PRECISION FARMING DEVELOPMENT CENTRES (PFDCS)

Footprints of success

National Committee on Precision Agriculture & Horticulture (NCPAH)

Ministry of Agriculture & Farmers Welfare

Government of India

Contents

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कृषि एवं किसान कल्याण मंत्री
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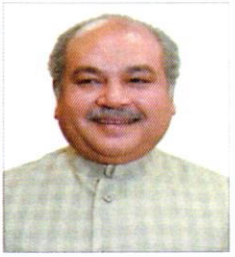
MINISTER OF AGRICULTURE & FARMERS WELFARE
GOVERNMENT OF INDIA
KRISHI BHAWAN, NEW DELHI

सत्यमेव जयते

आज़ादी का अमृत महोत्सव



MESSAGE

Indian agriculture has achieved self-sufficiency and today takes pride in not only meeting the needs of our population but also playing a major role in agricultural trade.

I would like to inform that agricultural growth remains one of the top most priorities for our Government and we are addressing the concerns of our farming community with renewed focus by ensuring technology transfer to farmers, generate employment both on and off the fields and to sustain agricultural development as well as to strengthen the country's nutritional and food security.

I am happy to learn that Precision Farming Development Centres (PFDCs) located in varied agro-climatic regions of the country are continually supporting the growers by way of conducting new & innovative research to enhance productivity and to uplift the well-being of the Indian farming community.

I hope this publication on Footprints of success will be a stepping-stone towards promoting precision farming & plasticulture applications under various central sector missions and would help to bring a revolution in agricultural community of the country.

(Narendra Singh Tomar)

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सत्यमेव जयते

आज़ादी का अमृत महोत्सव

भारत सरकार
कृषि एवं किसान कल्याण मंत्रालय
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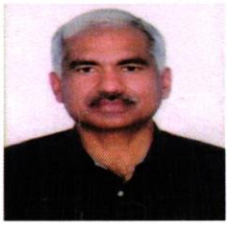

MESSAGE

India is bestowed with diversified agro-climatic conditions and varied soil types which makes India an agrarian economy. Growing demand to feed the inhabitants of rural and urban India is a major challenge for the research community to develop soil-based/ crop-based field technologies addressing the sustainability of the food basket and to have footprints on the global agricultural map by producing quality of Agri./Horti produce.

Advent of Plasticulture Applications coupled with precision farming techniques have proved beneficial to the farmers of the country supported through structured applied research by Precision Farming Development Centres (PFDCs) located at ICAR Institutes, IIT and SAUs of national level repute.

I have no doubt that this very sector and contribution made by plasticulture experts have helped the Indian farmers to achieve diversified and inclusive growth along with better livelihood for rural Indians. It had not only provided enhanced productivity but also generated employment opportunities for rural youth of the country.

The vision of Government to achieve doubling of farmer's income could only be possible by adoption of such technology-led interventions.

I hereby convey my best wishes to team NCPAH led by Dr. Prabhat Kumar, Member Secretary, NCPAH & Horticulture Commissioner, MoA & FW, GoI in bringing out this publication at the right moment to popularise these technologies at national level.
I hope the readers will benefit with this publication.

(Manoj Ahuja)

29th Day of August, 2022

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Dr. Prabhat Kumar
बागवानी आयुक्त
Horticulture Commissioner
Member Secretary (NCPAH)

सत्यमेव जयते

भारत सरकार
कृषि एवं किसान कल्याण मंत्रालय
कृषि एवं किसान कल्याण विभाग
Government of India
Ministry of Agriculture & Farmers Welfare
Department of Agriculture & Farmers Welfare

FOREWORD

Agriculture being the mainstay for India deploys 70 per cent of the population in varied horizons to sufficient food, feed & fibre. Due to accelerated growth of cities with change of food habits alarms to grow more with limited resources to have sustainable food reserves for feeding the gruelling population.

Precision Farming Practices coupled with Plasticulture inputs have proved to be driving force to cope-up with this task by introduction of application oriented research conducted by state-of-the –art Precision Farming Development Centres (PFDCs) which are housed at varied agro-climatic regions in ICAR Institutes, IIT and State Agricultural Universities to cater the need of developing real-time field protocols for producing more per unit area, by adoption of precision farming techniques, to enhance the productivity into many folds thereby increasing the returns from Agri./Horti produce.

These centres are monitored through national level agency of National Committee on Precision Agriculture & Horticulture (NCPAH) constituted by Ministry of Agriculture & Welfare, Government of India.

More than two decades 22 such PFDCs have been operating under the ambit of central sector programmes of Ministry of Agriculture & Farmers Welfare to bring out research recommendations for site-specific major crops with use of plasticulture applications for enhancing productivity & quality of produce in the region.

I am happy to learn that a consolidation of this is being brought out in form of Footprints of SUCCESS for enabling the growers to have insight on various recommendations that have been adopted from PFDCs research. The effort made herein will encourage the plasticulture frontiers to enhance more area under these technologies.

Kumar

(Prabhat Kumar)

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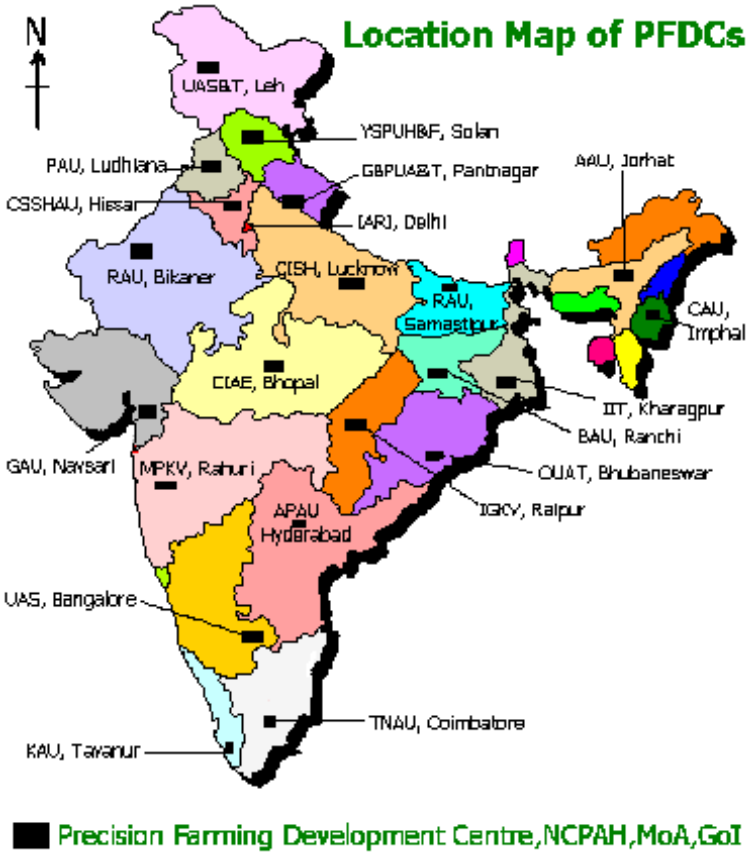
Introduction

The National Committee on Precision Agriculture & Horticulture (NCPAH), Ministry of Agriculture & Farmers Welfare, GoI, has been promoting use of various precision agriculture applications through its Precision Farming Development Centres (PFDCs) in India. PFDCs that promotes use of appropriate technologies in harmony with environment, which permits grass-root participation, use of local resources and builds capacity by involving all the channel partners such as KVKs, Horticulture Deptt. NCPAH gave support through 22 PFDCs housed in various institutions/ Agricultural Universities, and IIT, Kharagpur.

PFDC provides farmers friendly recommendations to end users as a business model for using these modern technologies such as precision farming technologies for agri/horti sector that promotes sustainable livelihood among small and marginal farm families. NCPAH has been instrumental through its PFDC and to become a link between technology and the end users who are small and marginal farmers. PFDC personnel provided the technical, managerial and marketing support to the end users for raising high value crops with the use of modern agricultural technologies. Some of the success made by end users by adopting these modern precision technologies are summarised below:

Precision Farming Development Centre (PFDC)



Footprints of Success

The plant is the teacher…, we learn from what we experienced from all our years that we farm. However, there is still a lot that we did not know! The modern method of cultivation that was transferred by PFDCs helped us to discover so many new things! Precision applications/technologies area providing scientific ways to learn and to improve our farm productivity.

Over the decades Ministry of Agriculture & Farmers Welfare have provided financial assistance under its flagship schemes with targeted objectives and goals which has benefitted many growers of India in upscaling their productivity and quantity of produce by adopting modern agri./horti. Practices and bringing change in their livelihoods.

Team NCPAH and PFDCs under the able guidance of Dr. Prabhat Kumar, MS (NCPAH) & Horticulture Commissioner, DA &FW, MoA & FW, GoI made an effort to consolidate this publication titled "Footprints of Success", for displaying the success reaped so far and to encourage more growers to adopt these technologies.

Just look at the amazing results achieved by adopting precision farming technologies!"

Greenhouse Cucumber: Harbinger of Prosperity

Anshul Malviya
Village - Khaparia, Block –Seoni Malwa
District - Hoshangabad
Madhya Pradesh
Contact No - 08109231536

Profile	
Age	27
Education	ME
Land Owner	Yes
Land on lease	NA
Farming Experience	Traditional farming
Annual Income	Rs.1.20 lakh

Shri Anshul Malviya, 27 Years old M.E student from Shri Govindram Seksaria Institute of Technology and Science, Indore M.P .He has Agriculture Land in Hoshangabad District Madhya Pradesh. His Family was cultivating traditional field crops in area of 6.05 acres that he owns. By cultivating Soybean during kharif and Wheat or Bengal gram in Rabi he was earning a net income of about One lac twenty thousand annually.

After he attended training programmes organized by PFDC one at Hoshangabad and after visiting PFDC, Bhopal experimental cum demonstration fields he was convinced of generating higher income from vegetable cultivation. He also went for training on horticulture at Institute of Technology Noida.

In the year 2014, with the help of state horticultural department he got subsidy (50 %) for installing Naturally Ventilated Poly house under NHM. PI PFDC visited his field and guided him for Polyhouse lay out and trellising of vegetable crop and all essential activities under poly house for vegetable production.

Technologies Intervention	
Technology adopted	Naturally Ventilated Poly house under NHM
Year of establishment	2014-15
Crop / Variety under technology	Cucumber (Var: rijkzwaan multi star rz F1
Area under crop/technology	1 Acre
Govt. Scheme / Self finance	NHM & Self finance

With the interaction with PFDC, Bhopal in subsequent visits, he was impressed with the plastic mulching technology and purchased plastic mulch film (silver colour) and Immediately after installation of Poly House in One Acre area in August 2014, he prepared beds sowing of Cucumber on 21 August 2014) under plastic mulching with drip irrigation system.

He produced about 31.48t Cucumber (variety: rijkzwaan multi star rz f1. Sold at market at an average price of Rs.14/ kg and after deducting the operational expenses of Rs 2, 28,200/- he got a net profit of Rs.2, 12,520.

Economics	
Yield of Cucumber	31.48t
Period	August to November
Average Sale price/kg	14
Gross revenue (Rs.)	440720
Cost of operational expenses (Rs.)	228200
Net Income (Rs.)	212520

As the market rate of cucumber in this season was high he sold it at a rate of Rs. 14/kg he recovered his recurring investment within 4 months by the adoption of drip irrigation with plastic mulching in Naturally Ventilated Poly house through cucumber cultivation. The farmer at present is cultivating same cucumber variety again in poly house He is disseminating the technology to other farmers.

