

## Crop Pest Surveillance and Advisory Project<sup>i</sup> (CROPSAP)<sup>1</sup>

Prabhat Desai, Commissioner Agriculture, Government of Maharashtra, Pune is chairing a Review Committee meeting on an afternoon of July, 2008 and is a worried man. Agriculture in Maharashtra being a predominantly rain fed phenomenon, is under tremendous pressure. On top of the two successive dry spells in June and July especially in Vidarbha and Marathwada regions of the State, the increasing cases of farmers' suicides in Vidarbha areas worries the Committee even further. The plight of farmers in the state and elsewhere in the country is deplorable and every administrator connected with the well being of the farmers are stressed and wish to find a solution. An estimated loss of Rs. 1392 crores due to pest outbreak on soybean crop resulting in crop devastation was further worrying the administrators.

### The Problem

Cotton and soybean are the two major *kharif* crops of Maharashtra that cover 65.74 lakh hectares and collectively account for approximately 45% of the total area under *kharif* crops. Better productivity and prevailing higher market prices motivated farmers to commit increased area under soybean and cotton crops in Vidarbha and Marathwada regions of the state. Exhibit-1 presents a snapshot of the major crops of the state of Maharashtra.

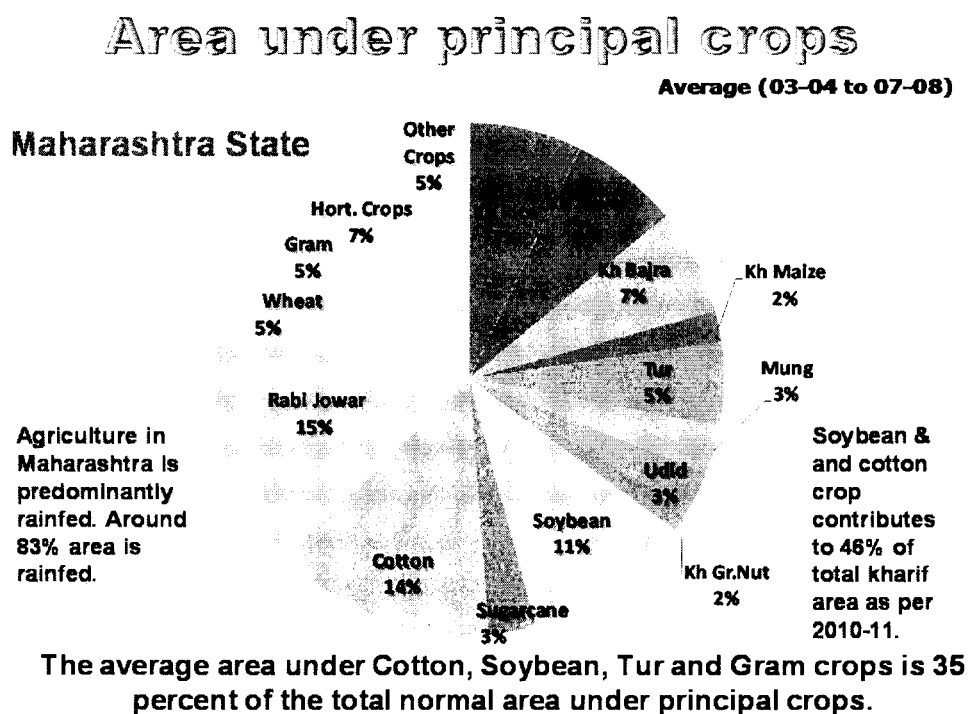


Exhibit-1: Principal Crops of Maharashtra

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During 2008-09, there were two dry spells of 15 days each in June and July which delayed the crop sowing. Dry spell again repeated in August resulting in severe outbreak of defoliators viz. *Spodoptera litura* coupled with *Helicoverpa armigera* and other leaf eating caterpillars on soybean crop in the state in general and Vidarbha and Marathwada regions in particular leading to massive crop devastation. Approximately, 48% of the total sown area under soybean was infested, with 71.31% of the infested area having an intensity of more than 50%. The impact of such an onslaught of pest was rather serious and resulted in significant crop productivity loss as depicted in Table-1 for Soybean. Monetary losses were estimated to the tune of Rs.1392 crores. The problem got further aggravated due to many reasons such as built-up of pest in initial crop stage; failure in identifying the pest by farmers and field functionaries; lack of appreciation of the gravity of the situation resulted into severe pest outbreak. Panicked from situations occurring all over the State, the farmers and people's representatives took up this matter through public agitations and started demanding compensation for farmers from government. Under pressure, the state government ended up paying compensation worth Rs. 450 crores to farmers.

Table-1: Impact on Soybean Productivity

S.No.	Particulars	Annual Average 2003-2008	2007-2008	2008-2009
1.	Area(Lakh HA)	22.44	26.64	30.63
2.	Production(Lakh MT)	27.01	39.76	18.40
3.	Productivity(Kg/HA)	1204	1493	601

