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Impact Assessment of 'BMP-PIM Cotton Project'

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Executive Summary

The BMP-PIM Cotton project was conceptualised in 2013-14 to build on the achievements and success of the initial collaborative effort between DSC and IKEA International on Better and Sustainable Cotton from 2009-13. The key objectives of the project were to promote better management practices for sustainable cotton cultivation, build capacity of WUAs in PIM and improve service delivery of farmer collectives to their member farmers for irrigation and agriculture support activities.

This study covers 29 villages across 5 districts of Gujarat namely, Mehsana, Sabarkantha, Aravalli, Amreli and Rajkot. A total of 170 farmer respondents in 5 operational areas of DSC including four PIM locations of Dharoi, Guhai, Mazum and Dhoraji and one rain-fed location of Dhari were covered.

In terms of the extent of land devoted to cotton cultivation, farmers in Dhoraji have the highest (86%) share of total land allocated to cotton, followed by 69% in Dhari, 37% in Guhai, 36% in Dharoi and 35% in Mazum. For irrigation of cotton, a large proportion of farmers are dependent on wells and borewells. While farmers in Dhoraji draw water from both wells and canals to irrigate the cotton crop, there is very little dependence on canal but high dependence on deep tubewells among farmers surveyed in Dharoi, Guhai and Mazum. Excessive extraction of groundwater especially in Dharoi has resulted in water tables going down to as much as 1000 feet in some parts. Also, high TDS levels have made groundwater unsuitable even for irrigation purpose.

Cotton yields have suffered a decline of 30-40 per cent over the past 2 years on account of adverse weather conditions, instances of wilting and pink bollworm attack. Coupled with this, global prices of cotton have been on a downswing due to changes in the global as well as domestic business environment. The combined effect of low yields and subdued market prices has had a huge impact on income from cotton cultivation.

Under the project, farmers have received training and exposure on a wide range of sustainable cultivation practices that aimed to improve yield, reduce cost of cultivation, increase farmer income and improve soil health. These included practices related to seed use, yield improvement, water management, disease and pest reduction, fertiliser reduction and harvest and post harvest management.

In terms of adoption of the recommended quantity of seed, while most farmers in Dhoraji and Dhari follow DSC's advice of putting a single cotton seed in one hole, farmers in Dharoi and Guhai have been using upto 1.5 times and those in Mazum upto 2 times the required quantity of seed resulting in higher expenses. As far as adoption of yield improvement practices is concerned, a majority of farmers across all project locations use treated, legal and HYV seeds. However, preparation of seedling nursery and undertaking gap filling are not commonly seen except in Dhoraji where farmers also use Plnofix to prevent premature dropping of flower and small bolls and spray liquid NPK to provide nutrients for enhancing growth at boll formation stage.

Adoption of water management practices like land levelling, preparation of modified bed and furrow and alternate row irrigation is high in Dhoraji and Dhari but comparatively lower in Dharoi, Guhai and Mazum. The practice of mulching is almost absent in all project locations. Upto 83% of farmers in Dharoi, 50% farmers in Guhai and 40% farmers in Mazum carry out flood irrigation. On the other hand, 48% of farmers in Dhoraji and 20% farmers in Dhari have adopted drip irrigation as compared to 13%, 3% and 3% of farmers in Mazum, Dharoi and Guhai.

It was found that all farmers covered under the study carry out deep ploughing in their fields before sowing cotton and are aware about preserving beneficial insects as part of better management practices for disease and pest reduction. However, spraying of neem oil and use of marigold, cow pea and maize is more common among farmers of Dhoraji and Dhari. Practices such as use of trichoderma viridi and pheromone trap have been adopted well in nearly all locations whereas use of yellow sticky trap and chilli garlic extract is seen to be more common among farmers of Dhoraji. Besides, farmers were also made aware of the importance of pest scouting, timely spraying of pesticides, use of pesticides at economic threshold level and technical know-how on production of bio-pesticide and bio-fertiliser.

As far as adoption of fertiliser reduction practices is concerned, a majority of farmers across all project locations are carrying out soil testing and administering fertiliser as indicated in soil test reports. Dhoraji and Dhari lead as far as use of azotobactor, psb culture, micronutrients and spot application of fertiliser in root zone are concerned. A uniformly high level of adoption of weeding/hoeing/inter-culture and use of FYM can be seen across all locations. With the exception of Dhari, vermi-compost and organic manure are also used to a fair extent by farmers in Dharoi, Guhai, Mazum and Dhoraji.

Regarding harvest and post-harvest practices, farmers show a high degree of adoption of many practices like picking rough quality cotton separately, collecting cotton in clean cloth after picking, drying cotton in the sun before storing, taking care to prevent contamination and ensuring its clean transportation. Farmers in North Gujarat prefer to pick cotton between 8am to 12 noon whereas this activity carries on for almost the entire day in Saurashtra and women and children are mostly not involved in cotton picking.

Even though a majority of farmers pick rough quality cotton separately, very few of them are able to maintain segregation between good and poor quality cotton at the time of storage - only 5% of farmers in Dharoi, 7% farmers in Mazum and 40% farmers in Guhai do not mix good and poor quality cotton. This is happening primarily because of lack of proper storage facilities at farmer-level and lack of price incentive from buyers for better quality of cotton. Among other harvest and post harvest practices, wearing of cap while picking cotton is less common in Saurashtra while most of the farmers still continue to use empty Urea/DAP bags for storing cotton.

Farmers faced a number of issues trying to adopt BMP in cotton in the initial stages of the project. While reduction in use of chemical fertilisers and pesticides significantly affected yield of cotton in the first year, farmers also faced problems in the production and use of bio-pesticides and bio-fertilisers. Also, control of pests and wild animals proved more difficult using these bio-inputs. However, a good overall level of adoption of BMP can now be seen across all project locations along with a gradual replication of the good practices on other crops as well.

The impact of the project is visible in a number of areas. Among the most significant is input cost savings to farmers as a result of increased use of bio-pesticides and bio-fertilisers and reduced dependence on chemical inputs. This has reduced farmer expense on chemical pesticides by between Rs. 927/- in Dhari and Rs. 3135/- in Dharoi per Ha. Similarly, expenditure on chemical fertilisers has reduced by Rs. 1279/- in Dhari and Rs. 9360/- in Dharoi. These savings have been much higher in Dharoi and Guhai as compared to Mazum, Dhoraji and Dhari, indicating a greater impact of adoption of bio-inputs in these areas. Similarly, savings on seed expenses of farmers vary between Rs. 17/- per Ha in Mazum and Rs. 407/- per Ha in Dhoraji. The total savings per farmer range from Rs. 2206/- per Ha in Dhari to Rs. 12783/- per Ha in Dharoi and are generally higher across North Gujarat as compared to Saurashtra.

Improvement in yields of cotton after the project can also be seen from the difference in yield between sample and control farmers which varies from 127 kg per Ha in Guhai to 323 kg per

Ha in Dhoraji. The twin benefit of reduced inputs costs and improved yield has led to higher economic benefit for farmers that ranges from Rs. 11238/- per farmer per Ha in Mazum to Rs. 18728/- in Dharoi. There have been a number of less quantifiable benefits too. Improvements are being reported by farmers in soil health as indicated by loosening up of soil; reduction is its hardness and salinity, increase in earthworms, bacteria and micro-organisms and higher water retention capacity. As a result of better soil health, quality of cotton has also improved in terms of increase in weight, increased staple length, larger cotton bolls, fuller development of plants and better quality and shine of cotton.

Extensive capacity building of farmers and WUAs has been undertaken for cotton farmers as part of the project. While farmers have mainly benefitted from advice related to BMP in cotton and input supply, they have also been able to access mobile-based weather, market and canal irrigation related information under the project. In addition, the project has helped increase farmers' overall awareness of the diseases and pests of cotton crop, the precautions to be taken while using pesticides and their correct method of application. Besides, strengthening of WUAs has resulted in increased farmer involvement, more effective WUA administration and improvement in the timeliness of irrigation services.

Although the project has been able to achieve a good overall level of BMP adoption among farmers, the degree of adoption tends to vary across different locations. In order to realise the full potential of the project, it is important that efforts are made to identify which specific practices have low adoption, what are the issues or challenges being faced by farmers in adoption and how these issues can be addressed in each project location. For this, closer monitoring of adoption in the field is necessary.

The commonly grown Bollgard II variety of BT cotton is known to be resistant to pests like bollworms but has become increasingly vulnerable to bollworm attack over the years. This has started to affect cotton production, particularly in Saurashtra where a growing incidence of pink bollworm is being reported. Good agricultural practice recommends using 20% non-BT cotton along with BT cotton farmers usually do not follow these instructions. This is making BT cotton more vulnerable to pest attacks, ultimately threatening both the future of BT cotton as well as the livelihoods of farmers dependent on it. It is therefore crucial that DSC strongly emphasises the use of both non-BT seed and BT seed during farmer training to limit BT cotton's further resistance to bollworm.

Deep tubewells/borewells are emerging as the preferred source of irrigation for farmers especially in North Gujarat. Added to this, the low adoption of drip irrigation is making the already severe groundwater problem in this part of the State worse. Considering the huge environmental cost of excessive groundwater extraction and the time, effort and resources

that have gone into nurturing and strengthening WUAs as part of promoting PIM in Gujarat over the past two decades, it is important that urgent steps are taken to address this issue. However, despite a decline in direct irrigation from canals for cotton, the importance of their role in recharging sub-surface water levels must not be ignored.

Going forward, a few other areas that need attention are: one, ensuring that gaps in implementation of BMP in the field as identified in this study are addressed, two, encouraging farmers to install drip irrigation to increase water use efficiency and improve productivity. Three, extending the services of KPCL to Dhoraji so that farmers in this project area also get access to reliable and quality agriculture inputs at affordable prices. Four, improving understanding, marketing and visibility of BMP cotton in the market in order to help farmers realise better prices from its sale.

1. INTRODUCTION

1.1. Background

In August 2009, Development Support Centre (DSC) Ahmedabad and IKEA International started a collaborative initiative in the form of "Better and Sustainable Cotton" project. In order to assess the effectiveness of project interventions in DSC's irrigated and rain-fed areas, one Participatory Irrigation Management (PIM) location of Dharoi in Mehsana district and one rain-fed location of Dhari in Amreli district was chosen from amongst DSC's operational field units. Over the 40-month project period till December 2013, a total of 13,800 farmers were covered including 9,800 in Mehsana and 4,000 in Amreli. As part of the project, beneficiary farmers adopted Better Management Practices (BMP) in 11,000 Ha of the total 14,000 Ha project area, producing more than 14,800 tons of BMP cotton every year. Also, 2,635 farmers were linked with reputed buyers and ginners for selling of more than 2,100 tonnes of seed cotton.

An end-of-project evaluation by DSC and IKEA found that while the project had been successful in enhancing farmers' net income and improving conditions of cotton farming through promotion of better crop practices, development of farmer-buyer tie ups etc., there still remained post project sustainability related issues. A need was therefore felt to integrate IKEA's BMP project with DSC's PIM interventions for a more holistic development of agriculture based livelihoods of small and marginal farmers. Thus, the BMP-PIM Cotton project was conceptualised in 2013-14.

1.2. About the project

The BMP-PIM Cotton project covered 7 irrigation projects involving nearly 35,000 farmers representing 195 WUAs across 140 villages and 60,000 hectare designed canal command area in Mehsana, Sabarkantha, Aravali, Ahmedabad and Rajkot districts of Gujarat. The main objectives of the project were to promote better management practices for sustainable cotton cultivation, build capacity of WUAs in PIM and improve service delivery of farmer collectives to their member farmers for irrigation and agriculture support activities.

The key activities taken up as part of the project were:

A. Identification, awareness creation and capacity building of targeted farmers for promotion of better and more sustainable crop management practices of cotton.
B. Field demonstration of better crop practices, seeds, technologies and organic inputs.

C. Organising farmer-to-farmer and farmer-scientist workshops and development and outreach of IEC materials for addressing knowledge and information gaps.
D. Sensitisation of farmers, community members and school children for adopting environment friendly crop practices and use of appropriate dose of inputs.
E. Project registration of farmers and formation of farmer producer organisations for collective backward and forward linkages.
F. Liaison with reputed private ginners and cotton buyers for exploring better market tie ups and training and exposure on post harvest processes and quality management.
G. Awareness and capacity building of Water User Associations (WUAs) for effective canal irrigation management.

A brief about the project achievements is presented in Table 1 below.

Table 1: BMP-PIM Cotton project achievements

Name of irrigation projects	No. of farmers registered under the project	Total area covered under BMP cotton (in Ha)	No. of WUAs covered by capacity building*
Dharoi	18531	11651	109
Guhai	5986	8465	25
Mazum	4128	3203	12
Bhadar	3566	7855	12
Fofal	2032	5456	10
Kujad	42	99	15
Vehlal	508	393	12
Total	**34793**	**37123**	**195**

* Details of capacity building inputs are given in Table 30 on pg. 39

1.3. Aim of the study

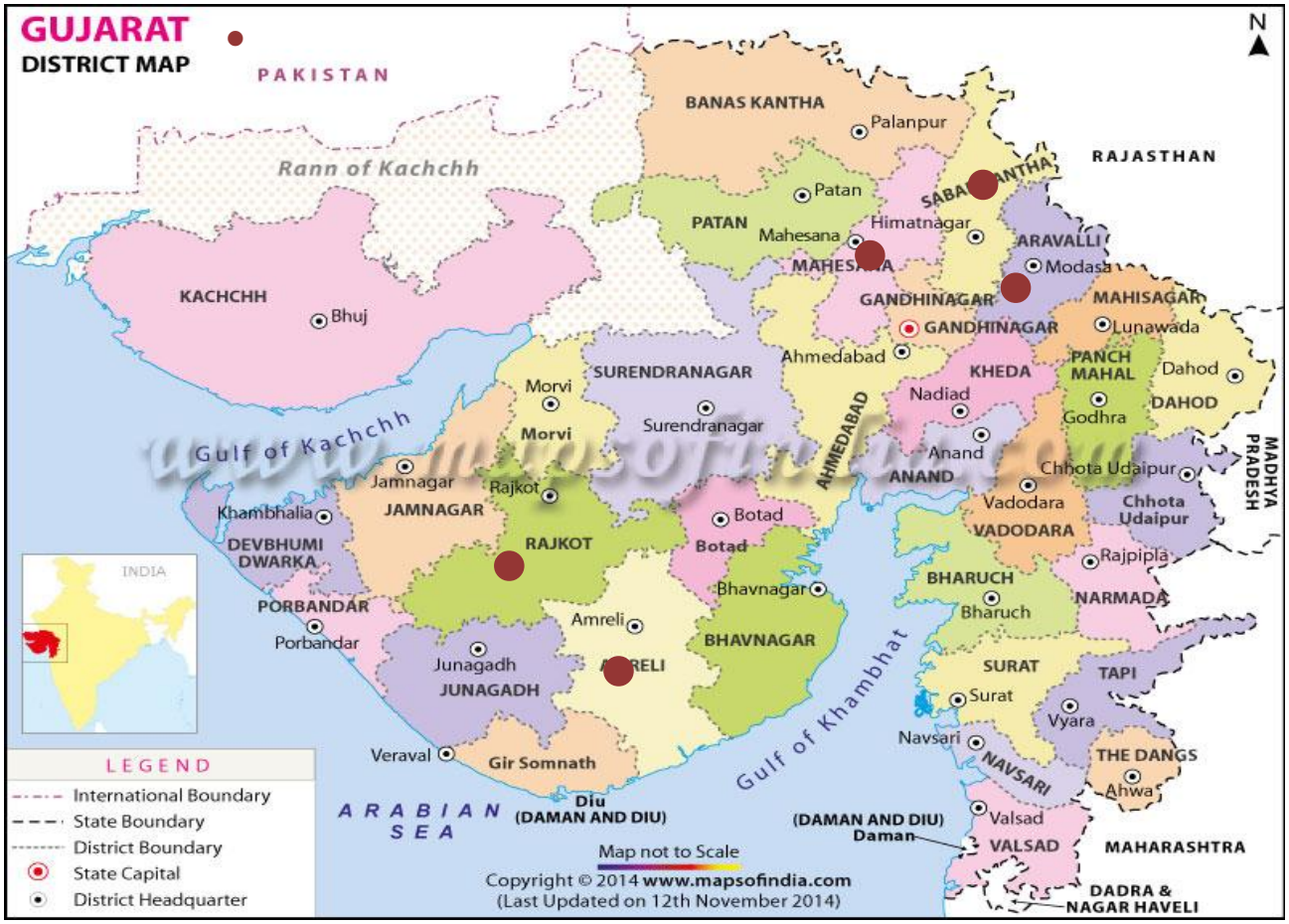
After completion of more than two years of the project, it was felt necessary to undertake a comprehensive impact assessment of project interventions. The aim of the present study therefore is to help DSC and IKEA to understand and assess the qualitative and quantitative impacts of the activities, processes and practices adopted under the BMP-PIM Cotton project and utilise this learning to better inform future field interventions, training design and policy advocacy initiatives.

1.4. Scope of work

The study was carried out across **29 villages of 5 districts** of Gujarat namely, Mehsana, Sabarkantha, Aravalli, Amreli and Rajkot. A **total of 170 farmer respondents in 5 operational areas of DSC** – 4 PIM locations of Dharoi, Guhai, Mazum and Dhoraji and 1

rain-fed location of Dhari - were surveyed. Although Kujad and Vehlal were part of the initial survey design, the two locations were subsequently dropped as these areas have recently been declared industrial areas and no cotton project activities are being carried out. Also, while Dhari was not a project area under the BMP-PIM project, it was included in the current study in order to understand impact of interventions carried out during the "Better and Sustainable Cotton" project from 2009-13.

Figure 1 below shows the project locations covered under the survey while Table 2 provides details of the area-wise number of farmers and number of villages selected for the study.