In Greenhouse-Gerbera, cultivation is lucrative

Shri Rajkumar Ahirwar
Village - Gudaval, Block - Obdullaganj,
Tehsil -Goharganj, District –Raisen,
Madhya Pradesh
Mob - 08120609051

Profile	
Age	39
Education	10th
Land Owner	Yes
Farming Experience	Traditional farming
Income annually	Rs 0.20 lakh
Technologies Intervention	
Technology adopted	Naturally Ventilated Poly house
Area under crop/technology	500 Sqm
Year of establishment	2013-14
Crop / Variety under technology	Gerbera Six colour varieties
Govt. Scheme / Self finance	NHM & Self finance
Economics	
Yield of Gerbera	400 flowers per day
Period	December 2013-2014
Average Sale price/kg	3
Gross revenue (Rs.)	318000/-
Cost of operational expenses (Rs.)	200000/-
Net Income (Rs.)	118000/-

Shri Rajkumar Ahirwar, 39 Years old, 10th pass. He has Agriculture Land in Raisen District Madhya Pradesh. His Family was cultivating traditional field crops in area of 1 acre that he owns. By cultivating Soybean during kharif and Wheat or Bengal gram in rabi he was earning a net income of about twenty thousand annually.

Initially he was doing small grocery shop at Bhopal it was not so beneficial so in the year 2013 he sowed okra in his field and got One Lac income from One acre field then he was interested to grow horticulture crops.

He contacted Horticulture staff Raisen and attended a training at PFDC Bhopal for protected cultivation gaining. He got good exposure to various horticulture activities. In the year 2013, with the help of state horticultural department he got subsidy (50 %) for installing Naturally Ventilated Poly house under NHM in 500-m2 area.

In December 2013, he transplanted gerbera with different six colour varieties. He produced about 400 flowers per day and on average 1,06,,000 flowers were sold by him at Rs. 3 per flower at a total return of Rs. 3,18,000/- after deducting the operational expenses of Rs 2 00,000/- he got a net profit of Rs.1,18,000/-. Farmer is convinced of adopting plasticulture technologies such as Naturally Ventilated Poly house drip irrigation, for obtaining higher income through Gerbera cultivation.

Gerbera under Greenhouse: Signal of prosperity

Md. Asfaq

Village -ShahpurMadha
Block - Sanchi, District Raisen
Madhya Pradesh
Contact No - 09981338595

Profile	
Age	33
Education	10th
Land Owner	Yes
Farming Experience	Traditional farming
Income annually	Rs.0.50 lakh
Technologies Intervention	
Technology adopted	Naturally Ventilated Poly house
Area under crop/technology	2000 Sqm
Year of establishment	2013
Crop / Variety under technology	Gerbera with Six different colour.
Govt. Scheme / Self finance	NHM & Self finance
Economics	
Yield of Gerbera	1000 flowers per day
Period	December 2013-2014
Average Sale price/kg	3
Gross revenue (Rs.)	10,80,000
Cost of operational expenses (Rs.)	6, 00,000/-
Net Income (Rs.)	4,80,000/-.

Shri Mohd. Ashfaq, 33 Years old, 10th pass. He has Agriculture Land in Raisen District Madhya Pradesh. His Family was cultivating in area of 2 acres that he owns.

By cultivating Soybean during kharif and Wheat or Bengal gram in rabi and some horticulture crops like Zinger, Gladiolus, Guava etc. he was earning a net income of about fifty thousand annually.

He contacted Horticulture staff Raisen for training on Green house and attended training at PFDC Bhopal for protected cultivation. In the year 2013, with the help of state horticultural department

He got subsidy (50 %) for installing Naturally Ventilated Poly house under NHM in 2000 m^2 area in December 2013. He transplanted Gerbera with different six colour varieties. He produced about 1000 flowers per day and on average 3,.60.000 flowers were sold by him at Rs. 3 per flower at a total return of Rs. 10,80,000/- after deducting the operational expenses of Rs 6, 00,000/- he got a net profit of Rs.4,80,000/-.Initially Farmer face problem in summer season due to higher temperature. So as suggested by PFDC staff he Pasted Lime on Poly house roof. He was regular touch with PFDC staff Some Plant protection measures also told to him by PFDC staff. He is disseminating the technology to other farmers

Precision farming in Capsicum and Tomato

1. Name of Farmer: **Shri B. Ramesh S/o Shri Byrappa**
2. Education: SSLC Age:- 38
3. Address & (Mobile No.):Shivanarahalli village, Mulbagal taluk, Kolar district, Karnataka
   Mob No: - 8453069744, Karnataka
4. Crop / Technology Adopted:- Precision farming in capsicum and Tomato (Open condition)
5. Total Area under Crop /Technology: 3.00 Acre (1.2 ha)
6. Name of the Scheme & Detailsunder which subsidy availed or Own Source:
   i. Drip irrigation System installed under OFWM scheme (OFWM)
   ii. Precision farming in Capsicum and Tomato from NHM Scheme.
7. Month / Year (Installation of Drip irrigation System): 2013-14 & 2014-15
8. Total Costs of System: 3.00 lakhs
9. Total Yield: capsicum 90 tons & Tomato 85 tons sold at Rs. 25-30 per kg for Capsicum and Rs. 6-15 per kg for Tomato.

The farmer has good landholding and irrigating crop by flood irrigation he is not able to cultivate whole of his land. The water scarcity also results in low yield which was not giving good returns to the farmers even though tomato & capsicum is a cash rich crop of the region. The farmer attended Farmers' training programme on Precision Farming organized by Precision Farming Development Centre, UAS, Bangalore.

Thereafter, he applied for drip irrigation system under OFWM scheme, installed in 1.2 ha area bigha in 2013-14, and planted Tomato & Capsicum. With the help of modern drip irrigation system, he was able to increase the yield of the crop and get good return.

Technologies Intervention	
Technology adopted	Drip irrigation system under OFWM scheme
Area under crop/technology	1.2 ha
Year of establishment	2013-14
Crop / Variety	Capsicum and Tomato
Govt. Scheme / Self finance	NH & Self finance
Economics	
Yield of Capsicum & Tomato	90 tons & 85 tons respectively
Period	2013-14 & 2014-15
Average Sale price (Rs./kg)	25-30- Capsicum & 6-15 Tomato

The impact and socio economics benefits- With the encouraging yield of Tomato and capsicum Mr. Ramesh got the good price for his commodity and purchased the 2 acre of land and a motorbike.

Drip irrigation in Banana

K.M Nanjundappa

Village –Kilagani, Mulbagal taluk

Distt. – Kolar, Karnataka

Contact No - 09535071315

1. Name **of Farmer /** Beneficiary: Shri K. M. Nanjundappa
2. Education: 7th Age: 48
3. Address & (Mobile No.): Kilagani village, Mulbagal taluk, Kolar District, Karnataka. 9535071315
4. Crop / Technology Adopted: Drip Fertigation to the Elaki Banana
5. Total Area under Crop /Technology: 2.00 Acre (0.8 ha)
6. Name of the Scheme under which subsidy availed or Own Source: Drip installed under OFWM Scheme. Banana suckers are planted on his own source.
7. Month / Year (Installation of System): 2013-14 & 2014-15
8. Total Costs of System: Rs 1.50 lakhs
9. Total yield - Total yield is 29 tons (Avg. bunch weighs nearly 15-18 kg.) and sold at Rs. 8.50 per Kg. and earn Rs 246500/-

Beneficiary visited in Kisan mela where Precision Farming Development Centre (PFDC), Bangalore has setup stall to display the latest technologies related to Precision Farming and Plasticulture applications for mass awareness. PFDC staffs elaborately explained the precision farming technologies viz., Drip irrigation, Fertigation, Plastic mulching etc. and shared information on Government schemes for promotion of various plasticulture applications.

After that beneficiary attended customized training programme organized by PFDCs, get motivated, and adopted drip irrigation system for Banana under OFWM scheme through horticulture department of Karnataka.

The impact and socio economics benefits - After adoption of Drip irrigation system in Banana he got good yield and good price for his produce and he cleared the loan amount and constructing the small house in the farm itself. Now he was planning for second crop in the same field.

Drip irrigation in Chilli

Nandlal Gurjar

Village –Moharakakhed, Asind

Distt. – Bhilwara, Rajasthan

Contact No - 9928012125

1. Name of Farmer / Beneficiary:**Shri**NandlalGurjar
2. Education: Age: 36
3. Address: Moharakakheda Tehsil- Asind, Disst. Bhilwara, Rajasthan, Mob no: 9928012125
4. Crop / Technology Adopted: Chilli/ Drip Irrigation
5. Total Area under Crop / Technology: 1 ha.
6. Name of the Scheme & Details under which availed or Own Source: Availed subsidy under National Mission on Micro Irrigation (NMMI).
7. Month / Year (Installation of System): August 2012
8. Total Costs of Drip irrigation System: Rs. 40000/-
9. Total Yield- 32000 kg, Rs / Kg- 12 , Costs of Production- 156000, Net return- 228000 and Return of Investment (RoI): 6 months

Due to scarcity of water in his tube well farmers are not able to irrigate the total available land hence getting less realization. Meanwhile he contacted Precision Farming development Centre, RAU, Bikaner and get trained and knows various plasticulture technologies in detail including micro irrigation and fertigation. After that in the collaboration with PFDC, RAU, Bikaner he adopted all the drip irrigation system in his own farm under National mission on micro irrigation through State. On his request during training conducted by PFDC, Bikaner. The PFDC staff visited his farm and gave technical advice regarding proper operation and maintenance of micro irrigation system installed at field and suggested him to grow cash/vegetable crops under drip irrigation system.

Scheme and Eco-Socio Benefits: by adopting the package of practices developed by PFDC Bikaner for cultivation of chilli under drip irrigation system the farmer was able to harvest more yield from same piece of land apart from cultivating additional area due to water saving by use of micro irrigation.

Strawberry Cultivation under Drip irrigation & Mulching

Shri Jagdish Prajapat

Village –BagedaMamadev, Block-Nimbaheda
Distt. - Chhitorgarh Rajasthan
Contact No - 09784943055

1. Name of Farmer / Beneficiary: Shri Jagdish Prajapat
2. Education: Age: 48 Gender: M
3. Address & (Mobile No.): Village- BagedaMamadev, Teh- Nimbaheda, Disst. Chhitorgarh, rajasthanMobile No. 9784943055
4. Crop / Technology Adopted: Strawberry/ Mulch with Drip irrigation system
5. Total Area under Crop / Technology: 0.4 ha.
6. Subsidy availed under National Horticulture Mission(NHM)
7. Month / Year (Installation of System): 2013
8. Total Costs of System: Rs 60000/-
9. Total Yield- 3400 kg, sold at Rs 150 per kg, Costs of Production- 328000, Net return- 182000 and Return of Investment (RoI); Six Month

Technologies Intervention	
Technology adopted	Mulch with Drip Irrigation System
Area under crop/ technology	0.4 ha
Year of establishment	2013
Crop / Variety under technology	Strawberry
Govt. Scheme / Self finance	NMMI
Economics	
Yield of Strawberry	3400 kg
Period	2013
Average Sale price/kg	150
Gross revenue (Rs.)	510000
Cost of operational expenses (Rs.)	328000
Net Income (Rs.)	182000

The farmer inspired to use of mulch and drip system during his visit to PFDC, Bikaner and he installed this system on his field under the guidance of PFDC staff. This centre helped him in collecting the information a technology required for cultivation of strawberry.

Results / Impact of such successful adoption of farm practices &technology. Farmer grow strawberry by using plastic mulch resulted be grab high yield with high income as well as less cost and time also.