### **Government initiatives**

Central Government deputed an experts' team to study the affected areas in the state. Central Team in consultation with other stake holders viz. State Agriculture Universities (SAUs), Directorate of Soybean Research (DOSR), Indore; Central Institute of Cotton Research (CICR), Nagpur; Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad; Indian Institute of Pulses Research (IIPR), Kanpur and National Centre for Integrated Pest Management (NCIPM), New Delhi made the following observations and recommendations.

1. Inability to identify the type of pests that is defoliating the crop coupled with paucity of manpower to tackle situation.
2. Negligence and lack of collective approach by various agencies towards pest management in response to the emergent severe pest outbreak.
3. Multitasking nature of duties in State Department of Agriculture (SDA), the personnel could not properly focus on a particular crop and specific pest problems.
4. Inadequacy to adopt Integrated Pest Management (IPM) practices on the crop for better crop protection and indiscriminate use of pesticides and their dosages.
5. *Spodoptera litura* being a polyphagous pest having wider dispersal capability, the exact niches of its development were unknown.

- 21
6. In Gadchiroli and Chandrapur tracts drastic crop diversification from rice to soybean was conducive for development of Lepidopterous pests (e.g. *Spodoptera*).
  7. Conducive climatic conditions in pockets, profuse vegetative crop growth coupled with heavy attacks of *S. litura*, which later spread to adjacent places.

The prevailing system of pest monitoring practice was based on visual observations and failed miserably. As a result, till the pest attack covered around 14.64 lakh hectare crop area, it was not even properly detected. It was a challenge to the Agriculture Department to develop a long term scientific strategy to counter such issues in future and prevent crop losses thereby protecting the interest of the farming community so crucial to the economic development of the state. An innovative Programme “Crop Pest Surveillance and Advisory(CROPSAP)” was launched in 2009-10 under Rashtriya Krishi Vikas Yojana(RKVY).

### **The Project**

The CROPSAP project was envisaged to attempt the following objectives:

- Developing scientific approach to pest surveillance and monitoring
- Developing On-Line Pest Monitoring System for major pests infesting Soybean, Cotton, Tur and Gram, on real time basis
- Identifying the hot-spots based on the pest status and issue relevant advisories.
- Creating awareness among the farmers about Integrated Pest Management(IPM) and Integrated Crop Management( ICM)
- Guiding the farmers for management of major pests in selected crops by issuing appropriate advisories

The project envisaged covering 33 Districts, 89 Sub-divisions spread over some 30,000 villages. Total area under surveillance was 107.38 Lakh HA covering crops such as Cotton, Soybean, Pigeon Pea/Tur, Paddy and Gram.

