource conservation techniques in Jute cultivation for more profit in Malda

Background:

Jute crop is being cultivated conventionally in Malda (Old alluvial Gangetic Plains). In jute cultivation, the farmers apply one irrigation and another after sowing (if needed). In jute cultivation maximum cost is required for land preparation and weeding. In this situation, resource conservation technique helps in effective utilization of residual soil moisture and minimizes the weed and overall cost of cultivation, opens a new opportunity for earning more profit.

Resource conservation technique in Jute cultivation is for effective utilization of residual soil moisture as the seeds are sown in zero tillage condition immediately after harvesting of the preceding crop. Seeds are germinated with residual moisture and weed population is less in the fallow land condition. In this practice, seeds (@ 6.0kg/ha) are sown along with granular fertilizer (NPK 10:26:26) @ 100kg/ha through Zero Till Drill. In case of up-land dry soil, one light irrigation may be given. After germination one hand weeding + thinning at 15DAS and application of Quizalofop @ 2ml/l is sufficient to control weeds. At this stage one TD is applied to the Jute crop or

it may be given as foliar (1% urea spraying). Jute growing in zero tillage condition grows at faster rate and yield is more than conventional method with less cost.

Role of KVK:

The technology of zero tillage technique in jute as resource conservation was implemented by Malda KVK at farmers field in areas of the district fall under sub-tropical humid climate with gangetic old alluvial soil, sandy clay loam in texture, good water holding capacity, well drained, with acidic to neutral reaction and moderate fertility status. Cultivating jute with this technology farmer got more yield with less cost. So, the technology can be replicated in jute growing areas of the eastern plains.

Economic benefits:

Area (Rs/ha)	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return	BC ratio
Farmers who followed the technology	32700.00	84375.00	51675	1.58
Farmers practice	48750.00	71250.00	22500	1.46

Impact and up scaling: The technology is highly potential because it uses natural resources and conserves the soil properties as well. Farmers are highly impressed and interested to adopt this technology because production cost per unit area is less and return is more.

Success Story – 19

Use of different plant growth regulators and micro nutrients for increase the productivity and better fruit quality of litchi in Malda

Background:

Huge economic loss litchi was identified as a problem in Malda district of West Bengal. The loss in litchi is mainly due to dropping of flower and fruit followed by cracking of fruit and scorching to a great extent. This problem occurs due to lack of plant growth regulators or absence of micronutrients which are responsible for flowering and fruiting such as naphthalene acetic acid, (NAA), triacontanol etc. Fruit cracking and scorching occur due to lack of different micro nutrients like zinc, and boron. So keeping all the point in mind, the technology was carried out for increase the productivity of litchi by using various plant growth regulators and micro nutrients.

The litchi orchard management by different cultural practices like tilling, watering, fertilization and plant protection should be started just after harvesting of litchi fruit. It must be kept in mind that 3 to 4 months before initiation of flowering the litchi orchard should not be disturbed by any cultural practices because this practices hamper flower panicle initiation.

Role of KVK:

The technology was implemented by Malda Krishi Vigyan Kendra at farmers' field of different block in Malda district. Different plant growth regulators like Triacontanol @ 0.30 ppm or Naphthalene acetic acid (NAA) @ 20 ppm are used for spraying of litchi plant to increase the production by enhancing the female flower in the panicle and reducing the fruit drop. PGRs were sprayed 3 times between October and December at monthly interval because this is the critical time for flower bud initiation. The spraying was done in early in the morning within at 7-9 am by thoroughly wetting upper and lower surface of leaves and whole plant. After fruit setting, use of boron in the form of boric powder containing 20% of boron @ 1g/lit + zinc ethylene di amine tetra acetic acid (zinc EDTA containing 12% zinc) at 1.5 g/L of water reduced fruit cracking and scorching. Spraying of micro nutrients was done after fruit setting at 15 days interval upto 15 days before harvesting of litchi fruits. The spraying of micro nutrients also improved the quality of fruits.

Economic benefits:

Area	Cost of cultivation(Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	BC ratio
Farmers who followed technology	93,300.00	1,71,000.00	77,700.00	1.83
Farmers practice	75,000.00	1,10,000.00	35,000.00	1.46

Impact and up scaling: The performance of growth regulators play a positive role in the production of litchi in Malda district. It further revealed that use of improved technology recorded the highest yield of 121.0 q/ha. There were tremendous scope and potential of PGRs in litchi to increase the production by enhancing the female flower in the panicle and use of micro nutrients to reduce the

fruit drops as well as fruit cracking. Presently most of the farmers of Malda district are using the PGRs for increase in productivity of Litchi.

6.2.2.2. Gangetic New Alluvial sub region

(East Medinipur, Bardwan, Hooghly, Howrah, Murshidabad, Nadia, North 24 Parganas)

Success Story – 20

Prateeksha (IET-15191) - an improved high yielding paddy variety for replacing Swarna Masuri in Hooghly district

Back ground:

Paddy is the major crop of Hooghly district covering around 1,85,000 ha area with productivity of 4.4 t/ha during kharif season. The most predominant variety of kharif paddy in the district is Swarna Masuri. Low productivity of Swarna Masuri (MTU 7029) of paddy variety is a major concern to the farmers mainly due to its susceptibility to sheath blight disease.

Role of KVK:

To address the problem of low productivity, KVK, Hooghly conducted an On Farm Trial for consecutive three years (from 2010-11 to 2012-13) on 3 varieties, namely Prateeksha (IET-15191), Kanak (IET-19886) and Swarna sub-1. Out of which the variety Prateeksha was found superior in terms of yield and disease tolerance resulting higher productivity to the traditional Swarna Masuri. After getting good response in OFT, this variety is now succesfully upscaled in FLD programme in farmers' field. Recently the Prateeksha variety is becoming very popular among the farmers.

The Technology:

Improved rice variety: Prateeksha (IET-15191).
Duration: 135-140 days

Grain type: Medium long

Special character: Tolerance against sheath blight disease

Advantage over other variety:

The variety, Prateeksha produces more number of effective tiller per hill and number of seeds per panicle and thereby giving higher yield than other varieties. Around 14 % yield is increased over the farmer's common variety i.e. Swarna Masuri. It also possesses sufficient tolerance against sheath blight disease.

Economic benefits:

Sl. No	Name of variety	Yield q/ha	Cost of cultivation/ha	Gross income/ha	Net income/ha	BC ratio
1	Swarna (MTU7029)	45.5	42880	60060	17180	1.40
2	Prateeksha (IET-15191)	51.9	44070	67470	23400	1.53

Horizontal spread of technology: This technology is now on going in 28 villages of 8 blocks.

Impact:

After getting better result over Swarna Masuri, Prateekha is now a very popular variety to the farmers of Hooghly district and during kharif season, area under this variety is increasing at a very faster rate.

Demonstration field of variety: Prateeksha (IET-15191)

Success Story – 21

Seed production of potato –a new venture in Hooghly District

Background:

Hooghly district is situated in Agro-Ecological Zone described as "Bengal Basin", hot moist, sub-humid Agro-Ecological Sub-region - New Alluvial Zone of West Bengal and main cropping system is Rice-Potato-Sesame. Potato is the most important cash crop over a period of time. During rabi season potato coveres about 80,000ha land area out of 2,20,000ha cultivable land and major varieties are Kufri Jyoti, Kufri Chandramukhi etc. The farmers mainly depend on Punjab for potato seed (tuber) and they have to purchase the non certified potato seeds with very higher price from unreliable sources. It leads to higher production cost and reduce profit margin.

Role of KVK:

Hooghly KVK has taken intervention as a technical partner for seed Production of potato in this district through a pilot project on "Value chain management of potato in Hooghly district" initiated by NABARD. During the first year, farmer produced Breeder to Foundation seed and in second year, Foundation to Certified seed with the technical support from this Kendra. This Kendra has disseminated the potato seed production technology in the district involving four co-operatives and two Farmers' Producer Organizations (FPO).

Interventions:

A) Training programme-

Hooghly KVK provided 30 nos. of training programme in potato cultivation and seed production. More emphasis was given on different specific aspects of seed production technologies like seed sorting, seed treatment, spacing, roguing, irrigation, dehaulming etc along with soil health management and IPM. In total 1500 no. of farmers from different Co-operatives societies and Farmer Producer Organization participated in this training programme. This Kendra has made the farmers capable of producing potato seed through the training programme.

B) Developing Master Farmers-

KVK has organized Master Farmer Development Programme keeping in view the objective of the seed production technology through 18 days course in two crop seasons including credit and marketing.

C) Training of other farmers by Master Farmers-

After completion of the course each master farmer conducted training to other 20 farmers under the project area. Finally 800 no. of farmers were taught by them to engage into seed production process.

Potato seed production field

Training by Master farmers to other farmers

Dehaulmed potato field

Training on Potato seed production

Master farmers development programme

Economic benefits:

Crop	Name of variety	Yield (q/ha)	Cost of cultivation/ha	Gross income/ha	Net income/ha	BC ratio
Potato	Kufri Jyoti	300	158000	195000	37000	1.23
Potato Seed	Kufri Jyoti	185	172000	277500	105500	1.61
Potato	Kufri Chandramukhi	262	170000	222700	52700	1.3
Potato Seed	Kufri Chandramukhi	160	183000	320000	137000	1.75

Output:

a) Potato seed production technology was dessiminated among 2000 farmers of different co-operatives and FPOs.

b) 40 nos. of Master Farmers were developed.

c) In the 2nd year, 2250 ton certified potato seed has been produced.

Impact:

a. Transfer and demonstration of appropriate technologies aimed at cost minimization and profit maximization with focus on small and marginal farmers.
b. Overall perception change in the awareness levels of the farming community reflected in technology adoption and better returns through seed production.
c. Improved social status for the Master Farmers.

Success Story – 22

Cultivation of palak and cauliflower under low cost poly house with sprinkler irrigation in Howrah District

Background:

Palak is a popular vegetable in West Bengal and people prefer its tender leaves. But in summer-rainy season, due to high temperature, the tenderness of *palak* leaves cultivated in open field is lost. So, the farmers get very nominal price.

Role of KVK:

Under the technical guidance of Howrah KVK, Mr. Sunil Bera has initiated the cultivation of *palak* and cauliflower under low cost poly house with sprinkler irrigation facility in order to obtain maximum return from the market, particularly during rainy season. Mr. Bera cultivates *palak* under poly house where leaf quality is being retained as good as winter crop. Thus, he can get more profit from his produce.

For the construction of the low cost poly tunnel he used properly treated bamboo and 5 layered UV stabilized 200 micron poly film. The central height of the structure is 8 ft with a width of 12 ft with convenient length. He covered the poly film in such a way so that he can remove and cover it as and when required. These poly tunnels have sprinkler irrigation system. Under these poly tunnels he grows palak, early cauliflower, garden pea and beans.

During January month he applies Calcium carbonate @ 1.5 q /bigha in order to control pH level of his field. The land kept fallow up to April. During May he applies vermicompost @ 1 ton/ bigha along with PSB @ 500g/ bigha, Azotobactor @ 2 kg/ bigha, Pseudomonas and *Trichoderma viride* @ 1 kg/ bigha during land preparation in every 60 days interval. Ten days after he added SSP @ 30 kg/bigha, MOP @ 10 kg and sows palak seed @ 5 kg/ bigha. He harvests the crop after 25 days and it continues up to August and then onwards *palak* is cultivated with early cauliflower as mixed crop.

Economic benefits from 1 bigha land:

Crop	Sowing	Harvesting	Yield	Return	Expenditure	Profit
Palak	*Jaistha* (May-June)	*Ashar* (June-July)	1400 kg	28000.00 (Rs.20.00/kg)	13100	14900.00
Palak	*Ashar* (June-July)	*Shravan* (July-August)	1400 kg	35000.00 (Rs.25.00/kg)	7160 (no vermi)	27840.00
Palak	*Shravan* (July-Aug)	*Bhadro* (August- Sept)	1200 kg	30000.00 (Rs.25.00/kg)	13100	16900.00

Crop	Sowing	Harvesting	Yield	Return	Expenditure	Profit
Cauliflower (early)	*Bhadro* (Aug- Sept)	*Kartik* (Oct-Nov)	4500 pc	117000.00 (Rs. 26.00/pc)	26860	90140.00
Palak as intercrop	*Bhadro* (Aug- Sept)	*Ashwin* (Sept-Oct)	1200 kg	48000.00 (Rs.40.00/kg)	800.00 (seed + harvesting cost)	47200.0
Palak as intercrop	*Ashwin* (Sept-Oct)	*Kartik* (Oct-Nov)	1200 kg	24000.00 (Rs.20.00/kg)	800.00 (seed + harvesting cost	23200.00
Beans and garden peas	Late *Kartik* (November)	*Magh-Falgun* (Dec-Jan)	-	20,000.00	5750.00	14250.00
	TOTAL (1 year)			**302000.00**	**67570.00**	**234430.00**
Polyhouse repairing + land development (Chaitra - Baisakh)					**5000.00**	
Low cost Bamboo made Polyhouse + micro irrigation system Rs.177000.00				=	35400.00 (taking consideration of 20% depreciation/ year)	
Total					107970.00	
Net Profit (Gross return@ Rs. 302000.00-Total cost @Rs.107970.00)						**194030.00**

Success Story –23

Scientific pig rearing brought prosperity

Background:

Smt. Shobha Naskar, wife of Sri Niranjan Naskar is 34 years old woman farmer belongs to a nuclear family of one 13 years old daughter and one 6 years old son both are studying at neighboring school. They live in mud floored small house. Mr. and Mrs. Naskar used to live as daily wage labours and cultivate 2.5 bigha land. They had only 10 numbers of deshi cows before adopting large scale pig rearing in scientific intensive system.

Role of KVK:

In 2009, she participated in a one day training programme on scientific and profitable pig farming organized by BLDO, Domjur in collaboration with KVK, Howrah. She became encouraged and received frequent advice from the neighboring BLDO. She purchased one 3 months old boar and one sow of Ghungroo breed in December, 2009 and tried to adopt the scientific management

practices. After six months, she received sale proposal of Rs. 7500/- against her boar and sow each. She instantly moved to the BLDO and acknowledged the Government-efforts towards participatory training programme. After few months (in 2010), she was provided with one male piglet and 8 numbers of female piglets of White Yorkshire, 2 numbers of male Ghungroo piglets and 9 numbers of Ghungroo female piglets under 40% subsidized P.R.I. scheme. After getting training from KVK, Howrah and BLDOs, she decided to cross between LWY Sow and Ghungroo boar for the birth of crossbred piglets.

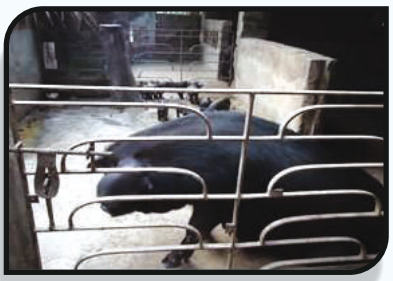
Economic benefits:

Year	Net expenditure (per annum)	Net profit	Benefit cost ratio
2012	Rs. 86,500/-	Rs. 2,65,000/-	3.06
2013	Rs. 94,000/-	Rs. 3,18,000/-	3.38
2014	Rs. 80,000/-	Rs. 2,85,000/-	3.56

As per her experience, Ghungroo gilt reached muturity at 8 months age. Litter size of Ghungroo sow was 6-8 at 1st farrowing, 10-12 at 2nd farrowing and 11-15 at 3rd farrowing. Corresponding figures in the progeny of LWY Sow × Ghungroo boar cross were 8-12, 11-15, 12-16 numbers of piglets. Live body weight of piglet/ pig was 20-25 kg at 3 months age, 70-85 kg at 6 months age, 95-115 kg at 9 months age, while live body weights of the progeny of LWY Sow × Ghungroo boar cross were 30-35 kg, 85-105 kg and 120-135 kg live body weights at 3 months, 6 months and 9 months of age, respectively.

Impact:

Mr. and Mrs. Naskar are now self-employed and highly satisfied. Their family is now economically stable. She renovated her dwelling house and purchased a matador carriage transport vehicle. Her piggery farm is being used as demonstration unit to the trainees of Howrah KVK and BLDO, Domjur. One farm school was also organized in 2012 at her piggery farm. This farm is also an input supplier of specially Ghungroo breed and also White Yorkshire breed in and around Howrah district. Mrs. Naskar has shared her experience in farmers meet session in Technology Week and Krishi Mela-2014 organized by Howrah KVK. She has also got recognition from Block Gramin Mela. She has participated in Radio Talks, Akashbani, Kolkata for several times. Documentary films for publicity were made by ETV and ARD Dept. (BLDO, Domjur). Naskar family has made a model piggery farm in the district.



Success Story – 24

Preparation of Vermicompost from waste materials to augment profitability

Background:

Sk. Abdul Hanif is a resident of Kannamoni village of Sankrail block of Howrah district. He is 50 years old. He has 0.5 acre of agricultural land. From this land he gets meager amount of paddy sufficient for 10 months only. He also has 10 katha of upland where he has planted few banana plants. In his orchard he also cultivates vegetables for homestead consumption.

He was concerned about the fact that over the years productivity from his agricultural land was decreasing and cost of cultivation was also gradually increasing. He was aware that application of adequate quantity of organic fertilizers was required to improve the soil health but could not do so as he did not have needed resources to produce organic manure.

Role of KVK:

He went to the Block Agricultural Development Officer (ADO) who suggested him to construct a vermi-compost unit at his house. ADO promised him to give him a subsidy of 50% if he could construct a vermi-pit of worth Rs. 16,000/-. But he was not in a position to invest that money at that time. Sk Hanif participated in several capacity building programs on vermi-composting organized by ACF (Ambuja Cement Foundation) with the technical support from Howrah KVK and BCKV. He learned about the benefits, uses, composition and preparation process of vermi-compost in detail. Motivated by several awareness training and exposure visits, he started decomposition of organic waste (cow dung, green leaves, skin of vegetables, trunks of banana trees, water hyacinths etc.) at one corner of his upland. After one month when the decomposition was over he was given a low cost and portable vermi-compost pit made up of good quality tarpaulin by ACF. This pit was 10 feet long and 3.5 feet wide. At a time one can produce 1 ton of vermi-compost from this pit. Two thousand numbers of vermi worms were also released in this pit. For all this he only had to pay only Rs. 500/- to ACF.

Economic benefits:

Table 21 : The cost incurred by him for the production of 2217 kg of vermi-compost in the first year (2009)

Cost for the construction of temporary sheds	Amount (Rs)
Bamboo	Gathered from village
Tarpaulin	170/-
Raw materials required	
4800 kg Cow dung	1500/-
Straw	Available at home.
Green leaves	Available at home.
Pills of vegetables	Available at home.
Water hyacinths	Available at home.
Carrying cost of water hyacinths	150/-
Trunk of banana plants	Available at home.
Total	1820/-

Table 22 : Detail of vermi compost sold in 2009

Source	Quantity sold (kg)	Rate (Rs)	Amount (Rs.)
ADO Sankrail	350	5/-	1750.00
ACF Sankrail	1007	5.5/-	5538.50
6 local farmers	110	4/-	440.00
	1467		7728.50

In this two and half months he has earned a profit of (7728.50 – 1820.00) = Rs 5908.50. Besides this he has put 750 kg of vermi-compost in his own paddy field.

Impact:

In the following years he increased the no. of portable pits to 4. In the year 2012-13 he permanently constructed two concrete pits of size 9 ft x 3 ft x 1.5 ft. It has the capacity of producing 1600 kg of vermi-compost at a time. For this construction he invested Rs.11500.00 and received a subsidy of Rs. 8000.00 from the block agriculture office. Now he has the capacity of producing 15,000 kg vermi-compost a year but produces 5000 kg considering his own need and market demand. He uses 2500 to 3000 kg for his own agricultural lands and sells rest. He is a member of a farmers club named "Nabajagaran Farmers' Club." In the year 2012-13, on behalf of his farmers club he has also supervised the construction of 4 vermi-compost pits for 4 farmers in the surrounding villages.

Success Story – 25

High value protected cultivation- an emerging arena of farmers' choice in Nadia District

Back ground:

Nadia District has been identified as vegetable export zone by APEDA. This district is having a

cropping intensity of 230% and average holding size 0.86 ha. This is the most diversified district of the state as well as country. Due to recent trend in consumption pattern of urban and peri-urban areas of south Bengal mainly adjacent to Kolkata, demand for the exotic and high value crop is increasing day by day. These exotic and high value crops include Green and Colour capsicum, broccoli, Red cabbage, strawberry etc. A project was formulated and submitted to District Authority for financial support with an aim to standardize production management of high value crops under different protected systems during 2007. After receiving project proposal from Nadia KVK, NHM financially supported this KVK to implement a project on "High value crop management under protected practices ''during 2009-10. At the same time Govt. of West Bengal also introduced subsidy based programme on protected cultivation through centrally sponsored schemes like RKVY, NHM etc. Ten farmers from different parts of Nadia district were initially selected for protected cultivation through Govt. assistance. They were sent for 10 days residential skill development training at KVK during 2010-11. Nadia KVK is serving as technology generation, standardization, proliferation institute at the district.

The Farmer and technological interventions:

Mr. Ananda Biswas, Age 47, Male, S/O Shri Tarapada Biswas of vill: Dhokhola, P.O. Dharmada, P.S. Nakashipara, Dist.-Nadia is one of the trainees for protected cultivation at KVK. He has farming experience of 25 yrs with his owned land of 5 bigha (0.665 ha) and leased in land of 44 bigha (5.86 ha). He is successfully producing vegetables like early and normal season Cole crops, bringal, tomato, chilli, EFY etc., fruits like banana, ber, mango, papaya etc., flower like tuberose, gladiolus, rose and several seasonal flowers. Now he has also introduced high value crops like Green and Colour capsicum, broccoli etc. He has constructed a 1000 sq.m. medium cost (50% Govt,. subsidy and rest 35% agri-loan from SBI) polyhouse and nearly 700 sq.m. low cost shade net structures at his farm. After getting skill development training, he started production of green and colour capsicum from 2010. An area of 0.665 ha for green capsicum in open field condition, green capsicum under low cost shade structure in 700 sq.m. and 5 types of colour capsicum in 1000 sq.m. medium cost polyhouse. Initially seedlings were raised in plug-tray under insect proof structures at Nadia KVK and supplied to Sri biswas. Now Shri Biswas has started own unit of seedling production.

The main crop under polyhouse cultivation is capsicum. Cultivation / utilization period is from month of Mid September to 1st week of April. The rest five month i.e. from April to August, the infrastructure remains unutilized under gangetic new alluvial zone condition. Several cropping sequence under polyhouse was tried at Nadia KVK viz. Color Capsicum- seedling production of early cole crop; Color capsicum- off season leafy vegetable like coriander, palak, radish etc.; Capsicum-summer cauliflower/ cabbage. Shri Ananda Biswas accepted color capsicum- off season leafy vegetable model.

Table 23 : Economic analysis of targeted crop (capsicum) under different production system

Crop with production system	Yield/ha	Ave. Sale Price	Cost of production	Return	Profit
Green capsicum in open field	155 q	Rs. 30/Kg.	Rs. 2.25 lakh/ha	Rs. 4.65 lakh/ha	Rs. 2.40 lakh/ha
Green capsicum in shade structures	185 q	Rs. 30/Kg.	Rs. 2.62 lakh/ha (including loan etc.)	Rs. 5.55 lakh/ha	Rs. 2.93 lakh/ha
Colour capsicum in polyhouse	325 q	Rs. 40/Kg.	Rs. 7.5 /ha (Including loan interest @ 4% upto 5 yrs.)	Rs.13.00 lakh/ha	Rs.5.50 lakh/ha

Table 24 : Economic analysis of capsicum based different cropping sequence

Capsicum under different cropping sequence	Cost of production	Gross return	Net profit
Green capsicum in open field - EFY	Rs. 5.81 lakh/ha	Rs. 12.15 lakh/ha	Rs. 6.34 lakh/ha
Green capsicum under shadenet –summer cauliflower-palak	Rs. 4.11 lakh/ha	Rs. 13.05 lakh/ha	Rs. 8.94 lakh/ha
Green capsicum under shadenet – Palak-palak-palak	Rs. 3.73 lakh/ha	Rs. 12.30 lakh/ha	Rs. 8.57 lakh/ha
Colour capsicum in polyhouse- palak-palak-palak-palak	Rs. 8.90 lakh/ha	Rs. 22.00 lakh/ha	Rs.13.10lakh/ha
Colour capsicum in polyhouse- coriander leaf – coriander leaf	Rs. 9.74 lakh/ha	Rs. 31.00 lakh/ha	Rs. 21.26lakh/ha

Table 25 : Production system under capsicum based cropping sequence

Capsicum under different cropping sequence	Seasonality of the cropping sequence	Land Situation
Green capsicum in open field - EFY	Sept.- Apri lApril-August	Upland-Irrigated
Green capsicum under shadenet – summer cauliflower-palak	Sept. – April April- July July-August	Medium to Upland Irrigated
Green capsicum under shadenet – palak-palak-Palak	Sept.- April April-May June-July July-August	Medium to Upland Irrigated
Colour capsicum in polyhouse-palak-palak-palak-palak	Sept.- April April-May June-July July-August August-Sept.	Medium to Upland Irrigated
Colour capsicum in polyhouse-coriander leaf – coriander leaf	Sept.- April May-July July-Sept.	Medium to Upland Irrigated

Shri. Biswas is getting a net profit of Rs. 21.26 lakh / ha. He has now 3 polyhouse units of 1000 sq. m. each. The maximum net profit obtained by Shri Biswas in a unit area of 1000 sq. m. is from the cropping sequence - Colour capsicum in polyhouse- coriander leaf – coriander leaf with an amount of Rs. 2.13 lakh profit per year.