Tuberose Drip irrigation with plastic mulching

Mr. Mani

Village –Thaneerpandalthottam, Kolathupirivu
Bannari road, Sathyamangalam, Erode District
Tamil Nadu
Contact No - 09535071315

1. Crop		Tuberose (0.4 ha)
2. Technology adopted		Drip irrigation System & plastic mulching
3. Name of the Scheme under which subsidy availed	:	Micro irrigation scheme & NHM Government of Tamil Nadu, June 2012
4. Total cost of system	:	Rs. 1,25,000/-
5. Total Yield & Income	:	4.5 tonnes, Rs.5,40,000/-
6. Cost of production	:	Rs. 1,50,000/-
7. Net return	:	Rs. 3,90,000/-
8. Return of Investment (RoI)	:	One Year
9. How the Farmers / Beneficiaries knew about adopting precision farming practices & use of plasticulture application/s	:	Awareness programme conducted by PFDC, Coimbatore especially on plastic mulching techniques and other plasticulture applications. Beneficiary has participated in training programme conducted by PFDC Coimbatore and shared the information on Govt scheme for popularize Micro irrigation.
10. Results / Impact of such successful adoption of farm practices & Technology	:	In the farmer field, the growth parameters and flower yield in tuberose were enhanced by the combined effect of drip fertigation with plastic mulching over to conventional irrigation without mulch. The highest yield of 4.5 – 5 tonnes of loose flower yield and one lakh spike yield was recorded in drip fertigation with plastic mulching compared to conventional irrigation without mulch.
11. Farmers Feedback	:	The farmer found that moisture was conserved and weeds were not grown in the field due to the plastic mulches laid on the field. It helped in reduction of labour cost for weeding for the farmer. Since there are no weeds in and around the target plants, all the nutrients applied by fertigation are available only for the cultivated plant. Hence, the growth of the plant is better.

Drip irrigation & fertigation in Pomegranate

Mr. Thiru.C.Chennimalai

Village –Kothamangalam

Tamil Nadu

1	Crop / Technology Adopted	:	Pomegranate/ Drip irrigation and Fertigation
2	Total area under Crop / Technology	:	0.5 hectares
3	Name of the Scheme & Details under which availed or Own Source	:	Micro irrigation Scheme, Govt. of Tamil Nadu
4	Month / Year (Installation of system)	:	2011
5	Total cost of system	:	Rs. 40,000/-
6	Total Yield & Income	:	10 tonnes, Rs.5,00,000 /-
7	Cost of production	:	Rs. 80,000/-
8	Net return	:	Rs. 4,20,000/-
9	Return of Investment (RoI)	:	One year
10	How the Farmers / Beneficiaries knew about adopting precision farming practices:	:	Through Micro irrigation scheme, Government of Tamil Nadu
11	Results / Impact of such successful adoption of farm practices & Technology	:	The farmer says that there is an increase in the quantity and the quality of fruits in drip irrigation and fertigation system when compared to the conventional irrigation. The farmer got the yield of 11 tonnes and got the net return of Rs. 4, 70,000/-
12	Farmers feedback		According to the farmer, drip irrigation reduces the labour charges spent for weeding, ploughing to remove the weeds when compared to conventional irrigation system. There is also water and fertilizer saving of 30 percent in drip irrigation.

Vegetables under Greenhouse and Mulching

Rubul Hussain Chaudhary

Village –Bhomolahati

Distt. – Kamrup, Assam

Contact No - 08812079425

1. Crop / Technology Adopted: polyhouse/Mulching
2. Total Area under Crop / Technology: 5 bigha
3. Use Suitable Photograph – Crop / Technology:
4. Name of the Scheme & Details under which availed or Own Source: RKVY
5. Month / Year (Installation of System):2011
6. Total Costs of System: Rs. 6 lakhs only.

7. Return of investment (RoI) -Cost of production

Particulars	**Cost (Rs.)**
Polyhouse	600000
Subsidy	50%
Cost incurred by beneficiary for polyhouse	60000
Considering 5 years life span	12000
fertilizer/pesticides	5000.00
Sucker	1,96,000
Labours (180mandays@Rs.150)	27000
Total	2,40,000

Crop	**Total yield (piece/year)**	**Rs /piece**	**Total income (Rs.)**	**Return of investment (Rs.)**	**Net return (Rs.)**
Gerbera	1, 20,000	5	6, 00,000	2,40,000	3,60,000

8. How the farmers /beneficiary knew about adopting precision farming practices: He was very much interested in flower cultivation, but their production was limited to a certain period of the year only due to heavy rainfall and wind. Therefore, they were motivated to use polyhouse for year round cultivation of flowers like Gerbera, through PFDC training.
9. Results / Impact about crop /technology, Scheme and Eco-Socio Experiences etc.): After he started cultivating inside polyhouse, he was able to cultivate different flower crops under protected condition. As a result, both his yield and income increased many fold.

Plant propagation under Shadenet house

Md. Jallaluddin Ahmed

Village –Padupara, Distt. – Gaalpara, Assam

Contact No - 09859540784

1. Education: H.School Age: 55 Gender: Male
2. Plant propagation / Technology Adopted: Shade net house/drip irrigation/grafting in layering in fruit crops like mango, guava, litchi, cashew nut, sweet orange
3. Total Area under Crop / Technology: 8 bigha
4. Name of the Scheme & Details under which subsidy availed : Shade net house under HMNEH
5. Month / Year (Installation of System):2012
6. Total Costs of System: Rs 600000/-
7. Total yield, Rs/kg, cost of production, net return and return of investment (RoI)

Cost of production

Particulars	**Cost (Rs)**
Polyhouse	600000
Subsidy	50%
Cost incurred by beneficiary for polyhouse	60000
Considering 5 years life span	12000
fertilizer/pesticides	5000
Polybag	60000
Labours (1800mandays@Rs.150)	270000
Total	347000

Crop	**Total No of plants /year**	**Sale price Rs /plant**	**Total income (Rs.)**	**Return of investment (Rs.)**	**Net return (Rs.)**
Grafted plants	1, 00,000	20	20, 00,000	20,00,000	16,53,000

The beneficiary has participated in training programme conducted by PFDC, Guwahati and after getting exposure on various plasticulture applications and the subsidy scheme, he adopted shadenet house under HMNEH scheme for propagation of plant nursery. Now he is a specialised person mainly deals with layering and grafting of fruit crops like mango, litchi, guava, cashewnut, sweet orange and khasi mandarin inside shadenet house. Now he has turned out to be a very successful progressive farmer with a two star rating nursery in Goalpara district of Assam.

He is motivating the other small and marginal farmers to cultivate their crops as precision farming which gives a higher yield and income.

Pineapple cultivation under plastic mulching

Ch. Nabakumar Singh
Village –Wanghei, Imphal East
Manipur

1. Crop / Technology Adopted: Pineapple, Kew; Double row planting with Black polythene mulching
2. Total Area under Crop / Technology: 1 ha
3. Name of the Scheme & Details under which availed or Own Source: Own Source
4. Month / Year (Installation of System):
   Date of Transplanting: 13/03/2013
   Date of Harvest: 20/10/2014
5. Total Costs of System: Rs. 23,000.00
6. Total Yield, Rs / Kg , Costs of Production, Net return and Return of Investment (RoI) – (Total period = Month / Year):

Total Yield	**Rs / Kg**	**Total income**	**Costs of Production**	**Net return**	**Return of Investment Total period Month or Year**
21 t/ha	20.00	4,20,000.00	1,75,000.00	2,45,000.00	Within 1 year

7. How the farmers / Beneficiary knew about adopting precision farming practices & use of plasticulture application/s for achieving higher yield & income (**Narrate background, issues, challenges & solutions**)
   From training organized by PFDC, Imphal, through radio and T.V. talks given by P.I. (PFDC), and staff of PFDC, Imphal Centre .

By adopting new Technology under PFDC Programme (black plastic mulching of pineapple), income of the farmer was enhanced as compared to the conventional method. There is scope for further replication to more farmers, for which adequate fund is required.

Watermelon cultivation under low cost Polyhouse

Mr MaibamTomba
Village –Chingamakha Ningthoujam Leikei,
Imphal East, Manipur

1. Crop / Technology Adopted: Watermelon – Sugar Baby ; Low cost polyhouse
2. Total Area under Crop / Technology: 90 sqm. polyhouse
3. Use Suitable Photograph – Crop / Technology:
4. Name of the Scheme & Details under which availed or Own Source: Own source
5. Month / Year (Installation of System):

   Date of planting: 12/03/2014

   Date of harvesting: 30/06/2014
6. Total Costs of System: Rs.42000/-
7. Total Yield, Rs / Kg , Costs of Production, Net return and Return of Investment (RoI) – (Total period = Month / Year):

Total Yield	Rs / Kg	Total Income (Rs.)	Costs of Production (Rs.)	Net return (Rs.)	Return of Investment
1.9 t/90sqm	30.00	57000.00	*3000.00	54000.00	Within 3 -4 months

*expenditure towards Polyhouse construction excluded

8. How the farmers / Beneficiary knew about adopting precision farming practices: From training organized by PFDC, Imphal, through radio and T.V. talks given by P.I. (PFDC), and staff of PFDC, Imphal Centre.
9. Results / Impact of such successful adoption of farm practices & technology: By adopting new Technology under PFDC Programme (Low Cost Poly House and Soil Solarisation) income of the farmer was enhanced as compared to the conventional method. There is scope for further replication to more farmers, for which adequate fund is required.

Tuberose under Drip irrigation with plastic mulching

Mr .Anup Samanta
Village + P.O. – Radhamohanpur
District- PaschimMedinipur, West Bengal
Mob:9002107644

1. Crop / Technology Adopted: Tuberose (Pajjal)/ Drip irrigation, Mulching (Silver and black, 50 µ)
2. Total Area under Crop / Technology: 45 Decimal
3. Name of the Scheme & Details under which availed or Own Source: Self Financing*
4. Month / Year (Installation of System): March, 2008
5. Total Costs of System: Rs. 60,000/-
6. Return of Investment (RoI) – (Total period = Month / Year): 1 years 2 month = May, 2009

The village Radhamohanpur of Paschim Medinipur district is famous for flower cultivation. Farmers grow Marigold, Tuberose, Rose, Gerbera and many other flowers commercially. Irrigation is a major problem in this area because of light sandy soil as it has high infiltration rate. Flower crops require frequent application of water to maintain the moisture content at field capacity and it leads to more energy and labour consumption. To overcome the problem Mr. Samanta attended the training programme organized by PFDC Kharagpur in the year 2007 and he learnt the benefits of drip irrigation and plastic mulching technologies which would be easier to irrigate and save water and labour cost.

7. Major learning/s (Results / Impact):After installing the drip system and plastic mulch Mr. Samanta reported:
   - Reduced labour cost due drip irrigation system installation
   - Greater flower yield
   - Better quality of produce
   - Fertilizer saving
   - Effective use of nutrients
   - More profit

8. Feedback:-Sri Samanta stated that:
   - Decrease in labour cost due drip irrigation and plastic mulching.
   - Minimum disease, pest infestation.
   - Yield is doubled due to drip and plastic mulching.
   - Other farmers of the village are interested to adopt the technology

Gerbera cultivation under Greenhouse

Mr. Jugalkishor Jana

Village – Parbatipur, P.O. – Balak rout,
District- PaschimMedinipur, West Bengal
Mob. - +91 9732510848

1. Crop / Technology Adopted: Gerbera/Greenhouse, Drip irrigation, Fertigation, Foggers.
2. Total Area under Crop / Technology: 6000 m^2 (6 Nos. of saw tooth type greenhouse of 1000 m^2 each)
3. Name of the Scheme & Details under which availed or Own Source: National Horticulture Mission (availed subsidy 22% of total cost)
4. Month / Year (Installation of System): March, 2004
5. Total Costs of System: Rs. 54,00,000/-
6. Return of Investment (RoI) – (Total period = Month / Year):1 years 3 months

7. What made him / her to adopt precision farming practices & use of Plasticulture applications for achieving higher yield &income: Gerbera is a major cut flower among all the flowers grown in the country. It is cultivated in open field and under greenhouse conditions but the quality of flower is always superior under the greenhouse conditions. Sri Jana was cultivating many flowers from very early days. He experienced that in open field conditions it is very harsh to cultivate gerbera especially during rainy seasons. To get the good quality flowers throughout the year he fabricated the greenhouse in the year 2004. Today he harvests about 3400 numbers of good quality gerbera stick every day
8. Major learning/s (Results / Impact):After cultivating Gerbera under greenhouse Mr. Jana reported:
   - Greater flower yield
   - Better quality of produce and produce is also disease free than cultivating in open field.
   - Reduced labour cost due drip irrigation system installation inside the greenhouse.
   - Protection of crop from extreme weather conditions.
   - More profit
9. Feedback:- Sri Jana stated that:
   - His family is living happily because of increased income due the change in cultivation practices from open field to greenhouse.
   - Farmers of the nearby places visit these greenhouses and interested to construct polyhouses on their land.

