

**BASELINE SURVEY UNDER ON-LINE PEST MONITORING AND ADVISORY SERVICES  
PROJECT IN KHEDA DISTRICT OF GUJARAT**

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**ABSTRACT**

*Department of Agriculture & Co-operation, Ministry of Agriculture, Government of India sponsored project "On-line Pest Monitoring and Advisory Services under commercial crops (OPMAS)" on ICT based e-pest surveillance and advisory, implemented by NCIPM, New Delhi at Department of Entomology, BACA, AAU, Anand. The main objective is to monitor the pests in cotton, issue the pest advisories time to time to extension agencies and farmers, disseminate the IPM activities to cotton growers of Kheda district. With a view to, a survey should required for getting baseline information of different villages. For the purpose, three talukas of Kheda district were selected and in each taluka, three villages were selected. In each village, total twenty farmers were randomly selected for getting baseline information. Based on the survey, the total population of villages was in the range of 150 to 600, literacy rate about 60-90 per cent, respondents growing cotton as mono crop in Kharif, sandy loam to black soil type and mostly irrigated (tube well and canal). Respondents were applying 5 to 10 irrigation during crop season. Popular varieties (Bt cotton BG II) grown by respondents were Ajit 199, Asha, Ajit 155, Jay, RCH 2, Nanostar and Jackpot. Agro centre was a main source for getting seeds and pesticides. They were applying N:100 to 250 kg/ ha + P: 25 to 50kg/ ha (rarely Mg and FYM) as a routine fertilizer doses/ application. The respondents recognized sucking pests (aphid, jassid, whitefly, thrips, mealybug and red cotton bug as major insect pests while reddening of cotton leaves was major disease/ disorder. Monocrotophos, imidacloprid, prefenophos, flonicamid, acephate and dinotefuran were major pesticides used by them. They were applying 2 to 6 sprays of insecticides during the entire crop season. Agriculture in coupled with animal husbandry were very important sources for their income. Respondents harvesting on an average 25-35 q/ha seed cotton. Agro centers and KCC were recognized as most credible sources of advices for them. Up to 56 per cent of the respondents from Kheda district have knowledge regarding Integrated Pest Management (IPM) and natural enemies. The information generated through survey will help to farmers in formulating effective crop model suitable to respective area by utilising information disseminated through OPMAS project thereby getting higher seed cotton yield and net return.*

**Keywords :** baseline survey, OPMAS, cotton, respondents, kheda

**INTRODUCTION**

The purpose of a baseline study is to provide an information base against which to monitor and assess an activity's progress and effectiveness during implementation and after the activity is completed. Sometimes the data needed for a baseline, against which to measure the degree and quality of change during an activity's implementation, will already exist. In such cases the only task is to collate the data and ensure that it can be updated in the longer term. So it is important to find out what information is already available. But more commonly, there will not be any existing data, or it will be incomplete or of poor quality, or it will need to be supplemented or broken out into categories that are relevant for the project being implemented.

When planning a baseline study, the implementing organization needs to determine both what change needs to be assessed and what sort of comparison(s) will need to be made as part of that assessment of change. The study should be closely linked with the activity monitoring plan so that the data collected can be replicated if necessary during ongoing activity monitoring, for any mid-term review, when the activity is being assessed for the activity completion report and for any subsequent evaluations. Baseline data should provide the minimum information required to assess the quality of the activity implementation and measure the development results (Anon., 2012).

Cotton is well known cash crop and a major source of foreign exchange earnings through export. After introduction