The project brought effective coordination of multi-disciplinary partners comprising of agro - meteorologists, entomologists, pathologists, statisticians and computer specialists to work on scientific surveillance system for the benefit of farmers. Some of the benefits accrued from the project can be listed as under:

- Increased awareness among farmers as well as field functionaries for pest surveillance and pest management
- Timely survey helped in early detection of pest attack and taking corrective measures for pest management
- The detailed survey helped in identification of pest in their early growth stage which helped in taking proper control measures for pest management

Additionally, the project team attempted to develop standard method for surveillance of soybean, paddy, gram, tur and cotton pests. For the first time in India, GIS based pest mapping technology for soybean, paddy, gram, tur and cotton crops has been used.

As per independent evaluation by NCIPM, New Delhi, the Soybean productivity increased by 18.9% during 2009 despite a dry spell in August, 2009 resulting in a gross monetary benefit of Rs.1047.50 crores with the areas above Economic Threshold Level(ETL) having declined from 14.64 lakh HA to 4.8 lakh HA. The estimated project outlay amounted to Rs.8.83 Crores. Dr. Radhika Rani, NIRD, Hyderabad while acknowledging the contribution of the pest surveillance project recommended replication of such project in other states as well as to other crops. Overall, the project has been effective to the extent of 20-30% enhancement in production of various crops under implementation. Table-2 provides a snapshot of the impact as measured by the department.

Table-2: Project Impact on Crop Productivity

Crop	Production	2009-10	2010-11	% Increase in production	Increase in value (as per MSP) (Rs.Cr.)
Soybean	Lakh MT	22.77	41.88	+ 83.93	2751.84
Cotton	Lakh Bales of 170 Kg each	58.8	77.05	+ 31.04	775.63
Pigeon pea	Lakh MT	9.29	10.2	+ 9.80	273.00
Chick pea	Lakh MT	11.88	12.97	+ 9.18	191.84
Total					3992.31

### **Implementation Road-Map**

After elaborate consultations with key stake holders, an Information and Communication Technology (ICT) based project proposal for systematic and scientific pest surveillance, monitoring and management of major pest infestation was drafted. The proposal was presented to the then Principal Secretary(Agriculture) under Rashtriya Krishi Vikas Yojana(RKVY). It was decided to implement the proposal through Commissionerate of Agriculture, Maharashtra. The State Level Sanction Committee(SLSC) under the Chief Secretary, Government of Maharashtra recommended the Project proposal to Government of India which was approved by the Government of India. The project was an innovative and ambitious project involving Crop Scientists, IT experts, Communication Technology experts, State Department officials spanning crop areas in the State of Maharashtra.

To cater to this requirement, a series of meetings were held at Commissionerate of Agriculture, Maharashtra to develop an appropriate programme. The modalities of the project, area of operation was finalised and a project document was prepared in consultation with NCIPM and submitted to the State Agriculture department. The specific responsibilities of different stakeholders were earmarked and the time-line for project implementation was also documented. The project was financed under RKVY from 2009-10 to 2012-13 with a total outlay of Rs.49.55 crores. From the year 2013-14, the State Government has decided to implement the project

through State Plan. Some of the key activities included in grassroot level implementation of the project included:

- Developing software for on-line pest surveillance.
- Developing scientific pest management capsules in consultation with scientist for disseminating advisories.
- Developing network between Central Crop Research Institutes, State Agriculture Universities and State Department upto block level.
- Studying effect of environmental parameters on pest population dynamics.
- Appointment of contractual staff exclusive for pest surveillance and data uploading.
- Conducting pre-season training programmes for Pest Scouts, Monitors, Data Entry Operators and farmers.
- Conducting weekly village level farmers meeting to update about pest situation.
- Enrollment of farmers for free SMS service about pest management.
- Identifying hot-spots for pest management and arranging campaigns to deal the situation.
- Supply of pesticides on 50% subsidy by convergence of different crop schemes in hot-spot areas.

A Monitoring Unit for pest surveillance was created by hiring Pest Scouts(835) at village level, Pest Monitors(84) at Sub-division level and Data Entry Operators(84) at Sub-division level on contractual basis. The implementation commenced with effect from the year 2009-10.