- Project locations

Figure 1: Project locations covered under study

Table 2: Details of study sample

Name of irrigation projects	Name of block(s)	Name of District	No of villages	No. of beneficiary farmers surveyed	No. of control farmers surveyed	Total no. of farmers surveyed
Dharoi	Visnagar, Unjha, Kheralu, Satlasna, Vadnagar	Mehsana	12	59	12	71
Guhai	Himmatnagar	Sabarkantha	6	30	6	36
Mazum	Modasa, Dhansura	Aravalli	3	15	3	18
Bhadar	Dhoraji	Rajkot	3	15	3	18
Fofal	Dhoraji	Rajkot	2	10	2	12
Dhari	Dhari	Amreli	3	15	*	15
Total			**29**	**144**	**26**	**170**

* No control farmers were present in Dhari due to 100% project coverage. As a result, there is no data regarding control sample in Dhari in the report.

The study aimed to assess impact on the basis of key impact indicators such as:

i. Change in yield of cotton

ii. Change in crop practices and production related risks

iii. Change in cost of cultivation and price realisation from cotton

iv. Change in use of chemical fertilizers and pesticides and shift towards organic inputs

v. Level of adoption of efficient irrigation techniques like drip/ sprinkler etc.

vi. Effect on functioning and participation in WUA

vii. Change in the quality and timeliness of irrigation services provided by WUA to the farmers

viii. Information availability to farmers with regard to technology, weather, market etc.

ix. Project set-up, its effectiveness and message delivery system

x. Replication of learning from sustainable cotton cultivation to other crops.

1.5. Approach and Methodology

The study approach and methodology consisted of the following elements:

1. Review of secondary data and information on the project to understand the various activities, interventions and benefits accrued to farmers as part of the project.

2. Primary survey across the 5 operational areas of DSC using a structured questionnaire. Selection of villages in each operational area as well as farmers in each village was made in consultation with DSC. Farmer selection was based on the following criteria:

   i. 2 farmers owning less than 1 Ha land
   ii. 2 farmers owning between 1-2 Ha of land
   iii. 1 farmer owning more than 2 Ha of land and
   iv. 1 farmer not enrolled under the project (control)

   Control farmers were covered in order to understand the extent to which benefits to participant farmers could be attributed to project interventions. A total of 170 farmers including a control sample of 26 farmers were covered as part of the study.

3. Discussions with concerned DSC team members at Head Office and Field Offices.

4. A Focus Group Discussion (FGD) in each operational area with progressive/innovative farmers and members of Water User Associations (WUAs).

2. STATUS OF COTTON PRODUCTION

2.1. Land under cotton cultivation

Figure 2 shows the total land availability in descending order across the 5 project locations. It can be seen that the average land availability per sample farmer ranges from a high of 3.6 Ha in Mazum to a low of 2.3 Ha in Dharoi.

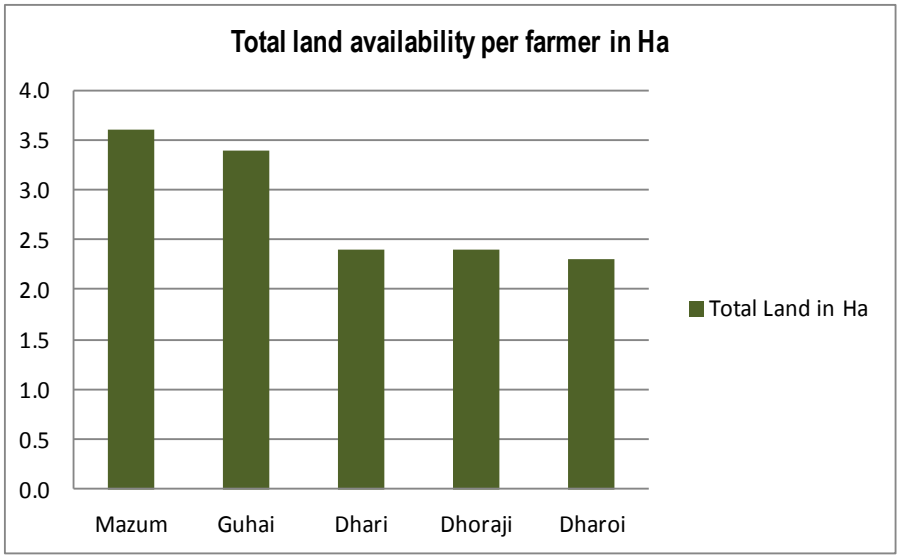


Figure 2: Total land availability per farmer

Considering that total land available with a farmer is a function of owned and leased land, total land availability can be defined as:

Total land availability = (Owned land + Leased in land) – (Leased out land)

Figure 3 depicts this information for all project locations where it is seen that the practice of 'leasing in' land for cultivation is not prevalent in Dhari and Dhoraji. In contrast, each farmer in Guhai has leased in an average of 0.8 Ha of land, followed by 0.4 Ha in Mazum and Dharoi. The number of farmers 'leasing out' land is negligible in comparison to the total sample and has therefore, not been considered in the analysis.

Figure 3 also shows that as far as land ownership is concerned, the pattern of ownership follows what has been seen in the case of total land availability where the extent of land owned by each sample farmer is highest in Mazum (3.2 Ha), followed by Guhai (2.6 Ha), Dhari and Dhoraji (2.4 Ha) and Dharoi (1.9 Ha). Land ownership figures in the case of

control farmers show a similar pattern with Mazum recording the highest average land holding size of 4.1 Ha per farmer and Dharoi, the lowest at 1.4 Ha.

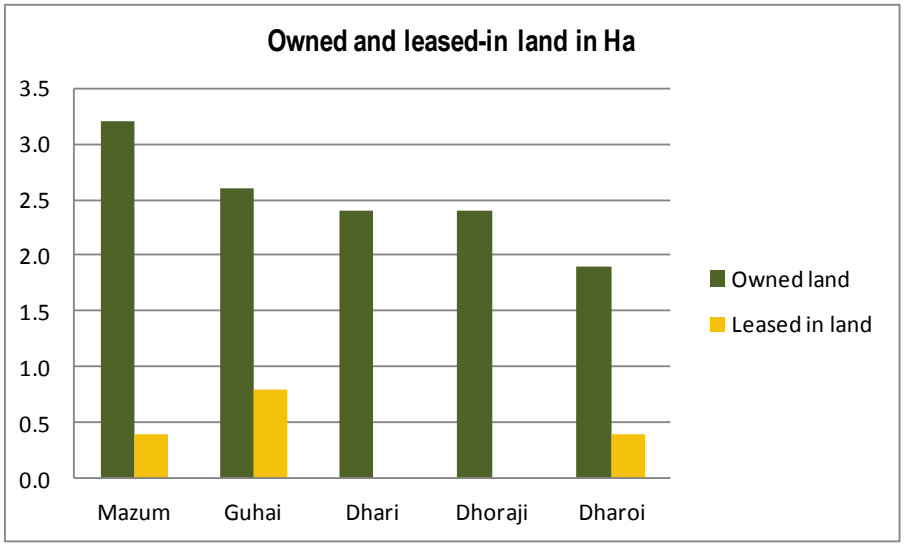


Figure 3: Owned and leased in land

Figure 4 presents a picture of the extent of land devoted to cotton cultivation by sample farmers and shows Dhoraji having the highest (86%) share of total land allocated for growing cotton, followed by 69% in Dhari. This figure however, drops significantly for Guhai (37%), Dharoi (36%) and Mazum (35%). The same trend is seen in the case of control farmers as well where Dhoraji has a higher proportion (62%) of land allocated to cotton as compared to Dharoi, Guhai and Mazum.

On account of the abundant availability of black soil, Saurashtra has been the traditional cotton growing region of Gujarat whereas cotton cultivation in North Gujarat only started 8-10 years back as a result of improved irrigation facilities and introduction of BT cotton. Since soil in North Gujarat is comparatively less suited for cotton, farmers in this region also grow a variety of other crops like fennel, castor, mustard and tobacco on their land apart from cotton. This may explain the differences in the extent of land under cotton between the two regions.

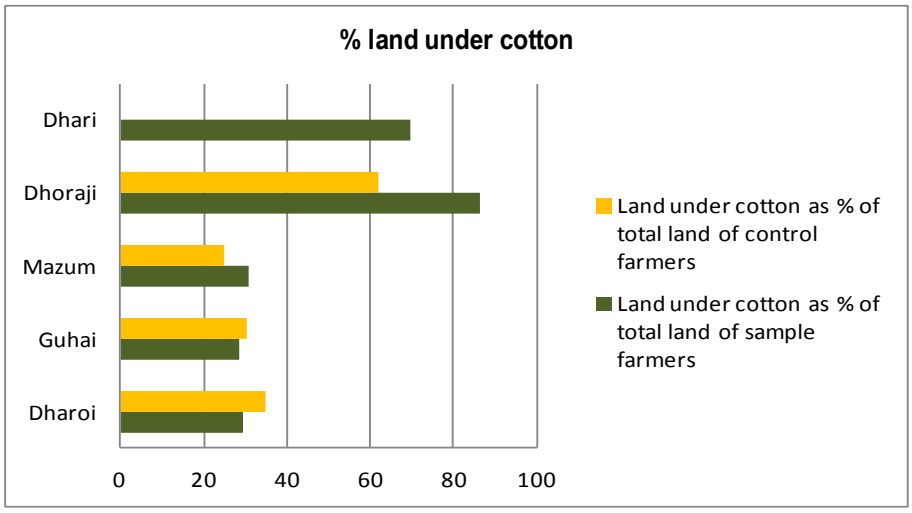


Figure 4: Extent of land under cotton cultivation

2.2. Irrigation

The BT cotton variety requires good irrigation and is usually sowed in Gujarat before monsoon in the months of May/June to take maximum advantage of water availability during the rainy season. However, to minimise the risk of crop failure due to poor monsoon, farmers ensure that land under the cotton crop is fully irrigated (see Table 3) through the use of multiple sources of irrigation (Table 4).

Table 3: Status of irrigation

Project area	Avg. land under cotton per farmer	Avg. irrigated land under cotton per farmer	Extent to which land under cotton is irrigated
	Ha	Ha	%
Dharoi	0.7	0.7	100
Guhai	1.0	1.0	100
Mazum	1.1	1.1	100
Dhoraji	2.1	2.0	95
Dhari	1.7	1.6	94

Table 4: Source of irrigation-sample and control farmers

Project area	Canal	Borewell	Well	Canal	Borewell	Well
	% of sample farmers			% of control farmers		
Dharoi	0	73	24	0	67	25
Guhai	13	43	50	17	33	50
Mazum	0	0	100	0	0	100
Dhoraji	100	4	88	20	0	100
Dhari	0	7	93			

It can be seen from the tables that a large proportion of farmers are dependent on wells and borewells for irrigating cotton. The case of Dhoraji is slightly different where 88% and 100% of farmers respectively draw water from wells and canals to irrigate the cotton crop. However, in the villages selected for sample survey in Dharoi, Guhai and Mazum, use of canal seems to be insignificant or absent at least for cotton cultivation (Table 4).

Additional data on the total irrigation received (for all crops) from canals by farmers in the sample villages over the past 3 years was collected from DSC (Table 5) to analyse the status of contribution of canl irrigation. The data shows that at an aggregate village level, canals are still supplying water for irrigation although the extent of irrigation has come down over the years, especially in Dharoi and Guhai. FGDs carried out with farmers as part of the study also revealed that farmers are taking a maximum of 2-4 waterings from canals during the months of October-December, especially when monsoons have withdrawn early.

Thus, based on an analysis of both primary and secondary data and FGDs, it is clear that farmers' dependence on canal water for irrigation has fallen in at least two of the project locations in North Gujarat. The shift from canal to borewells/deep tubewells can most likely be attributed to the lifting of dark zone restrictions in 57 talukas of Gujarat by the state government in 2012, paving the way for resumption in groundwater extraction through borewells and grant of licenses for new borewells. Secondly, the cost of drawing water from canals and borewells is nearly the same – canal irrigation rates are Rs. 1800/- per Ha for 5 waterings whereas rentals for drawing water using diesel/electric motor vary between Rs. 70 to Rs. 100/-. Also, an average of 4 hours of pumping is required per Ha for 1 watering; therefore, for 5 standard watering using motor, the total cost that a farmer bears is between Rs. 1400 to Rs. 2000/- per Ha. Further, electricity connections have become more easily available making borewells a preferred source of irrigation among farmers. In contrast, borewell irrigation is not very common in Saurashtra due to presence of rocks at sub-surface level. Therefore, farmers here mostly use well or canal water for irrigation.

Table 5: Extent of irrigation by canal in sample villages

Project area	2013	2014	2015
	Total area irrigated by canal in sample villages (in Ha)		
Dharoi	1970	1905	1647
Guhai	409	355	353
Mazum	109	123	131
Dhoraji	521	572	1123

The excessive extraction of groundwater through borewells especially in Dharoi has resulted in water tables going down to as much as 1000 feet in some parts. Besides, high TDS levels

measured by a 2011 study[1] conducted by DSC in Dharoi indicate that groundwater has turned brackish/saline and therefore unsuitable even for irrigation purpose. Various other studies indicate that artificial recharge and control on extraction of groundwater is the only long term and feasible solution for the problem.

2.3. Input cost

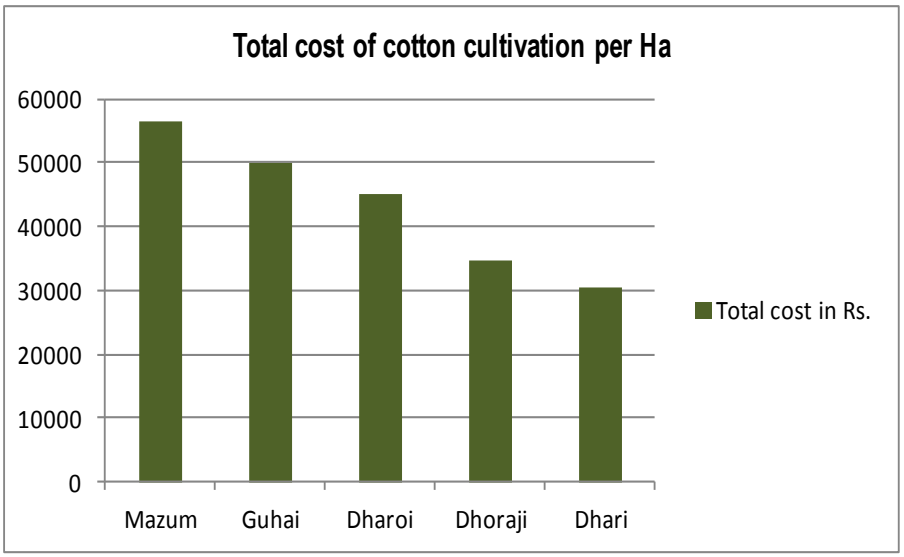


Figure 5: Total cost of cotton cultivation

Input costs for cotton production were ascertained from farmers under various heads including cost of irrigation, seeds, fertiliser, pesticide, weedicide, transport and marketing as well as labour costs involved in land preparation, sowing, spraying of fertilisers and pesticides, weeding, irrigation and harvesting. Cost of Farmer Yard Manure (FYM) has not been considered since farmers rarely buy FYM from the market and instead use what they get from their own animals. Also, the frequency of application of FYM is not yearly but every 2-4 years. The total cost borne by the farmer per Ha of cotton cultivation in each project location is presented in descending order in Figure 5. These costs have been further disaggregated into input costs and labour costs and shown in Table 6.

[1] Designed capacity of the Dharoi dam vs. Actual Command area irrigated', DSC 2011

It can be seen from the table that per Ha cost of inputs is much higher in North Gujarat as compared to Saurashtra. The higher level of input use in North Gujarat could possibly be explained on account of the smaller land parcels devoted to cotton cultivation in this region, from which farmers wish to take the maximum possible returns. On the other hand, farmers in Saurashtra have bigger land holdings under cotton cultivation and following a high input regime on large land parcels would become prohibitively expensive for them.

Table 6: Cost of cotton cultivation

Project area	Cost of inputs (Rs.) per Ha	Cost of labour (Rs.) per Ha	Total cost per Ha (Rs.)
	A	B	A+B
Dharoi	19980	25186	45166
Guhai	24004	26010	50014
Mazum	25694	30711	56406
Dhoraji	13880	20708	34588
Dhari	13031	17435	30465

The cost of labour is linked with input use and therefore shows a similar trend as above. However, lower labour costs in Saurashtra can also be attributed to the higher availability of migrant labour in this region owing to agriculture being the predominant economic activity in Saurashtra, unlike other parts of Gujarat.

2.4. Economics of cotton production

Figure 6 presents the average cotton yield per Ha in descending order across the 5 project locations for sample farmers. As can be seen from the Figure 6, the highest cotton yield has been recorded in Dhoraji at 2036 kg/Ha and lowest in Dhari at 1624 kg/Ha since the latter is a rain-fed area. FGDs with farmers revealed that yields have suffered significantly over the past 2 years owing to adverse weather conditions, instances of wilting and pink bollworm attack. Farmers claimed that in the past, where yields had been as high as 2900-3400 kg/Ha during favourable weather years, they were currently experiencing a 30-40 per cent loss.

Table 7: Cotton yield in Gujarat

Year	Cotton yield in kg/Ha
2004-05	1860
2005-06	2269
2006-07	2094
2007-08	2206
2008-09	1857
2009-10	1814
2010-11	1960
2011-12	2000
2012-13	1809
2013-14	2063
2014-15	1891
2015-16	1774*

*projected
Source: Cotton Advisory Board as reported in
Times of India dated 18 March 2016 (extrapolated data).