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of *Bt* cotton, we could achieve effective management of *Helicoverpa armigera* (Hübner) Hardwick and *Earias* spp., but it has been noticed that pink bollworm would pose a major threat to *Bt* cotton due to its crop-phenological niche and farmers' practices of neglecting their crop and not terminating even after the crop's potential yield period. Similarly there is a steady increase in infestation of sucking pests like jassids, white flies, thrips, aphids etc. The minor or unseen pests such as mirid bug, mealy bug and shoot weevil are also attaining economic importance in *Bt* cotton. Besides, in many locations, *Bt* cotton hybrids are grown in poor or marginal soils under rain fed situations, where the agronomic conditions do not support the high boll retention in *Bt* cotton hybrids consequently leading to abiotic stress situations. More attack of biotic stresses such as grey mildew, leaf spots, rusts etc. in extended *Bt* cotton hybrids were also noted. Under such situations, they reduce net leaf area expressing cry toxin and may further inhibit the level of toxin expression too, which makes the plant more vulnerable to attack by bollworms. The pest problems, particularly that of minor pests, have not been monitored regularly and often remedial measures are undertaken only after they reach epidemic or cause huge losses. A regular monitoring of cotton pests, using preferably Information Communication Technologies (ICT) and development of suitable IPM strategies is need of the hour, as it will lead to better preparedness by all agencies involved in plant protection and to issue proper advise to farmers based on actual pest problems. Now it is a high time for reorienting IPM approach in cotton. Development and implementation of suitable protection and related production packages is urgently required for improving the performance of *Bt* cotton. Though the *Bt* cotton led to increased yields and improved socioeconomic position of the farmers, but the sudden emergence of mealy bug and pink bollworm in Gujarat has increased the cost of plant protection. This increase coupled with the high cost of seed cotton, is having a strong impact on socio-economic condition of the farmers. The change in socio-economic status of the farmers due to large scale cultivation of *Bt* cotton and its after effects due to emergence of pest problems in India have not yet been studied in detail. Also there is a need to converge the pest scenario in *Bt* cotton throughout India, to know the shift in pest population, so as to enable our IPM missionary accordingly. Keeping all these things in mind the project viz., Online Pest Monitoring and Advisory Services (OPMAS) under National Food Security Mission- Commercial Crops is being implemented in 2014-15 in Kheda district (this district is best known as the cotton belt and majority of the farmers grow cotton on a large area during *khariif* season).

### OBJECTIVES

- (1) Before the crop season, baseline information should be collected from the villages (newly introduced) from the cotton growing farmers to know the resource endowments and the level of crop productivity
- (2) Development and implementation of web-based pest monitoring and advisory services for emerging pests, diseases and any other significant physiological problems in cotton crop
- (3) Sharing the information on pest scenario with state / central agencies for developing IPM strategies
- (4) Awareness through validation and demonstration of management strategies, trainings and electronic media to enhance the capabilities of farmers
- (5) Socio-economic studies for impact analysis
- (6) Collection of real time weather data, development of pest correlation with weather data and statistical analysis of pest data for hot spots
- (7) Monitoring of resistance in pink bollworm population

### Evaluation Process

- ♦ A baseline survey should be conducted to know the resource endowments of the farmers and the level of crop productivity.
- ♦ Concurrent evaluation should be done to assess the performance of the programme commensurate with its objectives.
- ♦ Impact evaluation study should be undertaken to assess the impact of various interventions in increasing the productivity of cotton and enhancement of farmers' income (Anon., 2014).

In order to achieve the above mentioned purpose, following data were collected :

#### Base line information of selected villages of Kheda district under OPMAS project (2014-15)

Sr. No.	Parameters
1	Total population of village
2	Literacy rate (%)
3	Cropping system
4	Cotton grown as mono or inter Crop
5	Soil type
6	Irrigated/ Rainfed
7	Source of irrigation
8	No. of irrigation

9	Popular varieties (BG II)
10	Source of seed
11	Fertilizers
12	Major insect pests
13	Major diseases
14	Major pesticides used
15	No. of sprays
16	Pesticide quantity
17	Source of pesticides
18	Main source of income
19	Yield ( q/ ha)
20	Source of advice
21	IPM-NE knowledge

Note: IPM-Integrated Pest Management;  
NE-Natural Enemies; q-quintal; ha-hectare.

### METHODOLOGY

The present study was conducted in Kheda district

**Table 1: List of villages under survey in Kheda district during 2014-15**

Taluka	Sr. No	Name of selected villages under OPMAS	GPS	
			Longitude	Altitude
Kapadwanj	1	Kapdivav	N 22° 59.287	E 073° 09.769
	2	Antisar	N 23° 01.852	E 073° 10.273
	3	Thavad	N 23° 07.185	E 073° 09.660
Kathlal	1	Sikandar porda	N 22° 55.799	E 073° 06.554
	2	Vishwanathpura	N 22° 56.916	E 073° 08.163
	3	Laxmipura	N 22° 54.132	E 073° 09.330
Thasra	1	Labhpura	N 22° 51.372	E 073° 09.045
	2	Mugatpura	N 22° 49.814	E 073° 08.434
	3	Ajupura	N 22° 50.946	E 073° 09.722

The data were collected through interview schedule were transferred on the master sheet. They were coded, processed, tabulated, classified and analyzed in light of the objectives of the study frequency and percentage.