Diversification with High Density of Planting

Shri Brahm Dev Singh

Village- Kodapur, Post- Diwanganj
District- Allahabad, U.P.- 212 402
Mob. 09919654630

1. Crop / Technology Adopted: Guava- High Density Planting/ Canopy Management, Intercropping, Organic farming, Vermicomposting, Gobar gas plant
2. Total Area under Crop / Technology: 2.0 Ha

Farmer being felicitated during conference of PFDC

3. Since 1967-68 the farmer was involved in traditional farming. He faced the problems of low production and poor income. He then ventured in to dairy farming. The increasing prices of the chemical fertilizers forced him to use the slurry of the plant was used as organic manure in the fields that gave good results. The slurry obtained from the gobar gas plant was used in the vermicomposting unit. He is producing about 150-200 ton vermi-compost per year from 28 beds. After attending the training programme conducted by PFDC, CISH, Lucknow he got exposure to High Density planting and canopy management in aonla and guava. He planted 1.25 ha of aonla and 1 ha guava under high density planting. By adopting proper canopy and fertilizer management practices under the guidance of PFDC he got encouraging results. The guava plants came into production within two years and yield of 3 tons was obtained.

4. Major learning/s (Results / Impact): Technologies developed by PFDC- ICAR-CISH, Lucknow viz. high density planting, intercropping, organic farming, disease and pest control for enhancing the production and quality in guava compelled the farmer to adopt these new technologies.

5. Feedback of beneficiary: Earlier the farmer was unaware of the new interventions in the field of guava production. High density planting, intercropping, Organic farming, vermicomposting, Gobar Gas plant, disease and pest control for enhancing the production and quality in guava compelled the farmer to adopt these new technologies. These technologies significantly improved their economic condition. The farmer also has made his plot as a demonstration plot for showcasing the technologies to other farmers during the visit programmes organized by the state horticulture department. Being a progressive farmer he has become an inspiration to the small farmers of the state.

6. The farmer is actively involved in extension activities and spreading the technology across U.P. through radio, TV, newspapers and magazines.

Hi-tech Nursery of Guava and its diversification

Mr. Shailender Kumar Raghuvanshi

Village and Post- Babiyaon, Block- Cholapur,
District- Varansai, Uttarpradesh

1. Crop / Technology Adopted: Guava Hi- tech Nursery / High Density Planting/ Canopy Management, Mulching& Greenhouse
2. Total Area under Crop / Technology: 4.5 Ha
3. Name of the Scheme & Details under which subsidy availed or Own Source: National Horticulture Mission
4. Month / Year (Installation of System): March, 2008-09
5. What made him / her to adopt precision farming practices: Earlier the farmer had a 35 year old guava plantation that was becoming almost senile. He lost his interest in guava production. After attending the training programme conducted by PFDC, CISH, Lucknow and was explained the tremendous results of the same he was quite excited and planted new 4 ha guava plantation under High Density planting system with drip irrigation and by adopting proper pruning schedule he is able to produce 226.8 tons of fruits per year. He was motivated for adopting rejuvenation technique as well. During his endeavor of planting of new orchard he faced problem in procuring the good quality plants in desired number. Therefore, he decided to put his own nursery in one hectare with 500 sqm. net house and 100 sqm poly house, so that, the other interested farmers can get good quality planting material. His nursery is supplying good quality plant to other states viz. Punjab, Haryana, Maharashtra, Madhya Pradesh and Andhra Pradesh etc. The nursery is recognized by U.P. Horticulture Department and 1 star by NHB. **Farmer being felicitated during conference of PFDC**
6. Major learning/s (Results / Impact):Technologies developed by PFDC- ICAR-CISH, Lucknow Drip irrigation, water harvesting and pond lining, high density planting, intercropping, disease and pest control, packaging for enhancing the production and quality in guava compelled the farmer to adopt these new technologies. The adoption of wedge grafting method can be used to propagate the plants throughout the year. This technique has a tremendous potential for multiplying saplings throughout the year. The farmer also has made many cooperative societies of guava producers and made them to produce guava products viz. jam, jelly, chees, cream, puree, powder and nectar and was involved in the exports of the same

7. Feedback of farmers: Earlier the farmer was unaware of the new interventions in the field of guava production. Drip irrigation, water harvesting and pond lining, high density planting, intercropping, disease and pest control, packaging for enhancing the production and quality in guava compelled the farmer to adopt these new technologies. These technologies significantly improved their economic condition. The farmer has created a Hi-tech nursery in the name of OM Hi-Tech Nursery, Pimpalgaon, Ahmadnagar, Maharashtra and is supplying the plants to other farmers in Maharashtra and other states. The farmer is actively

involved in extension activities and spreading the technology across Maharashtra through news papers, TV and magazines.

Precision Farming in Banana

Shri Mitesh Jayantibhai Patel
Village- Vanesa, Ta – Palsana
Dist – Surat, Gujarat
Mo. - 9825487406

1. Education: H.S.C. Age: 41 years Gender: Male
2. Crop / Technology Adopted: Banana / Tissue culture, Mulching, Drip-Fertigation and Sleeving
3. Total Area under Crop / Technology: 4.5 Ha
4. Name of the Scheme & Details under which subsidy availed or Own Source: National Horticulture Mission
5. Month / Year (Installation of System): March, 2009 to continue
6. Adopted Technology: Drip irrigation & Fertigation system and banana sleeve
7. Total Cost of System: Rs.120000
8. Total Yield: 95-110 t/ha Selling price: Rs. 6-7/Kg
9. Costs of production: Rs. 210000 – 220000/ha
10. Net return: Rs. 400000 – 420000/ha
11. Return of Investment: one year
12. How Farmer Adopted Technology? **:**

Due to continues planting of banana without using any plasticulture technologies, banana yield is decreased year by year. Meanwhile, he contacted PFDC, SWMRU, NAU, Navsari and get information about plasticulture technologies in detail viz; Mulching, Sleeving, Fertigation etc.

After that in the collaboration with PFDC, NAU, Navsari he adopted all the plasticulture technologies in his own farm as a demonstration of 1 ha. After getting good results, he adopted these technologies more in banana crop as well as in vegetable crops like brinjal and bitter gourd .

During adoption of these technologies, farmer confused for use of plastic mulch film and manages it, he get advice from PFDC, Navsari and successfully adopted this in banana.

Results/Impacts:

Particular	Before Adoption	After Adoption
Yield (t/ha)	70-80	95-110
Water saving (%)	-	30-40
Fertilizer saving (%)	-	25-35
Weed control (%)	-	70-80
Net return (Rs/ha)	285000	410000

13. Feedback of beneficiary: Mr. Patel stated that labour cost reduction by using drip irrigation and plastic mulching, Minimum disease and pest infestation, Yield is doubled due to drip and plastic mulching, good quality of produce and now other farmers of the village are interested to adopt the technology.

Rose Cultivation under Greenhouse

Shri Harishbhai Ranchodbhai Gavdi
Village- Ugata, Ta – Dharampur,
Dist – Valsad Gujarat
Mo. - 9586365688

1. **Crop / Technology Adopted:** Rose under Greenhouse & mulching and Drip-Fertigation is common for both the situations

   Situation a: Rose / Green house with high-density planting and Situation

b: Rose/ Mulching in open.

2. **Total Area under Crop / Technology:** 2.5 ha & 1 ha
3. **Adopted Technology:** Through NHM, PFDC and own interest
4. **System installation:** Year 2007-08 (mulching in open) and Year 2012-13 (green house)
5. **Total Cost of System:** Farmer Not known
6. **Total Yield :** (1) Mulching with open condition: 50000-60000 flowers/15 guntha **Selling price:** Rs. 2.5-3.0/ cut flower **Costs of production** : Rs. 50000 – 60000 /15 guntha **Net return** : Rs. 90000 – 100000 /15 guntha **Return of Investment** : one and half year

   Total Yield : (2) Green House 250000-300000 flowers/20 guntha **Selling price:** Rs. 2.5-3.0 / cut flower **Costs of production** : Rs. 300000 – 350000/20 guntha **Net return** : Rs. 300000 – 400000 /20 guntha

7. **Return of Investment**: one year

8. **How Farmer Adopted Technology?:**

Before 2007-08 farmer cultivate sugarcane crop and earn Rs. 40000-50000/acre

After that, he met Horticulture Officer Mr. Sumanbhai Gamit, he inspire him for cultivate the rose. Then, he stared rose cultivation in open condition with mulching and drip - fertigation system in 2007-08 and started greenhouse cultivation in 2012-13 with the help of SHM and PFDC officers.

Due to inexperience in cultivating of rose, he faced the sucking pest problems of mites and thrips and hence he hired the consultant for 2-3 years

After getting good experience, now he himself maintain the rose cultivation

Results/Impacts: Farmer told that, I can get income from 10 acre of sugarcane crop equal amount from 1 acre rose cultivation with the adoption of modern technologies.

Plant propagation under Plasticulture

Shri Harishbhai Ranchodbhai Gavdi
Village - Pipalgabhan, Ta – Chikhli,
Dist – Navsari, Gujarat
Mo. - 9825675262

1. Education: S.S.C Age: 67 years Gender: Male
2. Crop / Technology Adopted: Nursery Raising/Net House and MIS
3. Total Area under Crop / Technology: 2 ha /35 guntha
4. Adopted Technology: PFDC, NHM and own interest
5. System installation: Year 2002-03 to till date
6. Total Cost of the System: Rs. 1500000
7. Total Yield : Papaya 1.5-1.75 lacs plants/year Selling price: Rs. 10/plant, Hardening of banana tissue culture plant 4 lacs plants: Rs. 1/plant and Chilli-Brinjal 4 Lacs seedlings Selling price: Rs.1/seedling
   a. **Total costs of production:** Rs. 1350000-1400000/35 guntha
   b. **Net return:** Rs. 600000 – 700000/35 guntha
   c. Return of Investment: One year
8. **How Farmer Adopted Technology?**
   - He purchase seedlings from others before, but he did not satisfied with planting material
   - Due to that he started raising own nursery since 2002
   - He succeed in raising nursery and due to success in this practices other nearby farmers also raised their nursery at small scale level
   - Meanwhile, he came in to contact with SHM's / PFDC officers and get idea of raising nursery under the net house condition
   - After getting good results, farmer started his nursery in full fledge and commercially in net house with MIS in 35 guntha
   - Farmer produced around 1.5 – 1.75 lacs papaya plants, hardening 4 lacs plants of banana and 4 lacs seedlings of chilli and brinjal every year

9. Results/Impacts: His standard of living improved and their two son joint in this nursery business successfully.



Vegetable cultivation under Plastic Mulch

1	Name of the Farmer/ Beneficiary:	**Sri Harish Chandra Singh Bisht**
2	Education:	10th
	Age:	36
	Gender:	Male
3	Address :	Village- Wheel Kulwan, Post- Sirkot, Block & Tehsil-Garur District- Bageshwar (Uttarakhand) Mob. No.- 08958871372
4	Crop/Technology adopted:	Tomato and summer squash; Plastic mulch
5	Total area under crop/technology :	1400 sq m.
6	Use suitable photographs	Attached
7	Name of the scheme and details under which availed or own: source	Under demonstration component of PFDC, Pantnagar, the plastic mulch and seeds of tomato and summer squash were provided.
8	Month/year (installation of : the system)	Demonstrations started in 2009 and thereafter continuously carried out.
9	Total cost of system:	Cost of plastic mulching- Rs. 20000.00-25000.00 /ha
10	Return of investment (ROI) :	BC ratio > 3.00
11	Factors contributing to: success	Farmer's interest & Technical & input support given by PFDC
11	Any other relevant : information	Crop production of farmer motivated other nearest farmers to adopt the technology and now they are adopting the same and are in the contact with PFDC scientists.