Success Story – 26

Integrated fish farming in tribal villages of Haringhata in Nadia

Background:

Villages under Kastodanga II and I Gram Panchayats in Haringhata Development Block of district Nadia in West Bengal remains evergreen with seasonal field crops throughout the year for its plenty of underground water and water bodies. Farmers of these tribal villages are progressive in mind to adopt new technology for development. Therefore, beneficiaries were selected from these villages to impart knowledge through the training program on integrated fish farming and enable them to start farming on their own land.

Role of ICAR-CIFE, Kolkata Centre:

Twenty five tribal farm families were identified and trained on activity of diversified agriculture and allied livelihoods promotion through livestock-cum-fish farming at the ICAR-CIFE, Kolkata Centre in 2014. Those villages have huge scope of integrated farming as villagers have indigenous duck and chicken, indigenous pig, Black Bengal goat and indigenous and crossbred cattle and on an average every twenty farm family possess a pond size varied from 0.02- 1.5 ha, suitable for aquaculture practice.

All identified families were supplied with Khaki Campbell ducklings, 30 Nos. to each farmer along with duckling feed from State Poultry Farm, Gobardanga North 24 Parganas in the year 2014 and 50 Large White Yorkshire piglets having live weight of 14 – 22 kg so that each family got one male and one female piglet in the year 2015. Housing arrangement for the animals were done by the beneficiaries and animals are kept in brick/cemented floor having roof of tin, polythene etc.Birds were vaccinated with duck plagues vaccine. Antimicrobial medicine and dewormer were supplied to all the farmers. The birds were fed with balanced feed supplied by CIFE, Kolkata Centre along with locally available rice bran, boiled snails, rice gruel and boiled rice whereas the piglets fed with pig grower feed and supplemented with rice gruel, root crops, boiled rice polish, rice husk and kitchen waste.

Training imparted on Duck-cum-fish farming to the tribal farmers

Day old Khaki Campbell duckling distribution to beneficiaries

Distribution of piglets and pig feed to the farmers

Grown-up Khaki Campbell ducks with beneficiaries

Economic benefits:

At the age of 5 – 6 month the birds started laying and at the age of 11 month reached at peak production of 20 – 25 eggs. Farmers earned through sale of hatching eggs at the rate of Rs. 12/- per egg. Farmers also used egg for production of hatchling, got 7-8 duckling per duck with a hatchability of 75-80 %. Incidences of disease were less; few birds suffered with respiratory diseases and white diarrhoea cured with proper medication. The mortality percentage in adult bird

was about 5 %. Mature male were weighing 1.5 – 2.0 kg and females were 1.2 – 1.5 kg. Culled male and female were sold @ 300.00 and Rs.200.00, respectively. Ducklings were sold at the age of 3 months onwards @ Rs.30-40/- per bird and sale price of eggs was Rs.5.00 per piece. Fish productivity in different farmers' pond varied from 1.5 – 2.0 ton per hectare with little or no supplementation of artificial feed. Each farm family earned Rs. 20,000 – Rs. 25,000 as an extra income per year which improved their socio economic as well as livelihood status.

After getting sexual maturity, eight female pigs have given birth of 56 piglets, out of it, 48 numbers piglets survived. In the same period six surplus males were sold @ Rs. 8,000 – 9,000/- per animal. Majority of farmers decomposed their pig excreta and waste in earthen pit and used for pond manuring in every 15 days. Some farmers directly channelized the wastes to fish culture ponds. Manuring of pond with pig excreta reduced the requirement of fish feed. The production of fish (IMC) varied between 1.5 – 2.0 tonne per hectare. Each farm families earned Rs. 30,000 – Rs. 35,000 as an extra income per year which improved their socio economic as well as livelihood status.

Impact and scale up:

Under the new technologies, hygienic and well ventilated housing facilities were created that lead to reduce the disease incidence, prevent the mortality and increase the productivity of the animals. Excreta generated by the animals were utilized as pond manure thereby reducing the supplemental feed cost and enhancing the fish productivity. Thus, the technical interventions of ICAR-CIFE, Kolkata Centre made an impact on the livelihood of selected tribal population, paving the way for more technology adoption by poor farmers.

New born piglets with their mother reared by the tribal farmers

Harvested fish produced by the tribal farmers

Success Story – 27

Integrated farming - a sustainable source of income

Background :

Sri Sahadeb Basak has set an example as dedicated and innovative farmer. He is a Master's degree holder in Sociology from University of Kalyani. Later on, he has chosen agriculture as profession and started devoting his time focusing on a better farming. He did a certificate course in Organic Farming from IGNOU, of BCKV study centre in 2011 and came in contact with Nadia Krishi Vigyan Kendra.In a total of 3.0 ha of land area, he practices Integrated Farming. He usually grows field crops like paddy, green gram, lentil and sesame etc. covering 1 ha area. He is cultivating some new age horticultural crops viz. strawberry, berry and dragon fruit along with mango, jackfruit and papaya in 1.2 ha land area. He maintains a small dairy unit with 4 cows, a good duckery unit rearing about 200 numbers of Khaki Campbell ducks and a noticeable fishery area covering 1.6 ha land, rearing major and minor carps like *chital, vetki,* prawn, *koi* etc. There is a mushroom unit also as a part of his farming venture.

Role of KVK:

He was motivated by the scientists for cultivation of Aromatic rice and started Aromatic rice-based cropping system since April 2012 under RKVY Project on "Bengal Aromatic Rice" of Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal. As a result, he got the Organic Certification of Aromatic rice-based cropping system from the Certification Agency, IMO Control Pvt. Ltd., Banglore. As a progressive farmer, he always tries to do something more by adopting advanced technologies. He started commercial cultivation of temperate crops (viz. strawberry, brocolli, brushel sprouts etc.) in the field since 2010.

Economic benefits :

Year-wise income, cost-benefit ratio, gross and net income for two years

Crop/ Animal Husbandry	Year	Expenditure	Gross Income	Net income	Cost: Benefit ratio
Field crops		Rs. / ha.	Rs. / ha.	Rs. / ha.	
Paddy	2011	36,000.00	90,000.00	64,000.00	2.50
Paddy	2012	38,000.00	1,00,000.00	62,000.00	2.63
Green gram	2011	14,500.00	40,000.00	29,000.00	2.75
Green gram	2012	16,000.00	45,000.00	29,000.00	2.81
Horticulture crops					
Strawberry	2011	1,20,000.00	3,20,000.00	2,20,000.00	2.50
Strawberry	2012	1,00,000.00	3,20,000.00	2,20,000.00	3.20
Vegetables	2011	33,000.00	95,000.00	62,000.00	2.87
Vegetables	2012	35,000.00	1,05,000.00	70,000.00	3.00
Fisheries					
Major and minor carps, Chital, Vetki, Prawn etc.	2011	2,50,000.00	5,00,000.00	2,50,000.00	2.00

Crop/ Animal Husbandry	Year	Expenditure	Gross Income	Net income	Cost: Benefit ratio
Major and minor carps, Chital, Vetki, Prawn etc.	2012	2,20,000.00	5,50,000.00	3,30,000.00	2.50
Live Stock					
Dairy (Cow)	2011	45,000.00	55,000.00	10,000.00	1.22
Dairy (Cow)	2012	50,000.00	65,000.00	15,000.00	1.30
Mushroom					
Oyster Milky Mushroom	2011	38,000.00	84,000.00	46,000.00	2.21
Oyster Milky Mushroom	2012	48,000.00	1,12,000.00	64,000.00	2.33

NOTE:[Paddy = *Gobindabhog, Radhatilak, Kalabhat, Kalanunia* etc.; Vegetables = Red cabbage, Brocolli, Cherry, Tomato, Celery Parsely etc.; Fruits = Papaya, Strawberry, Dragon Fruits, Ber, Mango, Jackfruit etc.]

Impact:

Success of Sri Sahadeb Basak has influenced neighbouring farmers so much that many other farmers get interested and adopt new advanced technologies. Besides traditional crop cultivation, other farmers also take a chance to grow some newly introduced temperate crops. The cultivation of strawberry has spreaded to neighbouring farmers' fields of Santipur Block in Nadia district and Balagarh Block in Hooghly District. Sri Basak also supplied planting materials of strawberry to Jalpaiguri KVK, RKM Dayananda Ashram, Hooghly during 2011 and CADC Nadia during 2013. Sri Basak tried another new age crop, dragon fruit and his success influenced the farmers in Santipur Block of Nadia district so much that they started growing it from 2012.

Success Story – 28

Economic gain of farmers through strategic anthelmintic treatment in goat

Background :

Goat farming is quite popular among resource-poor farmers in west Bengal particularly among farm women due to minimal investment and high profitability. However, one of the major problems in rearing of goat is chronic parasitic infestation responsible for huge morbidity and reduced body weight. Study in tribal villages of West Bengal showed that strategic anthelmintic intervention along with mineral mixture supplementation may provide a good alternative to improve the health or growth of goats *vis a vis* profitability of farmers.

Role of ICAR-IVRI, ERS, Kolkata Center:

The study was carried out in three tribal villages (Kashipur, Bhagaldighi and Kankrazole) of North 24 Parganas, WB. The strategic anthelmintic treatment along with mineral mixture supplementation was given in goats from one village (Kashipur) whereas, only strategic anthelmintic treatment was carried out in anothervillage (Bhagaldighi). The third village (Kankrazole) of the same agro climatic condition was selected as control where no intervention was followed. From each village, 20 farmers (each having 4 number of goats) were selected and a total of 240 faecal samples per month were screened for parasitic infestation from 3 villages and weight of each goat (n = 240) was monitored on monthly basis. Strategic anthelmintic treatment was provided to those animals only when the infection level (egg per gram of faeces) reached to the desired label (more than 100).

The average weight gain of goats was found to be significantly higher in those villages received strategicanthelmintic treatment (36.95% at Kashipur and 35.24% at Bhagaldighi)as comparedto the control village (14.13% at Kakrazole) during eight month of study period. So net weight gain due to this intervention was 22.82% (36.95-14.13)in Kashipurand, 21.11% (35.24 - 14.13) in Bhagaldighiwhich was found to be average of 3.09 kg and 2.22kg increase of weight per goat. Due to this intervention, there was an increase of income of Rs.371/- and Rs.266/- per goat in two intervened villages after giving the input of average Rs. 45/- (cost of anthelmintic and mineral mixture supplementation).

Average weight of goats (in Kg) in 3 villages

	Nov	Dec	Jan	Feb	Mar	Apr	May
Bhagaldighi	10.5	10.44	11.24	12.46	13.14	13.83	14.2
Kashipur	13.56	15.13	15.88	15.83	17	18.2	18.57
Kakrazole	12.53	12.89	12.25	12.97	13.5	13.5	14.3

Economic benefits:

	% increase weight	%weight gain over control	Weight gain due to intervention (kg)	Extra income (meat price @ Rs. 120/kg) (Rs)	Total Input cost (Anthelmintic & Mineral Mixture)	Cost_benefit ratio
Bhagaldighi	35.24	21.11	2.22 (10.5X 21.11%)	266.01	45	4.91
Kashipur	36.95	22.82	3.09 (13.56 X 22.82%)	371.34	45	7.25
Kakrazole	14.13					

The cost-benefit ratio after scientific intervention in the farmers' field were 4.91 and 7.25 in two intervene villages i.e.farmers can get the return of Rs. 4.91 and 7.25 by spending of Rs. 1.00 in the form of anthelmintic and mineral mixture supplementation.

Success Story – 29

Tube rose cultivation–a profitable venture

Background:

In Nadia district approximately 3000 ha area comes under floral crops. Dhantala area of Ranaghat – II block is the prime zone of flower cultivation. Mainly tuberose, marigold, gladiolus, rose and seasonal flowers are cultivated in that zone of which Tuberose is the major one. Both single and double tuberoses are cultivated but the demand of the single tuberose is higher than that of the double. The variety named Earlier Calcutta single was the only single tuberose variety of that zone which is highly susceptible to foliar nematode *Aphelenchoides basseyii* and farmers were hardly able to fetch any profit from the crop due to the nematode attack. Sri Umesh Biswas was one of them and he took the responsibility to multiply the varieties for farther dissemination. Initially both the varieties were unable to attract the market because both the varieties possessed slight radish tinge in the flower bud, but due to its high resistance against foliar nematode as well as high production, *Prajjal* attracted the farmers just within two years. In the year 2009 the cost of single prajjal bulb was Rs. 2/- due to its high demand.

Role of KVK:

Nadia KVK started working with the flower growers of that zone from 2006. Initially, one training programme on nematode management was organised in Nadia KVK in January 2006 and in that training programme, farmers were exposed with the performance of some nematode resistant varieties. Among those varieties, *Prajjal* was preferred by the farmers. But due to shortage of the planting materials it was not possible to start the multiplication programme at the farmers' level. In the year 2007, AICRP on floriculture provided 25 bulbs of prajjal variety to Nadia KVK to start its multiplication. Nadia KVK directly handed over the bulbs to two farmers of the puratan chapra village of Dhantala area for multiplication with direct supervision of Nadia KVK.

Economic benefits:

Cost benefit analysis in 0.133 ha of land (one bigha)

Cost	Variety - Calcutta Single (Rs.)	Variety – *Prajjal* (Rs.)
Land preparation, basic fertilizer application, manure application	3,000.00	3,000.00
Cost of bulb	2,000.00	20,000.00
Planting – total 15 labour @ 150	2,250.00	2,250.00
Weeding – total 60 labour @ 150	9,000.00	9,000.00
Topdressing	700.00	1,500.00
Irrigation – two year contract	5,000.00	5,000.00
Harvesting charge –Rs 3/kg	3,000.00	18,000.00
Total cost	**24,950.00**	**58,750.00**

Cost	Variety - Calcutta Single (Rs.)	Variety - Prajjal (Rs.)
Total production – in two years	10 q	60q
Total market price –	Average Rs 70.00/ kg = 70,000.00	Average Rs 50.00/kg = 3,00,000.00
Net profit (Rs.)	**45,050.00**	**2,41,250.00**

Sri Umesh Biswas

Prajjal Variety in flowering condition

Impact:

In the year 2012, *Prajjal* variety has covered around 65 ha of land in this zone. Mr. Umesh biswas also participated in a TV programme which attracted a number of farmers from Malda, North and South 24 Parganas, Howrah, Murshidabad and Hooghly. Interested farmers purchased the bulbs of prajjal variety from the farmers of the puratan chapra village. The *Prajjal* variety ranked first as per farmers choice. Within the year 2014 *Prajjal* variety has covered 60% area of total tuberose coverage which is approximately 675 ha. This variety has already reached in almost all the tuberose producing blocks of Nadia district.

Felicitation: Sri. Umesh Biswas received Citation from ICAR, Research Complex for Eastern Region, Patna for contribution in floriculture in the year 2014.

Success Story – 30

Dairy farming- an option for self- employment

Background:

Mr. Sumanta Ghosh of Padmabila village under Chakdah block of Nadia district is a progressive dairy owner. In 2010, he possessed two crossbred milch cows. He became the owner of 26 milch cows, 11 calves/ heifers in the year 2015.With the total land of 2.5 acre, he dedicated 1.5 acre land for annual and perennial fodder production. Rest of the land is dedicated for cowshed and homestead. A family of five members is completely dedicated to animal rearing which has been turned into commercial venture. The size of the shed is about 1250 sq. ft. with the *pucca* structure and tin shed. Fodder production involves considerable number of manpower (350 mandays) which is available at his locality. The striking feature of Ghosh's venture is that he has not taken any kind of credit from Govt. or private institutions.

Role of KVK:

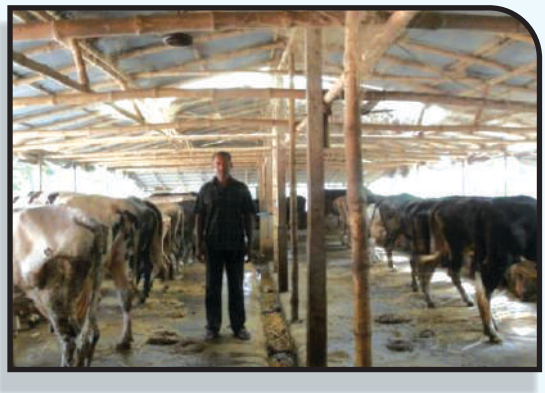
Necessary training received by Sri Ghosh is from Nadia KVK and Department of Animal Resources Development, Nadia, West Bengal. Nadia KVK has also supplied fodder crops like Maize, Barseem, Cowpea, Oats, Rice been, Sorghum, N.B. Hybrid which have been successfully grown by him. His fodder growing land has been the point of attraction to neighboring animal growers and also to the officials of Animal Resources Development Department, Nadia, West Bengal.

In recognition to his achievement Sri Ghosh has been awarded with "Best farmer award for dairy cattle in Nadia district", 2013-14 by NABARD, Nadia. Ancillary unit of Gobar gas plant to provide energy in cowshed, own house and mechanized feed preparing machine has also been installed. By products of Gobar gas plant, rich organic matter is used for fodder cultivation.

Economics benefit:

Item	Expenditure (Rs.)
Feed	2,600.00/day
Medicine	150.00/day
Milking charge	100.00/day
Fodder cultivation and cutting	100.00/day

Item	Expenditure (Rs.)
Total Expenditure per day	2,950.00
Total Expenditure per year	10,76,750.00
Items	**Income (Rs.)**
Sale of milk per year (Rs. 4320.00 X 365 days)	15,76,800.00
Sale of 10 calves/heifer per year @ 12000.00/ animal	1,20,000.00
Total	16,96,800.00
Items	**Net Income (Rs.**
Rs. 16,96, 800.00 - 10,76,750.00	6,20,050.00



Success Story –31

Crop diversification with integrated farming system model, resource conserving and cost effective farming technologies in Burdwan

Background:

Sri Bapi Shaikh is a medium farmer-cum-rural youth of village Mirjapur, Block Kalna-I of the district Burdwan. He has got a pragmatic view towards latest agricultural technologies and is keen to learn. He has total of 5 acres of land which he used to cultivate for support livelihood of his family. He used to cultivate jute in 3 acres of land and rest for paddy. But proposition of jute cultivation, was gradually becoming cost-ineffective due to high labour requirement, weed infestation causing diminished productivity, non availability of suitable retting water etc.To overcome the situation, he has started cultivating jute intercropping with pulse like black gram and green gram and with leafy vegetable like Amaranthus. This has given to cost effective return from jute cultivation apart from securing protein nutrition of his family from the additional pulse crop.

Role of KVK:

He obtained the necessary training on improved package of practices of jute cultivation from KVK Burdwan and since 2013, he was using improved technologies on jute like Multiple row Seed Drill, Nail Weeder and Microbial retting consortium developed by ICAR- CRIJAF, Barrackpore for sowing, weeding and retting of jute, respectively, which in turn has resulted in higher grade of fibre and higher return from fibre to the tune of Rs. 350 – 550/- per quintal.

Besides field crop he has a pond of around 1 acre and 1.5 acre of land in bund area. He has constructed one vermicompost unit in the bund area besides sheds for poultry birds and goats and planted various fruit plants like mango, guava, and tissue cultured banana around the pond and used to water the plants with pond water. The pond is used for pisciculture and jute retting purposes. Having had training from State fishery department and KVK Burdwan, he is successfully using the pond for multitier carp culture prior to retting and air breathing fish culture in the post retting period. This has augmented his income in the range of Rs. 3500 – 6000/- per season. The adjoining bund area is utilized for cultivating multiple vegetables which is irrigated using the pond water. He has prepared *Panchagavya* and *organic pesticides* using the animal and poultry bird excreta and other organic wastes which are used for pest control in vegetables as well as fish feed.

Economic benefits:

He has reduced the area under paady and diversified it towards cultivating various crops like, *kharif* onion, brinjal, early cauliflower, coriander, radish, cucurbits etc. that has helped him to fetch good amount of additional income. As a result his total income was doubled after 2014-15 to the tune of 3.6 lakhs /annum from a mere 1.8 lakhs prior 2014.

Prior to diversification (prior 2012)			After diversification (post 2012)		
Crop	**Area (acre)**	**Approx. Net return (Rs.)**	**Crop**	**Area (acre)**	**Net return (Rs.)**
Paddy (kharif)	5	30000.00	Paddy (kharif, through modified SRI)	4	32000.00
Mustard	2	14000.00	Kharif onion	0.3	7000.00
Potato	1	16000.00	Cauliflower	2	40000.00
Rabi onion	0.4	9000.00	Coriander	1	30000.00
Vegetables (Radish, spinach etc)	1	8000.00	Brinjal	0.2	10000.00
Paddy (Rabi)	3	21000.00	Radish	0.4	14000.00
Major carp	1	60000.00	Cucurbits	0.4	17000.00
Jute	2	13000.00	Jute with intercropping of pulses, amaranthaus	2	16000.00

Prior to diversification (prior 2012)			After diversification (post 2012)		
Crop	**Area (acre)**	**Approx. Net return (Rs.)**	**Crop**	**Area (acre)**	**Net return (Rs.)**
Dairy animal	3	6000.00	Rabi onion	0.4	9000.00
			Banana	0.1	15000.00
			Paddy (rabi)	2	14000.00
			Mustard	1	7000.00
			Potato	1	16000.00
			Vermicom post/vermi	—	6500.00
			Major carp with improved feed	1 acre pond	70000.00
			Air breathing fish	1 acre pond	45000.00
			Dairy animals with improved feeding	7 nos.	12000.00
			Goat	4 nos.	5000.00
			Poultry birds	40 nos.	4000.00
TOTAL		**177000.00**	**TOTAL**		**364500.00**

Impact:

As recognition for his expertise in various niche areas of crop production, Sri Bapi Shaikh was awarded Krishak Ratna by Govt. of West Bengal, Kriti Krishak by Govt of West Bengal and recognition from KVK etc. For his expertise, he was regularly hired by the State Department and KVK for farmers training at various locations. He also inspired an estimated number of 60 progressive farmers/rural youths to follow his clue for sustainable and profitable farm management.

Success Story – 32

Success Story on Vietnam Koi (*A. cobojius*) culture in seasonal fish pond in Murshidabad district

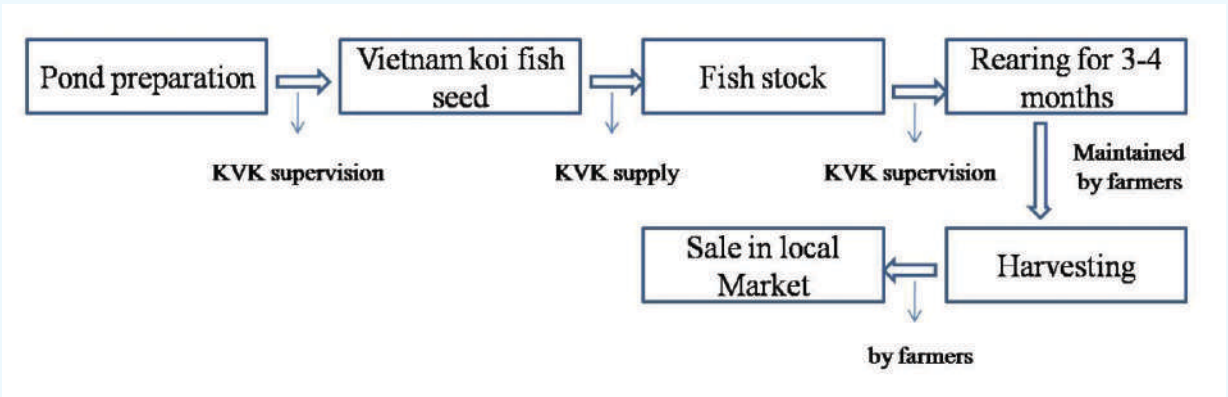
Background:

Air-breathing fish culture is an age-old practice but now- a- days high value fishes are cultured commercially. Mr. Subal Sur is a rural youth of Ayeshbagh, district Murshidabad and he presently cultures this air-breathing fishes in his own pond. Before starting culture, he was novice in fisheries profession. He came in contact with Krishi Vigyan Kendra, Murshidabad in the year 2016-17. The KVK scientist, Mr. S. Patra provided training and technical guidance to Mr. Subal Sur. Now he cultures Vietnam koi, a new variety of exotic koi native to Vietnam in his 0.04 ha (7 katha) area.