### RESULTS AND DISCUSSION

It is apparent from the data presented in Table 1 that the total population of nine villages of Kheda district was in the range of 150 to 6000, the highest population was observed in Antisar village with 6000 total population, 1781 in Vishwanathpura village and 500 in Thavad while the lowest populated villages were Ajupura and Mugatpura with 150 total population.

of Gujarat state. The total geographical area of the district is 3959 km<sup>2</sup>. The district lies between 20.75° N latitude and 72.68 E longitude situated at 21 m above mean sea level. The Vatrak River passes through the district. The soil of Kheda district is goradu, black and sandy. The soil of Kheda district in general possesses neutral to alkaline PH. Electricity Conductivity is too low. Organic carbon as well as nitrogen content low, phosphorus medium, potash is high. The soil salinity in Kheda is slighter to moderately saline. Overall, the soil fertility indices are good from the agriculture point of view.

A survey should requires for getting baseline information of different villages. For the purpose, three talukas of Kheda district were selected and in each taluka, three villages were selected. In each village, total twenty farmers were randomly selected for getting baseline information.

**Table 1: Total population of the villages**

Sr. No.	Name of villages	Population
1	Kapdivav	180
2	Antisar	6000
3	Thavad	500
4	Sikandar porda	432
5	Vishwanathpura	1781
6	Laxmipura	150
7	Labhpura	210
8	Mugatpura	150
9	Ajupura	150
<b>Mean</b>		<b>9553</b>

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The data presented in Table 2 shows that, the average literacy rate of selected villages of Kheda district was 76.67 per cent, the highest literacy rate was observed in Laxmipura and Ajupura as 90.00 per cent, Labhpura and Mugatpura as 80 per cent while the lowest literacy rate was found in Vishwanathpura (50.00 per cent) followed by Sikandar porda (60.00 per cent) villages of this district.

**Table 2: Literacy rate** n=180

Sr. No.	Name of Village	No. of respondents	Literacy rate (%)
1	Kapdivav	20	75
2	Antisar	20	80
3	Thavad	20	75
4	Sikandar porda	20	60
5	Vishwanathpura	20	50
6	Laxmipura	20	90
7	Labhpura	20	85
8	Mugatpura	20	85
9	Ajupura	20	90
<b>Mean</b>			<b>76.67</b>

**Table 4: Soil Type** n=180

Sr. No.	Name of Village	No. of Respondents	Soil Type	Irrigated/Rainfed
1	Kapdivav	20	Black	Irrigated
2	Antisar	20	Sandy loam	Irrigated
3	Thavad	20	Sandy loam	Irrigated
4	Sikandar porda	20	Sandy loam	Irrigated
5	Vishwanathpura	20	Black	Irrigated
6	Laxmipura	20	Sandy loam	Irrigated
7	Labhpura	20	Black	Rainfed
8	Mugatpura	20	Black	Irrigated
9	Ajupura	20	Sandy loam	Rainfed

Table 4 shows that, the soil type of majority of respondents from Antisar, Thavad, Sikandar porda, Laxmipura and Ajupura villages was found sandy loam whereas respondents from Kapdivav, Vishwanathpura and Labhpura and Mugatpura had black soil and also the soil was found mostly irrigated except two villages viz., Labhpura and Ajupura, the respondents from these villages had rainfed soil.

**Table 5: Irrigation System** n=180

Sr. No.	Name of Village	No. of Respondents	Source of irrigation	No. of irrigation
1	Kapdivav	20	Tubewell	6
2	Antisar	20	Tubewell/Canal	5
3	Thavad	20	Tubewell/Canal	6
4	Sikandar porda	20	Tubewell/Canal	6-7
5	Vishwanathpura	20	Tubewell	8-10
6	Laxmipura	20	Tubewell	7
7	Labhpura	20	-	-
8	Mugatpura	20	Tubewell/ Canal	6
9	Ajupura	20	-	-