Background information in which the technology was tested:

The State Uttarakhand is endowed with diverse agro-climatic conditions suitable for year round production of vegetables especially off-season vegetables in hills. Off-season vegetables fetch relatively higher returns for the producer as well as have high market growth prospects. However, the production in hill agriculture largely depends on rainfall as >90% of the arable land comes under rainfed zone. Due to this reason most of the farmers leave their fields fallow in one season and if some agronomic crops are grown, the production as well as productivity per unit area/input is very low due to lack of moisture and dependency on rainfall.

Owing to rainfed condition, the farmers are forced to grow high value vegetables only during rainy season but drought spell/high erratic rainfall and several biotic (diseases and insect-pests) stresses severely affected the productivity as well as quality of the produce. This dependency on natural factors of production restricts the growers to get the handsome returns of their produce. Thus, it needs protection against biotic and abiotic stresses for the successful and profitable early production. Hence, protected cultivation, viz. mulching, polyhouse, poly-tunnels etc., is almost necessary to obtain

quality and higher yields. Mulches are the grower's first line of defense in providing ideal conditions for plants and are also very cheap and easy amongst the protected cultivation practices. Mulching, i.e. covering of soil surface around the plant, is an age old practice and can be done by using various materials such as organic materials (dry leaf, paddy straw, dry leaves/twigs/grass, paddy husk, dry coconut leaves/husk etc.) as well as inorganic materials (plastic films).

Organic materials, though beneficial, were found to have inherent weaknesses and are not easily available in required quantities in Uttarakhand hills. In contrast, the plastic films are easily available, easy to handle, transport and lay. This leads to use of plastic films as most preferred material for mulches. The experiments show that black polyethylene sheet (25µ -100 guage) is more beneficial and during moisture stress conditions the high value vegetables viz. Summer squash and tomato can be easily grown under rainfed /un-irrigated condition without affecting quality and quantity of the produce. This mulch film has some inherent advantages viz., soil and water conservation, suppression of weeds, improved nutrient availability, and prevention against drastic variation in soil temperature, less incidence of disease and insect-pests and reduction in labour requirement and drudgery with early and higher yields.

Details of the technological intervention

Year 2009: Mr. Harish Chandra Singh Bisht, Village- Wheel Kulwan, Block- Garur District- Bageshwarwas a young farmer and totally dependent on agricultural income for family livelihood. As other farmers of the village he was also engaged in growing agronomic crops which were giving very low returns and not sufficient for living a normal life. One day he attended the training programme of PFDC, Pantnagar organized in Sirkot which was 4 km away from his village and after training he showed interest in off-season vegetable cultivation but he had some hesitation in growing vegetables due to lack of irrigation facility to the fields.

The scientist told him about plastic mulch technology and with the technical help and input support of PFDC he planted tomato (1 nali i.e. 200 sq.m.) and summer squash (1 nali- 200 sq.m.) under mulch. On this land before growing vegetables, he was growing Paddy, Wheat, Mandua and Jhingora (as per crop rotation). Due to early production and quality produce farmer got good returns from these vegetables.

Results obtained and monitory gain

The scientist through regular visit to his field monitored the vegetable crops and also suggested use of micro-nutrients and integrated crop management practices as per need. The results obtained are given in Table -1 and 2.

Economics of using polyethylene sheet

This black polyethylene sheet is available in a market at a price of Rs. 2.50-3.00/ m^2 and approximately Rs. 400-500 is additionally required for growing vegetables under mulch in 01 nali (200 sq. m.) area on the basis of 60-80% coverage of the area under the film. During first year of demonstration only two crops i.e. tomato and summer squash were suggested to the farmer for growing under mulch. With the recommended scientific production technology the farmers got 30-50% higher yield than the un-mulched crop and the produce also fetches relatively higher prices due to its superior quality. The extra income due to additional yield is always higher in the demonstration

plots than the cost involved in mulching (B:C ratio was observed more than 3 in all the cases).

Experiences and results:

Due to the encouraging results of the demonstrations of year-2009, the scientist organized extensive trainings on plastic mulching technology at village level in Garur block. Under the scheme the input with mulch was also provided to the farmers of other villages so that this technology could be extended to other parts of the Bageshwar district also. Three major off-season crops of the area i.e. tomato, capsicum and summer squash were taken for extensive trails and data collection pertaining to other crop parameters as earliness, harvest duration and production economics were also done. The data collected from 2009-14 were analyzed and presented in Table- 1 and 2. The results of the study given hereunder in brief:

The demonstrations were conducted to investigate the effect of black plastic mulch on earliness, yield, crop as well as harvest duration and production economics of summer squash, tomato and capsicum in hilly terraced land of district Bageshwar (Uttarakhand). The main problems as suggested by the farmers of the area regarding less area under vegetable cultivation were (i) lack of irrigation facility, (ii) lack of mechanization and due to this weeding and hoeing is done manually by females and these are already overburdened with other works so reluctant to go for vegetable growing due to higher labour requirement, (iii) lack of technical knowhow of growing vegetables (iv) lack of availability of inputs on time. Keeping these problems in mind, the PFDC scientists started work with giving extensive trainings on the vegetable cultivation with complete POP of BPM. Input support was also given to conduct the demonstrations. The females of the household also appreciated the technology as their engagement in weeding and hoeing was eliminated by mulching.

Demonstration data were recorded for days to first harvest, early and total marketable fruit yield as well as crop duration and harvest duration and presented in Table 1 & 2 after being pooled. Summer squash seedlings transplanted under mulch exhibited 10 days earlier first harvest while first harvesting in tomato and capsicum was approximately two weeks earlier than the un-mulched crop. Higher fruit yields under mulch demonstration plots (DP) were also recorded and these were 578.70, 404.30 and 215.25 q/ha in DP against 394.50, 307.20 and 152.60 q/ha in FP in summer squash, tomato and capsicum, respectively. The yield increases due to mulch effect were 46.69%, 31.60% and 41.05% in summer squash, tomato and capsicum, respectively. Harvest duration was also reported to be higher in DP as compared to FP in all the three crops under investigation and the harvest durations were increased by 18 days in summer squash, 19 days in tomato and 25 days in capsicum (Table 1).

Cost of cultivation, gross return, net return and benefit-cost ratio (BCR) for all the three crops were calculated under both the growing environments i.e. under mulch (DP) and without mulch (FP). Among all three important off-season vegetables of Uttarakhand hills the cost of cultivation of summer squash recorded highest i.e. ₹ 122250.00/ha for DP and ₹100650.00 for FP followed by capsicum (₹111300.00/ha for DP and ₹86800.00 for FP) and tomato (₹ 107500.00/ha for DP and ₹83600.00/ha for FP). However, highest gross and net returns were observed in tomato and it was also evident with the benefit-cost ratio (BCR). Maximum BCRs were recorded with

tomato (3.01 for DP and 2.94 for FP) followed by capsicum (2.71 for DP and 2.46 for FP) and summer squash (2.37 for DP and 1.96 for FP). The additional costs involved in summer squash, tomato and capsicum cultivated under mulch (DP) were ₹ 21600.00, ₹23900.00 and ₹ 24500.00 per crop cycle respectively. Additional returns and incremental benefit-cost ratio (IBCR) were also calculated for the technological intervention (mulch). IBCR values clearly indicated a net gain of ₹4.26 in summer squash, ₹3.25 in tomato and ₹3.58 in capsicum against the per rupee invested for the adoption of plastic mulch technology.

From the above demonstrations, it can be inferred that the use of BPM in off-season cultivation of important vegetable crops would substantially increase the overall income as well as improve livelihood of the resource poor farming community of the Uttarakhand hills. It is further suggested that sincere extension efforts are required to educate the farmers for adoption of this technology. Initial cost on purchasing and installation of plastic mulches would be the hindrance in large-scale adoption of this technology by the farming community. To overcome this barrier, the Government of India has provided subsidy @ 50% under National Horticulture Mission (NHM) and Horticulture Mission for North East and Himalayan States (HMNEH) for adopting this technology. The scheme is implemented through Department of Horticulture, Uttarakhand. With the adoption of this technology by more number of farmers, the off-season vegetable cultivation may be wide spread in area resulting in higher and quality production of the vegetables in the state and providing premium remuneration to the hill farmers.

Horizontal spread of technology

With this encouraging result of demonstration on mulching with high value off-season vegetables, the other farmers of his village and the farmers of other nearby villages as Hegad and Jyona Estate also started vegetable cultivation under plastic mulching.

The area under mulch is increasing year after year in the district i.e. Bageshwar and the area under plastic mulch are expanding to other hill districts of the Uttarakhand. Now the farmers are purchasing the polyethylene sheets for commercial growing of vegetables from Haldwani and Rudrapur market. After the enormous success of polymulch technology, other Plasticulture interventions viz., polyhouses, plastic low-tunnels, portrays, shade nets are also being used by the innovative farmers for commercial nursery and vegetable production. The encouraging results of the demonstrations on this technology are indicative of its feasibility, economic viability and greater adoption under stress prone agro-ecological situations in mid-hills of Uttarakhand. With the adoption of this technology by more number of farmers, the off-season vegetable cultivation may get wide spread in area resulting in higher and quality production of the vegetables in the state and providing premium remuneration to the hill farmers.

Further refinement in the technology

- The thinner polyethylene sheet (20-25µ) is unavailable in nearby markets anduse of higher guage plastics increases the cost of production and cut down the net profit.

- Eco-friendly and biodegradable polyethylene sheets are needed to avoid environmental hazards.