Role of KVK:

KVK fishery expert provided training and technical support to Mr. Sur for culturing successfully. This is the short duration culture practices for 3-4 months only. This species have high value and high growth rate and also BCR is 1.8. It is suitable for low water depth area and suitable for high seepage water area. Small area is required for culturing this species. This species is also suitable for jute retting pond. So farmers can use as an alternative fish species like IMC.

Production Cycle:



Outcome:

This is the short duration culture system maintained for 3-4 months by farmers and sold it @ 100-150 g average fish body weight in local market. They used 26% floating fish feed for the whole culture period.

Feed requirement for 1000 nos. of *Vietnam koi*

Feed	Quantity/day	Duration (Day)
Floating fish feed (26%)	600g	First 15 days
	800g	Next 15 days
	1000g	Next 15 days
	1200g	Next 15 days
	1400g	Next 15 days
	1800g	Next 15 days

Economic benefit:

Production cost of *Vietnam koi* culture (5500 pcs. Fry):

Categories	Rate (Rs.)	Amount (Rs.)
Pond preparation		6000.00
Seed	2.0/pc	11000.00
Feed	42/kg	18849.00
Lime	6/kg	720.00
Labour		1000.00
Medicine		500.00
Misc.		1500.00
Total		39569.00

Total fish production (survival rate 80%) = **440kg**

Gross income @ Rs. 250/ kg = (440x 250) = **Rs. 110000.00**

Net profit = (110000.0-39069.0) = **Rs. 70431.0**

Impact:

Farmers can earn Rs. 23477.0 per month after 90 days of rearing of 5500 nos. of *Vietnam koi* in 0.04 ha (7 katha) pond area. Now more farmers are interested to follow Mr. Sur for culturing this species in this area.

Success Story –33

Green fodder cultivation: an alternative income source in Murshidabad district

Background:

Shri Binay Ghosh, Motiur Rahman and Kayum Sk. of Murshidabad district worked as contract labours in the agriculture fields of the rich farmers as they have marginal land mostly unfertile in nature.

Role of KVK:

As per advice of the Scientist (Animal Science) and Farm Manager of Murshidabad Krishi Vigyan Kendra, they introduced the concept of green fodder cultivation in their own unfertile land in last two years. They cultivated maize and oats fodder alone or with cowpea or rice bean in 3:1 or 5:1 ratio because especially small ruminants refuse to take green leguminous fodder alone.

They earned sizeable income in last year. In next year they took lease of some unfertile land (0.12 hector each) to cultivate green fodder thoughout the year. They also sold to others farmers in bundle basis @ Rs. 10-15.00/- per bundle.

Benefit and Impact:

They individually earned Rs. 45,000.00/- by investing Rs. 12,200.00/- in 2017. Their income in a year is several times higher than the invested money as they used all their work force available in their own family first and hired one labour in a year. They have now built up good capital to invest throughout the year at large scale and have purchased cycle and motor bike to carry the fodder from field to the market. Now they have good houses to live in, bank accounts for sending their children to private school to give them better education.

Success Story – 34

Commercial Vanaraja farming for higher Profit in North 24 Parganas

Background:

Shri Pradip Ghosh Roy, a driver by profession, of Shimulpur village under Gaighata block of North 24 Parganas district of West Bengal, was a small poultry bird rearer. Previously he used to rear some indigenous poultry birds in backyard system. Along with this he used to keep a few goats. The productivity of those birds were not so good, moreover, the mortality rate of these birds were high due to poor management. His income was not enough to maintain his family of 5 members.

Role of KVK:

At this point, in the year 2015, he visited North 24 Parganas KVK for participating in one goatery training programme. There he visited the Vanaraja demonstration unit in the KVK premises. He was very much interested and gathered knowledge about this variety. At the beginning he ordered 75 no. 21 days old chick. He reared them in backyard system and compared their productivity with the desi variety he used to keep earlier. Vanaraja birds attained 1.8 kg – 2.2 kg body weight at the age of 3 months. Some birds he sold out and the rest was kept for laying. Hens started laying at around 5 months of age. On an average he got 115 eggs per hen. In the meantime Shri Ghosh Roy took training on poultry rearing, especially Vanaraja Birds rearing from the KVK.

Economic benefits:

Sl. No.	Components	Input cost (Rs.)	Gross Return (Rs.)	Net Return (Rs.)	B:C Ratio
1.	Vanaraja Birds (500 birds per batch x 4 batches yearly)	3,02,000.00	4,75,000.00	1,73,000.00	1.57

Impact:

Impact indicator	Before adoption	After adoption
Crop / Enterprise	Desi poultry birds (100 no per year) and Goats 15 no per year)	500 no Vanaraja birds per batch, total 4 batches per annum
Yield (per year)	100 no of birds with 1.5 kg body wt. per bird and 8 no of goats with 10 kg body wt. per goat	1,900 no Vanaraja birds with 2 kg body wt. / bird
Sale value	Rs.180.00 per kg live wt (birds) and Rs.300.00 per kg live wt. (goats)	Rs.125.00 per kg live wt (birds)
Input cost	Rs. 26,000.00	Rs. 3,02,000.00
Gross return	Rs. 51,000.00	Rs. 4,75,000.00
Net profit	Rs. 25,000.00	Rs. 1,73,000.00

Shri Ghosh Roy has made lowcost poultry house having capacity of 500 birds. He maintains four batches per year. He also saves labour cost due to active participation of family members. He is planning to expand his farm upto the capacity of 1000 birds at a time. He has become an inspiration to the fellow villagers. Some people come to visit his farm to gather practical knowledge on poultry farming and an inspiration to other farmers for this venture.

Success Story – 35

Fish breeding: a way of success

Background :

Mr. Dipan Biswas completed his graduation in Industrial Fish & Fisheries in 2011. Then he took up a short term course at ICAR-CIFE Kolkata centre to explore the potential of fish farming in the state. With the exposure and guidance received from CIFE, Kolkata, he made up his mind to start his own fish farming business.

He started mono-sex tilapia breeding in 2013 and trained many farmers about fish culture of scientific way. Then he also used to formulate medicines and feed supplement based on the skill and knowledge gained at CIFE, Kolkata.

Then in 2014 he started producing fish feed using a small pelletizer to upscale his farming activities.

Economic benefits and Impact :

By 2017 he expanded his farming activity to 20 acre area involving mono-sex tilapia, Vietnam Koi, Vannamei, Scampi and soft shell & hard shell crab culture.

His work has been appreciated by the State Government of West Bengal by awarding him with "Krishok Sanman" in 2017 for scientific fish culture. He was also awarded by CIFE, Kolkata Centre on 10th July 2017 on the occasion of fish farmers'day and also got State Fisheries Officers Award on 29th April 2017.

Success Story – 36

Enhancement in milk yield and farm income through supplementation of area specific mineral mixture in dairy cows

Background:

Shri Bivash Paul, B. Com, is a progressive dairy farmer at Ashokenagar, North 24 Parganas, West Bengal. Mr. Paul owns a dairy farm having 30 crossbred cows and 9 heifers. He tries to maintain around 17 – 18 cows to be in milking stage round the year. The cows were fed with ad-lib paddy straw, some amount of green grass and concentrate feed @ 4-5 kg/cow/day on an average. He was not aware of supplementing minerals with the feeds. He grows green fodders like hybrid napier, oat, sudan etc. round the year at his own farm land. On an average he used to get 8 liter milk/cow/day with an average lactation period of 196 days. Moreover, there were certain problems regarding reproduction of the cows. After knowing about KVK Ashokenagar of North 24 Parganas district from his relative, he visited KVK and discussed on reproductive problem of his cows with the expert of KVK.

Role of KVK:

The expert of KVK thought that there would be a chance of mineral deficiency and thus suggested Shri Bivash Paul to feed 40 g of area specific mineral mixture (UAFSMIN-P)/cow/day for at least 6 months (starting from last 2 months of gestation upto 4 months of lactation) with concentrate mixture, as supplementation of area specific mineral mixture (UAFSMIN-P), prepared by West Bengal University of Animal and Fishery Sciences, under FLD programme registered very encouraging results related to both production and reproduction in dairy animals for 3 years period of time in different villages. Shri Bivash Paul became convinced, agreed and then started to feed UAFSMIN-P after purchasing from KVK. Earlier, Shri Paul was growing green fodders at his farm land without any proper planning. He was advised to cultivate fodders like maize, berseem, cowpea in particular season along with existing fodders at his farm land for feeding the cows round the year.

Economic benefits:

Impact factor	Before Adoption	After Adoption
Farmer Practice	Feeding without Supplementation of minerals	Feeding with supplementation of mineral mixture
Milk Yield	8 liter/cow/day	9.5 liter/cow/day
Recurring Cost	Rs.25,838.00/cow/lactation	Rs.27,014.00/cow/lactation
Gross Income	Rs.47,040.00/cow/lactation	Rs.59,850.00/cow/lactation
Net Profit	Rs.21,202.00/cow/lactation	Rs.32,836.00/cow/lactation
B:C Ratio	1.82	2.21

Impact:

Shri Bivash Paul recorded an increase of 1.5 liter milk from each cow leading to 9.5 liter milk yield from each cow in a day. He also noted an extension of lactation period upto 210 days. Mineral mixture supplementation reduced reproductive problems too. Being satisfied, Shri Paul is regularly purchasing around 25 kg UAFSMIN-P every month. Shri Bivash Paul has set an example on the

benefits of feeding mineral mixture in dairy animals. Being inspired with the success of Shri Bivash Paul, the farmers of the surrounding area are coming to KVK for the technology and inputs. KVK Expert regularly organizes Field Day at Shri Paul's farm to make other farmers aware of this simple but effective technology so that they can adopt it for augmenting milk production in dairy animals and thus enhancing farm income.

6.2.2.3. Costal Saline sub region

(South 24 Parganas District)

Success Story – 37

Land shaping and rainwater harvesting technology: creating a new vista for integrated farming in the lowlands of South 24 Parganas

Background :

The Sundarbans fall under the complex-diverse-risk prone (CDR) agro-ecosystem situated between 2002' to 2206' North latitudeand 88025' to 890East longitudes. It consists of 102 islands of which 54 numbers are inhabited and rest is protected forest, not open to public tapping. Although, agriculture is the mainstay of occupation for majority of the people, about 68% of the total cultivable lands is low lying, mostly mono-cropped and low yielding because of excessive rainfall resulting in water-logging due to impeded drainage system in monsoon. Again, scarcity of irrigation water accentuated by high salinity in soil during summer, inundation of brackish water in cultivable land and non-availability of area specific technology for effective utilization of natural resources aggravate the problem to raise second crop in Sundarbans.

In low lands, only one crop of paddy could be grown in rainy season leaving the land fallow in winter as source of sweet water for cultivation of a crop in this season is non-existent. The problem of low land situation is compounded further by the fact that only indigenous rice varieties could be grown which are inherently low yielder. Having no means for growing a second crop and being compelled to grow only low yielding rice, the economic condition of the settlers remained miserably poor. In this situation, about 1/3rd of the total population of the Sundarbans, mainly from the island sector, are often forced to migrate elsewhere in search of their livelihood.

For reclamation of saline- water logged soils, two types of manmade systems of sub-surface drainage, viz. vertical and horizontal, have been developed and standardized where both types aim at lowering the water table in response to recharge caused by rainfall, irrigation, leaching water etc.

In Sundarbans, the farmers face a unique problem of almost six months of surplus water due to heavy rain (1700-1800 mm/year) most of which are unutilized and mixes with saline estuarine as run-off water in one hand and six months of dry spell with huge scarcity of sweet water on the other hand.

In this backdrop, Ramkrishna Ashram KrishiVigyan Kendra, Nimpith, West Bengal, has conceptualized and developed the Land Shaping and rainwater harvesting technology to address the twin problems of raising the level of the cultivable land and harvesting the rain water for second and third crops without altering the ground water level. Over the years, the said technology has undergone modifications and fine tuning through collaborative participation of the farmers and KVK scientists.

The KVK developed Land Shaping technology :

This is a multi-faceted method by which HYV paddy replaces low yielding indigenous ones in rainy season and makes growing of high value vegetable crops possible during winter season. At the same time, pisciculture with duck rearing in pond and growing of fruit plants is also possible on the embankment developed by the dug up soil.

The following points may be attributed to the technology –

- Engineering solution for productive use of low land
- Three dimensional (land, water and air) cropping options
- Diversified cropping possibilities with integrated approach
- Introduction of double and triple crops
- Additional crops in pond and land embankment
- Crop off seasonality fetching higher market price
- Water and energy saving module

Principle of Land shaping :

- Excavation of 1/5th area of the low land upto a depth of 9 feet
- Adjoining low land raised upto 1.5 feet
- Pond embankment – 5 feet wide and 4 feet height
- Land embankment around the area – 3 feet wide and 3 feet height
- 6 – 9 acre inch of rain water can be harvested and stored in the pond

Effects of this technology on production and economic gain :

The Land shaping technology provides immense scope of increasing income from any patch of mono-cropped lowland. By following this technology, various cropping patterns, as illustrated below, can be adopted for better economic gain by proper utilization of the raised land and the harvested rain water in the dugout pond.

Landshaping plot with crops & vegetables

Vegetables on pond embankment

Crops on land embankment

Suitability with existing farming system :

The following comparative study shows its suitability in terms of crop diversification, production potential and economic return in a sustainable manner.

Changing trends in cropping pattern and net income from a Land shaping plot (0.266 ha)

Before adoption of Land shaping technology		After adoption of Land shaping technology	
Kharif season	**Net income**	**Kharifseason**	**Net income**
Traditional paddy (0.266 ha land)	4500.00	HYV paddy (0.17 ha land)	5500.00
		Dolichos bean (0.011 ha land embankment)	4500.00
		Bottle gourd (Aerial cultivation)	1500.00
		Ridge gourd (0.015 ha pond embankment)	2600.00
***Rabi* season**		***Rabi* season**	
Fallow	-	Tomato(0.13 ha land)	17200.00
		French bean (0.010 ha land embankment)	2500.00
		Bitter gourd (0.015 ha pond embankment)	2600.00
		Bottle gourd (Aerial cultivation)	1600.00
		Year round	
		Fish, prawn & duck (0.05 ha pond)	18500.00
Total:	**4500.00**		**56500.00**

The above tableillustrates the cropping patterns and net income from 0.266ha plot by cultivating crops in both the seasons. It is observed that the net income of Rs.56,500.00 have been obtained from such Land Shaping plots while the income was only Rs.4500.00 before adoption of the technology.

Social impact of the technology :

The economic and social benefit of the farmers is further established from several demonstrations conducted in different villages over the years. Another important characteristic feature of this technology is the creation of mandays which resulted in reduction of migration rate. It has been observed that while before Land Shaping migration of at least 2 - 3 members from a family comprising of 6-7 members was common, after implementation of land shaping the migration of the members from a family have stopped altogether.

Economic and social upliftment :

No. of unit demonstrated	Total No. of BPL family covered	Average annual income before land shaping	Average annual income after land shaping
14282	8915	Rs.7500.00	Rs. 56500.00

Migration rate reduced due to year round work opportunity and mandays creation :

Land shaping Model	No. of days required for one unit	No. of labour employed in one unit	Total mandays created
Model-1 (0.20 ha)	19 days	15	285
Model-2 (0.266 ha)	27 days	15	405
Model-3 (0.39 ha)	40 days	15	600

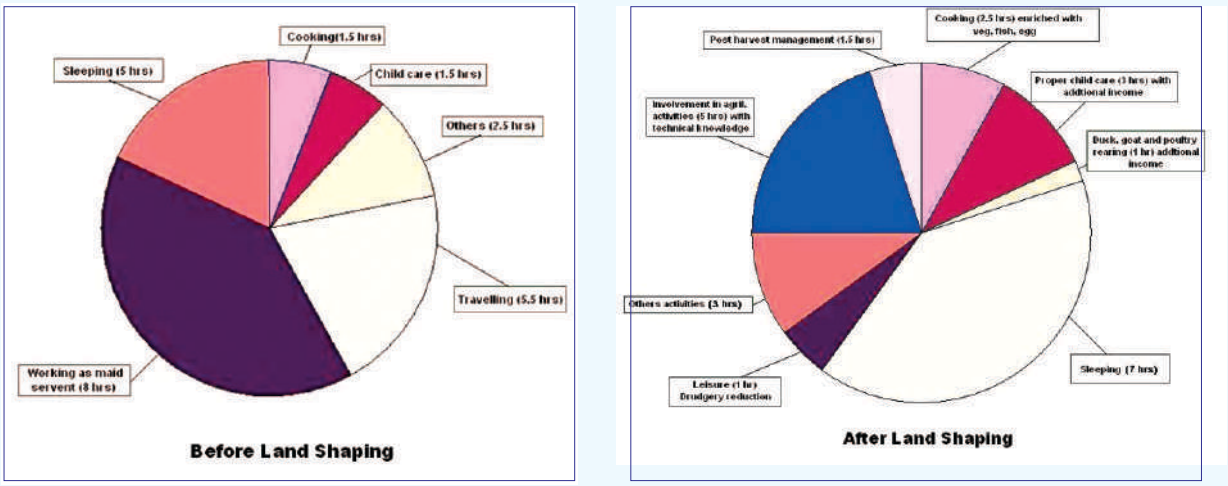
Other impacts of the technology :

- Reclamation of degraded land by reducing soil salinity through hindering the capillary movement of the salt ions from beneath due to the raising of the lowland by the excavated soil spread over it
- More than 20,000 ha mono-cropped low lying area converted to medium-high land with option for 2nd crop cultivation by harvesting more than 6.75 lakh acre-inch rain water during the span of last 5 years
- Contributed at least 4% increase in cropping intensity of the South 24 Parganas district of West Bengal and around Rs.200 crore of additional revenue has been generated during the last 5 years

Impact on livelihood of women :

It was also observed that the previously migrated members from a family included at least 1 female member. These womenfolk could now get engagement in their own farm in various agricultural activities besides leisure time. Adoption of Land Shaping technology has also resulted in the

upliftment of the social status of the farmers with respect to food, education, clothing, entertainment, etc.

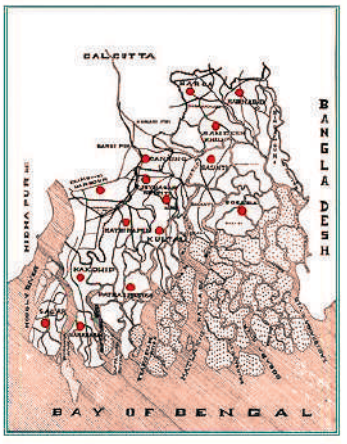


Impact of Land shaping on day's activities of farm women

Horizontal spread of the technology :

The Land shaping technology was first innovated in the year 1981-82 and it was tested in the KVK Instructional Farm and observing its remarkable additional income generating potential, this technology was demonstrated in six villages under Joynagar-II block in the year 1995. Within the span of next 5 years, most of the farmers of South 24-Parganas district realized the benefits of this technology and adopted it by their own, learning the technicalities from the KVK scientists and even from the KVK adopted Farm Science Clubs. Up to 2016-17, the Land Shaping technology spread in most of the villages of South 24 Parganas as well as the neighbouring North 24 Parganas district as well.

Technologydemonstrated in one block in the year 1995



Technology percolated in most of the blocks within the year 2016-17

Success Story – 38

Ail and Aerial cultivation – a sustainable technology for increasing vegetable production in Coastal Saline area of South 24 Parganas in West Bengal

Background :

In Sundarbans, due to frequent occurrence of storm resulting to breaches in the embankment, the cultivable land is inundated by brackish water frequently. Scarcity of irrigation water accentuated by high salinity in the soil during summer in one hand and non-availability of area specific technology for effective utilization of natural resources on the other hand aggravates the problem to raise second crops in Sundarbans during rabi-summer season. In this situation, about 1/3rd of the total population mainly from the island sectors are often forced to migrate elsewhere in search of their livelihood.

Keeping this view in mind, KVK has innovated a sustainable agro-technology for the coastal saline zone in the name of Land Shaping Programme. In this technology, 1/5th portion of the low land is dug up to make a pond and the earth so obtained is utilized for raising the rest of the low lying land including its land and pond embankment as well. The Land Shaping technology is well accepted by the farmers of Sundarbans. But, due to small land holding capacity of the farmers (less than 0.13 ha) and as most of the cultivable lands of Sundarbans is fragmented, the Land Shaping technology is not cost effective in that situation. Taking the concept from the Land Shaping technology, the KVK has found out the solution to utilize the land embankment of that fragmented low land having individual ownership in the form of Ail and Aerial cultivation technology.

The technology – Ail Cultivation (cultivation on land embankment) :

The so-called Ail is the land embankment, which is made surrounding a land to demarcate a given land with others. This demarcation is made to consider the land with individual ownership. Traditionally, the width and height of this Ail remain upto 40 cm and 30 cm respectively. In Sundarbans, it is usually noticed that the depth of the water on the low lands become 2½ ft. to 3 ft. during rainy season. Only long duration traditional paddy is grown in the low land situation keeping the Ail fallow. No vegetable crops are possible in this land situation during rainyseason and as the optimum moisture condition of the soil comes in too late, it is not also possible to grow any vegetable during winter season. Besides, source of sweet water for irrigation is minimum to irrigate the winter vegetables. To productive use of the Ail, KVK conceptualized and modified the width and height of this Ails to that level where vegetables can be grown both in rainy and winterseasons. To overcome the inundation problem during rainy season, the height of the Ail was raised upto 1 m keeping the low land paddy field aside. The width of the top of the Ail is made 90 cm where base remains 150 cm. The transverse section of this modified land embankment would be like a trapezium, which is required for strengthening the structure.

Irrigation water harvested in the trench for tomato Cultivation during winter season

Water harvested in the pond for irrigation

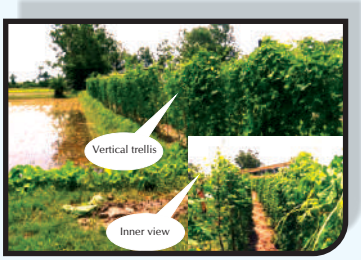
To make a raised land embankment along the circumference of 1 ha (10,000 sq. meter) land, having 400 running meter Ail, it requires 480 cubic meter soil. This volume of soil is collected by making a trench surrounding the Ail or by digging a small sized pond of about 24 mt length, 10 mtwidth and 2 mt depth within the paddy field itself. The trench (Fig. 3) so developed is utilized for harvesting of rain water which is utilized for life saving irrigation of the vegetable crops grown on the Ail during winter season. The pondexcavated (Fig. 4) within the paddy field for construction of Ail is not only utilized for harvesting rain water for irrigation but used for pisciculture also. As paddy-cum- fish culture is a popular practice here, the fish takes shelter in that pond when the water of the paddy field becomes insufficient or dry up. During rainy season, as the height of the Ail is more than that of the existing field, there is no chance of damaging the vegetable crops on Ail by submersion. In this way, the Ail can be developed in any land irrespective of its size and high value vegetables can be grown throughout the year. Once a raised Ail is developed, it lasts for about 8-10 years without incurring additional to great extent and only periodical repairing of the structure is required as and when necessary.

Cropping pattern and cultivation procedure :

Cultivation on the land embankment (Ail) starts from the month of June each year just before the onset of monsoon.

During rainy season, crop like Okra, Bitter gourd, etc. and during winter season. Tomato, French bean etc. are cultivated on the land embankment. The landpreparation starts from the second week to last week of May. After digging the soil with spade, well rotten manure mainly FYM is applied over the soil. Weeding, if needed, is done before the preparation of the soil. Then two rows of pits are made along the length of the Ail. The rows are made 60 cm apart from each other and the pit to pit distance varies according to the crop to be grown. Normally, 15 cm space is left on the both outer sides of the rows. The soil of each pit is mixed with Trichoderma virideor T.harzianumand Pseudomonas fluorescens @10 g eachper 1 kg organic nanure.