Execution of the project was a key to success. A Steering Committee was constituted under the Chairmanship of Commissioner(Agriculture) involving all stakeholders for project monitoring and its updation. Committee meets periodically to take the review of implementation and provides guidance for improvement. Hiring and training of contractual staff exclusively for pest surveillance, data feeding, advisory dissemination; training of field staff and farmers; enrollment of farmers for free SMS advisory; media publicity, regular village level meetings; and identification of hot-spots for making concentrated efforts to combat infestation constituted the major components of the strategy for execution of the scheme. NCIPM performed role of the technical nodal agency so as to formulate implementation guidelines and review the project on regular basis. Detailed plan for implementation is shown in Exhibit-2.

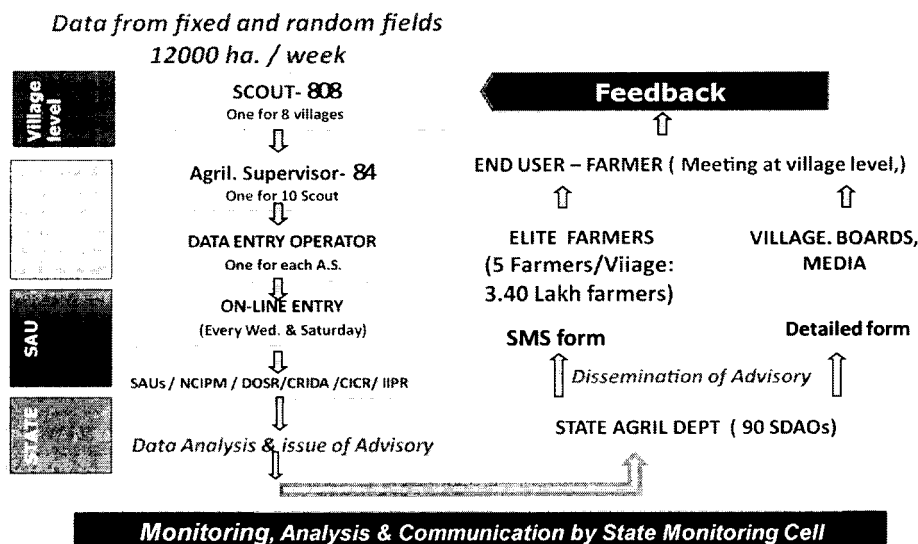
Key stakeholders and their roles in the Project execution included:

1. Commissioner Agriculture – Responsible for formulating the project, chairing the Steering Committee and monitoring the implementation of the project from 2009-10 to 2011-12. Obtained approval from State Plan and enhanced the project to incorporate new concepts like IPM village concept.
2. Principal Scientist (DOSR) – Involved in the project right from 2008-09 as Central Team Member to key stakeholder presently.
3. Principal Scientist and Computer Analyst (NCIPM) – Nodal agency for technical guidance and support for the project. Helped in drafting the project to its ongoing successful implementation. Taken initiative in developing software for pest monitoring and coordinated the activities.

4. Deputy Director(Agriculture) – Responsible for technical input, data monitoring, coordination, implementation, budgeting, project presentation, critical factor analysis and updating.



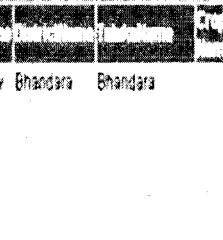
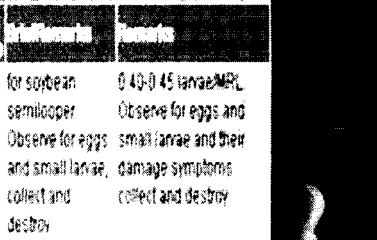
Exhibit-2: Flow Chart of Activities

## FLOW CHART OF ACTIVITIES



A sample Schedule of Surveillance followed by the project team is shown in Exhibit-3.