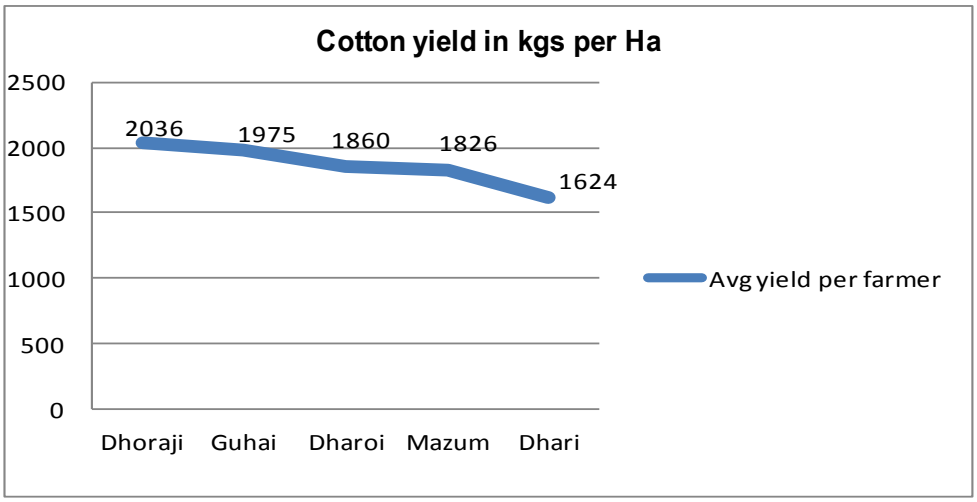


Figure 6: Cotton yield of sample farmers

This is also corroborated by past data on cotton yield from the Cotton Advisory Board (CAB) of India presented in Table 7. Since the CAB data set assumes cotton yield on the basis of the quantity of cotton *fibre* or *lint* extracted from raw cotton[2] and not the total quantity of seed cotton harvested, the data has been extrapolated for purposes of comparison with yields obtained from project locations. The data shows that while yields were 2063 kg/Ha in 2013-

[2] Taken as 35% as per various estimates

14, they declined to 1891 kg/Ha in 2014-15 and are projected to go down further to 1774 kg/Ha this year. Since the CAB data is aggregate state-level data and includes cotton production from rain-fed areas, the reported yields in Table 7 are comparatively lower than those reported from project locations in Figure 6.

To add to farmers' woes, global prices of cotton have shown a downward trend over the past couple of years due to changes in the macroeconomic environment including reduction of cotton imports by China and lower demand from Indian spinning mills. Where market prices of cotton had gone upto Rs. 67.50/kg in 2011-12, they are currently at a low of between Rs. 41-47/kg as reported by farmers across the different project locations (Table 8). Although farmers may get better prices by delaying the sale of cotton, most of them are in need of money at this time of the year due to the festive/wedding season and tend to sell their stock immediately upon harvest in Oct-Nov.

The combined effect of low yields and subdued market prices is having a huge impact on income from cotton cultivation. Seen against the total cost of cotton production, it is clear that expected profits from cotton are under a lot of pressure, especially in North Gujarat where input intensive cotton cultivation is undertaken (Table 9 and Figure 7).

Table 8: Expected income from cotton

Project area	Avg yield of cotton per Ha (in kg)	Market price of cotton# (Rs./kg)	Expected income per Ha of cotton (Rs.)
	A	B	A*B
Dharoi	1860	41	77134
Guhai	1975	43	84751
Mazum	1826	44	80430
Dhoraji	2036	47	95170
Dhari	1624	47	76111

#As reported at time of survey

Table 9: Economics of cotton production

Project area	Expected income per Ha of cotton (Rs.)	Total cost of cotton production per Ha (Rs.)	Expected per Ha profit (Rs.)
	A	B	A-B
Dharoi	77134	45166	31968
Guhai	84751	50014	34737
Mazum	80430	56406	24024
Dhoraji	95170	34588	60582
Dhari	76111	30465	45646

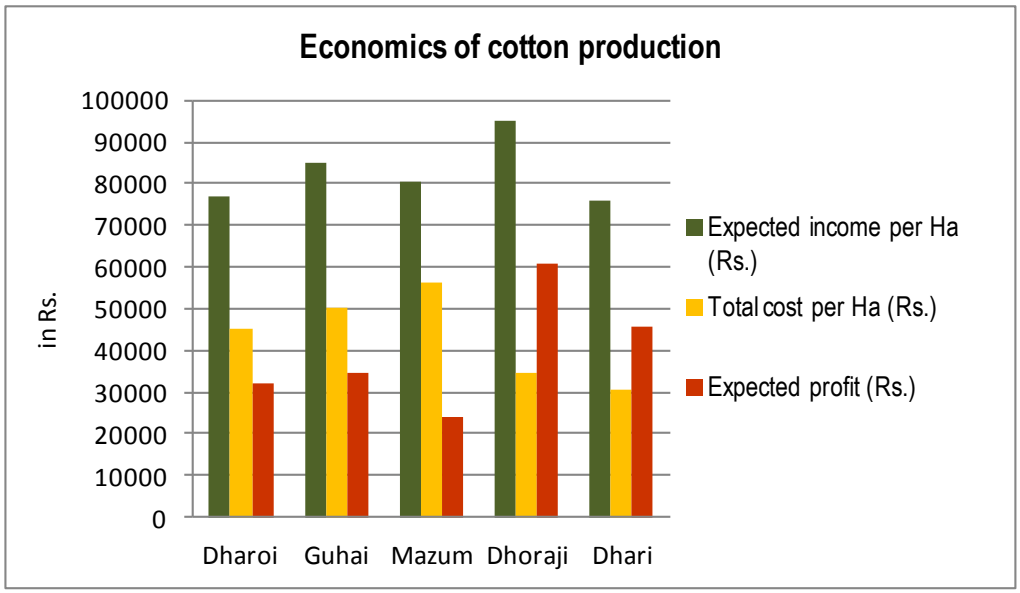


Figure 7: Economics of cotton production

3. LEVEL OF ADOPTION OF BMP

The Better Management Practices (BMP) on which cotton farmers were imparted training and exposure by DSC as part of the BMP-PIM project can be broadly divided into the following:

i. Seed rate
ii. Yield improvement practices
iii. Water management practices
iv. Disease and pest reduction practices
v. Fertiliser reduction practices
vi. Harvest and post harvest practices

The level of adoption of each of these BMPs is described in detail below:

3.1. Seed rate

As part of BMP for cotton, putting a single seed in one hole which translates into a seed rate of 1 packet of 450 gms of cotton seed per acre is recommended to farmers. However, it was seen that while most farmers in Dhoraji and Dhari have followed this recommendation, sample farmers in Dharoi and Guhai have been using between 1 to 1.5 packets of seed per acre while those in Mazum are using 2 packets of seed per acre on an average (Table 10). To compare seed rate between sample and control farmers, the expense made on seed purchase by both sets of farmers has been presented in Table 11: Expense on seed by sample and control farmers. The table highlights the savings on seed expenses of sample farmers due to adoption of BMP and shows that farmers in Dhoraji have achieved maximum savings followed by Guhai, Dharoi and Mazum.

Table 10: Seed rate

Project area	Average quantity of seed used per acre (in grams)	No. of seed packets used (assuming 1 standard packet = 450 gms)
Dharoi	565	1.3
Guhai	765	1.7
Mazum	900	2.0
Dhoraji	469	1.0
Dhari	487	1.1

Table 11: Expense on seed by sample and control farmers

Project area	Average per Ha expense on seed - sample farmer (in Rs.)	Average per Ha expense on seed - control farmer (in Rs.)	Seed expense saving per Ha (in Rs.)
Dharoi	3045	3333	288
Guhai	3326	3639	313
Mazum	3858	3875	17
Dhoraji	2443	2850	407
Dhari	2086	NA	NA

3.2. Yield improvement practices

The following yield improvement practices have been recommended by DSC under BMP to farmers:

a. Use of treated legal seed in place of spurious, uncertified seeds to minimise seed failure
b. Use of High Yielding Variety (HYV) seed for achieving better productivity
c. Use of single seed in one hole to reduce expense on seeds
d. Preparation of seedling nursery for gap filling in case some of the seeds do not germinate
e. Undertaking gap filling for maintaining both the desired population of plants as well as the expected yield from cotton
f. Use of Plnofix (chemical) for preventing premature dropping of flower and small bolls during cloudy weather conditions
g. Spraying liquid NPK at boll formation stage for enhancing growth of the cotton boll by compensating nutrients that are not available in the soil

An analysis of the level of adoption of these practices (Figure 8 & Table 12) reveals that a majority of farmers across all 5 project locations use treated, legal and HYV seeds. However, lower levels of adoption are seen with regard to use of single seed in one hole, especially by farmers in Guhai and Mazum. In fact, in Mazum, the percentage of farmers using single seed is as low as 20% which explains the highest seed rate in Mazum as mentioned in the previous section.

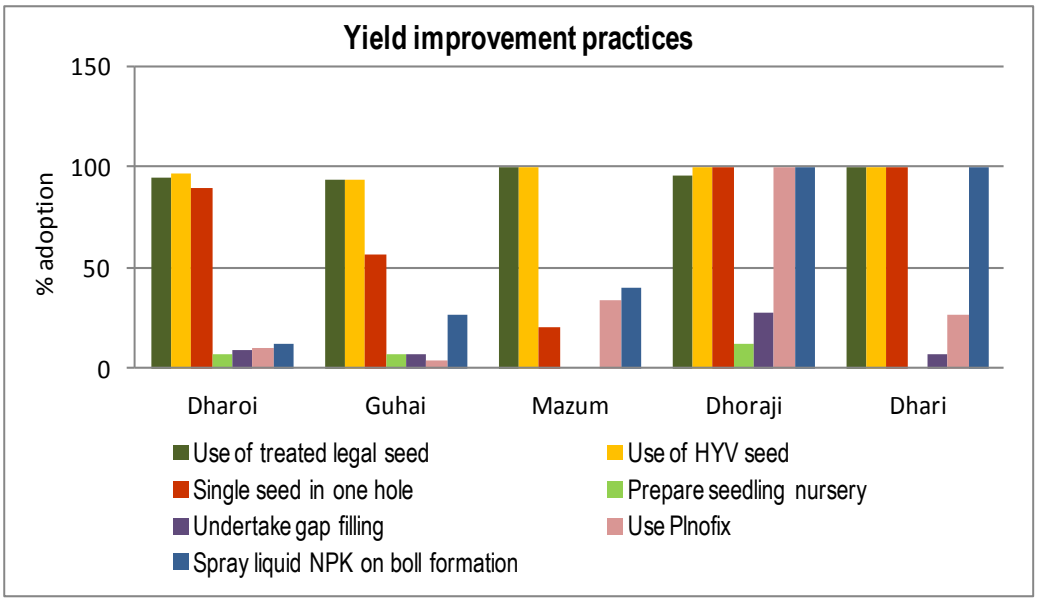


Figure 8: Yield improvement practices

Table 12: Adoption of yield improvement practices

Project area	Use of treated legal seed	Use of HYV seed	Single seed in one hole	Prepare seedling nursery	Undertake gap filling	Use Plnofix	Spray liquid NPK on boll formation
	% of farmers adopting						
Dharoi	95	97	90	7	8	10	12
Guhai	93	93	57	7	7	3	27
Mazum	100	100	20	0	0	33	40
Dhoraji	96	100	100	12	28	100	100
Dhari	100	100	100	0	7	27	100

Practices such as preparation of seedling nursery and undertaking gap filling are virtually absent except to some extent in Dhoraji. Also, 100% of sample farmers report using Plnofix in Dhoraji. Further, Dhoraji and Dhari farmers lead in adoption of the practice of spraying liquid NPK at boll formation stage.

3.3. Water management practices

The following water management practices have been recommended by DSC under BMP to farmers:

a. Water scouting before irrigation to determine how much water is needed by the plant
b. Land levelling before sowing to ensure even spread of irrigation water on the farm
c. Preparing modified bed and furrow that helps in saving water, since irrigation is carried out by simply running water down a seedbed furrow as opposed to flood irrigation. Incidence of weed also gets reduced since water flooding is not done and weeds do not get enough water to grow.

d. Irrigating alternate rows in order to save water and irrigation at critical stages of vegetative growth.
e. Avoiding irrigation of entire farm/carrying out flood irrigation to minimise wastage of water and growth of weed.
f. Adopting drip irrigation to reduce water use and improve productivity. It is claimed that drip irrigation can save upto 80% water and improve productivity by 1.5 times besides saving labour costs for watering and administering fertiliser/pesticide (since these can be done through drip itself)
g. Mulching or the application of a layer of organic material like grass, straw etc. on the top of soil in order to conserve moisture, improve soil health and fertility and reduce weed growth.

An analysis of the level of adoption of these practices (Figure 9 & Table 13) shows that 100% of sample farmers in Dharoi, Guhai, Dhoraji and Dhari and 73% of sample farmers in Mazum undertake water scouting before irrigation. However, a look at the overall level of adoption of water management practices shows that land levelling, preparation of modified bed and furrow and alternate row irrigation have high levels of adoption in Dhoraji and Dhari but comparatively lower levels of adoption in Dharoi, Guhai and Mazum. The practice of mulching is near-absent across all 5 project locations.

Survey data also reveals that upto 83% of farmers in Dharoi, 50% farmers in Guhai and 40% farmers in Mazum irrigate their whole farm/carry out flood irrigation – a practice that not only results in wastage of water but also leads to more weed growth. On the other hand, 48% of farmers in Dhoraji and 20% farmers in Dhari have adopted drip irrigation as compared to 13%, 3% and 3% of farmers in Mazum, Dharoi and Guhai. Although the state government has increased subsidy on installation costs of drip irrigation from 50% to 60%, the adoption of drip remains low in North Gujarat. This could be explained on account of the small land holdings of farmers (especially in Dharoi), high cost of installation of drip systems and presence of co-operative borewells as a result of which, it may be difficult to get common agreement from all member farmers of the co-operative.

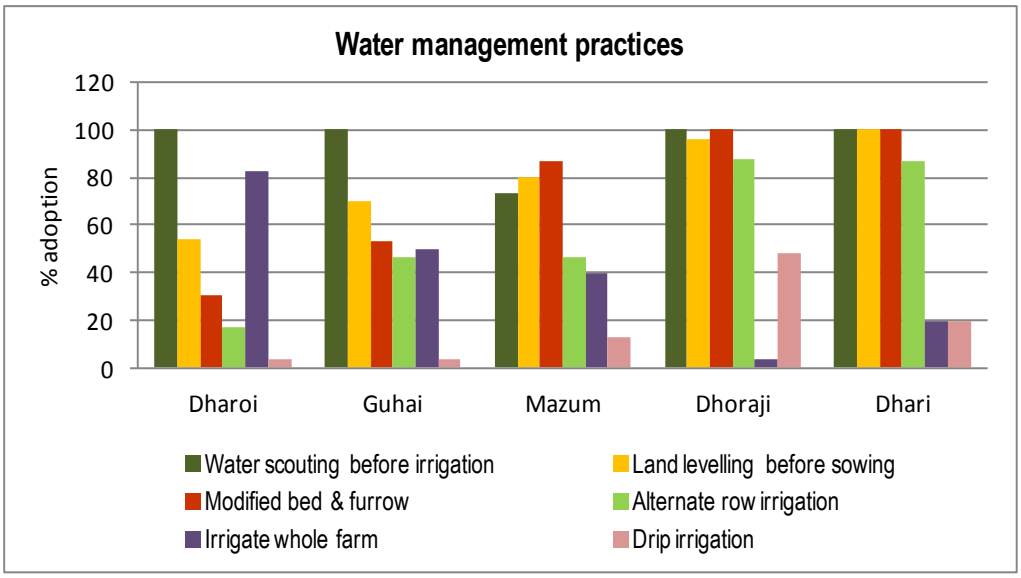


Figure 9: Water management practices

Table 13: Adoption of water management practices

Project area	Water scouting before irrigation	Land levelling before sowing	Modified bed & furrow	Alternate row irrigation	Irrigate whole farm	Drip irrigation	Mulching
	% of farmers adopting						
Dharoi	100	54	31	17	83	3	2
Guhai	100	70	53	47	50	3	0
Mazum	73	80	87	47	40	13	0
Dhoraji	100	96	100	88	4	48	4
Dhari	100	100	100	87	20	20	0

3.4. Disease and pest reduction practices

The following disease and pest reduction practices have been recommended by DSC under BMP to farmers:

a. Precautionary use of trichoderma viridi to prevent/minimise wilting in cotton plant. Trichoderma is usually mixed with vermi-compost and care has to be taken that adequate moisture is available in soil at the time of its application.
b. Deep ploughing before sowing of cotton to ensure that eggs of pests like mealybugs etc. get directly exposed to the summer sun and cannot survive.
c. Spraying of neem oil on leaves of the cotton plant for prevention of sucking pests like Aphid, Jassid and Thrips since the natural chemical 'Azaderectin' present in neem acts as a pest repellent.
d. Use of light trap for reducing incidence of sucking pests
e. Use of pheromone trap to control bollworm

f. Use of yellow sticky trap for catching sucking pests
g. Use of bird stand to control bollworm which birds naturally feed on
h. Preservation of beneficial insects to prevent incidence of sucking pests. Beneficial insects naturally exist in the environment but get killed by the chemical pesticides used by farmers.
i. Use of marigold/cow pea/maize as mixed crop along with cotton to control sucking pests which prefer these mixed crops over cotton.
j. Spraying chilli garlic extract to control sucking pests

An analysis of the level of adoption of these practices (Figure 10 & Table 14) shows that 100% of sample farmers in all 5 project locations carry out deep ploughing in their fields before sowing cotton. While practices such as preservation of beneficial insects have been adopted to a high degree by farmers across all locations, spraying of neem oil and use of marigold, cow pea and maize is more common among farmers of Dhoraji and Dhari.

Practices such as use of trichoderma viridi and pheromone trap have been adopted well in nearly all locations whereas use of yellow sticky trap and chilli garlic extract is seen to be more common among farmers of Dhoraji. Use of light trap and bird stand is not significant across any project location.