Okra cultivation on Ail during rainy season



Bitter gourd cultivation on Ail rainy season on vertical trellis

Neem cake @ 25 gper pit is used as a part of organic manure. Then the water soaked seed or germinated seed are sown in the pit @ 2 to 3 seeds/pit depending upon the crop varieties. After sowing, the pits are covered with straw or other biomass to keep the underneath soil cool and moist. Generally, in the rainy season, no irrigation is required for crop growth, development and production. Little life-saving irrigation, in few cases, is given at the time of initial phases of crop

stand. During winter season, bucket orcan irrigation is provided using the rain water so harvested in the trench aside the *Ail*. Even, non-saline pond water from the pond so excavated within the paddy field is also taken using mud pitcher or metallic bucket to irrigate the crop particularly in the critical stages of crop growth. The trellis are required to provide support the crops like French bean and bitter gourd and these vertical trellis are made upto the height of 150 cm to 200 cm. Two rows of vertical trellis along the crop rows are installed. To strengthen the structure, bamboo is used as vertical pole and G.I.wire are tied with the poles at two to three parallel horizontal levels. Jute string is also used for providing the support to the plant to climb upwards

.*Aerial* Cultivation :

Aerial cultivation is commonly known as 'No land cultivation' where viny cucurbits are grown on the pond embankment and allowed to spreadover the bower usually kept over the pond water.This type of bower is made up by bamboo, G.I. wire, jute string and unused fishing net. As the crop is spread over the bower, there is no requirement of horizontal space over the land for its growth, generally seen in the traditional cultivation of cucurbit crops. This type of cultivation is also becoming popular in the low land situation wheredeep-water paddy is not remunerative during rainy season. Even, a farmer having a small drainage or irrigation cannel nearer to his homestead land, bower is made over that water body and cucurbitaceous viny crops are grown over that bower to mitigate the household demand. During rainy season bitter gourd, ash gourd etc. and during winter season, bottle gourd, ridge gourd and other gourds are grown. There is no need of irrigation during rainy season and during winter season the life saving bucket/can irrigation is provided from the pond water.

Aerial cultivation of Bitter gourd on one side of the pond

Aerial cultivation of Bottle gourd and Ridge gourd over

Economic Impact of the Technology :

It has been observed that from one hectare of land, at least 400 m long *Ail* are obtained having the width of 90 cm at the top. The main field is engaged with paddy during *rainy* season and the *Ail* land is utilized for cultivation of vegetables which fetches good marketability and creates two

economic situation of a small fragmented holding *viz*., i) mega-economics of the monsoon paddy which is less remunerative and often threatened by the natural calamity and ii) micro economics from the *Ail* which many times become more viable than mega economy. In the traditional system, 120 sq.m of land is utilized for construction of *Ail* whereas in the modified system of *Ail* cultivation, additional 280 sq.m of land is utilized on the main field.

Comparative economics of before and after Ail cultivation in 1 ha area:

Before Ail cultivation:

Type of land	Area	Kharif			Rabi	Tota
		Crop	Production	Net profit (Rs.)	Crop	Profit per year (Rs.)
Cultivable low land	**9880 sqm**	Paddy	25 q	12,000	Fallow	12,000
Traditional *Ail*	**120 sqm**		Fallow	-	Fallow	-
Total net profit from 10,000 sqm (9880 sqm + 120sqm) land per year						**12,000**

After Ail cultivation:

Type of land	Area	Kharif			Rabi			Total
		Crop	Production	Net profit (Rs.)	Crop	Production	Net profit (Rs.)	Profit per year (Rs.)
Cultivable low land	**9160 sqm**	Paddy	23 q	11,040	Fallow	-	-	11,040
Modified *Ail*	**360 sqm** (400 m × 0.9 m)at top & **600 sqm** (400 m × 1.5 m) at base	Bitter gourd **or** Okra	6.0 q 6.5 q	4200 3800	Tomato **or** French bean	13 q 4 q	3650 3300	7,850 7,100
Pond area	**240 sqm**	Fish (Cat fish, IMC etc.)	1.5 q	-	-	-	5500	5,500
Total net profit from 10,000 sqm (9160 sqm + 600 sqm + 240sqm) land per year								**23640 to 24,390**

From the Tables, it is observed that in the traditional practice, 9880 sq. m of lowland is utilized for deep-water paddy cultivation yielding 25q paddy during *kharif* season keeping the land fallow in *rabi*. Besides, 120 sq. m area is utilized for construction of traditional *Ail* which remains fallow for both the seasons. Average net profit amounting to Rs 12,000.00 is generally obtained only from the deep-water paddy throughout the year in this system of cultivation.

In the modified system of *Ail* cultivation, it is clear from the Table that the total cultivable lowland area utilized for deep-water kharif paddy is reduced from 9880 sqm to 9160 sq. m resulting to 2 qreduction in paddy production. This reduction in lowland area yields 360 sq. m of *Ail* and 240 sq. m ofpond area where vegetable and fish cultivation are made possible for both the seasons, respectively. A net profit of Rs7,100 to 7,850 is obtained from vegetable cultivation on the 360 sqm modified *Ail* and Rs. 5,500.00is received from the fish cultivation in the pond area of 240 sqm even after utilizing few quantity of harvested water for irrigation purpose. So, it is observed that by sacrificing 720 sqm (9880 sqm – 9160 sqm) lowland paddy cultivation area for constructing *Ail* and pond, an additional net profit of **Rs. 11,640/- to Rs. 12,390/-** is achieved per year showing the doubling of farmers' income.

In *Aerial* cultivation, it has been found to be remunerative where micro situation based cucurbits cultivation on the pond embankment provides a diversified option for increasing income from a unit area. It is a unique model of integration with fish culture as the crop is obtained in the aerial periphery of the pond by constructing a net enclosure and it has also been observed that from an area of 0.065 ha, **Rs. 4000/- to Rs. 5000/-** additional income is achieved throughout the year.

Social Impact the Technology:

A study was conducted by the KVK in the year 2015-16 regarding the social impact, in respect toreduction of migration rate, so happened by implementing the technology. In this impact analysis process, 200 number of farm families per village were surveyed randomly under three different blocks. Children having less than 15 years of age were not considered in this study.

It was observed from the study that, the *Ail* and Aerial cultivation technologies have a great impact to reduce the migration rate of the rural people, who are often seen to migrate towards city in search of their livelihood. It has been noticed that this technology itself has reduced the migration ratewith an average of 9.50% within a span of 5-6 years in three sample villages under different blocks by providing work opportunities and creating mandays in the field of civil work for construction of *Ail*, making bower, different cultivation stages for both the seasons, marketing of produce etc.

Spread of technology:

Seeing the rapid change of economy, presently no farmer waits for any institutional funding for construction of land embankment in their own field. It is needless to say that *Ail* and *Aerial* cultivation technologies have not only spread in south 24-Parganas district but also it percolated in the neighboring district like North 24-Parganas having more or less same type of agro-ecological condition. TheState Agriculture Department has included this technology as a component of Natural Resource Management of NWDPRA (National Watershed Development Programme for Rainfed Area), MGNREGA and RKVY programme implemented in these districts.

Conclusion:

The *Ail* and *Aerial* cultivation technologies developed by KVK, South 24-Parganas have created an immense impact for augmenting the vegetable production throughout the year particularly in the lean period. This sustainable technology has not only increased the vertical productivity of vegetables but also improved the standard of living of small and marginal farmers by increasing their income per unit area. A very rapid horizontal percolation of this technology has been observed than any other contemporary technology in South 24-Parganas district as well as neighboring districts. Still now, there is huge opportunity for spreading of this technology, which intern, will assure much more food and income security along with reduction in migration rate of the people of this district in future.

Success Story – 39

Seed Production of Asian Catfish, *Clarias batrachus* in South 24 Parganas

Background:

In India, although there is a great demand for catfish, its commercial culture has yet to gain popularity. Insufficient availability of fingerlings acts as a barrier to promote its culture on a large scale.

At present there are three species of catfish cultured in India. These are the Asian catfish, the African catfish and the Thai catfish. Of these, the Asian catfish is indigenous to the low lying paddy fields of the Sundarbns in the South 24 Parganas district of West Bengal. However up-gradation of low lying paddy fields to encourage cultivation of high yielding variety (HYV) of paddy in place of traditional variety resulted in the use of more and more chemical fertilizers and pesticides. This had an adverse effect on the Asian catfish, which naturally had its breeding grounds in adjoining places of the inundated paddy fields.

This has virtually led to the near extinction of these species from this area. However, there are still low lying paddy fields in and around Sundarbans where traditional paddy varieties are still cultivated by poor and marginal farmers. Hence, there is still scope of once again introducing the

age-old practice of catfish culture in such conditions provided some steps are taken to produce the seeds.

Nimpith KVK began promoting the technology of controlled breeding of the Asian catfish since 1997. Through demonstration and skill training for the rural youths of the region, the KVK has been successful in empowering them with this technology. As a result, the demand for the Asian catfish seeds has been on the rise and every year the farmers from various corners of the Sundarbans obtain seeds of the catfish from these entrepreneurs. Hence, once again the culture of this endangered fish has become widely popular.

Technology Details:

Natural breeding

In nature, the fish breeds only once in the rainy season. In South24-Parganas the breeding period falls during June to August, peak being July. In ponds and swamps these fish make small pits along the margin, congregate in pairs and spawn with the onset of rains. Immediately after spawning, the female fish move out of the pits and the males guard the young ones for a few days. The fry start moving around in search of food after the absorption of yolk sac. The paddy fields of the Sundarbans, which harbour a variety of insects, form a congenial habitat for *C.batrachus*. By virtue of the accessory respiratory organs, the catfishes are able to strive in adverse situation.

Confined breeding

In 1997, the KVK successfully attempted to breed the catfish in captivity by a process called stripping.

Step-I: Rearing of brooders: Brooders of Asian catfish can be raised in freshwater ponds, which are shallow with a water depth of 1.5 ft. The pond for rearing brooders has to be manured by applying raw cow dung@10,000kg/ha followed by liming @300kg/ha, 7days after manuring.

The pH of pond water should range from 7.5 to 8.5. The brooders have to be fed daily with a mixture of rice bran, mustard oil cake and dried shrimp @ 5% of their body weight. Occasionally, the fish should be randomly checked to assess their maturity stage.

Step-II: Identification of mature brood fish: Male and female brooders can be easily distinguished by observing some external characteristics, particularly in the breeding season.

Step-III: Preparing the brooders: A triggering dose of pituitary gland extract injection @30mg/kg body weight of females is found to be optimum for *C.batrachus*. This helps in loosening of the eggs in the ovary, which eventually facilitates in the process of stripping of eggs from the female.

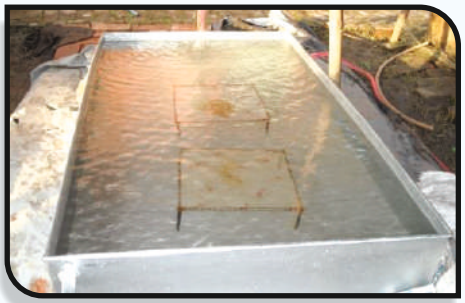
After this injection, the females are kept undisturbed in containers full of water or in cisterns. In the meantime, mature males are selected and kept in a separate container. Within 15-18 hours the females attains the optimum stage for stripping or the "free flowing condition".

Step-IV: Castration, stripping and fertilization: In the breeding process of the catfish, although the eggs can be obtained easily by stripping, the milt containing the sperm can only be obtained by cutting open the abdomen of the male, taking out the testis and then squashing it. Hence during each such operation the male has to be sacrificed. Therefore, more male brood fish have to be kept because of the fact that sometimes a male fish may bear only a single testis or the milt may not be sufficient to fertilize all the eggs stripped from a female.

Fertilization

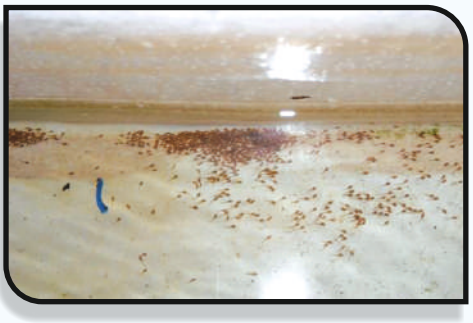
- The egg and milt suspension should be mixed with the help of a fine soft brush for fertilization.
- The optimum fertilization rate is found to very between 80-90% if all the conditions remain favorable.

Step-V: Hatching and water management in the hatching pool



- Soon after transfer of the fertilized eggs in the hatching pool, water circulation should be maintained. The eggs and hatchlings are prevented from escaping the hatching pool by fixing a fine meshed mosquito net around the inner circle of the hatching pool.
- The fertilized eggs hatches within 20-24 hrs depending upon the water temperature.
- The optimum pH and water temperature for successful hatching is found to be between 7-8 and 27-31°C, respectively.
- The optimum hatching percentage is found to vary between 70-80%.
- Food should not be applied till the hatchling reaches the spawn stage (yolk sac absorption) as mouth and other internal organs are fully developed only when the spawn stage is achieved.
- The spawns are transferred from the hatching pool to rearing tanks by siphoning .

Step-VI: Raising of spawns of catfish in rearing tanks



- The spawns should be stocked in the rearing tanks @ 50/litre of water.
- The spawns should be fed with sieved zooplanktons collected from nearby freshwater ponds 4 times daily. Supply of zooplanktons @ 2 to 3 ml per litre of water is sufficient for the growing spawns.
- Zooplanktons are given to the spawns for a period of 15 days.
- After 15 days, the growing spawns should be fed 4 items daily with a mixture of mussel meat -70%, soybean cake -10%, whole egg 20%, vitamin C and vitamin B – premix 500 mg/kg feed for another 7 days when they reach the fry stage.
- The 22 days old fry measures about 26mm in length and 135 mg in weight.
- The success rate of obtaining fry from spawn varies between 65-70%e normally ranges between 65-75%.

Step-VII: Raising of fry of catfish in rearing tanks

- The 22 day old fry should be " thinned" appropriately so as to maintain a stocking density of about 25/litre of water.
- The fry should be exclusively fed with the feed mixture comprising of mussel meat, soybean cake, whole egg and vitamin–C and vitamin B-premix.
- It normally should take another 30 days for the fry to reach fingerling stage which measures 58 mm and 2.5 gram in case of C. batrachus.

Feeding Schedule						
Stage	Age (Days)	Frequency Of feeding per day (times)	Feeding interval(hrs)	Feed	Quantity	Remarks
Hatching	1-4	-	-	-	-	Yolk sac present
Spawn	5-20	2-3	8-12	Zoo plankton	2-3 ml/litre of water	-
Fry	21-40	4	6	Prepared feed	According to demand	-
Fingerling	41-60	4	6	Prepared feed	According to demand	-

Impact

- The controlled breeding of the catfish has helped to revive the age old practice once again as now there is again a steady supply of this catfish seed from KVK as well as from the hatcheries of KVK trained farmers and rural youths.
- The doorstep supply of the indigenous catfish seeds has encouraged farmers to pursue the farming of catfish to a large extent.
- It has opened up a new avenue for earning livelihood by generating self-employment

The willing farmers can now procure the seeds from their area and stock in their paddy fields which has contributed in increasing their profit margin and also provide nutrition security for their families.

Horizontal spread of the technology and upscaling

- Initially the KVK standardized the technology of catfish breeding and rearing in the year 1997 with a view to mitigating the problem of seed demand in the district. But on realizing that it is a colossal task for the KVK alone to meet the growing demand of catfish seed, not only for South 24 Parganas district, but also other districts, it imparted intensive training to 22 rural youths of 9 different blocks of the district in the year 2000-01. Out of them, 10 trainees successfully adopted the technology and are presently meeting the demand of the locality by setting up their own improvised hatcheries.
- Following the success of the KVK in the field of catfish breeding and rearing, the Sundarban Development Board, Govt. of West Bengal has proposed to set up an intensive breeding-cum-rearing unit of the indigenous catfish in different blocks with technical guidance from Nimpith KVK.
- The State Fisheries Dept. has implemented pilot project on Asian catfish breeding and culture in different blocks of South 24 Parganas in the lines advised by RAKVK, Nimpith
- The Forest Dept., Govt. of West Bengal has collaborated with the RAKVK for implementing the culture of Asian catfish in the ponds of SHG members of the fringe areas of Sundarbans with input from the KVK.

Diversification of existing practice

Incorporation of *C.batrachus* in carp culture ponds is being promoted by the KVK as an attempt to diversify and optimize the profit margin from an unit water area. So, alongwith the Indian major carps and exotic carps, the catfish fingerlings are being stocked @ 3750/ha and the farmers have readily accepted this addition.

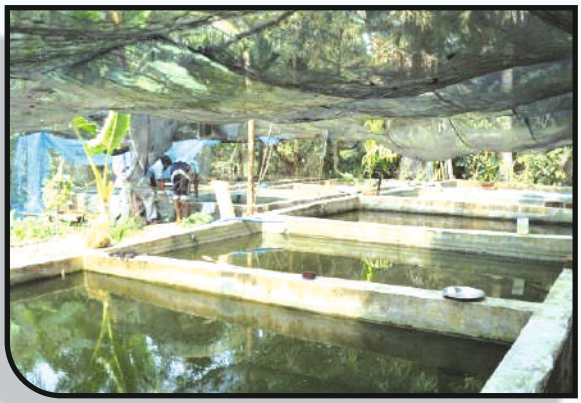
Besides, the technology of breeding and rearing of the Asian catfish – *Clarias batrachus* in controlled conditionis being applied successfully to breed another indigenous catfish, *Heteropneustes fossilis* or "singhi" Furthermore, observing the popularity of another indigenous and vulnerable species, *Anabas testudineous* or "koi", the KVK has also standardized its breeding and rearing in its instructional farm.

Economic impact of the technology

- Before the intervention, lowland paddy cultivation could only give a meagre income of about Rs.15,000/-/ha/year. Introduction of catfish fingerlings in these paddy fields could give an additional yield of about 290kg of marketable catfish which amounts to an income of at least Rs.1,00,000/-.
- Similarly, introduction of catfish alongwith carps in freshwater ponds has resulted in an additional income of Rs.17,500/- per 0.13 ha water area.
- The unemployed rural youths who are now engaged in breeding and rearing of the catfish could make net profit of atleast Rs.2.50 lakh per cycle of 4 months from this entrepreneurial activity (500 sqft area), which is almost or more than double of the present day income from any fishery enterprise.

Market linkage

The Asian catfish is hugely popular among the fish loving Bengali people for which there is a huge demand of seeds of this species. Therefore the seeds are directly sold from the hatcheries and till now no hatchery owner faces the problem of selling their produce.



Success Story – 40

Mud Crab farming at rural Sundarban areas in South 24 Parganas District

Background:

Mr. Harashit Mandal, a rural youth (Age: 24yrs) of Village- Kumirmari, Block- Gosaba, Sunderban, South 24 Parganas was a traditional fisherman till October 2014. He earned hardly INR 2,00,000/- per annum from his 1 Bigha brackish water pond coupled with fishing in local water bodies. He was striving to manage his family of four. Previously he used to go to the Sunderban forest for collecting crablets, crab and honey and sold it to the broker in very marginal rate.

Role of KVK:

KVK intervened and trained him in scientific Mud crab (*Scylla sp.*) farming in his pond.But after undergoing two trainings from Sasya Shyamala KVK and an exposure visit at CIBA Chennai, through Sasya Shyamala KVK sponsored by NFDB he understood the present scientific method of mud crab culture. A demonstration on scientific crab culture technique was organized in his pond in the mangroves, covered by high density polythene nets (HDPN) which were also provided by the KVK. He was managing his culture in semi-intensive methods and low cost dead fish or poultry waste feeding was done during the culture season. Ninety per cent of the stocked crablets survived and reached marketable size (500 gm) avoiding maximum cannibalism through providing shelter inside the pond. It is an aquaculture commodity which is very much liked for its taste, texture and nutritive value. It has a high potential for commercial aquaculture production in the country. It may be developed as a promising alternative to the prawn farming in the region. With high market demand and lucrative domestic and export price of live mud crabs coupled with available technology and adequate capitalization, opportunities for a profitable mud crab rearing are very encouraging.

Output of the intervention:

Mr. Mondal has established close linkage with the Sasya Shyamala KVK for developing new technology like crab in box culture, crab fattening etc. According to him, initially he started random traditional culture in a pond where mud silt was quite high and the pond water became

turbid with ammonia gas formation. There was no sign of moulting even after one month of feeding. His customers are happy and satisfied, and the crab from his farm is selling like hot cake. As the crab is grown in the natural environment, there is no capital cost involved, the source stressed.

The crab reached average weight of 400-500 g with 90 % survival rate whereas the conventional farmers get a survival percent of 20-30% only due to cannibalism. Live caught crab was marketed at Canning town market. This process also avoided the intervention of middle men and fetched maximum price higher than the prevailing retail market price. It was a great success due to high domestic demand for the live farm fresh crab. The crab seeds were provided to him for a mere Rs5.00 per piece and gave him Rs 1000.00 per kg of crab during harvesting after six months. The season for crab farming in the mangrove region is from September to May and there is huge demand for mud crab in international markets. Following the success of the demonstration, 59 nearby traditional farmers and rural youths replicated scientific crab farming programme. He is also working as the master trainer from Sasya Shyamala KVK for the crab farmers for this intervention in the rural Sunderban areas.

Details of Technology Interventions:

Name of the Farmer	**Mr. Harashit Mondal**	
Address	District- 24 Parganas (S), Block: Gosaba, Gram Panchayat: Kumirmari, P.O.- Kumirmari, Village: Kumirmari, Pin- 743370	
Technological Intervention	Mud crab farming	
Economics of Intervention	Eenterprise	Mud crab farming
	Area (acre)/no.	4 units of crab farming in 1 bigha area
	Cost of production	2,50,000.00
	Return	7,50,000.00
	Net income	6,00,000.00
Time line	June'2014	Exposure Visit at Different Fisheries ICAR Institutes, in India sponsored by NFDB
	February'2015	Crab fattening training
	June'2015	Crab culture FLD
	July'2015	Fish Feed Training
	September'2015	Field days on crab culture
Technical Components	Crablets, high density polythene nets (HDPN) for boundary, Pond embankment restructure, Crab hiding substances, disease management	
Status of farmer before and after the intervention	The Net Return increased from 2,00,000.00 to Rs. 6,00,000.00/ after adopting the enterprise due to minimizing cannibalism and preventing the escape away from the pond. Previously he getting 20-25% of total crop and now nearly 90%.	

Success Story –41

Feed based carp and prawn polyculture and preparation of prawn pickle at Bali Island of Sundarban delta in South 24 Parganas

Background:

The ICAR-CIFE, Kolkata Centre conducted livelihood upliftment programme through on spot demonstration on "feed based carp and prawn polyculture" and "preparation of prawn pickle" during the year 2013 – 2016 at Bali Island in Gosaba Development Block, Sundarban, South 24 Parganas district, West Bengal. Nearly 5500 farming families reside in the nine (9) identified villages under Bali. Among these more than 200 farming families of the village belong to scheduled tribes which are most neglected part of the society. Soil salinity is a major problem, particularly after devasting cyclone **Aila in 2009.** Mono cropping of paddy is practiced in kharif season**.** The population of livestock is comparatively less in the villages; goat, sheep, duck and poultry birds do exist. The villages having 10-12 large water bodies suitable for fish cultivation. Moreover, nearly all the households are having 1-2 small ponds with seasonal rain water. Fish culture without any inputs is practiced by the farmers only for household consumption.

Role of ICAR-CIFE, Kolkata Centre:

Farmers were trained through hands on demonstration on "feed based carp and prawn polyculture**"** and "preparation of prawn pickle**"** and a Bengali manual was provided to all selected farmers for effective implementation of technologies. It was observed that proper feeding management significantly increased the production of prawn and carps under polyculture system.

Economic benefits and Impact:

At the end of 8 months of culture*, catla* (*Catlacatla*) grew round 2 - 2.2 kg and live weight of prawn (*M. rosenbergii*) was around 190-210 g. Average production of carp at the end of 8 months was 6400 kg / ha and average production of prawn at the end of 8 months was 300 kg/ ha. In traditional practice per hectare carp production ranges between 2500 to 3000 kg, where as through adoption of feed based carp and prawn polyculture technology enhanced up to 6400 kg / ha and additionally 300 kg/ ha production of prawn was obtained in eight month. By adopting the technology provided by ICAR-CIFE Kolkata Centre, socio-economic status of the farmers of Bali Island, Sunderban has been improved a lot.