Exhibit-3: Sample Schedule of Surveillance

Survey	Online data feeding	Data analysis and Advisories by SAUs	Dissemination of advisory by SDAO
On Monday & Tuesday	On Wednesday	On Thursday	On every Thursday
On Thursday & Friday	On Saturday	On Monday	On every Monday
			

### Advantage Farmers

The most significant award that this initiative received was from the most significant and most voiceless stakeholder - the farmer. The farmers benefited from this project in various ways including:

- Identification of pests at early stage of infestation and approaches to combat it systematically.
- Use of IT tools, i.e. software, website and mobile SMS on real time basis and leveraging electronic and print media for effective pest management.
- Increased awareness among farmers and field functionaries about pest surveillance, monitoring and pest management.
- Understanding of ETL concept and adopting appropriate plant protection measures.
- Maintenance of the pest population below ETL level.
- Implementation of location specific advisories based on scientific observations.
- Judicious use of biological and chemical pesticides.

**The Team**

Prabhat Desai, the Commissioner Agriculture accepted the challenge. Extensive surveys were carried out by field staff of Agriculture Department and series of meetings were held with farmers and field officers. He pulled together all possible resource institutes. It was decided to appoint contractual staff exclusively for pest surveillance work. NCIPM shouldered the responsibility as technical nodal agency to develop software and monitor the project. Central Crop Research Institutes and State Agriculture Universities took the role to develop advisory modules and offer technical advice. Entire staff of Agriculture Department responded to the new concept wholeheartedly.

**Major Challenges**

The post epidemic analysis of pest attack by team of experts brought forward some salient reasons for severity of the problem and difficulties encountered in its effective management. Lack of systematic approach and rigorous pest surveillance efforts, slow pace of its implementation in isolated and piecemeal manner by different stakeholders could not showcase the success. Most of the pest outbreaks are unexpected over space and time wherein reactive analyses and actions are required. Monitoring pest infestation onset and its intensity is of utmost importance for effective pest management.

The project being an entirely new concept in the country, it was hard to get administrative and financial approvals. Coordinating different Research Institutes, working on e-based solutions, training field staff and making farmers appreciate the concept was a big task. Recruitment of Pest Scouts (835) and Data Entry Operators (84) on contractual basis for the seasonal activity was also a major challenge considering legal issues involved. Few legal cases were filed by contractual staff claiming permanent government job. However, this was defended in the Court of Law. Monitoring, system updation and training the farmers were other challenges that the team faced.

## **The Impact**

As per Agriculture Census-2010 there are 137 lakh *Khatedars* in Maharashtra covering an area of about 106.31 Lakh HA. All the 33 districts, 348 blocks and 41,000 villages in the state are presently covered under the project. The year wise and crop wise project area and the estimated cost incurred on the project are shown in the Table-3.

Table-3: Year wise area coverage and cost incurred  
(Area in lakh HA)

Sr. No.	Crop	2009-10	2010-11	2011-12	2012-13
1	Rice	--	--	15.00	15.20
2	Soybean	30.19	27.29	25.30	32.18
3	Cotton	33.91	39.42	43.50	41.46
4	Arhar (Tur)	10.93	13.02	12.00	10.81
5	Gram	12.91	14.23	10.51	12.54
Total		87.94	93.96	106.31	112.19
Project Cost (Rs.Cr.)		29.58		9.57	10.40
Cost per hectare (Rs.)		16.26		9.00	9.27

Year 2007-08 is taken as a base year for comparison as year preceding to the problematic year. During 2008-09, there were two dry spells of two weeks in June-July. That delayed the crop sowing initially and crop condition of sown crops subsequently. Dry spell repeated in August for three weeks resulting in severe pest infestation on Soybean and other crops. As a result productivity of the crops had declined considerably. The lesson learnt has resulted in appreciation of the initiative of scientific pest monitoring project that was implemented from 2009-10 onwards. The cost of surveillance per hectare declined substantially over a period of time.