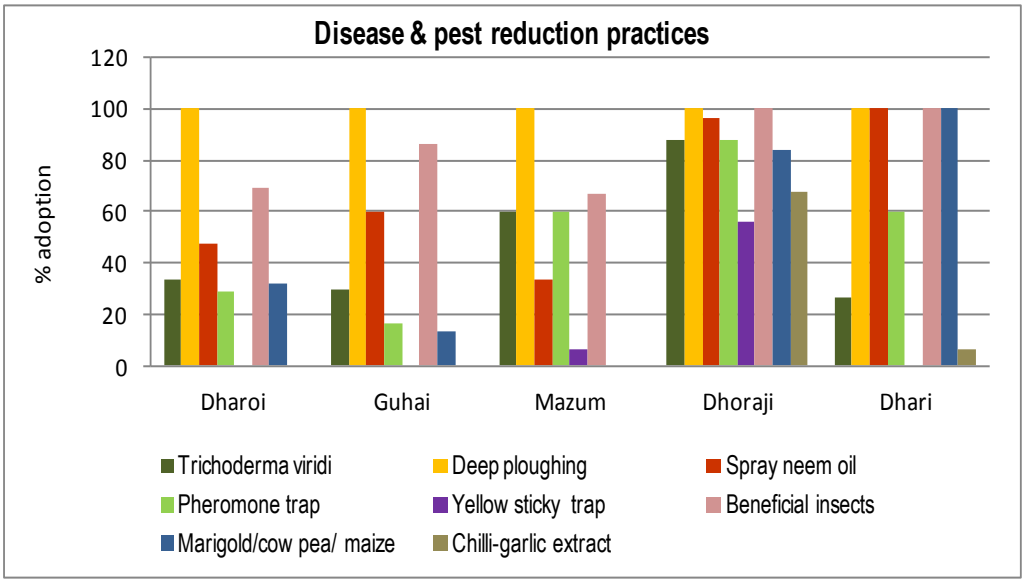


Figure 10: Disease and pest reduction practices

Table 14: Adoption of disease and pest reduction practices

Project area	Tricho-derma viridi	Deep ploughing	Spray neem oil	Light trap	Phero-mone trap	Yellow sticky trap	Bird stand	Beneficial insects	Marigold/ cow pea/ maize	Chilli-garlic extract
	% of farmers adopting									
Dharoi	34	100	47	0	29	0	0	69	32	0
Guhai	30	100	60	0	17	0	0	87	13	0
Mazum	60	100	33	0	60	7	0	67	0	0
Dhoraji	88	100	96	16	88	56	12	100	84	68
Dhari	27	100	100	0	60	0	0	100	100	7

Besides the above set of practices, farmers were made aware of the importance of pest scouting, timely spraying of pesticides and use of pesticides at economic threshold level. The project also imparted technical know-how on production of bio-pesticide and bio-fertiliser as a result of which, between 80-100% of farmers have reported increased use of bio inputs and reduced use of chemical fertiliser and pesticides - Table 15 highlights the level of adoption of these practices across different project locations.

Table 15: Extent of adoption of practices related to pesticide use

Project area	Carry out pest scouting	Use pesticide immediately on spotting disease/pest	Spray pesticide at eco threshold level	Reduced use of chemical & increased use of bio inputs
	% of farmers adopting			
Dharoi	19	41	67	84
Guhai	27	17	83	80
Mazum	0	13	73	80
Dhoraji	100	96	96	100
Dhari	93	100	100	100

3.5. Fertiliser reduction practices

The following fertiliser reduction practices have been recommended by DSC under BMP to farmers:

a. Soil testing to determine the extent of macro/micro nutrient deficiency in soil and application of fertiliser as per soil report
b. Weeding/Hoeing/Inter-culture to ensure elimination of weed, preserve moisture in the soil and facilitate better soil aeration. Reduced incidence of weed also reduces fertiliser requirement.
c. Use of Farmer Yard Manure (FYM) or cow dung as a natural fertiliser. It is however important that FYM is fully decomposed before use since un-decomposed FYM contains high levels of cellulose that can lead to termite infestation in the farm.

d. Use of vermi-compost
e. Use of organic manure made out of castor, neem or tobacco seed cake as an alternative fertiliser.
f. Use of bacteria like azotobactor and psb culture for converting the nitrogen and phosphorus available in the soil into a more usable form for plants.
g. Use of micro-nutrients to fulfil any nutrient deficiency in soil and offer a 'balanced diet' to the plant
h. Use of village pond clay (where available) as a fertiliser. Pond clay is usually made up of rich black soil and is a good source of nutrients.
i. Spot application of fertiliser in root zone as opposed to broadcasting for more effective absorption of fertiliser.

Considering the wide range of recommended practices, analysis of their adoption among farmers is presented in two separate parts - Figure 11 & Table 16 and Figure 12 & Table 18 - for a better understanding. Figure 11 shows that a majority of farmers across all 5 project locations are carrying out soil testing and administering fertiliser as indicated in soil test reports. A further analysis of soil testing by frequency in Table 17 highlights that soil testing is mostly carried out by farmers either every year or once every 2 years.

According to Figure 11/Table 16, Dhoraji and Dhari lead as far as use of azotobactor, psb culture, micronutrients and spot application of fertiliser in root zone are concerned. Some of the common micro-nutrients used by farmers include magnesium, zinc, boron and sulphur. Also, 81% of farmers use DAP/NPK/urea/ammonium sulphate based fertilisers in basal dose while 94% of farmers use urea, ammonia and sulphur based fertilisers in split dose.

As per Figure 11, a uniformly high level of adoption of weeding/hoeing/inter-culture and use of FYM can be seen across all locations although farmers in Dhoraji and Dhari do not decompose the FYM before use. A fair degree of adoption of vermi-compost and organic manure can be seen across all project locations except Dhari where no project interventions are currently being carried out. However, farmers in Dhoraji and Dhari claim to be using village pond clay as a fertiliser.

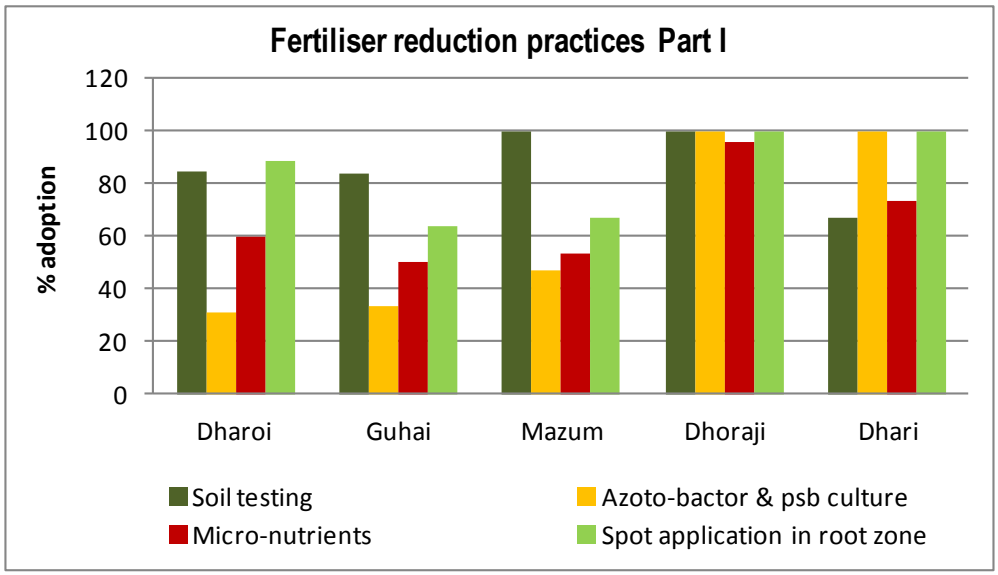


Figure 11: Fertiliser reduction practices Part I

Table 16: Adoption of fertiliser reduction practices part I

Project area	Soil testing	Fertiliser use as per soil report	Azoto-bactor & psb culture	Micro-nutrients	Spot application in root zone
	% of farmers adopting				
Dharoi	85	85	31	59	88
Guhai	83	83	33	50	63
Mazum	100	93	47	53	67
Dhoraji	100	96	100	96	100
Dhari	67	53	100	73	100

Table 17: Frequency of soil testing by farmers

Project area	Not done	Before sowing	Every year	Every 2 years	Every 4 years
Dharoi	17	0	20	58	5
Guhai	17	0	17	62	3
Mazum	0	0	40	60	0
Dhoraji	0	8	68	24	0
Dhari	27	0	53	13	7

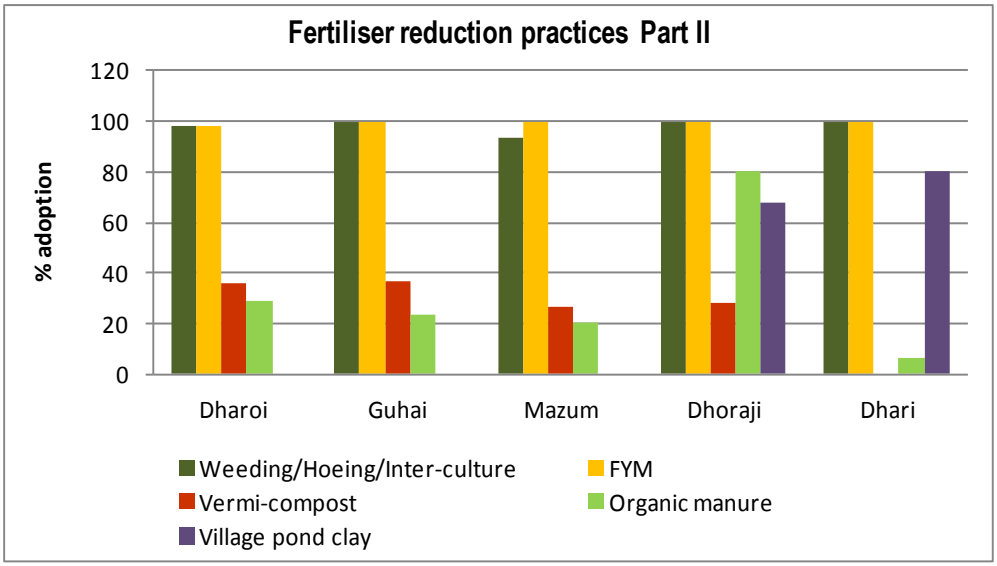


Figure 12: Fertiliser reduction practices Part II

Table 18: Adoption of fertiliser reduction practices part II

Project area	Weeding	Weeding/Hoeing/ Inter-culture	Inter-culture	FYM	Decomposed FYM	Vermi-compost	Organic manure	Village pond clay
	% of farmers adopting							
Dharoi	98	98	98	98	66	36	29	0
Guhai	100	100	100	100	53	37	23	0
Mazum	100	93	87	100	87	27	20	0
Dhoraji	100	100	100	100	8	28	80	68
Dhari	100	100	100	100	0	0	7	80

3.6. Harvest and post-harvest practices

The following harvest and post-harvest practices have been recommended by DSC under BMP to farmers:

a. Wearing cap to prevent falling hair from mixing with cotton and degrading its quality.
b. Picking rough quality cotton separately to prevent mixing of good quality and inferior quality cotton
c. Collecting cotton in a clean cloth after picking to keep it dirt-free
d. Drying cotton in sun before storing so as to remove any moisture that may negatively affect its quality (staple length, whiteness, shine etc.) and market price.
e. Avoiding storage of cotton in empty Urea/DAP bags to prevent traces of urea/DAP from getting mixed with cotton
f. Avoiding contamination of cotton with tobacco (gutka) pouches
g. Ensuring that the vehicle used to transport cotton is also clean

An analysis of the level of adoption of harvest and post-harvest practices by farmers (Figure 13 & Table 19) depicts a high degree of adoption of many practices like picking rough quality cotton separately, collecting cotton in clean cloth after picking, drying cotton in the sun before storing, taking care to prevent contamination and ensuring its clean transportation. This shows the increased understanding and sensitivity of farmers towards quality parameters of cotton as a result of the project.

As per analysis of survey data, farmers in North Gujarat usually pick cotton between 8am to 12 noon whereas this activity carries on for almost the entire day in Saurashtra. Women and children are not involved in picking cotton except in Dhoraji, where the ratio of women/ children to men involvement is 20:80. Even though a majority of farmers pick rough quality cotton separately, very few of them are able to maintain segregation between good and poor quality cotton at the time of storage. This is brought out by data on the percentage of farmers who do not mix cotton across the 5 project locations (Figure 13). It can be seen that only 5% of farmers in Dharoi, 7% farmers in Mazum and 40% farmers in Guhai do not mix good and poor quality cotton. FGDs with farmers revealed that there are primarily two reasons for this - lack of proper storage facilities at farmer-level and lack of price incentive from buyers for better quality of cotton.

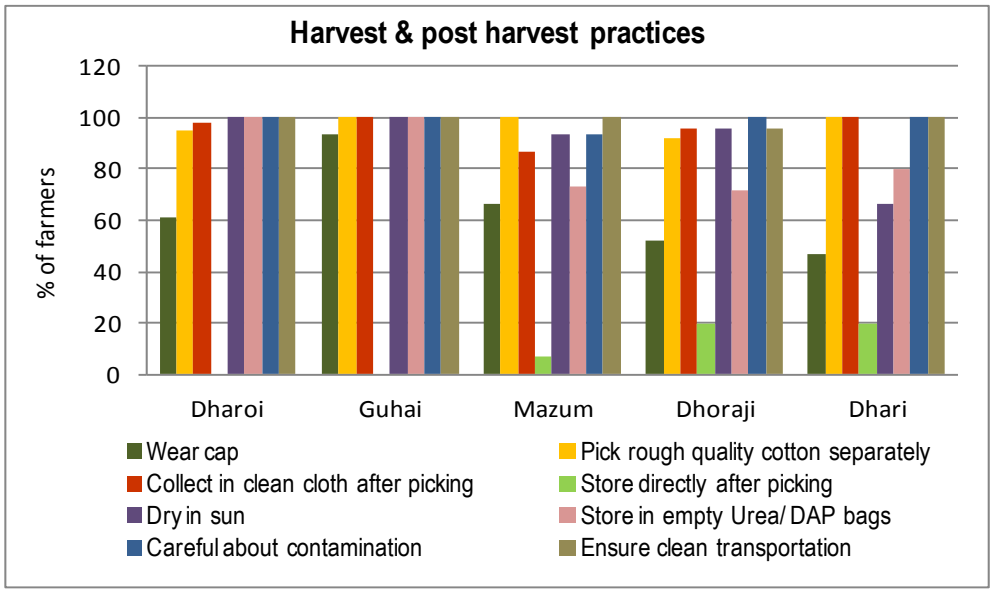


Figure 13: Harvest and post harvest practices

Among other harvest and post harvest practices, wearing of cap while picking cotton is less common in Saurashtra. Overall, a very low percentage of farmers are storing cotton directly after picking (without drying it) which is a good indicator. However, most of the farmers still continue to use empty Urea/DAP bags for storing cotton, a practice that needs to be discontinued.

Table 19: Adoption of harvest and post harvest practices

Project area	Wear cap	Pick rough quality cotton separately	Collect in clean cloth after picking	Store directly after picking	Dry in sun	Store in empty Urea/ DAP bags	Careful about contamination	Ensure clean transportation
	% of farmers adopting							
Dharoi	61	95	98	0	100	100	100	100
Guhai	93	100	100	0	100	100	100	100
Mazum	67	100	87	7	93	73	93	100
Dhoraji	52	92	96	20	96	72	100	96
Dhari	47	100	100	20	67	80	100	100

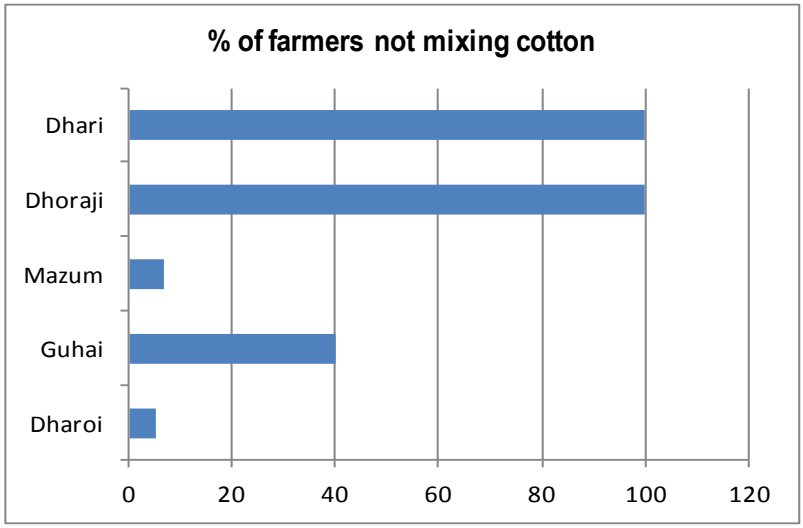


Figure 14: Segregation of good & poor quality cotton

3.7. Replication of adoption

In the initial stages of the project, farmers faced a number of issues while trying to adopt BMP in cotton. While some reported that the first year production was low due to reduced use of chemical fertilisers and pesticides, others faced problems in the production and use of bio-pesticides and bio-fertilisers. Also, control of pests and wild animals proved more difficult using these bio-inputs. Some others could not undertake deep ploughing in their fields as crops were still standing. However, most of these issues now seem to have been resolved and a good overall level of adoption of sustainable cultivation practices can be seen under the project. In fact, farmers have started replicating the good practices learnt on other crops as well – micro-nutrients are being used by Visnagar farmers on castor, fennel and tobacco and on mustard and wheat by farmers in Vadnagar. Farmers in Guhai have begun adding vermi-compost to their wheat crop while Dhoraji's farmers have started using drip irrigation for groundnut.

4. PROJECT IMPACT

One of the methods of measuring impact of the project is through the 'recall approach' where respondents are asked to describe the situation as it existed before the project and the changes they have noticed as a result of the project. However, the degree of recall is usually inversely proportional to the recall period which means that more the time that has elapsed after a particular project intervention, lesser is the recall of its impact in peoples' minds.

To overcome this limitation, project impact can also be measured by comparing the situation of the project participant group or 'sample' with that of non-participants or 'control', wherever information on the latter is available. For the purposes of this study, both recall approach and comparison of sample and control group situation have been used, either separately or in combination, to bring out the various dimensions of impact.

4.1. Input cost savings

Some of the most significant input cost savings to farmers have resulted from the increased use of bio-pesticides and bio-fertilisers and reduced dependence on chemical inputs after joining the project. This phenomenon was briefly discussed in the previous chapter and is further illustrated in Table 20 below.