Growth of Prawn after 8 months of stocking of juvenile


Growth of Craps after 8 months of stocking of carps fingerlings


Demonstration on prawn fish pickle preparation to the farmers

6.2.3. Zone VII: Eastern Plateau and Hill Region

6.2.3.1. Undulating Red and Laterite sub region (Bankura, Birbhum, Purulia, West Medinipur)

Success Story – 42

Bitter gourd cultivation—a new vista towards the socio-economic change for the tribal community in Binpur-II Block, West Medinipur

Background:

Rice based crop production system is prevailing farming system in the red and laterite agro-climatic zone of Paschim Medinipur. Under the prevailing geo-hydrological constrains, farmers are bound to grow rice as a monocrop with a nominal income. Likewise the villages namely Dhobakuria, Kantasole, Chiapara, Sarengasuli and Mahulboni under Ergoda GP of Binpur-II Block, the farmers used to cultivate its resource base with traditional wisdom and available critical input support.

Nearly 384 families were bound to migrate for their livelihood sustenance. The farming community was bound to lead a life of abysmal poverty and degradation. The lack of knowledge on diseases and pest control, water management and marketing support were the constraints. The

farmers were able to get only minimum profit from per unit area, which was not sufficient to maintain their family and were bound to migrate for their livelihood sustenance.

Role of KVK:

After intervention of KVK, Jhargram during 2014-15 and 2015-16, they acquired the knowledge by motivation, orientation, training, field-days and farm advisory services time to time. They were advised to adopt the crop sequence of Aman paddy- bitter gourd- ridge gourd and to focus on the modern technology of bitter gourd and ridge gourd. It results in increased cropping intensity (**272%**) and net return (Rs. **337500.00**) from the cropping field. Apart from these, the mandays (**255/ha**) and marketing efficiency were also significantly increased.

By getting the promising benefits from bitter gourd cultivation, a new vista has been created towards socio-economic change in this area by mobilizing the creative and active participation of the FIGs. Being inspired by the farmers of these above mentioned villages, the farmers of neighboring villages are also taking initiative to follow the suggested cropping sequence and the improved technology.

FLD Conducted by KVK

Field Visit by KVK Scientist

Farmer

Direct Marketing of Crops From Field

Comparative income statement from per unit area

SL. NO.	PARTICULARS	BEFORE INTERVENTION	AFTER INTERVENTION
1.	Name Of Villages	Dhobakuria,Kantasole, Chiapara, Sarengasuli and Mahulboni under Ergoda GP of Binpur-II Block	Dhobakuria, Kantasole, Chiapara,Sarengasuli and Mahulboni under Ergoda GP of Binpur-II Block
2.	Total geographical area	452.57ha	452.57ha
3.	Total families	384 (SC/ST 232; others-152)	384 (SC/ST 232; others152)
4.	Previous farming system	Aman Paddy-Fallow-Fallow	Aman paddy - Bitter gourd Ridge gourd
5.	Source of irrigation water	WHS	WHS
6.	**Income/ha.**	**26,800.00/ha**	**3,37,500.00/ha**

Economics:

Sl. No.	Type of Cultivation	Cost of cultivation / ha.	Gross income / ha.	Net income / ha.	B:C Ratio
1.	Traditional seasonal cultivation	123530/-	214670/-	83530/-	1.74
2.	Off season improved cultivation	166250/-	642310/-	476060/-	3.86

Success Story – 43

Increasing income by three times through diversified farming system

Background:

Mr. Sandip Ghosh of Basajhuri in Binpur-II Block *Age: 27 years* is a graduate youth from a small farm family. He possesses 8 acres of land which was mono cropped. Income from farm activity (Rs 58300/-per annum) was not sufficient for maintaining 7 members family. His brother was engaged in garment making to earn family bread. Sandip has keen interest on farm activity and he always helped his father in farm activities.

Role of KVK:

Being motivated by Sirshi Farmers Club, Sri Ghosh approached KVK for help and support. KVK, extended all kind of help and support through training, demonstration, farm advisory and convergence of services of line departments. Since last five years he is growing paddy, potato, rabi and summer vegetables production. He has established mixed orchard with 0.4 acre mango, 0.42 acre banana, 0.07 acre ber and 0.10 acre papaya with the help of NHM. In the rest of the land he is growing paddy, potato, rabi and summer vegetables including high value crops like capsicum and brocoli. In 0.2 acre constructed pond, he is growing fish. He has also established a vermi composting unit and installed sprinkler irrigation system at his farm.

Economic benefits:

By adopting diversified farming system, his annual net income raised up to Rs. 1, 60,660/- which was Rs. 58300/- with traditional cultivation method.

Impact factors	Before Adoption	After Adoption
Crop / Agricultural Practice	Paddy – 2 acre, oilseed – 2 acre	Integrated farming with agronomical Crop,Vegetables, Mixed Fruit Orchard & Fish farming,Vermi composting
Yield of crop / product	Paddy 45 q,Oilseed – 12 q	Paddy –45q,Fish- 4.0 q,Fruits –23 q,Oilseed & pulses -7q, Vegetables – 100q
Sale Value	Rs. 81,000/-	Rs. 3,23,000/-
Input Cost	Rs. 10,200/	Rs. 69,500/-
Labour Cost	Rs. 12,500/	Rs. 90,500/-
Any Other Cost	Nil	Rs. 2,340/-
Net Saving / Net Profit	**Rs.58300/- from crop cultivation**	**Rs. 1,60,660/-**

Impact:

Now he is being treated as an opinion farmer in the area. He is keeping close contact with KVK. Being inspired with the success of Sri Ghosh farmers, the rural youth of the surrounding area arecoming to KVK for training and assistance for orchard development and IFS models.





Success Story – 44

Augmentation of family income three times through Khaki Campbell duck farming in backyard system

Background:

Duck rearing is common practice in villages. But it was limited to families having ponds nearby. Slow growth, poor laying (75– 80 eggs/year), affinity to water were main constrains. In backyard farming, duck needs no special care. The farmers are used to let loose the ducks at morning after giving some food and take back them in the evening.

Role of KVK:

To overcome low productivity of Deshi duck, Seva Bharti KVK conducted OFT on Khaki Campbell (KC) duck farming in backyard system. Getting encouraging result, several numbers of Front line Demonstration on KC ducks in backyard ware conducted. Training on backyard duck farming was conducted for groups of farm women. They were provided with brooded ducklings, feed, dewormer as critical inputs. Periodical visit by KVK scientists for health care and vaccination against Duck Plague were followed. The ducks started laying eggs at the age of 5 months. The size was bigger than eggs of deshi duck. Faster growth, high laying capacity (160- 185 eggs/year), less water requirement (small earthen pit is sufficient) are advantages for KC duck farming.

Economics of 20 birds unit:

Expenditure for deshi duck	
Cost of 22 nos(20 Female & 2 male) 30 days old ducklings @ Rs.40/-	880.00
Cost of traditional feed for 485 days (50 gms /duck/day) total 530 kg@ Rs.10/-	5300.00
Total cost	6180.00
Income from deshi duck	
Sale of eggs (75 eggs/duck/yr) total 1500 nos @ Rs.5/-	7500.00
Sale of culled duck 22 nos @ rs.100/-	2200.00
Total income	9700.00
Net Income from deshi duck	**3520.00**

Expenditure for KC duck	
Cost of 22 nos(20 Female & 2 male) 30 days old ducklings @ Rs.60/-	1320.00
Cost of supplementary feed for 485 days (70 gms /duck/day) total 747 kg@ Rs.15/-	11205.00
Cost of medicines	330.00
Total cost	12855.00
Income from KC duck	
Sale of eggs (175 eggs/duck/yr) total 3500 nos @ Rs.6/-	21000.00
Sale of culled duck 22 nos @ rs.120/-	2640.00
Total income	23640.00
Net Income from KC duck	**10785.00**

A farm woman can get a net profit of Rs.10785/- form 20 KC ducks in a year as compared to as Rs. 3520/- in case of deshi ducks. Replacement of deshi ducks with KC ducks in backyard system could bring changes in income of farm women by increasing income three times from rearing of 20 KC ducks.

Impact:

Seeing the encouraging result, farm women of nearby villages started placing their demand for KC ducklings on payment basis. Backyard farming of KC ducks has spread over six blocks of Jhargram sub division, one block of Bankura district and adjoining villages of East Singhbhum of Jharkhand. The local duck breeds are being up graded through cross breeding with KC ducks. KVK is now able to supply about 3000 ducklings to more than 300 farmers each year. The state government has also started large scale production of KC ducklings at State Poultry farm, Medinipur to fulfill the need of the district.




Success Story- 45

A model of diversified farming for income generation

Background:

Enata is a small village, situated at a remote corner in Jamboni Block of Paschim Medinipur District. The village is surrounded by small hillocks (rich in Manganese ore) at 3 sides. The hillock is the border of Bengal and Jharkhand State. A small rivulet Dulung flows through the end of the village. There are 350 farm families with 1700 population in the village and mostly monocropped is practiced in the village. The income from agricultural source was not sufficient to run their families. Mr. Khagen Das is 40 years old and eight standard passed rural youth of the village having 1.35 acres of agricultural land in which he used to grow paddy, musturd, sesame and some local vegetables.

Role of KVK:

Mr. Das along with few farmers of the village approached Seva Bharati Krishi Vigyan Kendra (SBKVK) to know about improved agricultural technology and allied agricultural practices. SBKVK intervened in the problem and provided support to them through training and demonstration under different programmes. As a result, mono cropped area has become multi cropped area.

Economic benefits:

The villagers erect temporary weir on the rivulet passing through their village and used to get irrigation for crop fields. The productivity has enhanced by using quality seeds, seedlings and improved practices. Besides paddy, they are now growing mustard (29.40 acre), sunflower (29.40 acre), sesame (29.40 acre), maize (1.25 acre), redgram (2.10 acre), lentil (1.25 acre), groundnut (0.84 acre), chilli (8.4 acre), bitter gourd (2.52 acre), brinjal (2.10 acre), cowpea (1.25 acre), cucumber (1.05 acre) and ridge gourd (1.68 acre) in cultivable land of the village. The village now remains green during most of the year. They have started backyard goat farming rearing of improved poultry birds and ducks which are offering additional income.

Impact factors	Before Adoption	After Adoption
Crop / Agricultural Practice	Paddy -1.35 acre, Musturd – 1.0 acre, Sesame – 1.0 acre	Paddy -0.42 acre Chilli – 0.21 acre Brinjal – 0.21 acre Sweet gourd – 0.21 acre Mango – 0.08 ha
Yield of crop / product	Paddy -5.5 q Musterd – 2.5 q Sesame – 3.8 q	Paddy – 7 q Chilli – 3q Brinjal – 6q Sweet gourd –10q Mango – yet to get yield
Sale Value	Rs.21,950 .00	Rs.33,400.00
Input Cost	Rs.06,300 .00	Rs.09,000 .00
Labour Cost	Rs.03,000 .00	Rs.05,500 .00
Any Other Cost	Nil	Nil
Net Saving / Net Profit	**Rs.12,650 .00**	**Rs 18,900.00**

Impact:

Till date 10.12 ha fallow land has been developed as mango orchard comprised of 3113 nos quality plants with the financial help from MGNREGA through SBKVK. Besides, farm women are also engaged in making of sal leaf plate by collecting sal leaf from nearby forest. The growing awareness about proper utilization of natural resources moulded them to use improved agricultural and allied techniques. Mr. Khagen Das took the lead role to implement this entire programme successfully. He was able to develop himself as a progressive farmer of the area and started working as Farm Led Extension Worker under the guidance of SBKVK. Mr. Das has been awarded "Best Farmers Led Extension Worker" during Technology week celebration, 2013 by SBKVK for his contribution towards changing the agricultural scenario of the village.




Success Story – 46

Entrepreneurship developed through scientific poultry farming in Purulia district

Background:

Purulia district of West Bengal is a drought prone area where 40% of total geographical area (approx 1,21,266 ha) comes under unbunded uplands, where main crops are Pulses and Oilseeds (blackgram/Greengram/redgram/groundnut) during kharif season and in other season it remains fallow. Poultry farming in Purulia is traditionally age-old practice among the village level poor and marginal farmers with the population of 23 lakhs as per the district animal census report. Entrepreneurship development through scientific poultry farming like Broiler and Duck by Adesh Dubey, a progressive and smart Rural Youth is now a remarkable example of this district for properly utilizing the unbunded uplands by Poultry farming which remains fallow after cultivation of the Kharif pulses and oilseeds.

Mr. Adesh Dubey started Broiler Farming with the capacity of 200 nos. of birds in the year 2014. However, he experienced huge loss in the first batch due to attack of ranikhet diseases. In the subsequent batches the production of meat from broiler failed again and again. In the mean time he was associated with the Krishi Vigyan Kendra, Kalyan, Purulia. The then KVK experts heard his problems. After detailed investigation, they advised him to follow the scientific poultry farming and management strategy of scientific farming for preventing different type of diseases as well as the low cost feed formulation using the locally available ingredients and proper hygienic management. He was also invited to participate in the training programme on scientific poultry farming organised by the KVK. Mr. Dubey implemented all the advisory service extended by the KVK and eventually obtained good results in the following year. Presently, his farming capacity is with 5000 nos. of broiler and 2000 nos. of coloured broiler duck per batch with net return of Rs. 9 lakhs per annum and the creation of 5475 man days. He learned by doing and now become a master trainer and he is extending training to the novices through teaching by doing.

Economic benefits:

The farm family comprises of 5 members who are solely dependent on the farm for their livelihood. Among 5 members 2 (the farmer and his father) are involved with farm activities throughout the year. The farmer has taken records of inputs and selling of farm products except the labour given by them. The return from the farm during the last financial year (2016-17) is as follows.

Sl. No.	Components	Input Cost (Rs.)	Gross Return (Rs.)	Net Return (Rs.)
1	Broiler (5000 nos. per batch x 5 batches yearly)	37,50,000.00	43,99,200.00	6,49,000.00
2	Coloured Broiler Duck (2000 nos. per batch x 5 batches yearly)	15,30,000.00	17,82,000.00	2,52,000.00
Total		**52,80,000.00**	**61,81,200.00**	**9,01,200.00**

Impact Indicator	Before Adoption	After Adoption
Crop/ Enterprise	Pulse during	5000 nos. of Broiler and 2000 nos. of coloured Kharif seasonbroiler duck per batch of two months; Total batch 5 per annum
Yield	3.2 q/ha (blackgram)	25000 nos. of broiler with 2.4 kg per bird and 10000 nos. of coloured broiler duck with 2.2 kg per bird
Sale value	Rs. 7000.00/ q	Rs. 130.00/ kg dressed chicken and Rs. 150.00/kg dressed duck
Input Cost	Rs. 2000.00	Rs. 34,50,000.00 yearly (broiler) Rs. 13,80,000.00 yearly (duck)
Labour Cost	Rs. 1000.00	Rs. 300000.00 yearly (broiler) Rs. 150000.00 yearly (duck)
Gross return	Rs. 7000.00	Rs. 4399200.00 yearly (broiler) Rs. 1782000.00 yearly (duck)
Net Saving/ Net Profit	Rs. 3000.00·	Rs. 6,49,000.00 yearly (broiler)· Rs. 2,52,000.00 yearly (duck)

** Input like chicks feeds and medicines were provided by the producer company.*

Impact:

The farmer used poultry manure as well as the litter in the poultry shade mainly for fish feed and also poultry feed by proper mixing with the concentrate feed available in the market in very low amount for reducing the feed cost. Therefore, the model farming system followed by the farmer is profitable one in the district of Purulia. Mr. Adesh Dubey is a burning example where a little intervention could make a simple entrepreneur to an Institute.

Success Story – 47

Diversified farming system for augmenting income in Purulia district

Background:

Sri Adhir Mahato is a young and energetic farmer of age 42 years of Purulia. The area is drought prone and dominated by red & lateritic soil. The summer months are very harsh with temperature reaching upto 48°C and very low relative humidity (30-60%). Therefore, water requirement of the crops is very high. The farmer is having a small farm pond with 0.13 ha area and a dug well of 8ft diameter and 32 ft depth. So, availability of irrigation water for the farm is not sufficient. For this reason, the farmer has allocated area under different components considering the available water resources.

Role of KVK:

He was associated with KVK in the year 1994 through participation in the training programmes conducted both at KVK campus as well as in the Farm Science Club (FSC) at his village Kaluhar. He was provided with some demonstrations of agronomic, horticultural, fishery and animal husbandry components in different time since 1995 for his the farm area of around 1.2 ha. Gradually he has developed a diversified farming model.

Component wise distribution of area:

Sl. No.	Components	Area (ha)
1	Orchard (Mango : Var- Amarapali, 12 nos., with 6 seeded plants;Year of plantation 1995; Guava : Var- L-49, Allahabad Safeda, 35 no., with another 15 seeded plants, Year of plantation 1995; Acid lime : Var- Madrasi pati, 5 nos., Year of Plantation : 1995	0.15
2	Border area plantation around periphery of farm with Mohul, Palmiara Palm, Eucalyptus, Mango, Segun, Sisso, Acacia, Neem, Karanj etc as wind break.	0.18
3	Vegetable plot (For seasonal vegetables; Winter-Cabbage, Cauliflower,Tomato, Brinjal, Chilli, Palak, radish, Dhania etc.; Summer – Onion, Cucurbits; Kharif – Bottle gourd, ridge gourd, Bhindi, Maize, Elephant foot yam etc)	0.58
4	Paddy Field (Paddy var.- Lalat, Super Sonali etc.)	0.12
5	Farm Tank (For irrigation and Psiciculture with Indian major carps)	0.13
6	Animal husbandry (2 bullocks for ploughing, 7 goats for meat purpose, housing for animals and tree fodder)	0.04
	Total	**1.20 ha**

Economic benefits:

The farmer has taken records of inputs and selling of farm products except the labour given by them. The return from the farm is as follows.

Sl. No.	Components	Input Cost (Rs.)	Gross Return (Rs.)	Net Return (Rs.)
1	Orchard	1500.00	36000.00	34500.00
2	Border area Plantation	0	20000.00	20000.00
3	Vegetables	2000.00	38000.00	36000.00
4	Paddy	500.00	7000.00	6500.00
5	Pisciculture	300.00	2500.00	2200.00
6	Animal Husbandry	600.00	5000.00	4400.00
	Total	**4900.00**	**108500.00**	**103600.00**

Overall profitability of the system:

The farmer used farm yard manure as well as compost prepared from the crop residues, grasses, leaves, twigs, etc. in the field with a very nominal quantity of inorganic fertilizers. For this reason, the pest and diseases attack was very less and corresponding expenditure for pesticides was also less. Therefore, the net return from this farming system was very high (*i.e.* Rs. 1,03, 600.00) from 1.2 ha land per annum and profitable one in the district of Purulia, a drought prone area.




Success Story – 48

Shifting from mono crop to multi crop production in Bankura district

Background:

During the late eighties Sri Biswanath Karmakar was a share cropper in the village Rapatgaunj adjoining area to KVK. The area was mainly monocropped with meager irrigation facility. He was having 0.13 ha land in his personal possession where he cultivated rainfed kharif paddy for his home consumption only. Mr Karmakar was very motivated farmer to improve his economic status through full utilization of his land holding. After the establishment of KVK, Bankura he was keenly associated with this office for all kind of technological help.

Role of KVK:

The source of income of Sri Karmakar was only cultivation and labour. He improved his agriculture farming with the advanced knowledge from this KVK to uphold his economic condition. Besides aman paddy, he started different vegetables viz. cauliflower, cabbage, tomato, pulses like *arhar*, blackgram, greengram and oilseeds like mustard. Now, after 24 years, he is the owner of 3.2 ha of land with irrigation facilities and he earns Rs 2.5 lakh yearly from his cultivation.

Impact:

At beginning Sri Karmakar was the only motivated farmer from his village Rapatgunj. With the time his prosperity has made several other farmers motivated. Now more than 10 farmers from that village are the resistered grower of KVK. All farmers regularly visit this KVK and they purchase their required seeds from this organization.The Panchayat Pradhan is highly satisfied and expressed his gratitude toward our KVK for its role to improve the farming system of the village.

Success Story – 49

More paddy production through SRI technique in Bankura district

Background:

Smt Chhabita Pramanik is the group leader of Rangamatichar Bhachati Swanirbhar Dal, P.O. Dihipara, Sonamukhi, Bankura. Smt Pramanik is 35 year old, passed 8 standard, having little own cultivated land. She is leading her Women Group (having 15 acre land area) for 10 years and also plays important role in cluster activity. She keeps close contact with DRDC, Bankura, DRDC, Burdwan and KVK, Bankura. The village Rangamatichar is situated in the embankment of river Damodar. The soil in the area is highly sandy in nature. Paddy cultivation in this area requires huge cost for irrigation. Again flood occurs during end of September to October, causing total devastation of the crop.

Role of KVK:

KVK, Bankura conducted training among the village women of different SHGs of that area.The SHG of Smt Chhabita Pramanik approached KVK to demonstrate the technology at field level.Sri Binod Das of their village came to help the women SHG to lend his 1 acre land at lease on the ground that if the crop failed nothing will be charged as interest. All the 10 SHG members have prepared the seedbed, total transplantation and interculture operation under the close supervision of KVK scientists. Smt Pramanik and all SHG members came to KVK office to inform that they are highly criticized by their family members, villagers and nearby villagers too. Scientists of KVK assured them about their upcoming results. After 4-5 weeks, the field totally changed as deep green than the surrounding field. The pest disease attack was remarkably less than the other field.

Impact:

The SHG members have informed District offices about their achievement. The PD, DRDC, District Agriculture Officers from neighboring district Burdwan have visited the plot. The TV channel DD Bangla has broadcast the programme in Krishi Darshan. The members harvested 1.7 times more of the production they usually get from their field. They offered half of their produce to Binod Babu as gift to value their research thought. The villagers also were very impressed and described achievement of village women before Govt. Official. This year all the villagers have approached KVK, Bankura to adopt the SRI method under the supervision of KVK scientist.

SRI Paddy Field *(Goatra Bidhon-I)*

Success Story – 50

Progeny Orchard development for income generation in Bankura district

Background:

The orchard developed in an area of 5.33 ha was previously lying as barren land and used as pasture land. There was no source of irrigation water. The land was undulated and was covered with wild jungles. The top soil of the area is loamy in texture up to a depth one ft. Below that level; a gravel layer is noticed up to a depth of 6-7ft, beyond which there is layer of hard rock underneath.

Role of KVK:

FLD on introduction of regular bearing hybrid mango varieties like Amrapali and Mallika, high yielding guava variety 'KG' and citrus variety Pati lime for area expansion programme on orchard to bring fallow lands of the red and lateritic zone of the Bankura district under orchard development was taken up. FLD on Porous pitcher was set at the base of individual plants for irrigating the plants by drip method by utilizing the minimum available water from the wells dug in three different locations of the orchard area to combat with acute water scarcity of that area was also included.

Impact:

At present the orchard has been developed fully by introducing porous pitcher irrigation after rainy season. Bloom of mango was noticed in the end of January which was broken for the normal vegetative growth of the plants. After two years development of the plants, fruits produced in the plants of the orchard to be harvested from the third year onwards. Till then the inter space is utilized for the cultivation of vegetable crops during rainy season. All the activities performed by the farmers in the said orchards which are new to the local farmers, like introduction of porous pitchers breaking of blooms up to the age of two years of the plants in utilization of inter spaces up to three years have inspired the farmers of the surrounding areas to develop similar type of orchards in their area with their individual capacity and to adopt similar type of practices in their orchards.

Success Story – 51

Dairy farming and self- employment in Bankura district

Background:

Soumya Kanti Banerjee completed his Secondary (standard X) education in the year 1998. After that he could not proceed for further education due to financial problem. He searched for job but he could not find a suitable job and returned to his native village at Churamonipur. Though his family is having 1.6 ha of cultivable land, but the land had been recorded as 'Barga' by the sharecroppers. Therefore, their income from the land property was not more than Rs. 11,000/- during that time. Their yearly family income in the year 2002, before the technical intervention from KVK was Rs. 50,000/-.

Role of KVK:

In the year 2002, Soumya took training on Dairy husbandry from this KVK. He then applied for a bank loan. His proposal was cleared by the United Bank of India, Sonamukhi Branch. An amount of Rs. 60,000/- was sanctioned as loan by the bank. With that, he purchased 4 nos. of cross bred cows. Since then he engaged himself in the business of milk trading and dairy farming. The benefit of use of vitamin and mineral mixture with the concentrated ration to augment the milk was demonstrated at his farm through Front Line Demonstration (FLD) from this KVK. On Farm Trial (OFT) on the control of tick borne diseases in dairy cows was also taken up at his farm.