Year 2009-10 to 2011-12 also witnessed 2-3 dry spells despite timely onset of monsoon. Pest incidences were there after dry spells but those were detected in good time and corrective measures were taken that have protected the crops. Thus, productivity never declined to the level of 2008-09. Due to continuous vigil through e-pest surveillance no major pest outbreaks were recorded. The net returns based on MSP of the crop which declined during 2008-09 due to dry spells followed by pest attack have been improving continuously since 2009-10 onwards despite climatic variations, resulting in an increase in farmer income.

## **ICT in the service of Rural Farmers**

On-line scientific monitoring through use of ICT proved to be the high point of the project for accurate analysis of field situation. SMS to farmers, advisories pasted on village panchayat boards, village meetings and media publicity made significant improvement in delivery time to end users. The scientific advice helped the farmers to avoid wasteful expenditure on pesticides when not needed.



The participatory response of farmers through SMS enrollment, advisories issued, SMS sent and shift towards use of safer bio-pesticides is shown in Table-4.

Table-4: Beneficiaries response to SMS service and adoption

Year	Advisories and SMS			Shift towards bio-pesticides use (MT)
	No. of subscribers (Lakhs)	No. of advisories issued	No. of SMS sent (Lakhs)	
2009-10	1.63	13517	31.93	1788
2010-11	2.40	55602	112.00	2200
2011-12	3.11	62410	199.06	2500
2012-13	3.40	62515	360.83	2800

Interestingly, the number of farmers enrolled for SMS service has doubled, the advisories issued has increased by 4.63 times, SMS send has increased by 11.30 times and shift towards use of safer bio-pesticides has increased by 1.57 times since the inception of project in 2009-10.

e-Pest surveillance has simplified the procedure for pest monitoring. The software helped the experts to get scientifically analyzed data. Use of rapid communication technology like email and SMS helped the field level functionaries to understand situation and relevant advice. Awareness campaigns helped knowledge updating of farmers and field staff. Media publicity created social awareness. As such, use of ICT tools in pest management has proved to be boon for farmers to protect their crops from vagaries of pest problem. Some of the technology components which were used in the project included:

- Laptops for on-line data entry
- Internet Modems for connectivity
- SQL Server 2000 for off-line data entry and uploading of data and maintaining data base
- asp.net for on-line reporting
- GPS Kit for GIS based Pest Mapping
- SMS broadcaster for wide spread advisories
- Use of e-mail communication system

Flow Chart of e-Pest Surveillance and GIS based mapping of major insect pest of soybean and cotton are shown in Exhibit-4 and Exhibit-5 respectively. Sample of Advisories displayed on Gram Panchayat Notice Board and Advisory Disseminated through SMS are shown in Exhibit-6 and Exhibit-7 respectively.

### **Appreciation and Sustainability of the Project**

Efforts of the department did not go waste as the Government of India appreciated the project in National Conference Kharif 2010 and recommended that other states in the country should replicate the project. The Secretary, Government of India stated, "*States are also requested to implement comprehensive pest surveillance for major crops vulnerable to pests and diseases under Rashtriya Krishi Vikas Yojana (RKVY) as done by Maharashtra*". Madhya Pradesh, Andhra Pradesh and Karnataka are in the process of implementing this concept. Even the originating state of Maharashtra has extended the project to Rice crop too effective from 2011-12.

The project has been acknowledged by many agencies both within and outside the state. National Centre for Integrated Pest Management, New Delhi estimated monetary benefits to the extent of Rs. 1047.50 crores during 2009-10 as a result of the implementation of the scheme. National Institute of Rural Development, Hyderabad has recommended replication of the project in other states. Agriculture Finance Corporation Ltd., Mumbai has appreciated the training provided to the farmers as an exemplary effort. According to their report, the timely guidance received by the farmers through SMS effectively enabled the farmers to take preventive measures resulting in reduction of losses.