Table 20: Pre and post project expense on bio-inputs

Project area	Expense on bio- pesticide			Expense on bio-fertiliser		
	Before project	After project	Change	Before project	After project	Change
	All figures are average per farmer per Ha in Rs.					
Dharoi	0	758	758	0	424	424
Guhai	0	783	783	0	376	376
Mazum	0	336	336	0	350	350
Dhoraji	1058	1197	139	76	819	720
Dhari	280	913	633	0	622	622

The above table highlights the expenses farmers have made on bio-inputs before and after the project across various locations. While farmers in Dhoraji were already making use of bio-pesticides before the project, the project has been successful in bringing about greater use of bio-inputs in North Gujarat where this practice was earlier non-existent and dependence on chemical inputs was high.

As a result of greater adoption of bio-inputs, farmer expense on chemical pesticides per Ha has come down by between Rs. 927/- in Dhari and Rs. 3135/- in Dharoi (Table 21). Similarly, expenditure on chemical fertilisers has reduced by Rs. 1279/- in Dhari and Rs. 9360/- in

Dharoi. Thus, the percentage savings on chemical input costs have been much higher in Dharoi and Guhai as compared to Mazum, Dhoraji and Dhari, indicating a greater impact of adoption of bio-inputs in these areas.

Table 21: Pre and post project expense on chemical inputs

Project area	Expense on chemical pesticides				Expense on chemical fertilisers			
	Before project	After project	Saving	% savings	Before project	After project	Saving	% savings
	All figures are average per farmer per Ha in Rs.							
Dharoi	6385	3251	3135	49	15786	6426	9360	59
Guhai	6174	4218	1956	32	16730	7881	8849	53
Mazum	5712	4353	1359	24	12180	8742	3438	28
Dhoraji	4633	3448	1185	26	5258	3767	1492	28
Dhari	4500	3572	927	21	4729	3450	1279	27

In order to confirm that the above savings are indeed a result of the project, a comparison of sample and control farmers' expenses on chemical inputs is presented in Figure 15 which shows that control farmers in Dharoi, Guhai, Mazum and Dhoraji spend more on chemical pesticides and chemical fertilisers than sample farmers.

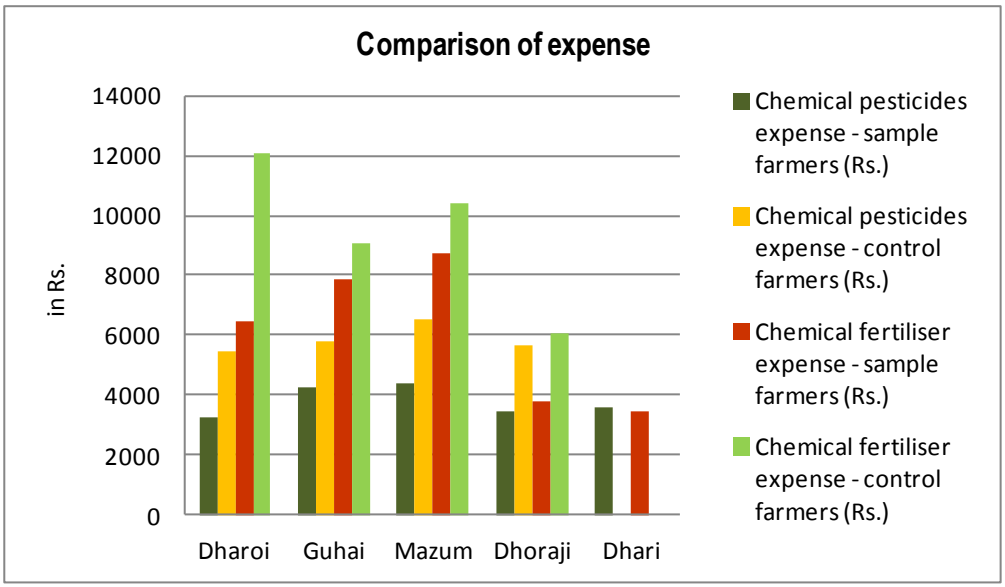


Figure 15: Chemical input expense of sample and control farmers

As far as water cost savings are concerned, although there has been some adoption of water management practices under the project, it is probably still too early for a clear picture to emerge on the exact amount and cost of water saved by farmers. Lastly, a comparison of seed expenses of sample and control farmers (pg. 16) shows that per farmer savings vary between Rs. 17/- per Ha in Mazum and Rs. 407/- per Ha in Dhoraji, depending on the seed rate.

Aggregating the savings made by sample farmers on various input components (pesticide, fertiliser and seed) in Table 22, it can be seen that the total input cost savings achieved as a result of the project are highest in Dharoi, followed by Guhai, Mazum, Dhoraji and Dhari.

Table 22: Input cost savings due to project

Project area	Pesticide cost saving	Fertiliser cost saving	Seed cost saving	Total input cost savings
	All figures are average per farmer per Ha in Rs.			
Dharoi	3135	9360	288	**12783**
Guhai	1956	8849	313	**11118**
Mazum	1359	3438	17	**4814**
Dhoraji	1185	1492	407	**3084**
Dhari	927	1279	NA	**2206**

4.2. Increase in yield

One of the key outcomes of the project has been improvement in yields of cotton farmers. This is brought out most clearly through a comparison of yields between sample and control farmers in Table 23. The difference in yield varies from 127 kg per Ha in Guhai to 323 kg per Ha in Dhoraji and highlights that sample farmers have been able to improve farm productivity as a result of adoption of BMP in cotton.

Table 23: Cotton yields among sample and control farmers

Project area	Avg yield of cotton per Ha (in kg) - sample farmers	Avg yield of cotton per Ha (in kg) - control farmers	Difference in yield per Ha (in kg)
Dharoi	1860	1715	145
Guhai	1975	1848	127
Mazum	1826	1680	146
Dhoraji	2036	1714	323
Dhari	1624	NA	NA

4.3. Higher economic benefit

Calculation of the cumulative economic benefit of the project by measuring the economic value of every BMP adopted by the farmer is outside the scope of this study. However, in order to arrive at an indicative figure, available data on input cost savings and increase in yield has been considered. The total value of economic benefit could not be determined in the case of Dhari due to lack of yield information but economic benefit figures for the remaining 4 project locations are presented in Table 24.

It can be seen from the table that the total value of economic benefit per farmer is similar in the case of Dharoi (Rs. 18728/-) and Dhoraji (Rs. 18265/-), but the reasons behind this similarity are entirely different. While farmers in Dharoi have mostly benefitted on account of input cost savings which are the highest (Rs. 12783/-) in this location, Dhoraji farmers have seen the maximum improvement in yields (323 kg/Ha) as a result of the project. These results are in line with the higher overall level of adoption of BMP in Dhoraji which may have led to a positive impact on yield. On the other hand, the comparatively higher level of bio-pesticide and bio-fertiliser use in place of expensive chemical inputs in Dharoi seems to have brought down input costs for farmers.

It is however important to also mention here that these figures neither include labour cost savings nor quantify any benefits accruing to the soil and environment, which if considered, have the potential to increase the total economic value of project benefits even further.

Table 24: Economic benefit due to project

Project area	Total input cost savings per Ha	Increase in yield per Ha (in kg)	Market price of cotton (Rs./kg)	Value of increased yield (in Rs.) per Ha	Total value of economic benefit to farmer (in Rs.) per Ha
	A	B	C	D=B*C	A+D
Dharoi	12783	145	41	5945	18728
Guhai	11118	127	43	5461	16579
Mazum	4814	146	44	6424	11238
Dhoraji	3084	323	47	15181	18265
Dhari	2206	NA	47	NA	-

4.4. Improved soil health

Although a 3-4 year project intervention period may be too short a time frame to measure improvement in soil quality due to adoption of BMP, farmers across all project locations are beginning to see some green shoots as far as soil health is concerned. Figure 16 highlights that a majority of farmers are reporting better soil health in each location. Some of the major indicators of improved soil health cited by farmers include:

i. loosening up of soil resulting in better water percolation capacity
ii. reduction is soil salinity and soil hardness
iii. increase in the quantity of earthworms, bacteria and micro-organisms
iv. higher water retention capacity of soil, thus needing lesser irrigation
v. plants staying green.

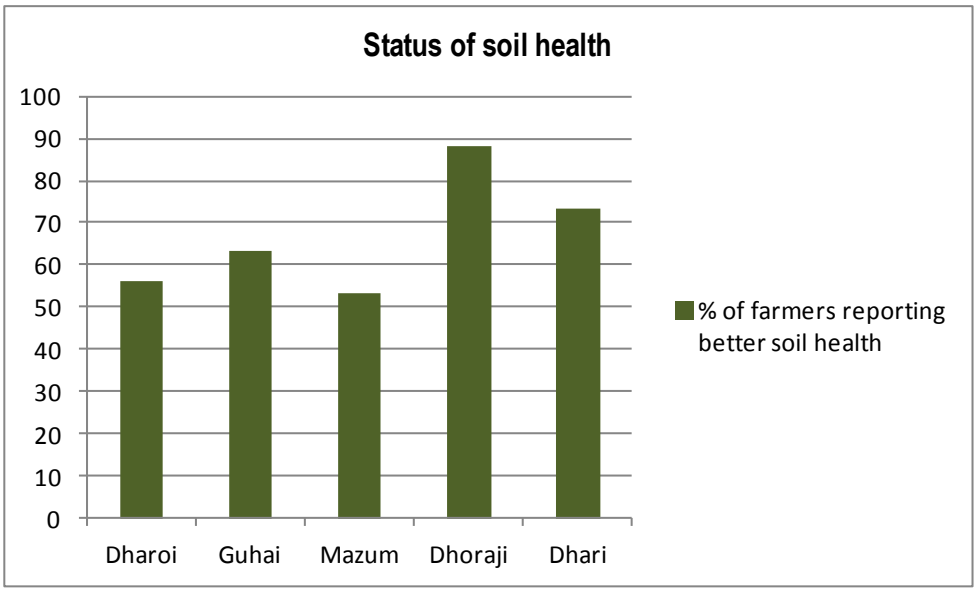


Figure 16: Status of soil health

Improved soil health has also started making a difference to the quality of cotton in terms of increase in its weight, increased staple length, larger cotton bolls which open properly, fuller development of the plants and better quality and shine of cotton.

4.5. Farmer capacity building

An extensive programme of capacity building for agriculture extension has been offered by DSC to cotton farmers under the project. This includes awareness campaigns, trainings, workshops, exposure visits, field days and crop demonstrations, details of which are presented in Table 25. Over a 3-year period, more than 762 such programmes have been organised, benefitting over 9383 farmers.

Table 25: Capacity building of farmers under BMP cotton project

	Particulars of capacity building	2013-14		2014-15		2015-16		Total	
		Total nos.	Participants	Total nos.	Participants	Total nos.	Participants	Total nos.	Participants
1	Mass awareness on Better and Environment Friendly Crop Management Practices (BEFCMP) Video Show	6	245	21	871	-	-	**27**	**1116**
2	Village meeting for BMP cotton awareness	0	-	0	-	54	1496	**54**	**1496**
3	School awareness programme/ student quiz on BEFCMP	2	520	4	562	-	-	**6**	**1082**
4	Training of EVs/LRP on BEFAMP	19	370	9	139	4	15	**32**	**524**
5	Kharif crop BMP Workshop	2	86	7	333	6	344	**15**	**763**

	Particulars of capacity building	2013-14		2014-15		2015-16		Total	
		Total nos.	Participants	Total nos.	Participants	Total nos.	Participants	Total nos.	Participants
6	Rabi crop BMP Workshop	3	138	6	401	-	-	**9**	**539**
7	Workshop with ginners, buyers and traders for market linkage	5	90	4	130	2	89	**11**	**309**
8	Exposure visit to sustainable agriculture initiatives in Gujarat	3	69	4	112	3	68	**10**	**249**
9	Field day for cotton	19	684	41	1241	18	465	**78**	**2390**
10	Field day cum exposure on bio-pesticide & vermi-compost	-	-	-	-	11	307	**11**	**307**
11	Woman & child health related Workshop on BMP Cotton	-	-	-	-	1	100	**1**	**100**
12	Crop demonstrations with IPM/INM	99	99	117	117	38	38	**508**	**508**
	Total	**158**	**2301**	**213**	**3906**	**137**	**2922**	**762**	**9383**

Feedback was gathered from farmers on the usefulness of capacity building initiatives as well as farmers' overall satisfaction with DSC's services under the cotton project. For the purposes of agriculture extension and training, Extension Volunteers or Local Resource Persons (LRPs) were appointed by DSC.

Figure 17 highlights that in Dharoi, Guhai, Mazum and Dhoraji, LRPs have been able to visit farmers when needed most of the time. Also, the quality of information and advice received from the LRPs has been rated "Good" by a majority of farmers in these four locations as can be seen from Figure 18. In comparison, satisfaction levels of farmers in Dhari are lower, which could possibly be because the cotton project is no longer running in this unit and farmers are getting limited DSC support.

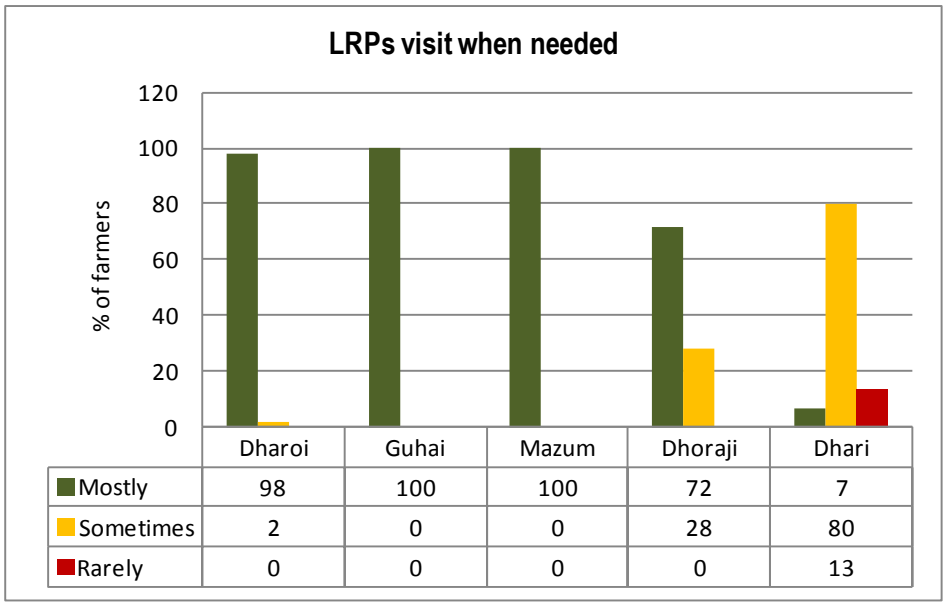


Figure 17: Frequency of LRP visit

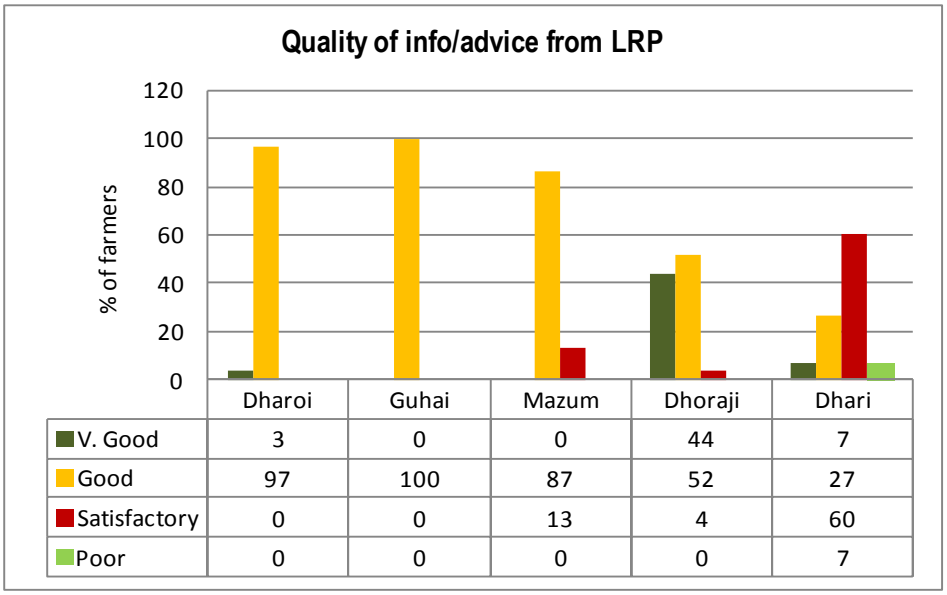


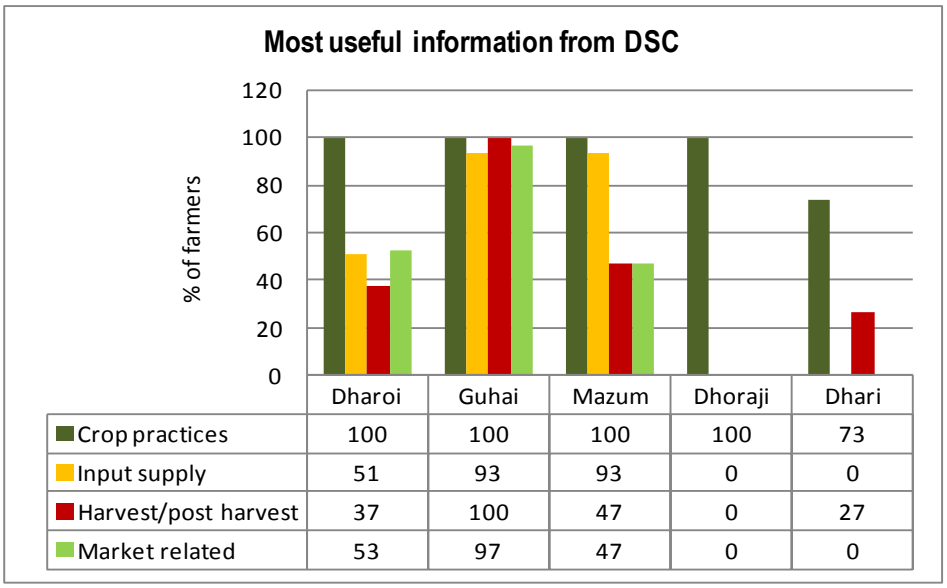
Figure 18: Quality of info/advice from LRP

Farmers were also asked about which information from DSC they found most useful. An analysis of this information in Table 26 brings out the following preferences across various project locations.