**Table 3: Cropping System** n=180

Sr. No.	Name of Village	No. of Respondents	Cropping System	Cotton grown as
1	Kapdivav	20	Kharif	Mono Crop
2	Antisar	20	Kharif	Mono Crop
3	Thavad	20	Kharif	Mono Crop
4	Sikandar porda	20	Kharif	Inter Crop
5	Vishwanathpura	20	Kharif	Mono Crop
6	Laxmipura	20	Kharif	Inter Crop
7	Labhpura	20	Kharif	Mono Crop
8	Mugatpura	20	Kharif	Mono Crop
9	Ajupura	20	Kharif	Mono Crop

From the above table, it is revealed that, cent per cent of the respondents from the selected villages were followed Kharif cropping pattern and majority of the villagers from them grown cotton as mono crop except the villagers from Sikandar porda and Laxmipura village, they grown cotton as inter crop with pigeonpea and castor.

It is clearly mentioned from the Table 5 that the majority of respondents from the villages of Kheda districts under study were adopting Tubewell as their main source of irrigation; these villagers had very good canal facility for irrigation and large number of respondents were applying averaged 6 to 7 irrigation/ crop season.

The data presented in the Table 6 shows that the majority of respondents from the selected villages procure seeds from Agro centres and majority of them grown Ajit 155 and Ajit 199 cultivars., the respondents from Kapdivav, Antisar and Thavad had grown cotton in May month whereas remaining respondents had grown during June.

**Table 6: Selection of Seed**

**n=180**

Sr. No.	Name of Village	No. of Respondents	Hybrid Varieties	Source of Seed	Sowing Date
1	Kapdivav	20	Ajit 199, Asha	Agro Centre	3 <sup>rd</sup> Week of May
2	Antisar	20	Ajit 155, Ajit 199	Agro Centre	2 <sup>nd</sup> Week of June
3	Thavad	20	Ajit 155	Agro Centre	3 <sup>rd</sup> Week of May
4	Sikandar porda	20	Jay	Agro Centre	4 <sup>th</sup> Week of June
5	Vishwanathpura	20	RCH-2, Ajit 155	Agro Centre	3 <sup>rd</sup> Week of June
6	Laxmipura	20	RCH-2, Nenostar	Agro Centre	1 <sup>st</sup> Week of June
7	Labhpura	20	RCH-2, Ajit 155, Ajit 199	Agro Centre	2 <sup>nd</sup> Week of June
8	Mugatpura	20	RCH-2, Jackpot, Nenostar	Agro Centre	3 <sup>rd</sup> Week of June
9	Ajupura	20	Ajit 155, Ajit 199	Agro Centre	3 <sup>rd</sup> Week of June

The data presented in the Table 7 revealed that N: 100 to 250 kg/ha + P: 25 to 50kg/ha + K: 25 to 50 kg/ha (rarely Mg and FYM) was an averaged routine dose of fertilizer for large number of respondents. The highest fertiliser dose (N: 250 kg/ha + P: 50 kg/ha + Mg: 40 kg/ha) was applying by respondents from Kapdivav village of this district followed by respondents from Thavad (N: 200, P: 50 K: 50) and Laxmipura (N: 200 FYM: 10 tones) while lowest one (N: 100 kg/ha + P: 25 kg/ha + K: 25 kg/ha + Mg: 25 kg/ha) was applying by respondents from Mugatpura and Ajupura village.

**Table 7: Fertilizer Doses**

**n=180**

Sr. No.	Name of Village	No. of Respondents	Fertilizers/Nutrients (kg/ha)
1	Kapdivav	20	N:250 P: 50 K: 50 Mg: 40
2	Antisar	20	N: 180 P: 50 K: 50
3	Thavad	20	N: 200 P: 50 K: 50
4	Sikandar porda	20	N: 125 P: 25
5	Vishwanathpura	20	N: 280
6	Laxmipura	20	N: 200 FYM 10 tones
7	Labhpura	20	N: 150 P: 50 K: 50
8	Mugatpura	20	N: 100 P: 25 K: 25 Mg: 25
9	Ajupura	20	N: 100 P: 25 K: 25 Mg: 25

From the below table, it was clearly observed that aphid, jassid, whitefly, mealy bug and red cotton bug were major sucking pests found in the field of majority of respondents while reddening of cotton was major disease/disorder observed in their field.