Present Position:

At present he is having 8 nos. of cross bred cows and 4 nos. of milch buffaloes. The daily milk production from his farm is now 35 – 40 kg. He sells 50% of his daily production to the house hold consumers and the rest is converted into milk product like Paneer.He sells milk @ Rs. 30/- a kg while for Paneer he got Rs.140/- per kg. From the savings of is dairy farming he has purchased one fat separator machine at a price of Rs.7800/- from Kolkata. Now, he is also preparing *Ghee* and selling the same at a price of Rs. 330/- per kg. He also prepares *Khoya* and sells at a price of Rs. 200/- per kg. Of late, with the investment of Rs. 50,000/- from his savings, he has opened one marketing outlet of his milk product in the market place of Sonamukhi. Presently, he is preparing and selling curd (Dahi) and other sweeteners from his dairy farm. His father actively helps him in the business.

Economic benefits:

At present Mr. Banerjee is earning Rs. 2, 00,000/- per annum as net profit. He has repaid the bank loan. From his earnings, he has repaired and remodeled his dwelling into a pucca dwelling house at a cost of Rs. 8,00,000/-.

Impact:

Having seen his dairy farm with diversified activities viz. production of milk and milk products and selling in the locality from own marketing outlet, the people in the milk trade have started to include some of the activities at their own farm. Thus, 21 nos. of milk traders have started producing

'Paneer' and selling the same to the nearby Durgapur city market. Now, the rural youths (RY) from different parts of the district are coming to this KVK to know the skill of the Dairy Farming for starting their own dairy farms. Already 120 nos. of such RYs have got the training and out of them one at Indus block has started his own dairy farm with 20 nos. of milch cows at his farm.

Success Story – 52

Augmenting income through pig farming by the tribal farmer

Background:

Sri. Shyam Tudu is a marginal ST farmer having only 0.4 ha. of unirrigated medium land. He resides at the village of Siberbandh of Kochdihi G.P. He manages his subsistence leaving partially from the rainfed farming, animal rearing and working as the agricultural labourer in the field of others. His annual income as estimated by him is Rs. 35000/- per annum. In his family, he is having his wife and three minor children. His wife also contributes through her earning from the work as the agricultural labourer.

Role of KVK:

On enquiry, Sri. Shyam Tudu expressed that, he heard about the benefit of rearing improved pigs and thus he was very eager to rear the pigs but he had no money to purchase the pigs. In the year, 2009-10, he was given a pair of piglets of T&D of 2-3 months age under FLD from KVK, Sonamukhi.

Economic benefits:

Sri. Shyam Tudu has earned Rs. 16000/- from the sale of piglets after weaning. In four nos. of furrowing, he got 26 nos. of piglets. Out of these he sold 16 nos. of piglets after weaning at a cost of Rs. 16000/-. Out of 26 nos. of piglets 3 nos. died at the early stage. At present he is having 7 nos. of piglets ready to sale. From his income of Rs. 16,000/- he has purchased 2 nos. of bullocks at a cost of Rs. 6000/- and two nos. of Black Bengal goats at a cost of Rs. 1200/- . Rest amount of Rs. 8,800/- he has spent for his family. Before the intervention his income was Rs. 35000/- per annum but after the intervention, his annual income has raised to Rs. 51000/- per annum (45% more).

Impact:

Now the neighbors are taking very much interest for pig rearing and they have placed demand for supply of piglets.



Success Story – 53

Mushroom production for self- employment in Bankura district

Background:

Earlier Sri Tapas Dey was engaged in agricultural cultivation like paddy, potato, vegetables, pulses etc. in his own land. His yearly income from the agricultural sources was Rs. 1, 00,000/-. He was interested in mushroom cultivation while purchasing a packet of mushroom from a salesman hawking at his village and he showed his interest to know about process of cultivation from the said salesman residing at Kotalpur. Apart from knowing something about this from the salesman, he contacted to the Block Dev. Officer, Joypur for detailed information and suggestion to establish a mushroom production unit in his own land. The B.D.O., Joypur suggested him to contact KVK, Sonamukhi for furthur guidance about this. Then he contacted this KVK in 2012.

Role of KVK:

In the year 2012, when he came to this KVK and expressed his interest for mushroom cultivation he was suggested to undergo a short course 'On-campus training on mushroom' from this KVK as soon as possible. As such he had undergone training on mushroom in September'12 for duration of 15 days. After taking the training successfully he initially started his unit with 7 packets of mushroom spawn supplied from this KVK to cultivate in 7 cylinders at his village. Then he started his programme in October'12 in commercial mode.

Present Status & Economic benefits:

Initially Sri Dey was able to produce 14-15 kg mushroom per day from 7 packets of spawn and the produced mushroom was sold in the local area @ Rs. 80/- per kg. But now he has been able to increase his production to the tune of 22-25 kg per day which is being sold in different markets like Bishnupur, Bankura, Durgapur etc. @ Rs. 90/- per kg. and the demand is rising high. His present yearly income is Rs. 1, 20,000/- from production of mushroom excluding his traditional agricultural source of income.

Impact:

Mushroom cultivation is a popular, successful and encouraging scheme indeed for self employment of the unemployed youths which needs minimum infrastructure and capital. In

Bankura, mushroom cultivation has got a remarkable impact. Numbers of youth, farm women and interested farmers from different blocks are contacting regularly to this KVK round the year showing their interest about mushroom cultivation for establishing mushroom production unit for their livelihood.

Success Story – 54

Empowerment on seed production of wheat

Background:

Sri Swapan Dasgupta is a progressive farmer of village Hamirhati, P.O. Sonamukhi, Dist. Bankura. Sri Dasgupta is 59 years old, a science graduate having 3 acres of land. After study he joined agricultural activity as a profession.

Role of KVK:

In the year 2010 he came to KVK, Sonamukhi, Bankura with a concern of excessive ground water utilization of Boro paddy in Hamirhati area resulting non availability of drinking water in the area during summer. KVK intervened into the matter and did PRA with the village people with active participation of Mr Dasgupta. The result of the brain storming session was that the farmers showed interest of Wheat cultivation as the crop earlier was in some parts of the area. KVK Scientist along with the farmers decided the trial of Wheat cultivars in the area to find out the one to be best suited in the existing crop sequences. Mr. Dasgupta readily accepted the proposal and said he spare land for the OFT programme as most of the farmers were small farmers to take up the risk. However the programme failed due to attack of 44 elephants in the area to ruin the crop by totally grazing at the vegetative stage of the crop. Mr Dasgupta determined not to give up and contacted KVK. The suggestion from Agronomist helped him to harvest the crop with little loss. He, however, gained the confidence of villagers for his achievement. Next two years from 2011-2012 the villagers joined Sri Dasgupta to find out the suitable variety in the area to be best suited in their land situation and crop sequences with the help of KVK.

Present Status:

As a result of trials 3 varieties were selected by the villagers and farmers to be suitable for them namely HD 2888, HD-2824 and HP1633.The farmers even joined hand to fight against elephant attack of the area. They even introduced Wheat harvester and thresher in the area for easy and early

harvest of the crop. In rabi, 2013 this KVK therefore took the mandate of seed production of Wheat in the area for govt. minikit supply. Sri Dasgupta has gathered and motivated four women SHGs nearly 50 farm women from the three adjoining villages for the said programme. He contacted KVK and arranged the training programme for the farm women in his village about the cultivation practices and rules of Wheat seed production. Sri Dasgupta helped the women SHGs to collect seed and select the land. About 20 ha area has been covered under the seed production of Wheat of the variety HD 2888, HD2824 and HP1633.The programme was a huge success and the farm women were highly happy with the expected achievement. Sri Dasgupta has personally contacted with several people for arranging the Wheat thresher small and big size so that the crop could easily and early be harvested and sent to KVK to escape elephant attack. His continuous support has strengthened the four women SHGs as well as helped them to get connected with KVK for upliftment of their livelihood as a whole. Sri Dasgupta has increased his landholdings from 2 acre to 7 acre, also purchased a 2 acre pond from which he earns Rs.60000/- per year. Sri Dasgupta became member of the local milk cooperative and introduced the habit of fodder cultivation among farmers in the area to feed 150 nos of cows in the area and a farmer gets an annual income of Rs.45000.00/- from year round one acre of local sale of fodder. The fodder seed is distributed to the farmers through KVK and cooperative.

Impact:

The impact is so well observable that daily 20-25 nos of farmers prior to rabi season come to KVK for quest of wheat seed and to get involved in the said programme. The local villagers are talking within themselves to convert the total roadside and adjoining fields into golden wheat instead of paddy. Nearly 50 ton of wheat seeds are expected to harvest from the said programme. The farmers of adjoining villages and from distant location have contacted with the members of SHGs for their requirement of seed for the next rabi season. Even the local seed dealers have shown their interest to collect seed from the SHGs for quality available locally.The dealers can save time and money to collect the same than from other state via transport. The villagers are happy with the availability of good quality wheat flour. At the same time the food habit has been changed from rice to atta in most of the farm families.

Success Story – 55

Entrepreneurship on backyard poultry farming with Rhode Island Red and/ or Vanaraja in Birbhum district

Background:

Backyard poultry farming is one of the most important viable non-crop enterprises of dry semi-arid zone of West Bengal. The meat of backyard scavenging chicken is highly accepted in the markets and more remunerative than commercial broiler meat because of its taste, lower fat content and texture.

Keeping these real level situations in mind, the Rathindra Krishi Vigyan Kendra has intervened through conducting an On Farm Trial Programme on Comparative Performance analysis of the Breeds viz. Vanaraja, Rhode Island Red and Indigenous (Deshi) Chicken in dryland farming situation of Birbhum District of West Bengal. At first, in the financial years of 2014-15 and 2015-16,the Rathindra Krishi Vigyan Kendra selected fourteen partner farmers from different villages of Birbhum district for the On Farm Trial Programmes.

Role of KVK:

Sri Tapan Kumar Ghosh was selected for the On Farm Trial Programme on comparative analysis of the performances of the different types of rural poultry breeds under backyard farming situation. Sri Ghosh was given intensive skill development training programmes on scientific poultry farming and management practices and low cost feed formulation of poultry from Rathindra KVK, Visva-Bharati, West Bengal.

He has started his backyard poultry unit at his own land and constructed a non-conventional low-cost poultry house made of locally available materials, such as bamboo and wood as night shelter and to protect the birds from predators. Birds were let loose as free range scavengers for utilizing the feed base, i.e., fallen grain, insect, earthworm, kitchen waste, green grass etc. with supplementary feeding of concentrate mixture prepared by the locally available feed resources. Almost one fourth of the amount of concentrate mixture was replaced by *Azolla* (*Azollapinnata*) and vegetables like *Kalmi* (*Ipomoea aquatica*) and Spinach (*Spinacia oleracea*) etc. De-worming and vaccination of birds were done by Mr.Tapan Kumar Ghosh as per the standard protocol with technological backstopping by the scientist of the Rathindra KVK.

Body weight of the Vanaraja breed at 52 weeks of age for male was about 3.7 kg, while for female it was about 2.5 kg and in case of Rhode Island Red the body weight of male was about 2.95 kg and 2.3 kg for female. Vanaraja produces 103-110 eggs and Rhode Island Red produces 150-160 eggs and age of first egg laying of these two breeds is almost similar *i.e.*175-180 days. Mortality upto 52 weeks of age for Vanaraja and Rhode Island Red is also negligible. Sri Tapan Kumar Ghosh has started to brood fertile eggs of both Vanaraja and Rhode Island Red by using his local hen for up-gradation of his chicken breeds.

Economic benefits:

Vanaraja and Rhode Island Red bird fetch a market price of Rs.180.00 – Rs. 200.00 /kg. which is similar with local poultry price in market. The price of newly hatched chick is around Rs. 22.00 to

Rs.25.00 per chick and table purpose egg fetches a price of Rs. 6.00 to Rs. 7.00 per egg. Improved Rural Poultry Bird Rhode Island Red significantly produced better BC ratio at 72nd week (1.67), than those Vanaraja and Indigenous (Deshi) birds. Sri Tapan Ghosh has got a net profit of Rs. 38,000.00 (Rupees Thirty eight thousand) by selling ready bird, table egg and newly hatched chicks from each unit and each batch.

This success of Sri Ghosh can be used as a model for formulating the strategies to double the income of the farmers of the Birbhum District, West Bengal within 2022.

Impact:

Mr. Tapan Kumar Ghosh, an unemployed rural youth, paved the way for other unemployed youths as well as farmers and farm women to take up poultry rearing of improved breeds like Vanaraja and Rhode Island Red as a viable rural entrepreneurship to generate low input and high output venture for sustainable livelihood development which can be achieved within a very short period of time.

Sri Tapan Kumar Ghosh with poulty birds at his bockyard poultry farm

Value Chain Development, Market Linkages and Trade Potential

7. Value Chain Development, Market Linkages and Trade Potential

- Reforms in agricultural marketing policies are intended to improve the efficiency and effectiveness of the marketing system in the State so that the benefits such as increase in farmers' net income, assuring remunerative and profitable price to farmers and affordable supplies of food stuff is realized.
- Minimum Support Price (MSP) and/ or remunerative price must be ensured by the Govt. to avoid distress sale. Policies for better market price realization need to be implemented.
- Procurement of food grains must be assured and FCI should make arrangements to procure food grains including pulses.
- Establishment of Government Procurement Centres at maximum places for facilitating the farmers and preventing losses at the farmers place
- Agri-marketing necessitates a bottom up strategy. According to FAO, Agricultural marketing includes: (a) the performance of physical and institutional infrastructure to transfer farm products from the farmers to consumers; (b) the discovery of prices at different stages of marketing; and (c) the transmission of price signals in the marketing chain specifically from consumers to farmers. It has to cover an all-inclusive plan, wherein it is possible to make everyone an owner of the Marketing Process. Since marketing is an on-going process, it demands constant vigil of customer needs, and adequate outlays in advertising, promotion and below-the-line activities to keep the attention of the customer on to products sold. Hence, the policies will aim at improving market infrastructure and assuring better marketing channels with an intelligence system in the State. FPO (FPC)s can play a crucial role in this sector.
- Instructional convergences should be strengthened with Govt., KVK,NABARD, FPO, NGO for better marketing.
- In a move of the Central Govt. to link farmers with online facilities to enable them to sell their produce anywhere in the country at the best price through click of a button and to learn the prices of agricultural produce in different mandis, 585 mandis are being linked with e-NAM portal. The e-NAM will reduce information disparity and intermediation costs and may provide transparency and competitiveness to enable farmers to get better price of their produce. Apart from e-NAM, the Central Govt. has launched Agricultural Produce Market Committee (APMC) Act (which includes private market yards, direct marketing) and all the State Govts. have been directed to implement it in their states. Also, the Central Govt. is working on a Model Act to promote contract farming.
- Physical infrastructure for agricultural marketing consisting of storage structures, roads and transportation facilities, marketing yards, grading equipment, packaging facilities, processing plants, food safety and hygienic practices, scientific waste management facilities, farmers/ traders rest house facilities, canteen and retail outlets need to be strengthened. The institutional infrastructure covering organizations (public, private or cooperatives) and rules of the game, prescribed by either government or market functionaries - individuals or their groups - for performing various marketing functions need to be set up. For areas earmarked for piggery or goat/sheep farming, modern abattoirs must also be constructed to ensure healthy processing and maximum recycling of all other ingredients that are not sold/packaged for consumption.

- Timely availability of credit to farmers is an important first step in the Marketing cycle. Government, Cooperatives or Banks should look into the matter to extend financial support timely to the farmers.

- The majority of those making a living out of agriculture are small/ marginal farmers/ share croppers/ oral lessees. In this situation, any marketing in order to succeed has to be tailored as a societal marketing strategy. It has to include all segments in the farming community, and not be confined to only those who are large farmers. The farmers earn not more than 15-20% ofthe price ultimately paid by the end consumer. 70-80% of the price is shared by the intermediaries. This can only be improved if the marketing channel is controlled more by growers than by middlemen. Thus, there is a need of shifting the farmers from unorganized form to an organized form. The "Producer (farmer) – Consumer markets" Farmers' markets) introduced in some states like AP, Tamil Nadu and Karnataka were found to be successful and beneficial to both farmers and consumers. The State Government may consider introducing the same concept in West Bengal. The promotion of Farmers Marketing Cooperative or Farmers Producer Companies or Self Help Groups may facilitate collective marketing. The Milk Federation in Gujarat and the famous Dabba Wallas in Mumbai are the most successful cooperatives in India. Creation of more and more commodity based farmers' clubs like fruit farmers'club, vegetable farmers'club, egg farmers'club, fish farmers' club could play an important role in agri-business and marketing in West Bengal.

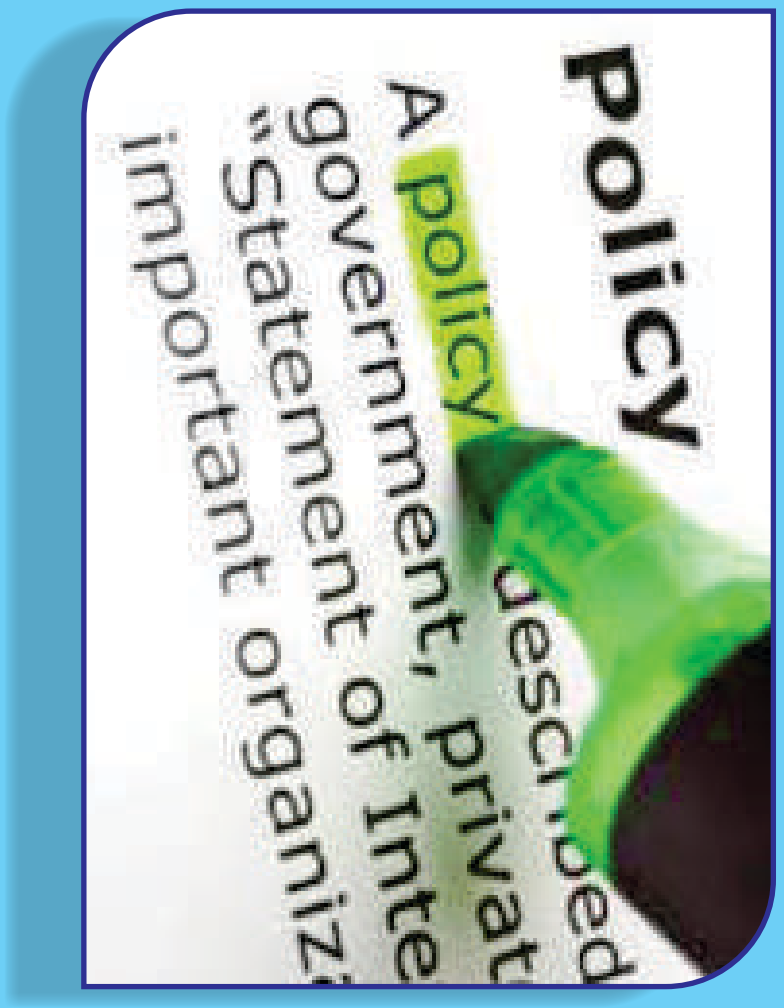
- Standardization of agro-techniques like identification of suitable varieties, organic farming and residue free IPM/ IDM technology particularly in Agri Export Zone (AEZ) for vegetables will make a dent for promotion of export from the state. There is a need for development of bulk handling system of tropical vegetables, including pre-cooling and controlled atmosphere/modified atmosphere (CA/MA) storage and post harvest protocols for air transport of majorvegetables. Disinfestation technology including vapour heat treatment (VHT) for export of fresh vegetables and extension of shelf life by preventing desiccation of vegetables should help in further export promotion.

- Globalization of agriculture has also opened up opportunities for export of agricultural commodities for which demand by importing countries and their quality specification and standards should be made available to domestic exporters to pave for export led growth. The farmers should also be made aware of the consequences of imports on domestic prices. This emphasizes the need for establishing a State Domestic and Export Market Intelligence Cell (SDEMIC) as in the case of the State of Tamil Nadu.

- Instead of depending on some private seed producing companies and a few public sector companies, seed production should be targeted through FPO (FPC) and FIG in seed production. This will not only reduce the cost of quality seeds but also will increase accessibility of the farmers to quality seeds. Exploitation of heterosis by development of hybrids could be the possible breakthrough to enhance the productivity of vegetables in the state as a whole. The productivity of vegetables could be increased more than 20 t/ha by the utilization of well adopted, early maturing and disease resistant hybrids of tomato, chilli, cauliflower, cabbage, okra, cucumber, ridge gourd, bitter gourd etc. Large scale of production of hybrid seeds like Ranibenur model in PPP mode particularly in the drier tracts of the state would be a breakthrough to generate more employment opportunities among rural youth and women of the state.

- Quality poultry birds, fish fingerlings may be produced in PPP mode. Hatcheries for fresh water prawn, mud crab, and ornamental fishes need to be set up in the state under PPP mode.

- Biofertilizer, biopesticide, animal feed may be produced in PPP mode.



Policy and Investment Requirements and Role of the Government

8. Policy and Investment Requirements and Role of the Government

8.1. Policies

- There is a need of policy for land leasing.
- There should be a national policy to help States to harness the irrigation potential and any investment on this count should be supported through a national programme.
- There is a need of policy for term credit and subsidy.
- Compensation amount during lean period, closed season and micro credit may be provided to start up small businesses to replace the lost income.
- Animal feed may be provided to the farmers through Govt rationing system.
- There is a need to enforce the ban period, craft and gear regulation and ban on destructive fishing practices.
- Policy to undertake the Kishan Credit Card in a massive way not only for crop production but also in Allied Activities such as Animal Husbandry and Fisheries.
- Formulation of guideline and action points for declaring selected areas or part as the "Fishery Reserve Areas" from the point of view of facilitating fish seed production, propagation and higher availability of catch size fishes, with special importance to hilsa.
- Labelling of organic inputs and certification mechanism of crops need to be considered.

8.2. Investment Requirements

- Restoration of soil fertility is the need of the hour all over the world, especially in the context of food security. The consumption of fertilizers in the State has been rising over the years. The importance of organic manure and bio-fertilizers has increased to enhance organic carbon content and microbial activities in the soil so that it becomes more responsive to crop production practices. Organic inputs not only reduce cost of production, but also help in healthy food production being environment friendly. The production of chemical fertilizers, organic manures and bio-fertilizer are not adequate at present and cater only 30% of local demand. To improve and maintain soil fertility status, production capacity of chemical fertilizers, organic manure and biofertilizers needs to be increased many fold.
- Water harvesting structures (10 % of a farming unit), mini deep tube well (can irrigate 5 ha of land), percolation tank, farm pond, check dam in streams available in villages, roof water harvesting in hill area, water pump procurement and distribution may be done utilizing fund from MNREGA and RKVY. Solar energy operated pump may be explored.
- Through the Grid Connected Rooftop Small Solar Power Programme, the Government can establish grid connected small solar projects on vacant fallow land and unused land between the fields. Through the project, generated electricity by the cells is directly sent to the grid. The generated electricity serves as an additional income source to the farmers. Besides this, solar pumps are also available on subsidy to the farmers.

- Govt. subsidy may be offered to the interested farmers for purchasing farm implements.
- Government should ensure better post harvest management to the farmers. To avoid undesirable spoilage of a significant loss of perishable horticultural crops and also for greater realization of price of the commodities produced by the farmers, it is necessary to create facilities for better post harvest care and management which include creation of on farm handling unit, collection centres, cool chamber, bulb stores, provision of motorized, vending card, organizing aggregators etc.
- There is a need of integrated cold chain. One of the important reasons for advancement in the trade of fruits and vegetables in developed countries is the adoption of cold chain in handling and storage of fruits and vegetables. The maintenance of low temperature at different stages of handling by means of a cold chain results in reduction of losses and retention of quality of fruits and vegetable and their products. Supply Chain Management (SCM) is the process of planning, implementing, and controlling the operations of the supply chain with the purpose to satisfy customer requirements as efficiently as possible. SCM spans all movement and storage of raw materials and supply finished goods from point-of-origin to point-of-consumption. The challenge in supply chain management is to maintain all three flows in an efficient manner, resulting in optimal results for farmers, growers, wholesalers and customers.
- There is enough investment opportunity for setting up ice plants, cold storages, insulated vans for dedicated chain of retail market for fish trading. It is necessary to establish multipurpose cold storage facilities for fish preservation either through private sector investment or PPP mode with government providing basic infrastructure.
- Considering the acute energy crisis and the non-availability of abundant cool storage facility, low cost/ low energy environment friendly commercial size (6-8 ton capacity) cool chambers may be promoted. Just like the Pusa Zero Energy Cool Chamber; this chamber can also reduce the temperature and maintain high humidity throughout the year and can increase the shelf life and retain quality. The commercial size cool chamber has already been found to be useful for the storage of citrus, banana, potato, tomato etc. and during the rainy season onion can be stored if water supply is stopped in the big cool chamber.
- Hatcheries of selected air-breathing fishes may be established. Seed banks may be set up in the State to ensure steady supply of fish/ prawn/ shrimp seeds.
- In brackish water aquaculture farms, the major expenditure is for water intake and outlet channels. There is a need for providing such infrastructures.
- Disease diagnostics and water quality testing facilities with modern instrumentations need to be developed with capable manpower.