Table 26: Most useful information from DSC

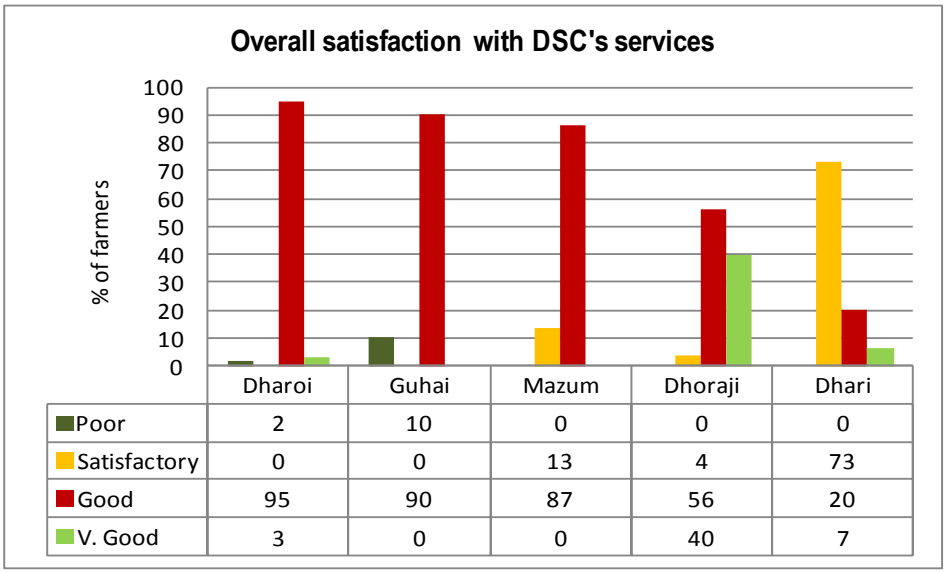
Project area	Crop practices	Input supply	Harvest/post harvest	Market related
Dharoi	✓			
Guhai	✓	✓	✓	✓
Mazum	✓	✓		
Dhoraji	✓			
Dhari	✓			

Thus, while advice related to crop practices was found most useful by farmers across all 5 project locations (Figure 19), information on input supply, harvest/post-harvest and market was equally useful for Guhai farmers. In addition to crop practices, Mazum farmers also highly valued input supply guidance from DSC.



	Dharoi	Guhai	Mazum	Dhoraji	Dhari
Crop practices	100	100	100	100	73
Input supply	51	93	93	0	0
Harvest/post harvest	37	100	47	0	27
Market related	53	97	47	0	0

Figure 19: Most useful info from DSC



	Dharoi	Guhai	Mazum	Dhoraji	Dhari
Poor	2	10	0	0	0
Satisfactory	0	0	13	4	73
Good	95	90	87	56	20
V. Good	3	0	0	40	7

Figure 20: Overall satisfaction with DSC services

In terms of overall satisfaction with DSC's services under the cotton project, a majority of farmers in Dharoi, Guhai, Mazum and Dhoraji have rated these services to be "Good" as is evident from Figure 20. In fact, 40% of Dhoraji farmers find DSC's services to be very good. Again, satisfaction levels are lower in the case of Dhari due to closure of the project in this unit.

4.6. Better information availability

As part of the project, DSC initially tied up with RML to deliver weather, market and canal irrigation related information to farmers on mobile phone through SMS. The canal irrigation information initiative finally fell through because of delays in receiving timely information on water availability in dam and schedule for its release from the Irrigation Department. Despite its limited success however, the initiative helped put in place a system of providing information on mobile phone which many of the farmers have continued with, albeit with other service providers.

On the whole, farmers in North Gujarat have reportedly benefitted more from access to weather and market information than their counterparts in Saurashtra with the percentage of farmers claiming to benefit from this service being 92% in Dharoi, 83% in Guhai, 73% in Mazum, 64% in Dhoraji and 47% in Dhari.

According to the farmers, weather information has been helpful for knowing about:

i. which crop to sow at what time as per weather suitability
ii. proper time of sowing and harvesting
iii. care to be taken at the time of sowing
iv. nature of disease and pest attack that can be expected
v. whether and how much fertiliser, pesticide and irrigation has to be given to crop

Similarly, market information has helped farmers find out prices of cotton in different markets and gives them the flexibility to sell in whichever market offers a higher price.

4.7. Increased farmer awareness

Table 27: Farmer recognition of cotton diseases

Project area	Wilting	Root rot	Leaf spots
	% of farmers recognising		
Dharoi	100	100	93
Guhai	97	100	83
Mazum	100	100	93
Dhoraji	100	100	96
Dhari	100	100	93

Apart from improving farmers' understanding and adoption of BMP in cotton, the project has also been instrumental in increasing their overall awareness of the diseases and pests of

cotton crop and how to control them with the correct use of pesticides. Table 27 & Figure 21 highlight the awareness level of farmers regarding cotton diseases.

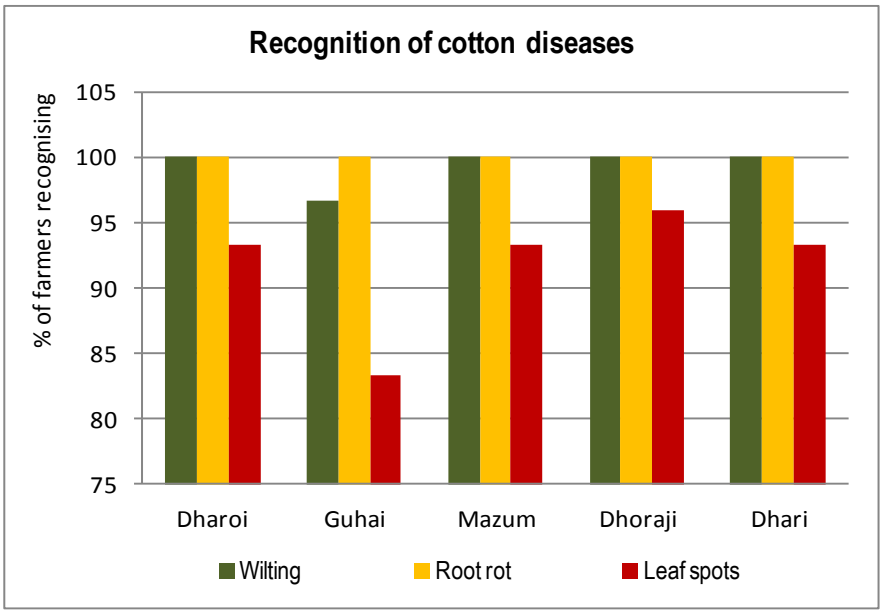


Figure 21: Recognition of cotton diseases

Farmers across all 5 project locations seem to fully recognise cotton diseases such as wilting and root rot but there is comparatively lower recognition of leaf spots. As far as cotton pests are concerned, while near-100% recognition of all kinds of pests can be seen among farmers in Dhoraji and Dhari (Figure 22 & Table 28), Aphid is recognised by a lower proportion of farmers in Dharoi (56%) and Guhai (67%) and particularly, Mazum (7%). Also, another pest of cotton - Thrips – is recognised by only about 50% of Mazum farmers.

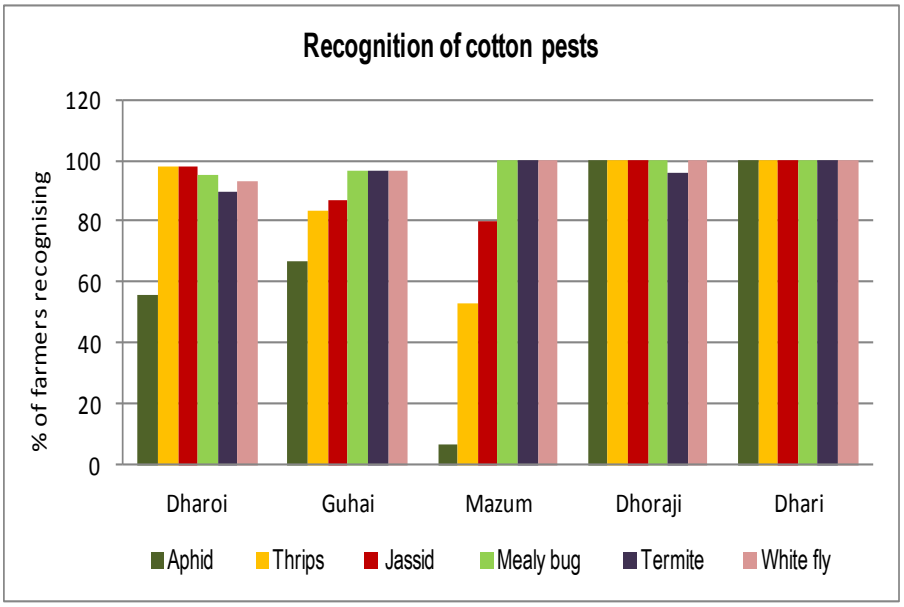


Figure 22: Recognition of cotton pests

Table 28: Farmer recognition of cotton pests

Project area	Aphid	Thrips	Jassid	Mealy bug	Termite	White fly
	% of farmers recognising					
Dharoi	56	98	98	95	90	93
Guhai	67	83	87	97	97	97
Mazum	7	53	80	100	100	100
Dhoraji	100	100	100	100	96	100
Dhari	100	100	100	100	100	100

Farmers have also become more aware about the nature and type of pesticides to be used for cotton as may be seen from Figure 23 & Table 29.

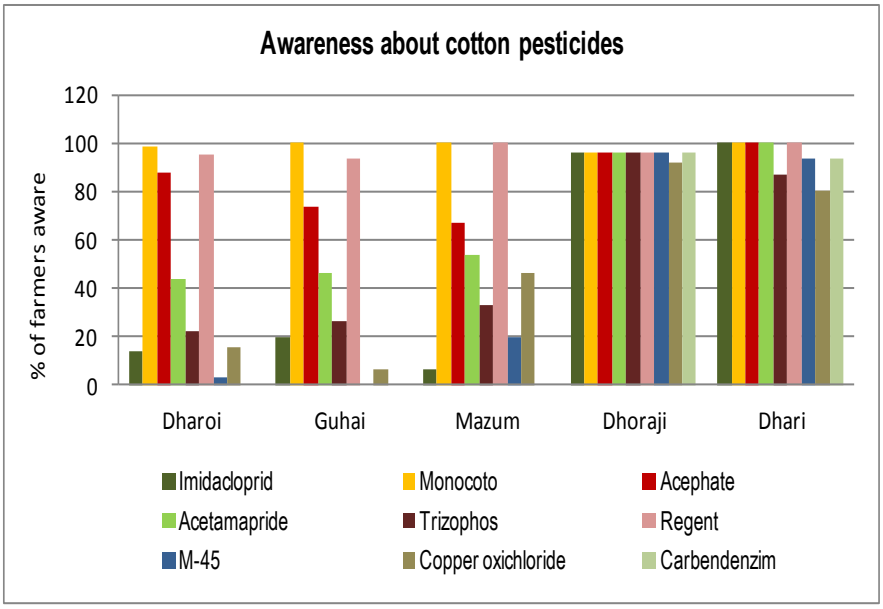


Figure 23: Awareness about cotton pesticides

Table 29: Farmer awareness of cotton pesticides

Project area	Imida-cloprid	Monocoto	Acephate	Acetama-pride	Trizophos	Regent	M-45	Copper oxichloride	Carbendenzim
	% of farmers aware								
Dharoi	14	98	88	44	22	95	3	15	0
Guhai	20	100	73	47	27	93	0	7	0
Mazum	7	100	67	53	33	100	20	47	0
Dhoraji	96	96	96	96	96	96	96	92	96
Dhari	100	100	100	100	87	100	93	80	93

However, while recognition of cotton diseases and pests is important, a more important contribution of the project has been increased awareness among farmers of the precautions

to be borne in mind while using pesticides and their correct method of application. Farmers covered under the study were able to list the following precautions in the use of pesticides:

i. Using/mixing pesticide as per the recommended quantity
ii. Being aware of the chemical substance and its concentration in the pesticide
iii. Not mixing two different types of pesticides
iv. Taking care to keep pesticide away from eyes and foodstuff and store it in a safe place, away from children.
v. Cleaning pump before filling pesticide
vi. Using safety kit – mask, gloves, handkerchief, boots - while spraying pesticides
vii. Spraying pesticide preferably in the evening or early morning and in the direction of wind
viii. Examining disease, pest and crop condition before using pesticide
ix. Spraying pesticide uniformly all over the plant and regularly every 10-15 days
x. Changing type of pesticide on a regular basis to avoid developing resistance

4.8. Strengthening of irrigation cooperatives

Besides building capacity of farmers to facilitate adoption of BMP, DSC also undertook capacity building of Irrigation Cooperatives/Water User Associations (WUAs) on the premise that stronger WUAs would be able to ensure better irrigation for cotton. As part of this programme, several meetings, workshops, video shows, trainings and exposure visits were organised across all project locations, details of which are provided in Table 30. Over a 3-year period, about 630 such activities were organised covering more than 45000 representatives from 200 WUAs.

Table 30: Capacity building of WUA representatives under BMP cotton project

	Particulars of capacity building	2013-14		2014-15		2015-16		Total	
		Total nos.	Partici-pants	Total nos.	Partici-pants	Total nos.	Partici-pants	Total nos.	Partici-pants
1	Village meeting for general awareness			47	567	33	780	80	1347
2	Video show of Motivational film on PIM	28	2589	14	988			42	3577
3	Jagruti yatra / School Programme	37	15515	17	13851			54	29366
4	Exposure visit on PIM (within 100 kms)	23	690	23	515			46	1205
5	Exposure visit on PIM (above 100 kms)	2	52			2	33	4	85
6	Plan & Conduct Committee meeting	78	850			133	1232	211	2082
7	Plan & Conduct General meeting	25	1346			30	1001	55	2347

	Particulars of capacity building	2013-14		2014-15		2015-16		Total	
		Total nos.	Partici-pants	Total nos.	Partici-pants	Total nos.	Partici-pants	Total nos.	Partici-pants
8	Video-show on participatory canal rehabilitation work					3	115	3	115
9	Village level workshop / video show for planning of good water distribution system through WUA	10	365					10	365
10	Video-show on farm water management & efficient use of irrigation water	6	245	31	1882			37	2127
11	Exposure visit to other state for better practices on water and crop management (4 days for 30% WUAs)			4	212	2	105	6	317
12	WUA formation training to WUA Office bearers	2	60					2	60
13	Training of Office bearers of WUA for 5 years perspective plan/ visioning (2 days)	1	30	6	163			7	193
14	Workshop on gender in PIM	4	165	7	412	1	35	12	612
15	Training on records and account keeping(2 days)	2	29	6	196	2	22	10	247
16	Training on Good Governance of Model WUAs (2 Days)					5	100	5	100
17	Training on canal rehabilitation works			1	38			1	38
18	Orientation Training on Irrigation Management			3	136			3	136
19	Water distribution training to Canal Operators			6	153	5	120	11	273
20	Workshop on irrigation planning, review & learning (before/after irrigation - 2 workshops)	8	347	6	392	2	108	16	847
21	Leadership Training for WUA office bearers (2 days)	8	229	6	89	1	31	15	349
	Total	**234**	**22512**	**177**	**19594**	**219**	**3682**	**630**	**45788**

Feedback on the capacity building received by WUA representatives and farmers shows a significant positive impact not only on WUA administration and working but also on irrigation services. The case of Goladhar village in Dhoraji with a population of 2200 people and an average land holding of 2-3 Ha per farmer is a case in point. Although a WUA was present in Goladhar, it was dormant and was revived by DSC under the IKEA-BMP project. As a result, where 55 Ha was irrigated before, 173 Ha started getting irrigated post revival of the WUA. This was possible not just because of repairs carried out on the minor canals but also due to more efficient water management and distribution to tail-enders. The WUA has started meeting monthly and collecting water charges in advance although members handle water

distribution themselves, since it does not have enough income to pay the Operator. Its turnaround has made it a 'model WUA' in the area.

As illustrated in Figure 24 and Table 31, 100% of farmers in Guhai, Mazum and Dhoraji and 75% of farmers in Dharoi have reported that their involvement in their WUA has increased and WUA administration has improved after the project due to the mass awareness campaigns with farmers and capacity building of WUA leaders.

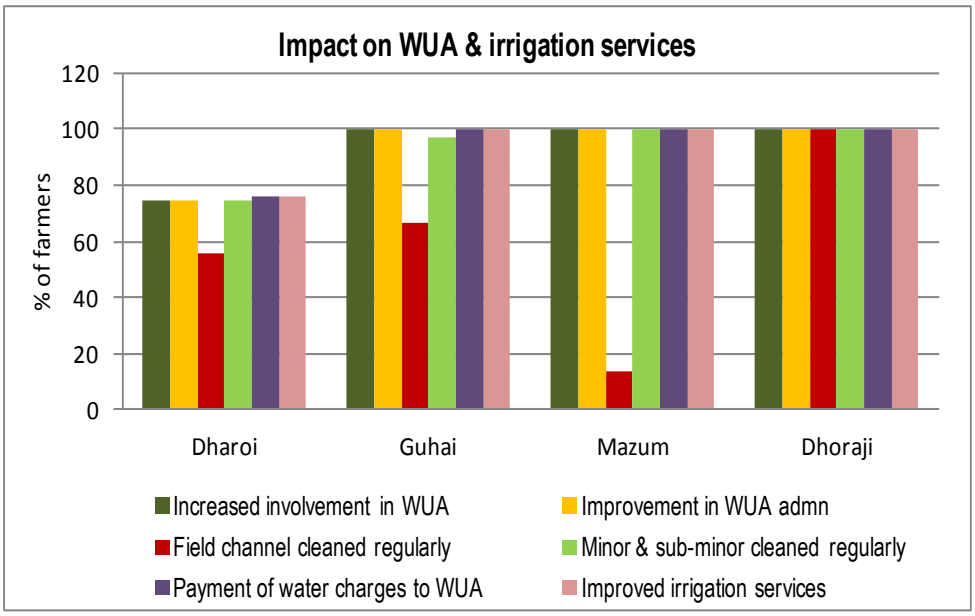


Figure 24: Impact on WUA & irrigation services

Table 31: Impact of capacity building on WUA & irrigation services

Project area	Increased involvement in WUA	Improvement in WUA admn	Field channel cleaned regularly	Minor & sub-minor cleaned regularly	Payment of water charges to WUA	Improved irrigation services
	% of farmers					
Dharoi	75	75	56	75	76	76
Guhai	100	100	67	97	100	100
Mazum	100	100	13	100	100	100
Dhoraji	100	100	100	100	100	100

This has had a direct impact on water charges collection and irrigation services - between 76 to 100% of farmers claim that they pay water charges to their WUA and have witnessed an overall improvement in the timeliness of irrigation services as a result of project interventions. However, more efforts are needed to ensure regular cleaning of field channels in Mazum and to some extent, in Dharoi and Guhai. Similarly, cleaning of minors and sub-minors needs more attention in Dharoi.