Table-1: Effect of BPM on earliness, yield and harvest duration of summer squash, tomato and capsicum

Crop	Days to first harvest		Fruit yield (q/ha)		% increase over control	Harvest duration (days)	
	DP	FP	DP	FP		DP	FP
Summer squash	42	52	578.70	394.50	46.69	83	65
Tomato	68	83	404.30	307.20	31.60	79	60
Capsicum	63	77	215.25	152.60	41.05	90	65

- *DP= Demonstration plot, ** FP= Farmers' practice
- # Crop duration (days)= From transplanting to final harvesting of crop

Glimpses of innovative farmer Mr. Harish Bisht's fields

Table-2: Economics of the use of BPM in summer squash, tomato and capsicum production

Crop	Cost of cultivation (₹)		Gross return (₹)		Net return (₹)		BCR		Additional yield (q/ha)	Additional cost (₹)	Additional return (₹)	IBCR
	DP	FP	DP	FP	DP	FP	DP	FP				
Summer squash	122250.00	100650.00	289350.00	197250.00	167100.00	96600.00	2.37	1.96	184.20	21600.00	92100.00	4.26
Tomato	107500.00	83600.00	323440.00	245760.00	215940.00	162160.00	3.01	2.94	97.10	23900.00	77680.00	3.25
Capsicum	111300.00	86800.00	301350.00	213640.00	190050.00	126840.00	2.71	2.46	62.65	24500.00	87710.00	3.58

- *BCR= Benefit-cost ratio, **IBCR= Incremental benefit-cost ratio

Peach cultivation under Plastic Mulch

1 Name of the Farmer/ Beneficiary: **Sh. Harendra Singh Bisht**

2 Education: 12th Age: 31 years Gender: Male

3 Address : Village- Naikana, P.O.- Narayan Swami Ashram, Ramgarh Talla, Distt.-Nainital (Uttarakhand), Pincode- 263 158

4 Crop/Technology adopted: Peach, Plastic mulch

5 Total area under crop/technology: 500 peach trees; 50 trees covered with plastic mulch (Silver on Black)

6 Name of the scheme and details under which availed or own source: Under demonstration component of PFDC, Pantnagar, the plastic mulch was provided.

7 Month/year (installation of the system): February, 2014

8 Total cost of system: Rs. 60 per tree

9 Return of investment (ROI): BC ratio- 5.06 (Economic analysis table attached as Annexure I)

10 Factors contributing to success: Farmer's interest & Technical & input support given by PFDC

11 **Any other relevant information:** Stress management is the primary issue for successful cultivation of any crop in stress prone hilly terraced land of Uttarakhand. Mulching is the first line of defense against any biotic or abiotic stress and also the cheapest technology among the protective cultivation technologies. After a remarkable success now the other farmers are also showing interest in the adoption of this technology for growing of their peach crop and are in the contact with PFDC scientists

Background information in which the technology was tested

Uttarakhand is endowed with a wide climatic variation ranging from sub-tropical to temperate, marked by seasonal variations in temperature but also affected by tropical monsoons. January is the coolest month with temperature reaching below freezing point in hills and 21 0C in southeast or plains whereas in May-July the temperature reaches around 400C in the plains but up to 27 0C in hills. This provides an immense possibility of producing number of fruit crops categorized under tropical to subtropical and temperate group.

However, the problem of low productivity is one of the most important constraints in the development of fruit industry and improving the production efficiency in the existing orchards. The Fruit productivity is as low as 4 MT/ha compared to 11.7Mt/ha of the country. The conditions of Uttarakhand hills are poorer due to poor technical knowledge of crop growing and rainfed conditions. For instance, the productivity of apple is 4.1 MT/ha in Uttarakhand whereas those of Jammu & Kashmir and Himachal Pradesh are 13 MT/ha and 8.8 MT/ha respectively.

The productivity of our target crop for this demonstration i.e. peach is around 3.5 MT/ha which is quite low as compared to the leading peach growing areas as well as nations. The main reason behind this is poor orchard management which results into

biotic and a biotic stresses in the fruit crops along with moisture stress during flowering and fruit growth period. The main period of fruit growth and development coincides with summer months with lack of moisture availability, hence many fruits drop down prematurely because of moisture stress. The present productivity of peach might be doubled by using the proper orchard management and moisture management strategies by adopting simple precision farming technologies viz., mulching and drip irrigation.

Mulches are the grower's first line of defense in providing ideal conditions for plants and are easy and cost efficient technology. Mulch is used to cover soil surface around the plants to create congenial condition for the growth. This may include temperature moderation, salinity and weed control. Weed growth has been found to be checked up to 100% by use of plastic mulch. It exerts decisive effects on earliness, yield and quality of the crop. Plastic mulches are a very effective way to reduce water loss. It is an integral component of water conservation in horticulture production. Similarly, both minimum and maximum soil temperature in 0-10 cm was found to be 3-4^{0}C higher under mulch in the same orchard.

Further, research studies carried out on plastic mulching by Precision farming development centre (PFDC) located in different agro climatic zones all over India have shown an increase in yield in different fruit crops (strawberry 40-50%, guava 25-30%, Kinnow 45-50% and Pomegranate 35-40%).

In view of the above, the work was started during February, 2014 in the famous peach growing area of the state i.e. Ramgarh area of the district Nainital. The area is situated between altitudes of 1400-1700 m above mean sea level. The belt is suitable for peach cultivation but water scarcity during critical stages of fruit growth and development (from March to onset of monsoon) significantly reduces the yield. A training programme including the topic of "Benefits of Plastic mulching in Horticultural crops" was conducted in Naikana village of the Ramgarh Talla on February 12, 2014. After the training one young farmer of that village (Sh. Harendra Singh Bisht) showed great interest in the technology and requested the PFDC scientists to train him in the application of mulching in his peach orchard.

Seeing his zeal and importance of the crop for the area, the PFDC scientists planned to conduct a demonstration on plastic mulching in his orchard. Later on during first week of March, the scientists again visited to his village and laid out the plastic mulch in his orchard and also showed method of mulch application to him and fellow orchardists. The prime objective of the demonstration was to conserve moisture so that the premature fruit dropping can be reduced owing to moisture stress. Earlier the farmers of that region were not using any kind of mulch for this purpose.

Details of the technological intervention

Mr. Harendra Singh Bisht, Village- Naikana, Ramgarh Talla, District- Nainital is a progressive farmer and totally dependent on farm income for family livelihood. The village Naikana is famous for its peach orchards and most of the farmers are engaged in peach cultivation. Mr. HS Bisht also has one orchard with 500 peach trees but the productivity is low due to moisture stress and other improper orchard management practices. One day he attended the training programme including the topic of "Benefits

of Plastic mulcing in Horticultural crops" conducted by PFDC, Pantnagar in Naikana village of the Ramgarh Talla on February 12, 2014. After training Mr. HS Bisht showed great interest in the plastic mulch technology. Seeing zeal of the farmer and importance of the crop for the area, the PFDC scientists planned to conduct a demonstration on plastic mulching in his orchard. Later on during first week of March, the scientists again went to his village and laid out the plastic mulch in his orchard (50 peach plants) and also showed method of mulch application to him and fellow orchardists.

Results obtained and monitory gain

During the first year of demonstration, total 50 plants were mulched with silver on black plastic mulch (100 micron). The earliness and total yield of these mulched trees were compared with unmulched trees. As per the observation, the mulched trees recorded 07-10 days earlier harvest maturity than the unmulched trees. The average yield of the sample unmulched trees (10 trees) were 27 kg/tree, however, mulched trees on an average produced 36.50 kg fruits /tree. In addition to the higher yield, the fruits on mulched trees also showed better coloration over fruits on unmulched trees as per the farmer's observation. The mulch sheet is available @ Rs. 240.00/kg and 1 kg sheet is sufficient for mulching of 04 trees, hence additional expenditure on mulch sheet is Rs. 60.00 per tree.

The average life of mulch sheet is 04 years, therefore, per year investment on each tree became Rs. 15.00/ tree. The additional yield due to mulch effect was 9.5 kg/tree and hence additional benefit after mulching was Rs. 76.00/tree (@ Rs. 08.00/kg). Hence, the BC ratio of using plastic mulch technology for peach cultivation was 5.06.

Impact and Eco-socio benefits

With this encouraging result of demonstration on mulching peach production, the innovative farmer Mr. HS Bisht is now thinking to spread the technology to the other unmulched trees in the following year i.e. 2015. The PFDC team will also provide input support to the progressive farmer and fellow orchardists for area increment under the technology. Beside the data collection and extensive trials for technology authentication, the scientists of PFDC will also conduct the training programme in the coming season i.e. 2015 so that the technology can get wide spread to the fellow peach growers of the area. Among the social benefits, the prime one was that "No weeding and hoeing was required after mulching beneath the tree for weed control and soil loosening, therefore, it reduced the work burden on females." We all know that apart all the household work all the agricultural operations except ploughing are carried out by the females in Uttarakhand hills.

So the women those are already overburdened with work, are also feeling somewhat relaxed with this technology. The other benefit is that the peach crop is known for its water sensitivity and mulched trees escape the adverse effect of water logging during the rainy season as the water stagnation in the root zone was not observed in the mulched trees.

Farmer's feedback

- The innovative farmer Mr. HS Bisht says 'Beside the trees saved by moisture stress, no weeding and hoeing was done during the entire peach growing season. This pleases the females of my house as weeding and hoeing is primarily done by females in the fields. Thus it reduces the work burden on them.'
- The growers are satisfied with the technology due to its feasibility, economic viability and greater adoption under stress prone agro-ecological situations of hill **agriculture.**
- The encouraging results of the demonstrations on this technology are indicative of its feasibility, economic viability and greater adoption under stress prone agro-ecological situations in Uttarakhand hills. With the adoption of this technology by more number of farmers, the peach cultivation may get wide spread in area resulting in higher and quality production of the crop in the state and providing premium remuneration to the hill farmers due to higher quality produce.

Further refinement in the technology

- Availability of high quality mulch at remunerative price in nearby city markets is the main hindrance in the area expansion.

Onion Cultivation under Drip Irrigation

Shri. Ratiram S/O Shri. Jaley Singh
Village: Pahel, Tensil : Mundawar, District
Alwar, Rajasthan
Mob - 09887426888

1. Education: B.P. Ed

2. Total land area available for: cultivation: 2.6 ha

3. Area under drip irrigation:2 ha

4. Source of water: Tube well – 600 ft, discharge- 10000 lph, Pump capacity- 5 HP

5.Water quality: **pH- 7.66, EC =390, K =5.26 mg/l, Na = 474.4 mg/l**

6**.** Soil quality and fertility status: **pH (1:2.5)-7.21; EC - 0.49 dS/m,**

N = 244.2 kg/ha, P= 16.52 kg/ha, K= 228.14 kg/ha

7.Soil type: Soil texture- Sandy Loam, infiltration rate- mm/h, bulk density – 1.46 kg/m3

8. Crop and variety: Onion (Prashant)

9. Crop season: Date of sowing-15 Sept 2015, Date of harvesting -18 Dec 2015

10.Crop geometry: Plant to plant distance- 10 cm, Row to row distance-15cm, No. of rows per lateral- 6

11. Irrigation system designs: Filters -2 (Hydro cyclone filter – 25 m3/h) disc filter- 25 m^3/h, Fertilizer injector- 1 inch and Injection rate- 200 lph, dripper discharge – 2.4 lph, distance between two drippers- 30 cm, distance between two laterals- 100 cm

12. Crop water requirement and: irrigation scheduling: Number of irrigations- 15

Total Water requirement- 232.18 mm

13. Fertilizer dose and fertigation scheduling: DAP -100 kg; MOP-80kg; Urea- 280 kg Micronutrient solution- 2litre, Apsa - 400 ml, Zinc 25 kg

14. Crop protection measures: Herbicides (Raft 1.20 litre)

15. Crop production: Yield obtained in drip- 19 t/ha, Yield obtained in flood- 12 t/ha

16. Economic analysis: Expenditure = 180000, Gross income = 324360

17. Impact of the technology: Water savings- 41 %, Increase in yield- 36 %, Energy savings

Onion under plasticulture

Shri. Karan singh S/O Shri. Harlaram
Village: Pahel, Tensil : Mundawar, District
Alwar, Rajasthan
Mob -09166408460

1. Education: 12th

2. Total land area available for cultivation: 3.25 ha

3. Area under drip irrigation: 2.5 ha

4. **Source of water:** Tube well with Solar pumping system – 600 ft, discharge- 10000 lph, Pump capacity- 5 HP