8.3. Role of the Government

- Soil testing infrastructure facilities at district and block level for comprehensive soil analysis need to be strengthened and soil health cardbased Integrated Nutrient Management may be introduced.
- Water harvesting structure assumes importance in the districts of Purulia, Bankura; parts of

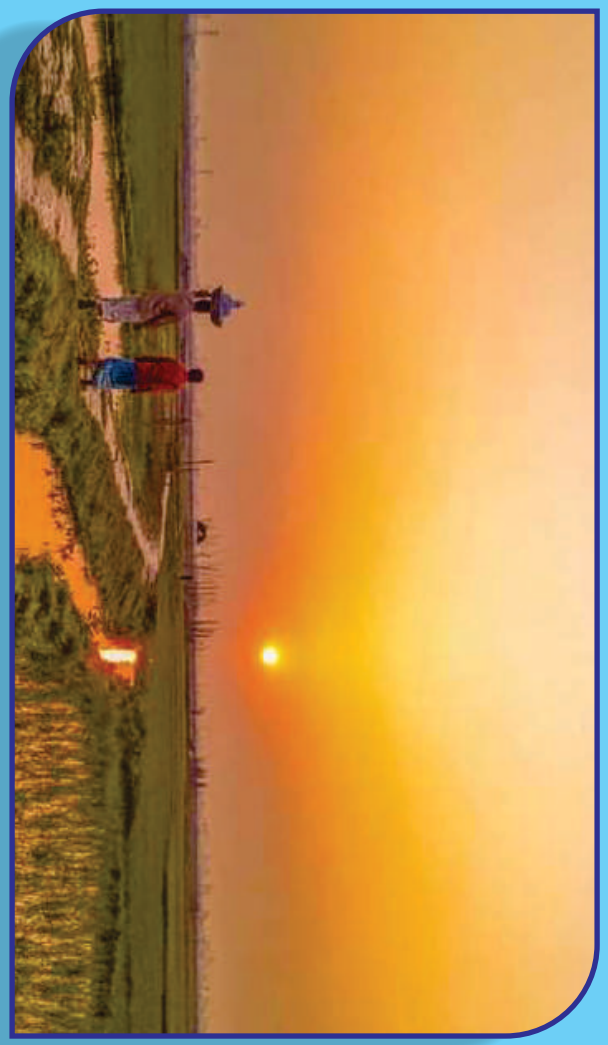
West Medinipur, Bardhman and Birbhum and such structures may have to be dovetailed in watershed management programme to boost irrigated agriculture in these districts.

- Rural infrastructure development programs like making land shaping structures for rain water harvesting in Govt. and private lands, excavation of new ponds and water reservoirs, desilting of beels and rivers, renovation of ponds can be taken up.
- The largest share of energy is utilized for pumping of irrigation water. Micro/ precision irrigation system could be installed with solar energy system to utilize available ground water/ surface water to the maximum possible extent for increase in horizontal coverage as well as cropping intensity.
- There is a need of establishment of more and more custom hiring centres for making available of laser land leveler, tractors, power tillers, rice transplanter, reapers, threshers, sprayers, power sprayers, power weeder, grass cutters, fruit pluckers, mini trucks to the farmers on a cooperative mode.
- Ergonomic tools and women-friendly tools in farming operations that could significantly enhance human labour productivity should be introduced through some programs. Emphasis may be given for introducing multi crop equipment such as medium range multi-crop axial flow threshers, multi-crop reapers and roto-tillers suitable by bringing about design improvement to suit the crops and the gender.
- Training needs to be imparted to the farmers on use of farm machineries along with maintenance and their repair.
- Availability of feed at affordable rate is a serious constraint in livestock and fish farming. Govt. may take initiative to establish cattle, pig, poultry, fish and shrimp feed manufacturing units and thus produce and make available of animal feed at reasonable rate for the farmers. This can be done either through private sector investment or PPP mode with government providing basic infrastructure.
- New improved fodder crops and varieties suited to both the local dry and harsh rain fed environment and refurbished irrigated farms for seed multiplication and extension of the most suitable fodder crops and varieties to be set up as fodder bank in district level.
- State Government should take up formation of Farmers' Producer Organizations (FPOs) on a large scale through centrally sponsored scheme to avoid involvement of middle man and these are to be designed in such a way so as to provide end to end service.
- There is a need for up-gradation of existing Animal Health Centres to deliver updated treatment facilities.
- Mobile veterinary clinics and services should be implemented in the entire State.

Implementation Plan and Institutional Responsibilities

9. Implementation Plan and Institutional Responsibilities

- The vision of **"Doubling farmers' income by 2022" may be implemented in two- three villages of each district as model pilot project by KVKs and other institutions.**
- There is a strong network of State line Departments in the entire State. The vision of **"Doubling farmers' income by 2022" may be implemented in the entire state in the mission mode with the active role of** State line Departments.
- Presence of two State Agriculture University (SAU), one State Animal and Fishery Science University, ICAR Research Institutes like CIFRI, Research centres of CRIJAF, NIRJAFT, CSSRI, CISH, NDRI, IVRI, CIFA, CIBA and CIFE in the State, may be the source of technologies for the technocrats and the farmers.
- Institutional convergences should be strengthened among State Government Departments, Central Government Departments, SAUs, ICAR Institutions, KVKs,NABARD, FPOs, NGOs, Farmers' Clubs,farmers' SHGs and others.



Summary Recommendation

10. Summary recommendations

Agriculture has been the way of life and continues to be the single most important livelihood of the rural masses in West Bengal. So, all the stakeholders of West Bengal need to work in a mission mode for development of Agriculture and Allied sector in a holistic manner with the vision of **"Doubling farmers' income by 2022".**

To fulfill this vision some recommendations are:

1. There is a basic need of quality certified seeds and good animal breeds which should be addressed on priority.
2. The cost of cultivation needs to be reduced for augmenting the farm income.
3. Minimum Support Price (MSP) and remunerative price in the market must be ensured to avoid distress sale.
4. Terms of trade for agriculture need to be improved.
5. The farmers need to be linked with the market intelligence.
6. There is need to develop agro-ecological zone specific, crop specific and the farmer centric technological modules.
7. Conservation of basic agricultural assets such as land, water and biodiversity and application of technologies for natural resource management are required.
8. Farm mechanization and irrigation facilities need to be expanded.
9. Integrated Farming System (IFS) approach needs to be encouraged.
10. Rice fallow area is to be utilized fully.
11. Soil fertility, nutrient management and crop response are to be integrated.
12. Crop diversification and cultivation of high-value crops are to be promoted.
13. New and innovative technologies for crop cultivation, animal husbandry practices and fish production are to be identified for the transfer to the farmer's field.
14. Technologies towards the use of solar energy need to be used. The largest share of energy is utilized for pumping of irrigation water. Micro/ precision irrigation system could be installed with solar energy system to utilize available ground water/ surface water to the maximum possible extent for increase in horizontal coverage as well as cropping intensity.
15. The facilities/ infrastructures are to be established for post-harvest technologies/ food processing/ value addition/ preparation of by-products.
16. Capacity through skill training is to be strengthened.
17. Application of climate resilient technologies to address climate change challenges like drought, excess rainfall etc. should be strengthened.
18. Public Private Partnership (PPP) mode involving the FPOs and NGOs etc needs to be fostered.
19. Some specific programmes need to be undertaken for the betterment of farmers belonging to SC, ST and backward classes; empowerment of women in agriculture.
20. ICT based agri-extension portal, a dynamic platform is to be used massively to disseminate crop, livestock and fishery related solution to the farmers at farm-gate level.

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Annexure 1

Northern Hill sub region

Darjeeling district at a glance

1.	Area	: 3,149 sq.km.
2.	Longitude & Latitude	: 87059' E to 88053' E 26031' N to 27013' N
3.	Agro ecological situation	: i) Due to sub-humid climate organic matter content moderate to high (2%) but decrease with depth ii) The eastern Himalayan region acidic to neutral range pH found
4.	Soil type	: i) Medium deep to very deep fine loamy soils (hill- brown forest soils), ii) Sandy loam soils (Medium lands to foot hills), iii) Shallow to medium deep Loamy soils (plains)
5.	Average Annual Rainfall	: 3037 mm
6.	Population (Census 2011)	: 18,46,825
7.	Population density per sq.km.	: 590
8.	Literacy rate	: 79.56%
9.	Net cropped area	: 1,43,860 ha
10.	Gross cropped area	1,76,200 ha
11.	Cropping intensity	: 122.48 %
12.	Irrigated land	: 8,940 ha
13.	Major farming system	Hill and mountain farming system with horticulture base crop enterprise. Major field crops: Rice, Maize, Wheat, Oilseeds (mustard, linseed). Major fruit crops: Mandarin and Pineapple. Major vegetables: Cabbage, Cauliflower, Radish. Flowers: Gladiolus Spices: Ginger and Large cardamom. Livestock: Cattle, goats, pigs and backyard poultry.

Darjeeling District is the northernmost district of the state of West Bengal in eastern India in the foothills of the Himalayas. The Darjeeling hill area is formed of comparatively recent rock structure that has a direct bearing on landslides. Heavy monsoon precipitation contributes to the landslides. Soils of Darjeeling hill areas are extremely varied, depending on elevation, degree of slope, vegetative cover and geolithology. The district is famous for its hill stations (often referred to as the Queen of the Hills) and Darjeeling tea. Kurseong, Siliguri and Mirik, three other major towns in the district, are the subdivisional headquarters of the district. Kalimpong was one of the subdivisions but on 14 February 2017, it officially became a separate Kalimpong district. The economy of Darjeeling hill area depends on tea production, horticulture, agriculture, forestry and tourism.

Teri and Teesta sub region

Jalpaiguri district at a galance

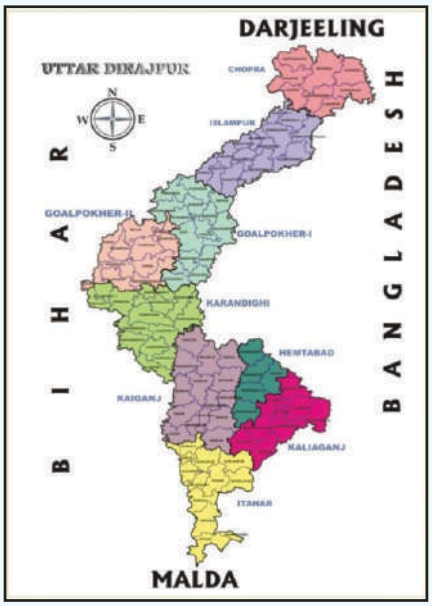
1.	Area	: 3,386.18 sq.km.
2.	Longitude & Latitude	: 88°23′2″ to 89°7′30″E 26°15′47″ to 26°59′34″N
3.	Agro climatic zone	: Terai-Teesta Alluvial: Topical per humid climatic
4.	Soil type	: Soil is sandy loamy and loose textural class which is prone to soil erosion and less water holding capacity. Soil contains less organic matter and devoid of loamy clay.
5.	Average Annual Rainfall	: 3160 mm
6.	Population (Census 2011)	: 23,81,596
7.	Population density per sq.km.	: 701
8.	Literacy rate	: 84.79 %
9.	Net cropped area	: 198256 ha
11.	Cropping intensity	: 186%
12.	Net irrigated area	: 79593 ha
13.	Major farming	I) Agriculture, ii) Agriculture- Livestock, iii) Agriculture- Livestock – Fishery

Jalpaiguri is said to be derived its name from olive (Jalpai) tree, which were last seen growing here in late 1900. This district has rich bio-diversity in both flora and fauna and has immense natural beauty. Jalpaiguri district is always known for 3 Ts – Tea, Tourism and Timber. The topography of the land is cut across by rivers, rivulets and hills and covered with tea gardens and forests. Its degraded area varies about 30000 to 35000 ha. The dominant agricultural products of Jalpaiguri district are jute and tobacco. Paddy is also grown before and after the rainy season. Common plantation crops are arecanut, coconut and black pepper. Vegetable, mustard plant, and potato cultivation are increasing.

Teri and Teesta sub region

Uttar Dinajpur District at a glance

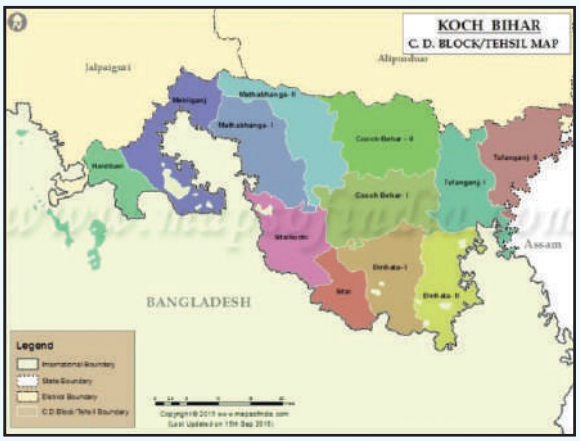
1. Area : 3142 sq.km.
2. Longitude & Latitude : 87°49' to 90°00' E
   25°11' to 26°49' N
3. Agro climatic zone : i) Terai zone (Islampur sub-division)- Soil pH varies from 4.6 to 6.2.
   ii) New and Old Alluvial zone (Raiganj sub-division)- Soil pH varies from 4.6 – 6.3.
4. Soil type : i) New Alluvium soil,
   ii) Alluvium soil,
   iii) Old Alluvium soil
5. Average Annual Rainfall : 2041.90 mm
6. Population (Census 2011) : 30,00,849
7. Population density per sq.km. : 960
8. Literacy rate : 60.12%
9. Net cropped area : 2,41,300 ha
10. Gross cropped area : 5,05,840 ha
11. Cropping intensity : 210%



Uttar Dinajpur is located along a principal highway axis and is well connected with Siliguri, Nepal, Bhutan, adjoining Bihar and Kolkata. The topography is generally flat with a gentle southerly slope towards which the main rivers like Kulik, Nagar, Mahananda. There are mainly 10 rivers in the district. Mahananda is the only river which flows throughout the district. The flood is caused generally by water logging and the lack of proper affluence of flood waters.It is warm dry to moist sub-humid eco region with brown forest and podozolic soils. The soil is very rich in alluvial deposition which helps to grow Paddy, Jute, Mesta and Sugarcane etc. The Dinajpur region has traditionally been known for cultivating a large variety of indigenous aromatic rice strains, of which the Tulaipanji variety is native to the Raiganj region and has got geographical indicator. Even though Uttar Dinajpur is a major rice-producing district, combined with a substantially underdeveloped irrigation potential, the current level of agricultural technology is generally poor. Crop losses are a frequent feature during the season of rains, because of the location of large parts of the district along the active floodplains of the rivers Mahananda and Nagar. High levels of rural poverty across the region also inhibit the growth of local markets. Along with marginality of soils in terms of native nutrient pool, poor irrigation endowment and inadequacy of situation specific technology options for appropriate crop sequencing that have given rise to poor productivity and low income from agriculture. The district has the chronically inter-twined socio-economic problems (48.8% BPL families) and is typically characterized by prevalence of very poor health index (0.62). The dearth of medium and large industry in the district severely restricts the scope for alternative non-farm employment. It is one of the most backward districts of India.

Teri and Teesta sub region

Coochbehar District at a glance



Geographical Area – 338700 Ha

Total Reporting Area - 331565 Ha

Forest Area - 4256 Ha

Area under Non-Agriculture Use - 69431 ha

Barren and Unculturable Land - 263 Ha

Permanent Pasture and other Grazing Land - 8 Ha

Annual Rainfall - 3200 to 3300 mm.

Cropping Intensity - 204%

Agroclimatic Zone - Terai, Teesta, Alluvial

Agroclimatic Region - Eastern Himalayan Region - 2

No. of Agricultural Sub-divisions - 4

No. of Agril Block - 11 (Tufanganj block consisting of Tufanganj-I & II Panchayet Samiti)

No. of Bargadars - 85959 Nos.

No. of Patta Holders - 141865 Nos.

No. of Small Farmers - 50748 Nos.

No. of Marginal Farmers - 249437 Nos.

Cultivators : 361840 (Male : 2,77,339; Female : 84,501)

Agricultural Labour : 285426 (Male : 170204, Female : 115222)

Avg. holding size during 2005-06:0.85 ha

Total irrigated area : 130416 ha

No. of Agricultural Farm - 9

No. of villages - 1,190

Population (Census 2011) - 1,06,760

No. of Farming Families : 327,127

Total no. of Self Help Groups - 17,227

No. of Regulated Market - 6

No. of Hats - 253

No. of Cold Storage - 12 (with Storage Capacity of 16,11,423.05 Qtls.)

No. of Input Dealer - 1500

Consumption of Fertilisers - 52000 M.T

Nitrogenous Fertilisers - 30.2 ('000MT)

Phoshatic Fertilisers - 12.2 ('000MT)

Potassic Fertilisers - 9.6 ('000 M.T)

Total Food grain Production - 1076414.5 MT.

Total Oil seed Production - 20915.47 MT.

Total Production of Jute - 505000 Bales

Total Production of Pulse - 5965.05 MT.

Total Production of Tobacco - 27394 MT.

Population: 2819086 (Male: 1451542; Female: 1367544) (SC: 1076142; ST:12044)

Old Alluvial sub region

Dakshin Dinajpur district at a glance

1. Area : 2219 sq.km.
2. Longitude & Latitude : 89°0′30′′ to 87°48′30′′E 26°35′15′′ and 25°10′55′′N
3. Agro-climatic Region : Old Alluvial
4. Soil type : Old alluvium and red soil
5. Annual Rainfall : 1690 mm
6. Population (Census 2011) : 16,70,931
7. Population density per sq.km. : 753
8. SC Population : 4.85 lakh (29%)
9. ST Population : 2.67 lakh (16.17%)
10. Literacy Rate : 73.86%
11. Cultivable Land : 58.72 thousand ha
12. Per head land : 0.95 ha
13. Cropping intensity : 189%
14. Irrigated land : 47.23 thousand ha
15. Total no. of family : 2.38 lakh
16. Agril. Family : 1.96 lakh
17. Agril. labourer : 38 lakh

Dakshin Dinajpur is predominantly an agricultural district with large area of land being under cultivation. The district is drained by north-south flowing rivers like Atreyee, Purnabhaba, Tangon and Jamuna River, to give rise to a sizeable, unorganised fishing community. Dakshin Dinajpur is a "Non Industry" district having no large-scale industry.

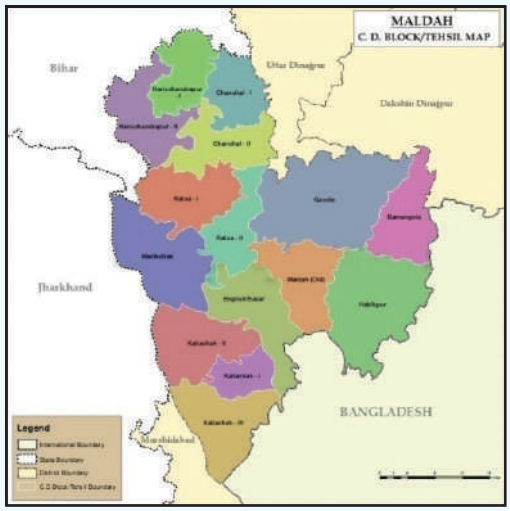
Major cropping systems

Sl. No.	Land situation	Farming system/enterprise
1.	Medium to Up land	Jute / Mesta – Rice – Mustard/Wheat, Fishery, Livestock, Poultry
2.	Medium to Low land	Fallow – Rice – Rice, Fishery
3.	Medium land	Jute – Rice – Vegetable / Potato, Fishery
4.	Upland	Vegetable – Vegetable – Vegetable, Fishery, Livestock, Poultry
5.	Lowland	Fallow – Rice – Fallow, Fishery
6.	River bed	Cucurbits (Rabi-Pre-kharif)

Old Alluvial sub region

Malda district at a glance

1.	Area	:	3,733.66 sq. km.
2.	Longitude & Latitude	:	87°45′50" E to 88°28′10" E and 24°40′20" N to 25°32′08" N
3.	Agro-climatic Region	:	Old Alluvial
4.	Annual Rainfall	:	1850 mm
5.	Population (Census 2011)	:	39,97,970
6.	Population density per sq.km.	:	1,071
7.	Literacy Rate	:	62.71%
8.	Cultivable Land	:	2.80 lakh ha
9.	Per head land	:	0.95 ha
10.	Cropping intensity	:	197%
10.	Irrigated land	:	41%

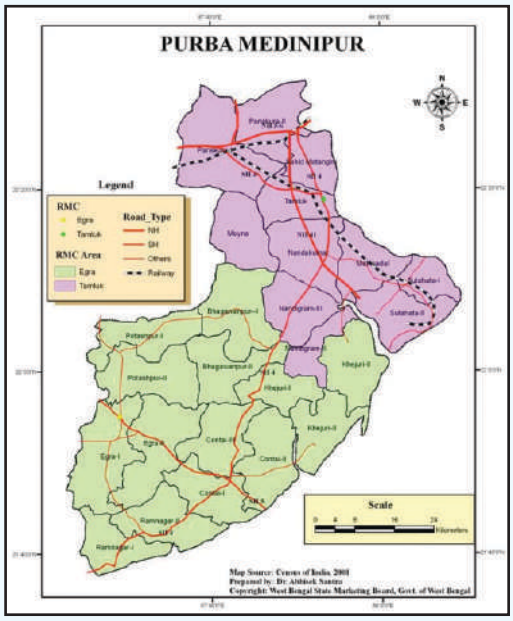


The district is placed under Lower Gangetic Plain Region and the largest proportion of it is falling under the Old Alluvial Sub-zone in term of soil-climatic features. Topographically, District has been divided into 3 distinct zones in form of Barind, Diara and Tal. The river Mahananda, flowing from north to east acts as a major dividing line and bi-furcates the district into 2 regions. Eastern region, characterized by relatively higher land of red clay soil of Old Alluvium nature, is known as Barind. Western region is further divided into two areas by river Kalindi. Whereas the northern low lying area is known as Tal, the southern and the most fertile segment of the district is known as Diara. The normal maximum temperature of the district during the summer and winter months are 35.8ºC and 23.8ºC, respectively. The normal minimum temperature during the summer and winter months on the other hand are 21.8ºC and 10.3ºC respectively. The district receives around 1850 mm average rainfall annually with the normal being 1453.10 mm. In the district of Malda, an area of 2.80 lakh hectare is available for cultivation, of which 14.97 per cent is lying under high land situation, 68.11 per cent lying under medium land situation and 16.92 per cent is placed under low lying situation. While 4.03 per cent cropped area of the district is drought prone, 7.55 per cent has been earmarked to be flood prone area. The soil type of the district is characterized by the existence of 11988 hectare sandy soil, 23875 hectare sandy-loam soil, 73222 hectare loamy soil, 38780 hectare sandy-clay loam soil, 60572 hectare clay-loam soil and 71563 hectare clayey soil. Soil pH varies from 5.5 to 8.2. Mango, jute and silk are the most notable products of this district. Mulberry plantations and mango orchards occupy large areas; mango trade and silk manufacture are the main economic activities. The special variety of mango produced in this region, popularly known by the name of the district, is exported across the world and is acclaimed internationally. Mango cultivars are Fazli, Ashwina, Gopalbhog, Langra, Lakshanbhog, Himsagar, Amrapalli and a score of excellent local ones known as Guti. Malda is the largest producer of excellent quality of jute in India. Rice, jute, legumes, and oilseed are the chief crops in the surrounding area. While, agriculture, horticulture and sericulture are the predominant economic activities in the countryside Malda, fishery and animal husbandry are the other two notable vocations particularly practiced by the resource poor rural gentry in the district.