A further analysis of timeliness of water charges payment across different project locations in Table 32 reveals that while payments are fully on-time in Dhoraji, between 67 to 70% of farmers in Mazum, Dharoi and Guhai are not paying their water charges on time.

Table 32: Timeliness of payment of water charges to WUA

Project area	No response	On-time	Late
	% of farmers		
Dharoi	25	5	69
Guhai	0	30	70
Mazum	0	33	67
Dhoraji	0	100	0

5. CONCLUSIONS AND WAY FORWARD

1. One of the most remarkable contributions of the project has been a reduction in agriculture input costs of farmers. Savings per farmer range from Rs. 2206/- per Ha in Dhari to Rs. 12783/- per Ha in Dharoi and are generally higher across North Gujarat as compared to Saurashtra. This has been possible mainly due to two factors – first, use of lower quantities of nutrients and fertiliser based on results of soil testing and second, replacement of costly chemical pesticides and fertilisers with low-cost bio-inputs. The above cost savings are particularly significant because they have been achieved in North Gujarat, a region where farmers practice high-cost input intensive agriculture. Thus, even though cotton prices have seen a significant decline over the past couple of years, the savings achieved in input costs have ensured overall economic benefit for farmers.

2. Besides input cost savings, the project has had a number of other positive impacts with respect to environment, cotton quality, information availability and farmer awareness. Farmers have reported loosening up of soil, better water retention capacity, reduction in salinity and rise in micro-biological activity all of which point towards an improvement in soil health. Already, benefits of this are becoming visible in terms of increase in the weight of cotton, increased staple length, fuller and more mature bolls and better quality and shine of cotton. In addition, farmers have started getting access to information about weather which is helping them take better sowing and harvesting decisions, determine the quantum of inputs required for different crop types and become more prepared to deal with pest and disease attacks. Information about prices prevailing in different markets is providing them greater flexibility to sell their produce at better prices. Also, there is increased farmer awareness of the different diseases and pests of cotton, more judicious use of water and agri inputs, precautions to be followed while using pesticides and production and use of bio-fertilisers and bio-pesticides.

3. Although the project has been able to achieve a good overall level of BMP adoption among farmers, the degree of adoption tends to vary across different locations (for example, seed rates vary from 1X of the recommended quantity in Dhoraji to 2X in Mazum). In order to realise the full potential of the project, it is important that efforts are made to identify which specific practices have low adoption, what are the issues or challenges being faced by farmers in adoption and how these issues can be addressed in each project location. For this, closer monitoring of adoption in the field is necessary. However, with capacity building activities using up a major portion of the project budget,

funding constraints come in the way of effective monitoring of adoption, especially considering the large number of farmers enrolling in the project every year.

4. A key factor affecting adoption is that BMP cotton is not certified and does not fetch a price premium over normally grown cotton. This acts as a major disincentive for farmers who tend to be driven more by considerations of the price they can get for their cotton than by cost saving and environmental benefits. Furthermore, the small land holdings devoted to cotton cultivation - especially in North Gujarat - make it particularly challenging for an organisation like DSC to press for greater BMP adoption as reducing chemical inputs may bring down productivity, making cotton cultivation unviable for farmers.

5. Cotton yields have suffered by as much as 30-40% over the past couple of years due to unfavourable weather and increasing incidence of pest attack. While per Ha yields were in the region of 2100 kg/Ha in 2013-14, they have now declined to 1774 kg/Ha. Although there is little control over crop losses due to weather, losses on account of pest damage can definitely be minimised. The commonly grown Bollgard II variety of BT cotton is known to be resistant to pests like bollworms but has become increasingly vulnerable to bollworm attack over the years. This has started to affect cotton production, particularly in Saurashtra where a growing incidence of pink bollworm is being reported. Good agricultural practice recommends that farmers grow at least 20% of non-BT cotton around the periphery of BT cotton for pests to feed on (thereby saving the BT cotton crop) but this instruction is seldom followed since farmers are reluctant to lose even this 20% production. Thus, not following the proper method of cultivation is making BT cotton more vulnerable to such pest attacks, ultimately threatening both the future of BT cotton as well as the livelihoods of farmers dependent on it. It is therefore crucial that DSC strongly emphasises the use of both non-BT seed (20%) and BT seed (80%) during farmer training to limit BT cotton's further resistance to bollworm.

6. Deep tubewells/borewells are emerging as the preferred source of irrigation for farmers especially in North Gujarat. Added to this, the low adoption of drip irrigation is making the already severe groundwater problem in this part of the State worse. The reduction of farmers' dependence on canal systems threatens to weaken the role of WUAs in DSC's PIM areas over the long term. Already, effectiveness and working of WUAs is beginning get affected in terms of delays in payment of water charges to the WUA and irregular cleaning of field channels, minors and sub-minors in Dharoi, Guhai and Mazum. Considering the huge environmental cost of excessive groundwater extraction and the

time, effort and resources that have gone into nurturing and strengthening WUAs as part of promoting PIM in Gujarat over the past two decades, it is important that urgent steps are taken to tackle this issue not just at the WUA level but also at the policy level.

7. Despite a decline in direct irrigation from canals for cotton, the importance of their role in recharging sub-surface water levels cannot be ignored. The 2011 DSC study on Dharoi found that geologically, Dharoi's soil structure and slope conditions provide good potential for recharge. That farmers today are being able to use wells and borewells for irrigation, especially in North Gujarat, is in large part due to the PIM initiatives carried out in these locations since the early 1990s.

8. DSC has carried out an extensive capacity building programme for BMP and PIM over the past 3 years which has not only improved understanding and adoption of BMP in cotton among farmers but also strengthened irrigation cooperatives at village-level. In addition, a strong cadre of extension volunteers has been developed that can continue to provide agriculture extension services to farmers beyond the project. Through its Krushi Dhan Producer Company outlets, DSC is able to provide agri inputs like certified seeds, nutrients and pesticides to farmers at lower than market prices. With the required manpower and infrastructure in place, DSC is now in a better position to push ahead for a fuller adoption of BMP and a gradual shift towards Better Cotton.

9. Going forward, a few other areas that need attention are: one, ensuring that gaps in implementation of BMP in the field as identified in this study are addressed, two, encouraging farmers to install drip irrigation to increase water use efficiency and improve productivity. Three, extending the services of KPCL to Dhoraji so that farmers in this project area also get access to reliable and quality agriculture inputs at affordable prices. Four, improving understanding, marketing and visibility of BMP cotton in the market in order to help farmers realise better prices from its sale.

6. ANNEXURES

6.1. Annexure 1: Sample questionnaire

ફોર્મ નં. ☐

પ્રાથમિક સર્વે પ્રશ્નાવલિ

“કપાસ પ્રોજેક્ટની અસરકારકતાની આકારણી તથા ફેર-અમલીકરણની તકો”

તારીખ: _____ સંશોધનકર્તાનું નામ: _____

ગામ: _____ તાલુકો: _____ જિલ્લો: _____

સંશોધનકર્તા માટેની સુચના: માત્ર **BMP** કપાસને લગતી તમામ વિગતો એકત્રિત કરો

સામાન્ય માહિતી

1. ખેડૂતનું નામ_____
2. ફોન નં. _____
3. કેટલા વર્ષથી તમે IKEA કપાસ પ્રોજેક્ટ સાથે સંકળાયેલા છો? _____
4. ખેડૂતની જમીનની વિગતો (એકર/વીઘા/ગુંઠા)
   a. માલિકીની_____
   b. ભાડાપેટે આપેલી_____
   c. ભાડાપેટે લીધેલી_____
   d. કુલ જમીન_____
   e. કપાસનો પાક કેટલી જમીન પર લેવાય છે _____
   f. કપાસના પાક હેઠળ કુલ સિંચાઇ જમીન_____

5. સિંચાઇનો સ્રોત (નિશાની કરો):

   a. કેનાલ_____

   b. i. બોરવેલ_____ ii. **હોર્સ પાવર** _____ i. કૂવો _____ ii **હોર્સ પાવર** _____

   c. એક કરતાં વધુ સ્રોત _____

6. કૂવો/ બોરવેલની ઉંડાઇ (ફૂટ) _____

7. સિંચાઇનો ખર્ચ:

		A. ઇલેક્ટ્રિક મોટર	B. ડીઝલ પમ્પ/મશીન	C. કેનાલ
I	દર (રૂ.)/કલાક અથવા/પિયત			
Ii	એક વીઘાની સિંચાઇ કરવામાં લાગતો સમય/વીઘા અથવા/પિયત			

8. એક વીઘાદીઠ સરેરાશ કેટલા કપાસનું ઉત્પાદન થાય છે? _____

9. કપાસની ખેતી માટે વીઘાદીઠ કુલ કેટલો ખર્ચ આવે છે?

	ખર્ચની વિગતો	વીઘાદીઠ કુલ કેટલો ખર્ચ (**Rs.**)
I	જમીન **તૈયારી ખર્ચ**	
Ii	**છાણીયા ખાતરનો ખર્ચ**	
Iii	બિયારણ	
Iv	રોપવાની મજૂરી	
V	**રા.ખાતરનો ખર્ચ**	
Vi	ખાતરનો મજૂરી ખર્ચ	
Vii	જંતુનાશકોનો ખર્ચ	
Viii	જંતુનાશકોનો મજૂરી ખર્ચ	
Ix	સિંચાઇનો મજૂરી ખર્ચ	
X	**આંતર ખેડ** કરવાનો ખર્ચ	
Xi	**હાથથી**નીંદણ દૂર કરવાનો મજૂરી ખર્ચ	
Xii	**કપાસ વીણવાનો ખર્ચ**	
Xiii	પરિવહન અને વેચાણ ખર્ચ	
Xiv	**કપાસનો કુલ ખર્ચ**	

10. **કપાસનો વેચાણ ભાવ કેટલો** મેળવી શકો છો? _____

11. શું ગર્ભવતી મહિલાઓ અને/અથવા બાળકો કપાસ વીણવાના કામમાં જોડાય છે? હા/ના _____

    જો હા, તો મુખ્ય કારણ જણાવો _____

ઊપજમાં સુધારો

12. ખેતરની પ્રત્યેક એકરદીઠ જમીન માટે તમે કેટલા બિયારણનો ઉપયોગ કરો છો? _____

13. બે હરોળ વચ્ચે તમે કેટલું અંતર રાખો છો તેમ જ હરોળની અંદર બે રોપાં વચ્ચે કેટલું અંતર રાખો છો?

    _____

14. ઊપજમાં સુધારો લાવવા માટે નીચે પૈકીનો કયો ઉપાય તમે અજમાવો છો?

	ઊપજમાં વધારા માટેનાં પગલાં	**હા**	**ના**
i	શું તમે કાયદેસર રીતે અગાઉ તૈયાર કરાયેલું કપાસનું બિયારણ વાપરો છો?		
ii	શું તમે વધુ ઊપજ આપતું કપાસનું બિયારણ વાપરો છો?		
iii	શું તમે એક કાણામાં (પોલાણમાં) એક જ બિયારણ નાંખો છો?		
iv	શું તમે બીમાંથી ઉછેરેલા છોડની નર્સરી તૈયાર કરો છો?		
v	પાકની હરોળ વચ્ચેની જગ્યામાં શું તમે રોપાં રોપો છો?		
vi	શું કપાસમાં **ખરતી બાજ**અટકાવવા માટે તમે પ્લનોફિક્સનો ઉપયોગ કરો છો?		
vii	**જીંડવા બેસવાના**સમયે પ્રવાહી NPK ખાતરનો છંટકાવ કરો છો?		

જળ વ્યવસ્થાપન

15. પાણી બચાવવા માટે અને પાણીની કાર્યક્ષમતા માટે તમે નીચે પૈકીનાં કયાં પગલાં અપનાવો છો?

	જળ વ્યવસ્થાપન માટેનાં પગલાં	**હા**	**ના**
I	શું તમે તમારા ખેતરમાં સિંચાઇ કરતાં પહેલાં પાણીની **જરૂરીયાત જાણો છો?**		
Ii	શું વાવણી કરતાં પહેલાં તમે જમીનનું લેવલિંગ કરો છો (જમીનને સમથળ કરો છો)?		
Iii	શું તમે ક્યારામાં સુધારો કર્યો છે અને તમે ખેતરમાં ચાસ પાડો **ને કપાસ વાવો છો?**		
iv	શું તમે એકાંતરી હરોળમાં સિંચાઈ કરો છો?		
V	શું તમે એકસાથે આખા ખેતરમાં સિંચાઈ કરો છો?		
Vi	શું તમારા ખેતરમાં ટપક પદ્ધતિ છે?		
Vii	શું તમે ખેતરમાં **મલ્ચિંગ કરો છો?**		

રોગ અને જંતુઓના ઉપદ્રવમાં ઘટાડો

16. શું તમે કપાસના પાકને થતા નીચે પ્રમાણેના રોગ ઓળખી શકો છો?

	કપાસના પાકને થતા રોગ	**હા**	**ના**
I	પાકને થતો એવો રોગ, જેનાથી તે કરમાઈ જાય છે (**સુકારો**)		
Ii	મૂળમાં સડો થવો (**કોહવારો**)		
iii	પાંદડાં પર ડાઘ થવા (**ખુણીયા ટપકાનો રોગ**)		

17. શું તમે તમારા ખેતરમા **જીવાતોની ગણતરી કરો** છો? હા/ના _____

18. કપાસના પાક પર થતી નીચે જણાવેલી જીવાતોને તમે ઓળખી શકો છો?

	કપાસના પાક પર થતી જીવાત	**હા**	**ના**
I	છોડ પર થતી જીવાત (એફિડ)		
Ii	થ્રીપ્સ		
Iii	તળ્તાડિયા		
Iv	મીલીબગ		
V	સફેદ માખી		
Vi	ઉધઈ		

19. રોગ અને જંતુનો ઉપદ્રવ ઘટાડવા માટે તમે નીચે પૈકીનાં કયાં પગલાં ભરો છો?

	રોગ અને જંતુનો ઉપદ્રવ ઘટાડવા માટેનાં પગલાં	**હા**	**ના**
I	**કપાસમાં સુકારો ન આવે તે માટે** તમે ટ્રાઇકોડર્મા વિરિડીનો ઉપયોગ કરો છો?		
ii	શું **ઉનાળામાં ઉંડી ખેડ કરો છો?**		
Iii	શું જંતુઓને નિયંત્રિત કરવા માટે તમે લીમડાના તેલનો છંટકાવ કરો છો?		
Iv	શું જંતુઓને નિયંત્રિત કરવા માટે તમે મરચાં-લસણના અર્કનો ઉપયોગ કરો છો?		
V	શું ફળમાખીને નિયંત્રિત કરવા માટે તમે ફેરોમોન ટ્રેપનો ઉપયોગ કરો છો?		
Vi	શું **ખેતરમાં** પક્ષી બેસવાનું સ્ટેન્ડ બનાવો છો?		
Vii	શું ચુસીયા જીવાતને નિયંત્રિત કરવા માટે તમે કપાસના પાકની વચ્ચે ગલગોટા/ ચોળી/મકાઇ વાવો છો?		
Viii	શું ચુસીયા જીવાતને નિયંત્રિત કરવા માટે તમે પીળા ચીકણા પાટિયાનો ઉપયોગ કરો છો?		
Ix	શું ચુસીયા જીવાતને નિયંત્રિત કરવા માટે તમે લાઈટ ટ્રેપનો ઉપયોગ કરો છો?		
X	શું તમે કપાસમાંનાં ફાયદાકારક જંતુઓથી વાકેફ છો?		

20. કપાસના પાકમાં વપરાતાં નીચે પૈકીનાં કયાં જંતુનાશકોથી તમે પરિચિત છો?