5. **Water quality: pH- 8.76, EC =298, K = 3.19 mg/l, Na = 465.90 mg/l**

6. Soil quality and fertility status: **pH (1:2.5)-7.21; EC - 0.49 dS/m,N = 244.2 kg/ha, P= 16.52 kg/ha, K= 228.14kg/ha**

7. Soil type: Soil texture- Sandy Loam, infiltration rate- mm/h, bulk density – 1.47 kg/m3

8. Crop and variety: Onion (Prashant)

9. Crop season: Date of sowing-4 Sept 2015, Date of harvesting -10 Dec 2015

10. Crop geometry: Plant to plant distance- 10 cm, Row to row distance-15cm, No. of rows per lateral- 6

11. Irrigation system designs: Filters -2 (Hydro cyclone filter – 30 m3/h) disc filter- 30 m^3/h, Fertilizer injector- 1 inch and Injection rate- 200 lph, dripper discharge – 2.4 lph, distance between two drippers- 30 cm, distance between two laterals- 100 cm

12. Crop water requirement and irrigation scheduling: Number of irrigations- 10, Seasonal crop Water requirement- 273.164 mm

13. Fertilizer dose and fertigation: scheduling: DAP -400 kg; MOP-200 kg; Urea- 700 kg, Micronutrient solution- 3 litre, Apsa - 2000 ml, Zinc 60 kg

14. Crop protection measures: Herbicides (Alto 1.20 litre)

15. Crop production: Yield obtained in drip- 24 t/ha, Yield obtained in flood- 12 t/ha

16. Economic analysis (Rs./ha): Expenditure = 160000, Gross income = 300000, Benefit (net income) = 140000

19. Impact of the technology: Water savings- 41 %, Increase in yield- 50 %Energy savings –

Drip irrigation increases the productivity of Onion

Shri. Ramavtar S/O Shri. Harlaram
Village: Pahel, Tensil : Mundawar, District , Alwar, Rajasthan
Mob -09887428684

1. Education: 10th

2. Total land area available for cultivation: 3.50 ha

3. Area under drip irrigation: 2.0 ha

4. Source of water: Tube well– 650 ft, discharge- 16000 lph, Pump capacity- 10 HP

5. Water quality: **pH- 8.22, EC =205.3, K = 3.09 mg/l, Na = 318.70 mg/l**

6. Soil quality and fertility status: **pH (1:2.5)-7.62; EC - 0.26 dS/m,N = 244.2 kg/ha, P= 10.15 kg/ha, K= 333.87kg/ha**

7. Soil type: Soil texture- Sandy Loam, infiltration rate- mm/h, bulk density – 1.46 kg/m^3

8. Crop and variety: Onion (Prashant)

9. Crop season: Date of sowing-8 Sept 2015, Date of harvesting -12 Dec 2015

10.Crop geometry: Plant to plant distance- 10 cm, Row to row distance-15cm, No. of rows per lateral- 6

11.Irrigation system designs: Filters -2 (Hydro cyclone filter – 30 m^3/h) disc filter- 30 m^3/h, Fertilizer injector- 1 inch and Injection rate- 210 lph, dripper discharge –2.5 lph, distance between two drippers- 30cm, distance between two laterals- 100 cm

12. Crop water requirement and irrigation scheduling: Number of irrigations- 14, Seasonal crop Water requirement- 273.164 mm

13. Fertilizer dose and fertigation scheduling: DAP -400 kg; MOP-200 kg; Urea- 700 kg, Micronutrient solution- 3 litre, Apsa - 2000 ml, Zinc 60 kg

14. Crop protection measures: Herbicides (Alto 1.20 litre)

15. Crop production: Yield obtained in drip- 24 t/ha, Yield obtained in flood- 12 t/ha

16. Economic analysis (Rs./ha):Expenditure = 160000, Gross income = 300000, Benefit (net income) = 140000

17. Impact of the technology: Water savings- 41 %, Increase in yield- 50 %, Energy savings

Pomegranate cultivation under Drip irrigation System

Mr Lalasaheb Bapurao Salunkhe
At Post Mandave, Tal: Malshiras,
Dist: Solapur-413111, Maharastra
Cell: 9423058330

1. Education: B.C.A, Age: 25 years Gender: Male
2. Crop / Technology adopted : Pomegranate with Drip Irrigation
3. Total area under crop / technology : 1 Acre
4. Use suitable photograph – crop / technology : Copy enclosed
5. Name of the scheme & details under which availed or own source: Own source
6. Month / Year (Installation of system) : October, 2010
7. Total cost of system : Rs 1,25,000/-
8. Total yield, Rs / kg, Costs of production, Net returns and Return of investment (RoI) (Total period = Month / Year) : Yield 13 tons/acre (Rate: 100Rs/kg)
   Net Returns =Rs 11,75,000/- (in 3 years) ;Total Period = 10 months
9. How the farmers / beneficiary knew about adopting precision farming practices and use of plasticulture application/s for achieving higher yield and income.
   Mr. Salunkhe Lalasaheb Bapurao was obtaining lower yields of pomegranate crops under traditional farming. Therefore, income was low. Precision Farming Development Centre, MPKV, Rahuri conducted Agri event at Mandve, Tal-Malshiras, Dist-Solapur in November, 2013.

   He attended this Agri event. Accordingly, he adopted precision production technology for pomegranate crop along with its plant protection measures. He also adopted the package of practices, which were suggested by PFDC, MPKV, Rahuri for pomegranate production. Besides this, he also started cultivation of various vegetable crops under protected cultivation. Thus, he is earning more as compared to earlier income.
10. Results / Impact of such successful adoption of farm practices and technology:
    Mr. Salunkhe has spent Rs.1,25,000/- on pomegranate cultivation and he obtained Rs.11,75,000/- during 2014-15 (3rd year). Therefore, his socio-economic status is very good now in his area. Currently, he started taking the new plantation of pomegranate due to more productivity and monetary benefits.

Capsicum under Shadenet House

Mr Arvind Udhavrao Bende
At:Ratchandana, Post: Murbhadi (Chinch),
Tal- Yavatmal, Dist:Yavatmal, Maharastra
Cell: 9423058330

1. Education: 9th, Age: 40 years, Gender: Male
2. Crop / technology adopted : Capsicum in shadenet house
3. Total area under crop / technology : 1 Acre, Shadenet house with drip irrigation
4. Name of the scheme & details under which availed or own source: Own source
5. Month / year (Installation of system) : October, 2010
6. Total cost of system : Rs 6,50,000/-
7. Total yield, Rs / Kg , costs of production, Net returns and Return of investment (RoI) (Total period = Month / Year) : Yield 13 tons/acre (Rate 160 Rs/kg),
   Net Returns = Rs 9,75000/-
   RoI = 1 season, total period = 9 months
8. How the farmers / beneficiary knew about adopting Precision-farming practices and use of plasticulture application/s - Mr. Bende was getting fewer yields of crops under traditional farming for different agronomical crops viz., paddy, soybean, chickpea etc. He attended the training organized by PFDC, MPKV, Rahuri at KVK, Yeotmal in which he adopted the ways of production technology of capsicum by which he harnessed maximum yield with minimum inputs.
9. Results / Impact of such successful adoption of farm practices & technology:
   (About crop /technology, scheme and eco-socio benefits etc.)
   Mr. Bende is one of the leader farmers in the region. He enjoyed the capsicum cultivation with his family in his region. He inspired the other farmers in his village and surrounding and adopted techniques given by Precision Farming Development Centre, MPKV, Rahuri for more monetary returns against conventional crop cultivation practices.

Watermelon under plastic mulching

Mr Mangesh Parshuram Kadam
At Post-Khambhave Tal- Vaibhavwadi, Dist: Sindhudurg, Maharastra
Cell: 9423058330

1. Education: 12th Age : 50 years Gender: Male

2. Crop/technology adopted Watermelon, plastic mulching (30 micron) Drip Irrigation

3. Total area under crop / technology : 40 R

4. Name of the scheme & details under which availed or own source: Own source

6. Month / year (Installation of system) : 2013-14

5. Total Costs of System : Rs 82000/acre

6. Total yield, Rs / Kg , costs of production, Net return and Return of investment (RoI) – (Total period = Month / Year) : Yield 18 tons/acre (Rate 7 Rs/kg)
   Net Returns=Rs 1,26,000/-
   Total period = 2.5 months,
   RoI = 1 season

7. How the farmers / beneficiary knew about adopting precision farming practices & use of plasticulture application/s - Shri. Mangesh Kadam, a farmer of Konkan region with red lateritic soil cultivating watermelon very successfully. As the area is receiving high rainfall, rice cultivation is the main source of income, but declining production and income was a cause of great worry. Adopting the production technology for mulching of vegetable crops Mr. Mangesh Kadam successfully cultivated the watermelon.

8. Results / Impact of such successful adoption of farm practices and technology: Under the guidance of PFDC, Rahuri, Mr. Kadam adopted the plasticulture technology. Irrigation, fertigation, plant protection measures were applied as per the scheduled given by PFDC staff.

Capsicum cultivation under Polyhouse

Mr Balasaheb Mohan Darandale
At - Landewadi, Post- Sonai, Tal- Newasa,
Dist: Ahmednagar, Maharastra
Cell: 9860369204

1. Education: BSc. Chemistry (Alcohol Technology), Age: 42 Years, Gender: Male

2. Crop / technology adopted Capsicum in polyhouse

3. Total area under crop / technology : 2000 sqm. (20R)

4. Name of the Scheme & Details under which availed or Own Source

   : National Horticulture Board

5. Month / year (Installation of system) : 2011-12

6. Total cost of system : Rs.1,11,275/-

7. Total yield, Rs / Kg, costs of production, Net returns and Return of investment (RoI):

   Yield 5.8 tons/half acre (sold at rate 45-65 Rs/kg),

   Net Returns = Rs 2,03,725/-

   Total period = 9 months, RoI = 1 season

8. How the farmers / beneficiary knew about adopting precision farming practices & use of plasticulture application/s - Under the guidance of PFDC, Rahuri Mr. Darandale cultivated the colour capsicum successfully. He followed the package of practices given by PFDC staff. The relevant information for cultivation of capsicum was successfully adopted by him.

9. Results / Impact of such successful adoption of farm practices & technology: Mr. Darandale is icon farmer for capsicum growers in his area. The colour capsicum production alongwith full package of practices was given by PFDC, MPKV, Rahuri. He cherished the farmer for colour capsicum in his region by creating pathways.

Tomato under Drip Irrigation System

Shri Dharam Singh
S/o Sh. Lakshmi Singh, Vill. Chewa, PO
Barog, Distt. Solan, Himachal Pradesh

1. Education: 10th Age: 47 yrs Gender: Male
2. Crop / Technology Adopted: Cauliflower/Tomato / Drip Irrigation
3. Total Area under Crop / Technology: **2 Bigha.**
4. Name of the Scheme & Details under which availed or Own Source: **Horticulture Technology Mission**
5. Month / Year (Installation of System): **2014**
6. Total Costs of System: **17000/-**
7. Total Yield, Rs / Kg , Costs of Production, Net return and Return of Investment (RoI) –

Crop/Agricultural practice	**Tomato**
Yield of crop/ product	2 kg/ plant
Sale value	Rs. 30/ kg
Input cost	Rs. 7,500/-
Labour cost	Rs. 4,000/-
Any other Cost	Nil
Net saving/ Net profit	Rs. 2,75,000/-

The farmer has good landholding but due to rainfed agriculture, he is not able to cultivate whole of his land. The water scarcity also results in low yield, which was not giving good returns to the farmers even though tomato is a cash rich crop of the region. . The farmer attended Farmers' training programme on Precision Farming organized by Precision Farming Development Centre at the Campus.