Gangetic New Alluvial sub region

East Medinipur district at a glance

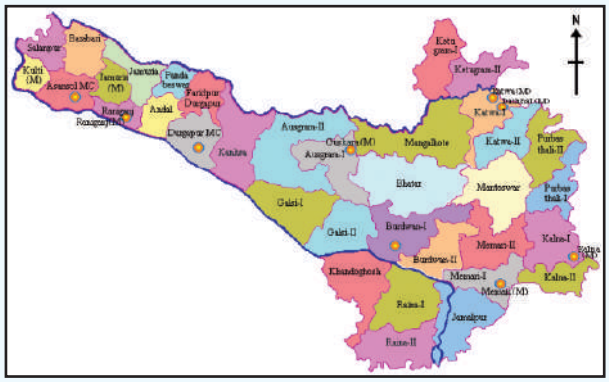
1. Area : 4736 sq.km.
2. Longitude & Latitude : 87°46′34.8132″ E
   21°56′14.2368″ N
3. Agro-climatic region : New Alluvial
4. Soil type : Clayey - 11%
   Clayey - loamy- 87%
   Loamy sandy - 2%
5. Annual Rainfall : 1746.6 mm
6. Population (Census 2011) : 50,94,238
7. Population density per sq.km. : 1,076
8. Literacy rate : 87.66%
9. Cultivable land : 295.67 thousand ha
10. Cropping intensity : 178%
11. Irrigated land : 1,45,917 ha (48%)
12. Vindya alluvium : 1,22,921 ha
13. Coastal alluvium : 1,81,879 ha
14. Saline (Mild) : 8,640 ha
15. Flood prone : 56,050 ha



It was formed on 1 January 2002 after the Partition of Midnapore into East Medinipur and West Medinipur. The state of Odisha is at the southwest border; the Bay of Bengal lies in the south; the Hooghly river and South 24 Parganas district to the east; and Howrah district to the north-east. East Medinipur district is part of the lower Indo-Gangetic Plain and Eastern coastal plains. Topographically, the district can be divided into two parts – (a) almost entirely flat plains on the west, east and north, (b) the coastal plains on the south. The vast expanse of land is formed of alluvium and is composed of younger and coastal alluvial. The elevation of the district is within 10 metres above mean sea level. The district has a long coastline of 65.5 km along its southern and south eastern boundary. Five coastal Blocks, namely, Khejuri II, Contai II (Deshapran), Contai I, Ramnagar I and II, are occasionally affected by cyclones and tornadoes. Tidal floods are quite regular in these five Blocks. Normally floods occur in 21 of the 25 Blocks in the district. The major rivers are Haldi, Rupnarayan, Rasulpur, Bagui and Keleghai, flowing in north to south or south-east direction. River water is an important source of irrigation. The district has a low 899 hectare forest cover, which is 0.02% of its geographical area.

Gangetic New Alluvial sub region

Bardwan district at a glance



1. Area : 7024 Sq.km.
2. Longitude & Latitude : 86°48' to 88°25' East
   22°56' to 23°53' North
3. Agro-Ecological Situation (AES) : **AES I:** Gangetic and New Alluvium Region
   Average annual rainfall 1300-1600 mm,
   Soil type- sandy loam, clay and clay loam,
   good water holding capacity, neutral to acidic soil with good fertility.
   AES II: Vindhya or Old Alluvium
   Region Average annual rainfall 1300-1500 mm,
   Soil type- sandy loam and clay loam,
   good water holding capacity, neutral to acidic soil with good fertility
   AES III: Red, Lateritic and Dry Region
   Average annual rainfall 1100-1400 mm,
   Soil type- sandy loam, coarse in texture, undulating land, medium to highly acidic soil
4. Annual rain fall : 1333 mm
5. Population (Census 2011) : 77,23,663
6. Population density per sq.km. : 1,100
7. Literacy rate : 88.62%
8. Net cropped area : 4,58,510 ha
9. Cropping intensity : 173 %
10. Irrigated land : 3,31,650 ha

The district both being an agrarian as well as industrial one, fairly large area in the district (25.2%) is under non-agricultural use. The district has only 4.14% area under forest. Main crops of the district are autumn rice, winter rice, summer paddy, jute, potato, mustard and sesame, sugarcane and vegetables. The district of West Bengal leads the table in the country so far as rice production is concerned and among its' districts Barddhaman is on top which is why the district is known as the 'Rice bowl of India'.

Gangetic New Alluvial sub region

Hooghly district at a glance

1. Area : 3,149 sq.km.
2. Longitude & Latitude : 87°30′20" to 88°30′15" E
   20°30′32" to 23°1′20" N
3. Agro ecological situation : Agro-Ecological Zone 15.1 described as "Bengal Basin", hot moist, sub-humid Agro-Ecological Sub-region
4. Soil type : Gangetic Alluvial Soil
   Vindhya Alluvial Soil
5. Annual Rainfall : 1500 mm
6. Population (Census 2011) : 5,520,389
7. Population density per sq.km. : 1,800
8. Literacy rate : 82.55%
9. Cultivable land : 2,23,390 ha
10. Cropping intensity : 241%
11. Irrigated land : 1,69,761 ha
12. Major farming system : Rice- Rice- Jute
    Rice- Potato- Sesame
    Rice- Vegetables- Rice
    Rice- Potato- Rice + livestock and fisheries

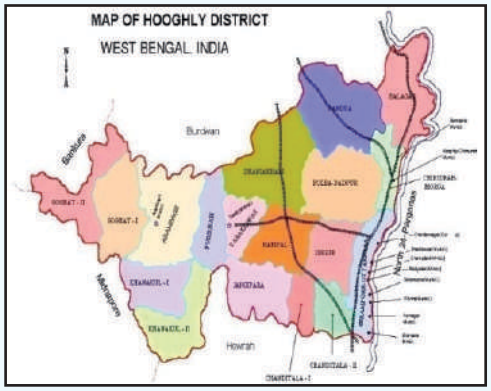


Table 15: Average income of the farmers in the district

Sl. No.	Category of Farmer	Percentage (%)	Average annual income (in ₹.)
1.	Marginal (0-1 ha)	86.00	54,000.00
2.	Small (1-2 ha.)	11.70	1,20,000.00
3.	Semi-Medium (2-4 ha.)	0.33	3,00,000.00
4.	Medium (4-10 ha.)	1.80	3,60,000.00
5.	Large (More than 10 ha.)	0.00	0.00

Hooghly is one of the most important industrial districts of West Bengal with numerous factories flanking the Bhagirathi, but its basic rural characteristics still remains where not less than 70% of its total population depends on Agriculture and its position as one of the major producers of cereals in the State. With highly fertile alluvial soils, well developed irrigation infrastructure, the district can safely be called as an agriculturally advanced district. Hooghly is one of the most economically developed districts in West Bengal. It is the main jute cultivation, jute industry, and jute trade hub in the state. The jute mills are along the banks of the river Hooghly in Tribeni, Bhadreswar, Champdani and Sreerampur. The benefits of intensive agriculture, however is confined to a few crops especially rice and potato and to an extent vegetables.

Gangetic New Alluvial sub region

Howrah district at a glance

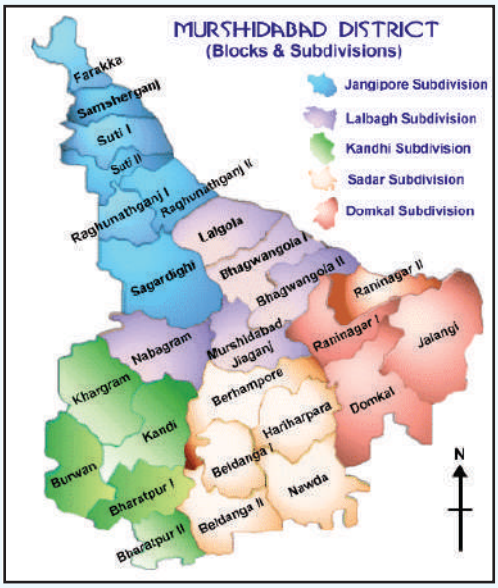
1. Area : 1,467 sq.km.
2. Longitude & Latitude : 88°232 E to 87°502 E
   22°482 N to 22°122 N
3. Agro ecological situation : i. Gangetic Alluvial Region
   - Soil type Loamy & clay loam
   - Soil pH : 6-7.2
   - Major crops: Paddy, sesame, ground nut, green gram, vegetables mustard etc.
   - Cropping intensity : 191%

   ii. Vindhya Alluvial Region
   - Soil type Loamy & sandy loam,
   - Soil pH : 5.5-7.0,
   - Major crops: Paddy, mustard, sesame, ground nut, green gram, vegetables, khesari etc.
   - Cropping intensity : 250%

   iii. Vindhya Alluvial & Coastal Saline Region
   - Soil type clay & Loamy
   - Soil pH : 5.5-7.5
   - Major crops: Paddy, sesame, ground nut, green gram, vegetables sunflowers, betel vine, flowers etc.
   - Cropping intensity : 173%
5. Annual Rainfall : 1461 mm
6. Population (Census 2011) : 48,41,638
7. Population density per sq.km. : 2913
8. Literacy rate : 83.85%
9. Cultivable land : 1,21,791 ha

Gangetic New Alluvial sub region

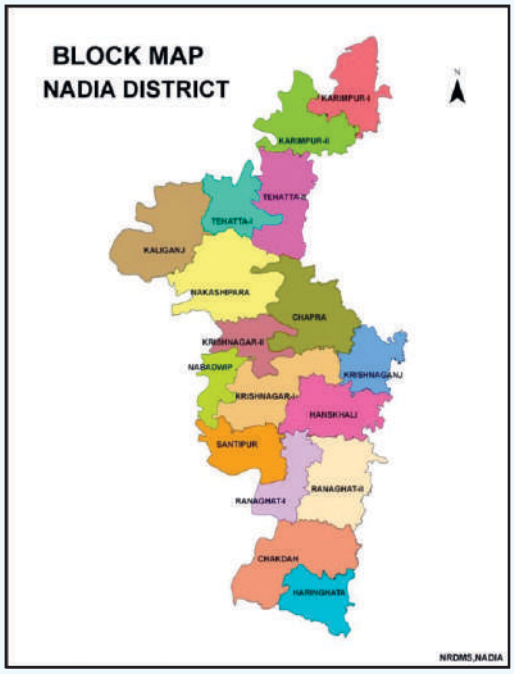
Murshidabad district at a glance



1. Area : 5,341 sq.km.
2. Longitude & Latitude : 87°49′17″ to 88°46′ E
   23°43′30″ to 24°50′ 20′ N
3. Agro ecological situation (AES) : **AES- I :** Old Alluvial Soil
   AES- II : Lateriate light Soil
   AES- III : New Alluvium Soil
4. Soil type : **AES- I :** Old Alluvial Soil- Moderate fertile
   AES- II : Lateriate light Soil- Less fertile.
   Reddish colour undulating topography
   AES- III: New Alluvium Soil
   Highly fertile
5. Annual Rainfall : 1300 mm
6. Population (Census 2011) : 71,02,430
7. Population density per sq.km. : 1,334
8. Literacy rate : 67.53%
9. Net cultivable land : 3,65,000 ha
10. Cropping intensity : 233.5%
11. Irrigated land : 60%
12. Major crops grown : Paddy, jute, wheat, oil seeds, vegetables, mangoes and pulses
13. Economics : The economics of the district is based on agriculture, handicrafts and sericulture. The Murshidabad Silk for making saris and scarves, is world famous.

Gangetic New Alluvial sub region

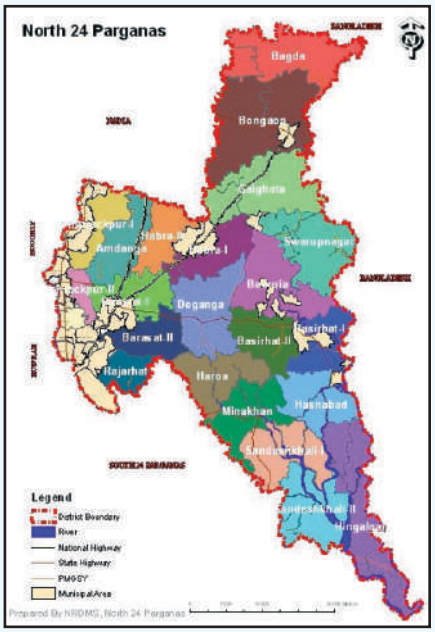
Nadia district at a glance



1. Area : 3,927 sq.km.
2. Longitude & Latitude : 22°08‘10“ to 88°48‘15“ E
   22°52‘3“ and 24°05‘40“ N
3. Agro ecological situation : Medium and low land situation
4. Soil type : Sandy loam
   (a) Up land
   (b) Medium land
   Clay
   (a) Low land
   pH varies from 6.5-7.5
5. Annual Rainfall : 1,401-1,671 mm
6. Population (Census 2011) : 51,68,488
7. Population density per sq.km. : 1,316
8. Literacy rate : 75.58%
9. Net cropped area : 272,135 ha
10. Cropping intensity : 268 %
11. Irrigated land : 79.48%
12. Major farming systems
    I. Agriculture and Horticulture-based farming system,
    II. Fish based production system,
    III. Livestock based production system

Gangetic New Alluvial sub region

North Parganas district at a glance

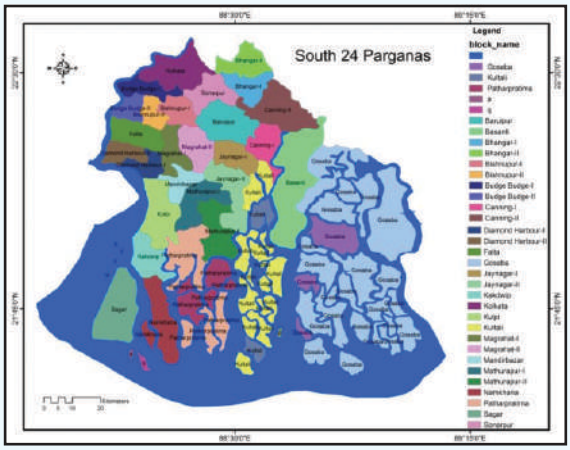


1. Area : 4,094 sq.km.
2. Longitude & Latitude : 88°20′ to 89°5′ E
   22°11′6′′ to 23°15′2′′ N
3. Agro ecological situation (AES) : **AES I :** It covers Bongaon, Bagdah, Gaighata and Swarupnagar Blocks. Since it is a basin area, it is permanently flood prone.
   AES II : It covers Amdanga, Barasat-I, Barasat-II, Barrackpore-I, Barrackpore-II, Habra-I, Habra-II, Rajarhat, Deganga, Basirhat-I, Basirhat-II and Baduria. The soil is highly fertile.
   AES III : It covers Sandeshkhali-I, Sandeshkhali-II, Haroa, Minakhan, Hingalganj, and Hasnabad. Due to salinity, most of the areas remain fallow during Rabi and pre-kharif season.
4. Soil type : Sandy loam, Loamy, Clay, Clay loam
   pH varies from 6.5–8.5.
5. Annual Rainfall : 1,200-1,500 mm
6. Population (Census 2011) : 90,25,832
7. Population density per sq.km. : 2,463
8. Literacy rate : 84.95%
9. Cultivable land : 2,71,845 ha
   Net cropped area : 2,64,952 ha
10. Cropping intensity : 180 %
11. Irrigated land : 1,67,128 ha
12. Major farming systems I. Agriculture and Horticulture-based farming system,
    II. Fish based production system,
    III. Livestock based production system

Costal Saline sub region

South Parganas district at a glance

Geographical area	9,96,000 ha
Longitude & Latitude	88°3′45′′ to 89° 4′50" E 21° 29" to 22° 33′45" N
Forest	15,566 ha
Gross cropped area	5,78,053.5 ha
Cultivable area	3,68,197 ha
Area under more than crop	2,18,205 ha
Area under than double crops	11,150 ha
Net cropped area	3,68,197 ha
Cropping intensity	159%
Current fallow area	35,275 ha
Soil Texture	Clay, Clay-loam, Sandy-loam
Net irrigated area	95,695 ha
Annual Rainfall (average)	1643 mm to 1787.5 mm
Total population (Census 2011)	8,161,961
Male	4,173,778
Female	3,988,183
No. of Agricultural Families	3,97,759
No. of Small Farmers	79,552
No. of Marginal Farmers	2,54,566
No. of Agricultural Laborers	4,44,692



Average income of the farmers in the district:

Category of Farmer	Annual Income (Rs.)
Marginal	95,988/-
Small	1,31,988/-
Medium	1,79,988/-

South Parganas District is comprised of two Agricultural Sub-divisions namely Alipore and Diamond Harbour. Presently there are five administrative Sub-divisions (Alipore, Baruipur, Canning, Diamond Harbour and Kakdwip), 29 blocks consisting of 312 Gram Panchayats and 7 Municipalities. South 24 Parganas is, indeed, a complex district, stretching from the metropolitan Kolkata to the remote riverine villages in the south up to the mouth of Bay of Bengal. The average temperature in the district varies from a maximum around 38 C to a minimum of around 13.5 C. The annual rainfall average 1800 cm, more than 75 percent of which comes during the monsoon. Nor 'westers from March to May and the Bay Cyclones from mid-June to mid-November ravage the land every year. Agriculture, Industry and Pisciculture are the major economical support of this district.

Undulating Red and Laterite sub region

Bankura district at a glance

1. Area : 6,788 sq.km.
2. Longitude & Latitude : 86°36' to 87°46' E
   23°38' to 22°38' N
3. Agro ecological situation : I. Uplalnd, undulated with steep to moderate slope,
   II. Medium land with moderate slope,
   III. Low land with minimum slope
4. Soil type : Sandy, Sandy loam, Loamy, Sandy clay loam, Clay loam, Clay (including sandy clay & silty clay)
5. Average Annual : 1216 mm
6. Population : 35,96,292
7. Population density per sq.km. : 520
8. Literacy rate : 70.95%
9. Net cultivable area : 4,30,000 ha
10. Net cropped area : 3,48,129 ha
11. Cropping intensity : 147%
12. Irrigated land : 46%

Drought constitutes a major hazard in the district. Intermittent gaps of precipitation and moisture stress during the monsoon gives rise to serious setback in production during the Kharif, which is the main stay of agriculture in the district.

Major farming systems :

Resource rich farmers : a) Crop based backyard poultry – Goat rearing/ seasonal fish farming.
b) Crop based – Dairy husbandry – Goat rearing.
c) Crop based backyard pig rearing and backyard poultry rearing / Goat rearing.
d) Crop based backyard poultry rearing and goat rearing.

Resource poor farmers : a) Land based backyard pig rearing and backyard poultry rearing / Goat rearing.
b) Land based backyard poultry rearing and goat rearing

Undulating Red and Laterite sub region

Birbhum district at a glance

1. Area : 4,545 sq.km.
2. Longitude & Latitude : 87°5′25″ to 88°1′40″ E 23°32′ to 24°35′ N
3. Agro climatic zone : I. Gangetic Alluvial Zone, II. Vindhyan Alluvial Zone, III. Undulating Red and Laterite Zone
4. Soil type : loam to clay loam (pH- 4.5-6.5), Sandy to sandy clay (pH- 5.2-6.5) and Clay to clay loam (pH- 4.8-6.5)
5. Average Annual Rainfall : 1453 mm
6. Population (Census 2011) : 3,502,404
7. Population density per sq.km. : 770
8. Literacy rate : 70.68%
9. Net cropped area : 3,20,610 ha
10. Cropping intensity : 171%
11. Irrigated land : 54.58%

Often called "the land of red soil, Birbhum is noted for its topography and its cultural heritage. The Visva Bharati University at Santiniketan, established by Rabindranath Tagore, is one of the places Birbhum is internationally renowned for. Birbhum is primarily an agricultural district with around 75% of the population being dependent on agriculture. Major crops produced in the district include rice, legumes, wheat, maize, potatoes and sugar cane. Principal industries of the district include cotton and silk harvesting and weaving, lac harvesting, stone mining and metalware and pottery manufacture. Birbhum is a major centre of cottage industries. Some of the notable forms of cottage industries of Birbhum include textile- especially cotton and locally harvested tussar silk, jute works, batik, kantha stitch, macramé (weaving by knotting threads), leather, pottery and terracotta, solapith, woodcarving, bamboo and cane craft, metal works and tribal crafts.

Major farming systems/enterprises

Sl. No.	Farming system/enterprise
1	Upland- Paddy, red gram, fruit crops
2	Medium land-Paddy, mustard, potato, sugarcane, sesame, black gram, vegetables, fruit crops, cow, goat, backyard poultry, fishery
3	Lowland- Paddy, sugarcane, wheat, potato, vegetables, duckery, fishery

Undulating Red and Laterite sub region

Purulia district at a glance

1. Area : 6,259 sq.km.
2. Longitude & Latitude : 85.75° to 86.65° E
   22.60° to 23.50° N
3. Agro climatic zone : Red & Lateritic
4. Soil type : i. Shallow to moderately deep coarse loamy fine loamy soils (hillocks, gravelly situation),
   ii. Moderately deep to deep coarse loamy to fine loamy red soils,
   iii. Shallow to moderately deep loamy soils
   Soils are mostly acidic in nature and pH varies from 5 to 6.5.
5. Average Annual Rainfall : 1375 mm
6. Population (Census 2011) : 29,27,965
7. Population density per sq.km. : 470
8. Literacy rate : 64.48%
9. Net cropped area : 3,17,000 ha
10. Gross cropped area 3,74,000 ha
11. Cropping intensity : 123 %
12. Gross irrigated area : 231,000 ha

In 2006, the Ministry of Panchayati Raj named Purulia one of the country's 250 most backward districts (out of a total of 640). Purulia district is drought prone district. The economy of the Purulia district is mainly driven by the industrial sector and tourism. The industrial sector is the backbone of the economy of the district. This district has attracted investments in steel, cement and power sectors. Among small scale industries, the lac industry and sericulture industry is another major source of income of this district. Purulia produces 90% of the lac produced in West Bengal. Lac is cultivated in all the blocks of Purulia. Sericulture industry is supported by the ample amount of caterpillar larvae as raw materials. Tourism is another source of income for this district. Forests, hillocks, rivulets, streams, wild life, flora and fauna have tremendous scope to be explored by the tourist.

Table 20: Major farming systems/enterprises

Farming system/enterprise
Very high unbunded upland- Forest/ Orchard/ (Blackgram/ Red gram/ Groundnut/ Niger/ Maize/ Bajra/ Vegetables) – fallow-fallow
Bunded Uplands- Kharif Paddy-fallow - fallow/ Kharif Paddy- Mustard / Vegetables -Fallow
Bunded Medium land – Kharif Paddy- Fallow / Kharif Paddy- Wheat/ Mustard - Fallow
Bunded Lowland – Kharif Paddy –Fallow-Fallow / Kharif Paddy – Summer Paddy-Fallow/ Kharif Paddy – Gram/ Lentil/ Lathyrus –Fallow.

Undulating Red and Laterite sub region

West Medinipur district at a glance

1.	Area	: 9,345 sq.km.
2.	Longitude & Latitude	: 87.3811° E 22.4080° N
3.	Agro ecological situation (AES)	: AES-I: Vindhya Alluvial and part red latiritc soil of 6 blocks of Midnapur sadar. AES-II: Vindhya Alluvial soil comprises of 5 blocks of Ghatal. AES-III: Red laterietic soil comprises of 8 blocks of Jhargram. AES-IV: Vindhya Alluvial and part red latiritc soil of 10 blocks of Kharagpur.
4.	Soil type	: I. Red & Lateritic soil: pH varies from 4.8 to 6.6. II. Vindhya Alluvial soil: pH varies from 5.5 to 7.2. III. New Alluvial Soil: pH range 5.8 – 6.6.
5.	Average Annual Rainfall	: 1300 – 1500 mm
6.	Population (Census 2011)	: 59,43,300
7.	Population density per sq.km.	: 640
8.	Literacy rate	: 79.04 %
9.	Net cropped area	: 5,95,210 ha
10.	Gross cropped area	: 10,15,141 ha
11.	Cropping intensity	: 170.55 %
12.	Net irrigated area	: 340394 ha (57.19%)
13.	Major farming system	i. Rice-Potato-Sesamum ii. Rice-Mustard-Vegetable/Moong iii. Rice-Rice-fallow iv. Rice-Groundnut-fallow v. Matstick /Betelvine/ flowers (perennial) vi. Rice-red gram/ black gram-fallow vii. Rice-vegetable-vegetable+ livestock and fisheries

West Medinipur district is subject to both floods and drought. Flood prone area is about 142647 ha (Ghatal and part of Kharagpur Sub-Division) and drought prone area is about 335248 ha (Jhargram, Kharagpur and Medinipur Sadar Sub-Division). The drought situation is particularly severe in Jhargram subdivision. Water logging during the rainy season affects much of the area. It is a backward district in the State.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