	જંતુનાશકનું નામ	**હા**	**ના**
I	ઇમિડેક્લોપ્રિડ		
Ii	મોનોક્રોટો		
Iii	એસિફેટ		
iv	એસિટેમાપ્રાઇડ		
V	ટ્રાઇઝોફોસ		
Vi	**રીજેન્ટ**		
Vii	એમ-45		
Viii	કોપર ઓક્સિક્લોરાઇડ		
Ix	કેરબેન્ડેન્ઝિમ		

21. કપાસના છોડમાં રોગ કે/અને જીવાત જોયા બાદ તમે તરત જ જંતુનાશકનો ઉપયોગ કરો છો? હા/ના ___

22. શું તમે આર્થિક રીતે પોષણક્ષમ તથા અસરકારક સ્તરે (**આર્થીક ક્ષમમાત્રા**) જંતુનાશકનો છંટકાવ કરો છો? હા/ના _____

23. i. જંતુનાશકનો ઉપયોગ કરતી વખતે ધ્યાનમાં રાખવાની બાબતો વિશે તમને જાણકારી છે? હા/ના ____
    ii. જો હા, તો ધ્યાનમાં રાખવાની મુખ્ય બાબતો જણાવો _____
    iii માહિતીના સ્રોત વિશે જણાવો _____

24. i.શું તમે જંતુનાશકનો છંટકાવ કરવાની યોગ્ય પદ્ધતિ વિશે જાણકારી ધરાવો છો? હા/ના _____
    ii. જો હા, તો જંતુનાશકોનો છંટકાવ કરવાની સાચી પદ્ધતિ વિશે વિગતો આપો _____

    _____

25. શું પ્રોજેક્ટમાં જોડાયા અગાઉ **જૈવિક ખાતર અને જૈવિક દવા**કેવી રીતે બનાવવી તેની જાણકારી તમે ધરાવતા હતા? હા/ના _____

26. શું **પ્રોજેકટમાં જોડાયા પછી તમે જૈવિક ખાતર અને જૈવિક દવાઓનો ઉપયોગ વધાર્યા છે?** હા/ના_____

27. શું જૈવિક **ખાતર /દવાના** ના પરિણામરૂપે તમે રાસાયણિક ખાતર તથા જંતુનાશકોનો ઉપયોગ ઘટાડ્યો છે? હા/ના_____

28. રાસાયણિક ખાતર અને જંતુનાશકોની માત્રામાં ફેરફાર

	ખાતર અને જંતુનાશકોની માત્રા	**A. પ્રોજેક્ટ પહેલાં**	**B. પ્રોજેક્ટ પછી**
i	વીઘાદીઠ રાસાયણિક જંતુનાશકોનો ઉપયોગ **(રૂપિયા)**		
Ii	વીઘાદીઠ રાસાયણિક ખાતરનો ઉપયોગ **(રૂપિયા)**		
iii	વીઘાદીઠ જૈવિક જંતુનાશકોનો ઉપયોગ **(રૂપિયા)**		
iv	વીઘાદીઠ જૈવિક ખાતરની માત્રા / વપરાયેલ વર્મી કમ્પોસ્ટ (લીટર કે કિગ્રા)		

ખાતરમાં ઘટાડો

29. ખાતરનો ઉપયોગ ઘટાડવા માટે તમે નીચે પૈકીનાં કયાં પગલાં ભરો છો?

	ખાતર ઘટાડવાનાં પગલાં	**હા**	**ના**
I	શું તમે ખેતરમાં માટીનું પરીક્ષણ કરો છો?		
Ii	શું તમે તમારા ખેતરમાં માટીના પરીક્ષણના રિપોર્ટ અનુસાર ખાતરનો ઉપયોગ કરો છો?		
Iii	શું તમે કપાસના છોડની બે હરોળની વચ્ચેનું નીંદણ દૂર કરો છો?		
Iv	શું તમે કપાસના છોડની બે હરોળ વચ્ચેનું નીંદણ હાથ વડે ખેંચીને/પાવડા વડે દૂર કરો છો?		
V	શું તમે કપાસના પાકમાં **આંતરખેડ**કરો છો?		
Vi	શું તમે **છાણીયા ખાતર**નો ઉપયોગ કરો છો?		
vii	શું તમે કોહવાટ વિના **છાણીયા ખાતર**નો ઉપયોગ કરો છો?		
Viii	શું તમે વર્મી-કમ્પોસ્ટનો ઉપયોગ કરો છો?		
Ix	શું તમે જૈવિક કચરાના ખાતરનો ઉપયોગ કરો છો? (આ ખાતર દિવેલનો ખોળ, લીંબોળીનાં બી, તમાકુનાં બી વગેરેમાંથી બનાવવામાં આવે છે)		
X	શું રાસાયણિક ખાતરનો ઉપયોગ ઘટાડવા માટે તમે એઝોટોબેક્ટર અને પીએસબી કલ્ચર (psb culture) નો ઉપયોગ કરો છો?		
Xi	શું તમે તમારા ખેતરમાં સૂક્ષ્મ પોષકતત્વોનો ઉપયોગ કરો છો?		
Xii	શું તમે તમારા ખેતરમાં ગામના તળાવની માટી નાંખો છો?		
Xiii	શું તમે **ખાતર કપાસના મૂળ વિસ્તારમાં આપો છો?**		

30. તમે તમારા ખેતરમાં કયાં સૂક્ષ્મ પોષકતત્વોનો ઉપયોગ કરો છો? _____

31. તમારા ખેતરમાં જમીનનું પરીક્ષણ કેટલા સમયે કરાવો છો?

i. દરેક પાકની વાવણી કરતાં પહેલાં _____ ii. દર વર્ષે _____

iii. દર બે વર્ષે _____ iv. દર ચાર વર્ષે _____

32. **પાયાના ખાતરમાં કયા ખાતર આપો છો?**_____

33. ત્યાર બાદ/છૂટક-સમયાંતરે તમે કયું ખાતર વાપરો છો? _____

કાપણી સમયની અને કાપણી બાદની પ્રવૃત્તિ

34. તમે દિવસના કયા સમયે કપાસ વીણો છો? _____

35. શું તમે બે જુદા-જુદા પ્રકારના કપાસને મિક્સ કરો છો? હા/ના _____

36. નીચે માની કાપણી સમયની અને કાપણી બાદની કઈ પ્રવૃત્તિઓ હાથ ધરો છો**?**

	કાપણી સમયની અને કાપણી બાદની પ્રવૃત્તિઓ	**હા**	**ના**
I	શું કપાસ વીણતી વખતે તમે ટોપી પહેરો છો?		
Ii	શું તમે **કાંડીવાળો** કપાસ અલગથી વીણો છો?		
Iii	શું કપાસને વીણ્યા બાદ તમે તેને સ્વચ્છ કપડાંમાં એકઠું કરો છો?		
iv	શું તમે કપાસ વીણ્યા બાદ સીધું જ તેને ભરીને મૂકો છો?		
V	શું કપાસને ભરીને મૂકતાં પહેલાં તમે તેને તડકામાં કોરૂં કરો છો?		
Vi	શું તમે કપાસને DAP કે યુરિઆની પ્લાસ્ટિકની ખાલી થેલીમાં ભરો છો?		
Vii	શું **વાળ,ગુટખા,કપાસમાં ન પડે તેનું ધ્યાન રાખો છો?**		
Ix	શું તમે **કપાસ વેચાણ માટે લઈ જવાતા સાધન ચોખ્ખું રાખો છો?**		

ખેડૂતોને લાભ

37. પ્રોજેક્ટમાં જોડાયા બાદ ટપક/ચાસ દ્વારા સિંચાઈ હેઠળ ખેતીના વિસ્તારમાં વધારો

i. પ્રોજેક્ટ અગાઉ ટપક/ચાસ દ્વારા સિંચાઈ હેઠળનો ખેતી વિસ્તાર _____

ii. પ્રોજેક્ટ બાદ ટપક/ ચાસ દ્વારા સિંચાઈ હેઠળનો ખેતી વિસ્તાર _____

38. પ્રોજેક્ટ હેઠળ વધુ સારી જળ વ્યવસ્થાપન પ્રવૃત્તિનો અમલ કર્યા બાદ પીયતમાં કેટલો ઘટાડો થયો છે અથવા તો કેટલા કલાક પાણી ઓછું આપવું પડે છે? _____

39. પાણી બચાવવાના પરિણામરૂપે તમારા **પાણીના ખર્ચમાં કેટલો ઘટાડો થયો?** _____

40. પ્રોજેક્ટમાં જોડાયા બાદ તમે બિયારણના ખર્ચમાં કેટલી બચત કરી છે?_____

41. પ્રોજેક્ટમાં જોડાયા બાદ ખાતરના ખર્ચમાં તમારે કેટલી બચત થઈ છે? _____

42. પ્રોજેક્ટમાં જોડાયા બાદ જંતુનાશકોના ખર્ચમાં તમારે કેટલી બચત થઈ છે? _____

43. શું કોઈ જિનરે તમારા ઘરેથી કપાસ ખરીદ્યું છે? હા/ના _____

44. i. શું પ્રોજેક્ટની દરમિયાનગીરીના પરિણામરૂપે તમારો પરિવહન ખર્ચ ઘટ્યો છે? હા/ના _____
ii. જો હા, તો પ્રોજેક્ટની દરમિયાનગીરીને કારણે પરિવહન ખર્ચમાં કેવી રીતે ઘટાડો થયો તે જણાવો

_____

45. i. શું જૈવિક-આગતના પરિણામરૂપે તમને જમીનની ગુણવત્તામાં સુધારો થતો જણાયો છે? હા/ના _____
ii. જો હા, તો આ સુધારાનાં ચિહ્નો (લક્ષણો) જણાવો? _____

_____

46. i. શું પ્રોજેક્ટમાં જોડાયા બાદ હવામાનની સ્થિતિ વિશેની બહેતર જાણકારીથી તમને ફાયદો થયો છે? હા/ના_____
ii. જો હા, તો વિગતે જણાવો _____

47. i. શું પ્રોજેક્ટમાં જોડાયા બાદ કપાસના બજાર ભાવ વિશેની બહેતર જાણકારીથી તમને ફાયદો થયો છે? હા/ના_____
ii. જો હા, તો વિગતે જણાવો? _____

48. પ્રોજેક્ટ દરમિયાનગીરીના પરિણામરૂપે કપાસની ઊપજમાં થયેલો ફેરફાર
i. પ્રોજેક્ટ અગાઉ વીઘાદીઠ થતી ઊપજ _____ ii. પ્રોજેક્ટ બાદ વીઘાદીઠ થતી ઊપજ _____

49. શું પ્રોજેક્ટ હેઠળ કપાસની ગુણવત્તા કેવી રીતે વધારવી તે અંગે આપને કોઈ તાલીમ/એક્સપોઝર આપવામાં આવ્યું છે? હા/ના_____

50. i. શું પ્રોજેક્ટની દરમિયાનગીરીના પરિણામરૂપે કપાસની ગુણવત્તામાં સુધારો થયો છે? હા/ના _____
ii. જો હા, તો કેવી રીતે?

_____

51. પ્રોજેક્ટ દરમિયાનગીરીના પરિણામરૂપે કપાસના ભાવમાં જોવા મળેલો તફાવત

    i. પ્રોજેક્ટ પહેલાંની કિંમત _____ ii. પ્રોજેક્ટ બાદની કિંમત _____

52. પ્રોજેક્ટની દરમિયાનગીરીના પરિણામરૂપે ચોખ્ખી આવકમાં ફેરફાર

    i. પ્રોજેક્ટ પહેલાંની ચોખ્ખી આવક _____ ii. પ્રોજેક્ટ બાદની ચોખ્ખી આવક _____

સંગઠનના લાભ

53. નીચે પૈકીના કયા એકમના તમે સભ્ય કે હિસ્સાધારક છો?

    i. કિસાન ક્લબ _____ ii. ક્યારથી _____

    iii. કૃષિ ધન FPC _____ iv. ક્યારથી _____

54. તમારા WUA ચેરમેન તથા ઓપરેટરનાં નામ આપો

    i. ચેરમેન _____ ii. ઓપરેટર _____

55. શું પ્રોજેક્ટમાં જોડાયા બાદ WUA (પિયત મંડળી)માં તમારી સામેલગીરી વધી છે? હા/ના _____

56. શું પ્રોજેક્ટ બાદ WUAના વહીવટમાં સુધારો જણાયો છે? હા/ના _____

57. શું ખેતરની ચેનલ નિયમિત રીતે સાફ કરવામાં આવે છે? હા/ના _____

58. શું માઇનોર અને સબ-માઇનોર કેનાલ નિયમિત રીતે સાફ કરવામાં આવે છે? હા/ના _____

59. શું તમે તમારા WUAને પાણીનો ખર્ચ ચૂકવો છો? હા/ના _____

    જો હા, તો i. તરત જ _____ ii. પછીથી _____

    iii. જો ના અથવા તો મોડી ચૂકવણી, તો, શા માટે _____

60. i. શું FPC / કિસાન ક્લબની રચનાને પગલે ખેતીકીય આગતના પુરવઠામાં સુધારો થયો છે?

    હા/ના_____

    ii. જો હા, તો જે ક્ષેત્રે સુધારો થયો હોય, ત્યાં નિશાની કરો:

    a. આગત પુરવઠાની સમયસરતા _____ b. આગત પુરવઠાની ભરોસાપાત્રતા _____

    c. આગત પુરવઠાની ગુણવત્તા _____

d. માહિતી અને માર્ગદર્શન/સલાહ (બિયારણ, જીવાત અને રોગો અંગે) _____

61. i. શું WUAની રચનાના પરિણામે સિંચાઈની સેવાઓમાં સુધારો થયો છે? હા/ના_____
ii. જો હા, તો જે ક્ષેત્રે સુધારો થયો હોય, ત્યાં નિશાની કરો:
a. સિંચાઈ સેવાઓની સમયસરતા _____ b. સિંચાઈ સેવાઓની ગુણવત્તા _____

62. WUA સાથે કામ કરવા દરમિયાન તમારો અનુભવ કેટલો સંતોષકારક રહ્યો?
i. ઘણો સંતોષકારક _____ ii. સંતોષકારક _____
iii. અસંતુષ્ટ (કારણ આપો)_____

63. કોટન પ્રોજેક્ટના ભાગૂરપે તમે જે જાણકારી મેળવી, તે જાણકારીનો તમે અન્ય પાક પર કેવી રીતે અમલ કરી શકો?_____

64. કપાસ પ્રોજેક્ટ હેઠળની કોઈ પણ પ્રવૃત્તિ લાગુ કરતી વખતે તમારી સામે કઈ અડચણો આવી?

_____

પ્રોજેક્ટ સેટ-અપ

65. શું LRPs/ફિલ્ડ લેવલે મદદ પૂરી પાડનાર વ્યક્તિ તમને નિયમિતપણે મળીને પ્રોજેક્ટ વિશે તમારી સાથે ચર્ચા કરતા હતા? હા/ના _____

66. શું તમને જ્યારે LRPs /ફિલ્ડ લેવલે મદદ પૂરી પાડનાર વ્યક્તિ તમારી જરૂરિયાતના સમયે તમારી મુલાકાત લેતા હતા? i. મોટા ભાગે _____ ii. ક્યારેક _____ iii. ભાગ્યે જ _____

67. LRPs /ફિલ્ડ લેવલે મદદ કરનારી વ્યક્તિ દ્વારા પૂરી પાડવામાં આવેલી માહિતી તથા સલાહને તમે કેવી રીતે મૂલવશો?
i. ખૂબ સરસ _____ ii.. સરસ _____ iii. સંતોષજનક _____ iv. નબળી _____

68. DSC દ્વારા આપવામાં આવેલી નીચે પૈકીની કઈ માહિતી તમને સૌથી વધુ ઉપયોગી જણાઈ?

i. પાકને લગતી પ્રવૃત્તિઓ _____ii. આગત પુરવઠાને લગતી માહિતી _____
iii. લણણી/લણણી બાદની માહિતી _____ iv. બજાર સંબંધિત માહિતી _____

69. કપાસ પ્રોજેક્ટ અંતર્ગત DSC દ્વારા પૂરી પાડવામાં આવેલી સેવાઓથી તમને કેટલો સંતોષ છે?

*(*તમારો જવાબ 1થી 5ના દરે આપો, જેમાં 1 ઘણું જ નબળું અને 5 ખૂબ જ સરસ ગણાશે*)*

1 (ખૂબ નબળી) _____ 2 (નબળી)_____ 3 (સંતોષજનક)_____

4 (સરસ)_____ 5 (ખૂબ સરસ)_____

70. DSCની સેવાના કયા ક્ષેત્રમાં સુધારો આવે તેમ તમે ઈચ્છો છો?

_____

_____

6.2. Annexure 2: Control questionnaire

ફોર્મ નં. ☐

નિયંત્રિત/પ્રમાણભૂત જૂથ સર્વેક્ષણ પ્રશ્નાવલી

“કપાસ પ્રોજેક્ટની અસરકારકતાની આકારણી તથા ફેર-અમલીકરણની તકો”

તારીખ: _____ સંશોધનકર્તાનું નામ: _____

ગામ: _____ તાલુકો: _____ જિલ્લો: _____

1. ખેડૂતનું નામ _____

2. સંપર્ક નં. _____

3. ખેડૂતની જમીનની વિગતો (એકર/વીઘા/ગુંઠા)

   g. માલિકીની _____ b. ભાડાપેટે _____ c. કુલ જમીન _____

   d. કપાસના પાક હેઠળ કુલ સિંચાઇ જમીન _____

4. સિંચાઇનો સ્રોત (નિશાની કરો):

a. કેનાલ_____ b. બોરવેલ_____ c. કૂવો _____d. એક કરતાં વધુ સ્રોત _____

5. આગત નો વીઘાદીઠ કુલ ખર્ચ:

   i. પાણી _____

   ii. બિયારણ _____

   iii. ખાતર _____

   iv. જંતુનાશકો _____

v. મજૂરી _____

vi. પરિવહન ખર્ચ _____

6. એક વીઘાદીઠ સરેરાશ કેટલા કપાસનું ઉત્પાદન થાય છે? _____

7. કપાસ માટે તમે કેટલી કિંમત મેળવી શકો છો? _____

8. કપાસ માંથી તમે કેટલી ચોખ્ખી આવક મેળવી શકો છો? _____

9. રાસાયણિક ખાતર અને જંતુનાશકો ના ઉપયોગ થી જમીન ની ગુણવત્તા ઉપર કોઈ નકારાત્મક અસરો જોવા મળી છે? હા/ના _____

10. ખેતી આગતના સ્ત્રોતો અંગે સૂચી જણાવો _____

_____

11. બિયારણ, જીવાત અને રોગો અંગે માહિતી અને માર્ગદર્શન/સલાહના સ્ત્રોતો અંગે સૂચી જણાવો

_____

12. તમને પડતી અડચણો અંગે ની સૂચી જણાવો:

i. ખેતી આગતના સ્ત્રોતો _____

ii. ખેતી આગતના સ્ત્રોતોની સમયસરતા _____

iii. આગતના સ્ત્રોતોની ગુણવત્તા _____

iv. માહિતી અને માર્ગદર્શન/સલાહ _____