Thereafter, he applied for drip irrigation system and installed in 2 bigha in 2014. He planted tomato as first crop under drip irrigation system. With the help of drip irrigation system, he was able to increase the yield of the crop and get good return (Rs. 30/kg) as he was able to produce crop before the market was flooded with tomato, whereas other farmers who were dependent on rains could get average rate of Rs. 10 - 15/ kg only.

His ability to produce good quality tomato before the rainfed tomato has inspired the farmers of his village and the farmers are requesting Precision Farming Development Centre for providing financial help for installing drip irrigation system in their field.

PFDC has suggested the farmers to install drip irrigation system in small area 1-2 bigha initially with subsidy under MIDH which they can easily bear.

Precision Farming in Tomato

Shri Tilak Raj
Vill. Jogi, PO Pandia, Tehsil Karsog, Distt.
Mandi, Himacahal Pradesh

1. Education: Graduate Age: 25 Gender: Male
2. Crop / Technology Adopted: **Drip Irrigation and plastic mulch in tomato**
3. Total Area under Crop / Technology: **1 Bigha**
4. **Name of the Scheme & Details under which availed or Own Source**: Own source
5. **Month / Year (Installation of System): ** April, 2014
6. **Total Cost**: 26,000/-
7. **Total Yield, Rs / Kg , Costs of Production, Net return and Return of Investment (RoI) –**

Crop/Agricultural practice	Tomato
Yield of crop/ product	2.7 kg/ plant
Sale value	Rs. 20/ kg
Input cost	Rs. 10,000/-
Labour cost	Rs. 4,500/-
Any other Cost	Nil
Net saving/ Net profit	Rs 1,50,000

Farmer's village is in remote area of Tehsil Karsog, Distt. Mandi and during survey being conducted by Precision Farming Development Centre he has a chance meeting with the PI and after that he was called for training in the main campus. After attending the training, he showed interest in drip irrigation system for vegetable crops. He installed drip irrigation system in tomato from his own source and later on added plastic mulch when he was assured that he will have much better return with application of mulch in conjunction with drip irrigation system. He was able to get good yield from the plants though initially he faced problems in managing the insect pest attack.

The farmer was able to get 2.7 Kg/plant yield which he harvested almost 15-17 days earlier than the rainfed crop of his other field and farmers. As the system involves many technical problems, he was time to time guided about the solutions. The farmers of his village are still apprehensive about using the drip irrigation system and mulching because of high cost of installation and availability of parts of drip system. However, they are showing keen interest in the efforts of Mr. Tilak Sharma and are likely to adopt drip system very shortly looking into the gains made by Mr Tilak.

Vegetable cultivation under Drip irrigation system

Shri Balan C.K
Ajantha House, Chettippadi(PO), Parappanangadi,
Kerala Mob: 9846724474

1. Education:10th Age:82 Gender: Male
2. Crop / Technology Adopted: Salad cucumber, Cowpea, Amaranthus, Tomato, Chilly, Cabbage, Bhindi, Plantains /Poly house/drip irrigation & Fertigation/open precision
3. Total Area under Crop / Technology: 650m^2 ,400m^2 ,40cent
4. Use Suitable Photograph – Crop / Technology:
5. Name of the Scheme & Details under which availed or Own Source:
   State Horticulture Mission (SHM), RKVY (Rashtriya Krishi Vikas Yojana)
6. Month / Year (Installation of System):2012 February
7. Total Costs of System:12 lakh
8. Total Yield, Rs / Kg , Costs of Production, Net return and Return of Investment (RoI) – (Total period = Month / Year):75% subsidy,6 lakh/year

He is very fond of agriculture and he attended several classes on agriculture techniques conducted by PFDC and from there he came to know about precision farming. From the first and second crop he got maximum yield and he felt it's a very success. When he starts to cultivate the third crop & forth crop he faced an utter failure. The seedling which he planted was fully spoiled due to fungal attack. Many farmers in the same area cultivated same crop and this reduced the market value. For the first four crops he used bio-fertilizers only. After facing so many issues, he started to practice some chemicals along with the bio-fertilizers.

Farmer gave exposure to his son who was running a studio and now he is more interested in farming which make developing one mobile APP named YARA for connecting the farmers for easily understanding the diseased condition of plants and solving the issues. They also were trying their own fertigation method



Vegetables – Round the year Cultivation under greenhouse

Mr Abdul Latheef
Palakkavalappil H, Peruvanna (p.o), Tirur , Kerala
Mob: 98465562984

1. Education:10th Age: 36 Gender: Male
2. Crop / Technology Adopted: Salad cucumber, amaranthus, cabbage, cauliflower, Gerbera/ poly house, drip irrigation & fertigation
3. Total Area under Crop / Technology: 400m^2
4. Name of the Scheme & Details under which availed or Own Source: State Horticulture Mission (SHM).
5. Month / Year (Installation of System): 2013 June
6. Total Costs of System: 5lakh
7. Total Yield, Rs / Kg , Costs of Production, Net return and Return of Investment (RoI) – He got 60% of his investment from the first crop itself and covered his installation cost in the succeeding year.

As a farmer he practiced the normal techniques of agriculture and attended several training programmes. Earlier the cultivation of crops was very easy to handle but now the frosty climatic conditions make damage to crops. PFDC suggested to him to go for protected cultivation and nowadays he is practicing the new techniques. Initially he faced marketing problem with the salad cucumber, though it's a hard face for him but with his efforts he solved the issue.

Now with the protected cultivation he is capable to help other farmers by providing suitable seedlings for their cultivation. According to him use of precision farming techniques can save the time and can achieve more output using minimum input.




Banana cultivation under drip fertigation

Mr. Kammadalikkutty
Kanakkil House, Pachiattri (PO), Tirur, Kerala
Mob: 09400830221

1. Education:10th Age:63 Gender: Male
2. Crop / Technology Adopted: Plantains/Plastic mulching, drip irrigation& fertigation
3. Total Area under Crop / Technology:2.8 acre
4. Name of the Scheme & Detailsunder which availed or Own Source: ATMA Mathruka Panchayath Programme
5. Month / Year (Installation of System):June 2013
6. Total Costs of System: Rs.2 lakh
7. Total Yield, Rs / Kg , Costs of Production, Net return and Return of Investment (RoI) – (Total period = Month / Year):

   40% more yield was obtained from the plantain cultivation and was able to cover installation cost.

He started his cultivation in the less quality soil lead to deficiency of many nutrients, which lead to poor quality fruits, and one of the other issues he faced was weed growth. PFDC conducted a survey programme in his Panchayat and suggested him for practicing plastic mulching. Later on he started to use fertigation and mulching using black plastic mulch of 100 micron.

According to the farmer, he got maximum yield for first two crops by using fertigation and plastic mulching. Drip irrigation and mulching reduce the use of water, growth of weeds and retain the nutrients in soil itself. These technologies ensure the quality of the fruit and help him to get a good marketable value.



Annexure-I

Address of Precision Farming Development Centres (PFDCs)

S.N.	State	Location	Address
1.	Assam	Guwahati	Precision Farming Development Centre, Horticultural Research Station, Assam Agricultural University, Kahikuchi P.O- Azara, Guwahati - 781017 **Assam**
2.	Bihar	Pusa, Samastipur	Precision Farming Development Centre, Dept. of Soil & Water Conservation Engineering, College of Agricultural Engg., Dr. Rajendra Prasad Central Agriculture University, Pusa (Samastipur) - 848125 **Bihar**
3.	Chhattisgarh	Raipur	Precision Farming Development Centre, Dept. of Horticulture, Indira Gandhi Krishi Vishwavidyalaya, Krishak Nagar, Raipur- 492 006 **Chhattisgarh**
4.	Gujarat	Navsari	Precision Farming Development Centre, Soil and Water Management Research Unit, Navsari Agricultural University, Navsari – 396450 **Gujarat**
5.	Haryana	Hisar	Precision Farming Development Centre, Dept. of Horticulture, College of Agriculture, CCS Haryana Agriculture University, Hisar - 125004 **Haryana**
6.	Himachal Pradesh	Solan	Precision Farming Development Centre, Dept. Soil Science & Water Management, Dr. Y.S. Parmar University of Hort. & Forestry, Solan, Nauni – 173 230 **Himachal Pradesh**
7.	UT of Ladakh	Leh	Precision Farming Development Centre, SKUAST-K-HMAARI, P.O. Box No. 146, Leh, Ladakh – 194101 **UT of Ladakh**
8.	Jharkhand	Ranchi	Precision Farming Development Centre, Dept. of Agril. Engineering, Birsa Agricultural University, Ranchi, P.O.- Kanke, Ranchi – 834006 **Jharkhand**
9.	Karnataka	Bangalore	Precision Farming Development Centre, Division of Horti., UAS, GKVK, University of Agricultural Sciences, Bangalore - 560065

			Karnataka
10.	Kerala	Tavanur	Precision Farming Development Centre, Kerala Agricultural University, Kelappaji College of Agril. Engineering & Technology, Tavanur - 679573 Malappuram District, **Kerala**
11.	Madhya Pradesh	Bhopal	Precision Farming Development Centre, Division of Irrigation and Drainage Engineering, Central Institute of Agricultural Engg. (CIAE), Nabi Bagh, Berasia Road, Bhopal - 462038 **Madhya Pradesh**
12.	Maharashtra	Rahuri	Precision Farming Development Centre, Dr. A.S. College of Agricultural Engineering, Mahatama Phule Krishi Vidyapeeth, Rahuri– 413722, Distt. Ahmednagar **Maharashtra**
13.	Manipur	Imphal	Precision Farming Development Centre, Department of Horticulture, College of Agriculture, Central Agricultural University, Iroisemba, Imphal – 795004 **Manipur**
14.	New Delhi	New Delhi	Precision Farming Development Centre, Water Technology Centre, Indian Agricultural Research Institute (IARI) **New Delhi -110012**
15.	Odisha	Bhubaneshwar	Precision Farming Development Centre, Dept. of Horticulture, Odisha University of Agriculture and Technology (OUAT), Bhubaneshwar - 751 003 **Odisha**
16.	Punjab	Ludhiana	Precision Farming Development Centre, Dept. of Soil and Water Engg., College of Agricultural Engg. & Technology, Punjab Agricultural University, Ludhiana-141004 **Punjab**
17.	Rajasthan	Bikaner	Precision Farming Development Centre, Agriculture Research Station, Beechwal Swami Keshwanand Rajasthan Agricultural University, Bikaner- 334006 **Rajasthan**
18.	Tamil Nadu	Coimbatore	Precision Farming Development Centre, Dept. of Soil & Water Conservation Engg., Agricultural Engineering

			College and Research Institute, Tamil Nadu Agricultural University, Coimbatore - 641003 **Tamil Nadu**
19.	Telangana	Hyderabad	Precision Farming Development Centre, Water Technology Centre, PJTSAU, Rajendranagar, Hyderabad - 500030 **Telangana**
20.	Uttar Pradesh	Lucknow	Precision Farming Development Centre, ICAR-Central Institute for Subtropical Horticulture (CISH), Division of Crop Production, Rehmankhera, P.O. Kakori, Lucknow - 226101 **Uttar Pradesh**
21.	Uttarakhand	Pantnagar	Precision Farming Development Centre, College of Technology, Dept. of Irrigation & Drainage Engg., GB Pant University of Agriculture & Technology Pantnagar -263145, Distt.- Udham Singh Nagar **Uttarakhand**
22.	West Bengal	Kharagpur	Precision Farming Development Centre, Dept. of Agricutural & Food Engg., Indian Institute of Technology, Kharagpur - 721302 **West Bengal**

National Committee on Precision Agriculture & Horticulture (NCPAH)

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