**Table 8: Main Insects-Pests and Diseases**

**n=180**

Sr. No.	Name of Village	No. of Respondents	Main insects pests/nematodes	Main Diseases
1	Kapdivav	20	Whitefly, Mealy bug and Red Cotton Bug	Reddening of cotton
2	Antisar	20	Jassid, Whitefly, Mealy bug and Red Cotton Bug	Reddening of cotton
3	Thavad	20	Whitefly and Mealy bug	Reddening of cotton
4	Sikandar porda	20	Jassid, Whitefly, Mealy bug	Reddening of cotton
5	Vishwanathpura	20	Whitefly and Mealy bug	Reddening of cotton
6	Laxmipura	20	Whitefly and Mealy bug	Reddening of cotton
7	Labhpura	20	Sucking pests	Reddening of cotton
8	Mugatpura	20	Sucking pests	Reddening of cotton
9	Ajupura	20	Sucking pests	Reddening of cotton



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It is revealed from Table 9 that monocrotophos, imidacloprid, Dinotefuran, prefenophos, flonicamid, thiamethoxam were major pesticides used by respondents from selected villages and they were applying averaged 2

to 6 sprays of mentioned pesticides at 15 days of interval with an average range of 0.5 to 1.0 litres/ ha. Overwhelming majority recognized agro centre as a major source for getting pesticides.

**Table 9: Pesticides Uses**

n=180

Sr. No.	Name of Village	No. of Respondents	Name of Pesticide	No. of Sprays (Days-interval)	Quantity (lit/ha)	Source of Pesticide
1	Kapdivav	20	Monocrotophos, Carbosulpfan and Acetamiprid	3-5	0.5	Agro centers
2	Antisar	20	Imidacloprid and Thiamethoxam	4	01.0	Agro centers
3	Thavad	20	Dinotefuran, Imidacloprid and Acetamiprid	2-5	0.5-1.0	Agro centers
4	Sikandar porda	20	Monocrotophos and Dinotefuran	4	0.5	Agro centers
5	Vishwanathpura	20	Monocrotophos, Flonicamid and Acetamiprid	3	0.5	Agro centers
6	Laxmipura	20	Monocrotophos, Thiamethoxam and Flonicamid	15 days interval	0.5-1.0	Agro centers
7	Labhpura	20	Imidacloprid, Dinotefuran and Acetamiprid	3-5	0.5	Agro centers
8	Mugatpura	20	Monocrotophos and Dinotefuran	5-6	0.5-1.0	Agro centers
9	Ajupura	20	Imidacloprid and Profenophos	3-5	0.5	Agro centers

The data presented in the Table 10 revealed that the large numbers of respondents from selected villages were recognized agriculture and animal husbandry as their main

sources for their income. The highest seed cotton yield was harvesting by farmers of Antisar, Laxmipura and Labhpura village @ 35 qtl/ ha.

**Table 10: Source of Income and Average Yield**

n=180

Sr. No.	Name of Village	No. of Respondents	Main Source of Income	Average Seed cotton Yield (Q/ha)
1	Kapdivav	20	Agriculture and Animal Husbandry	30
2	Antisar	20	Agriculture and Animal Husbandry	35
3	Thavad	20	Agriculture and Animal Husbandry	30
4	Sikandar porda	20	Agriculture and Animal Husbandry	25-30
5	Vishwanathpura	20	Agriculture and Animal Husbandry	30
6	Laxmipura	20	Agriculture and Animal Husbandry	35
7	Labhpura	20	Agriculture	35
8	Mugatpura	20	Agriculture	28
9	Ajupura	20	Agriculture	25

Table 11 shows that agro service centers, Kisan Call Centres, Sate Agricultural Universities and Village Level Workers were recognized as a main source of advisory/ information by overwhelming majority from the selected

villages of Kheda district; majority from them have a knowledge regarding Integrated Pest Management and natural enemies excepting the respondents from Kapdivav, Vishwanathpura and Mugatpura villages.

**Table 11: Source of advisory and Knowledge**

n=180

Sr. No.	Name of Villages	No. of Respondents	Main Source of advisory	Knowledge about IPM-NE
1	Kapdivav	20	KCC, VLWs	No
2	Antisar	20	Agro centers, KCC	Yes
3	Thavad	20	SAUs	Yes
4	Sikandar porda	20	Agro centers, KVK	Yes
5	Vishwanathpura	20	KCC, VLWs	No
6	Laxmipura	20	Agro centers	Yes
7	Labhpura	20	Agro centers, SAUs	Yes
8	Mugatpura	20	Agro centres	No
9	Ajupura	20	Agro centers, SAUs	Yes

IPM dissemination under OPMAS project through Cotton Day (400), Group meetings (719), farmers’ trainings (283), newspaper coverage (11), radio talks (04) and SMS sent to farmers through farmers portal (1,56,4128) during 2014-15 in Kheda district (Table 12).

**Table 12: IPM dissemination under OPMAS project through Group meetings, farmers’ trainings, newspaper coverage and radio talks organized for dissemination of IPM technology during 2014-15**

Sr. No.	Activity	No.	Total no. of farmers benefited
1	Cotton day	1	400
2	Village Group Meeting	16	719
3	Farmers’ Training	6	283
4	News paper coverage	11	-
5	Radio talks	04	-
6	Photos	> 350	-
7	Videos	01	-
8	Total SMS sent through Famers portal	15	13, 57, 169**
<b>Total benefitted farmers</b>			<b>13,58,571</b>

\* Covered entire zone “Vadodara District” and farmers from different districts of Gujarat

For dissemination of IPM under OPMAS project through Surveillance programme, 36 farmers fields were surveyed from 9 villages of Kheda district and selected 36 farmers as IPM farmers to know the impact of the project at the end of the season (Table 13).

**Table 13: Surveillance programme and data collection**

Particulars	Target	Achieved
Number of villages surveyed	9	9
Number of fields surveyed	36	36
Number of IPM farmers	36	36
Data observed (fixed and random)#	500	504
Data fed (fixed and random)#	500	504
Fortnightly Surveillance Report submitted to State Dept. of Agril. & NCIPM	08	08

(#Calculation is based upon the observations of 14 weeks in a season X 36 fields)

Due to thorough knowledge of IPM farmers supplemented to the farmers through various extension activities under OPMAS project, the area under cotton was increased (Table 14). Through IPM practices farmers can reduce number and quantity of chemical pesticides sprays

and thereby reducing cost of cultivation. Farmers can increase seed cotton yield by using IPM practices and thereby can get maximum net return and improve their social status too.

**Table 14 : Socio economic impact analysis Horizontal spread of IPM (farmer to farmer) under OPMAS during 2014-15**

No. of villages		No. of IPM farmers		No. of motivated farmers	
09		36		150	
Pesticide application in IPM and FP during 2014-15					
Number of sprays of chemical pesticides		Quantity of chemical pesticides applied (kg/ha)		Number of bio-pesticides sprayed	
IPM	FP	IPM	FP	IPM	FP
06	08	2.500	4.000	03	01

Note: IPM: Integrated Pest Management; FP: Farmers Practice

### CONCLUSION

In nutshell, from the above results it is concluded that the total population of villages of Kheda district was in the range of 150 to 600, literacy rate about 60-90 per cent, respondents growing cotton as mono crop in Kharif, sandy loam to black soil type and mostly irrigated (tube well and canal). Respondents were applying 5 to 10 irrigation during crop season. Popular varieties (*Bt* cotton BG II) grown by respondents were Ajit 199, Asha, Ajit 155, Jay, RCH 2, Nanostar and Jackpot. Agro centre was a main source for getting seeds and pesticides. They were applying N:100 to 250 kg/ ha + P: 25 to 50kg/ ha (rarely Mg and FYM) as a routine fertilizer doses/ application. The respondents recognized sucking pests (aphid, jassid, whitefly, thrips, mealybug and red cotton bug as major insect pests while reddening of cotton leaves was major disease/ disorder. Monocrotophos, imidacloprid, prefenophos, flonicamid and dinotefuran were major pesticides used by them. They were applying 2 to 6 sprays of insecticides during the entire crop season. Agriculture in coupled with animal husbandry were very important sources for their income. Respondents harvesting on an average 25-35 q/ha seed cotton. Agro centers and KCC were recognized as most credible sources of advices for them. Up to 56 per cent of the respondents from Kheda district have knowledge regarding Integrated Pest Management (IPM) and natural enemies. IPM practices farmers can reduce number and quantity of chemical pesticides sprays and thereby reducing cost of cultivation. The information generated through survey will help to farmers in formulating effective crop model suitable to respective area

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by utilising information disseminated through OPMAS project thereby getting higher seed cotton yield and net return as well as they can improve their social status too.

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