Significantly, the project has won 'Gold Award' under the category "Exemplary Re-Use of ICT Based Solutions" under National Award on e-Governance 2011-12 through a rigorous process of selection by DAR&PG, Government of India. The most crucial appreciation of the project is the decision of many other state governments to replicate the project and decision of the State of Maharashtra to continue as well as extend the project under the State Plan. To mention a few, the Agriculture Departments of Odisha and Gujarat Governments have already started the implementation on similar lines in their respective states. Encouraged by the success of this project, CRIDA is making GIS mapping of these parameters with reference to pest population dynamics. This is likely to provide long term research benefit by developing pest forecasting models. The project has opened up many more avenues for farmers. Even the centralized monitoring of crop pests at National Level can be possible through this approach.

Usually sustainability of the project remains an issue but this project was planned in 2009-10 for Cotton, Soybean, Tur and Gram crops. Subsequently, in 2011-12 it was extended to Rice, Mango, Pomegranate and Banana crops. The project is successfully under implementation for the last four years and State cabinet has decided to continue it for next five years.

Exhibit-4: Flow Chart of e-Pest Surveillance

### FLOW CHART OF E- PEST SURVEILLANCE

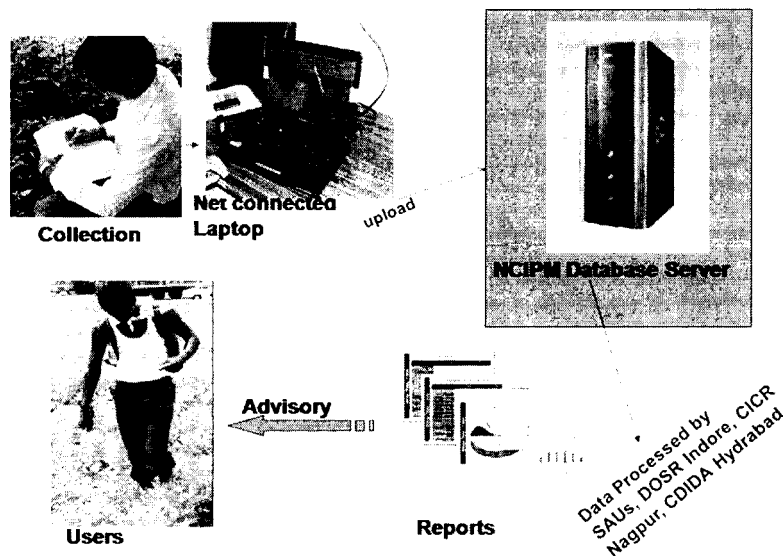


Exhibit-5: GIS based mapping of major insect pest of soybean and cotton

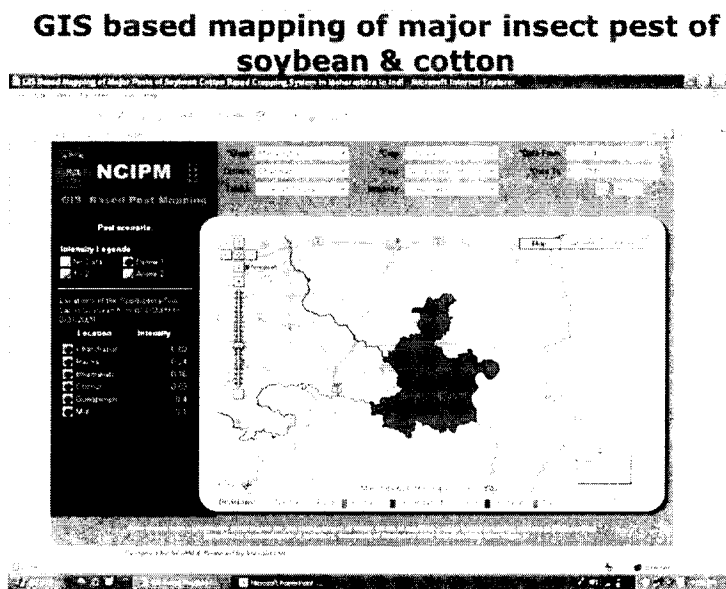
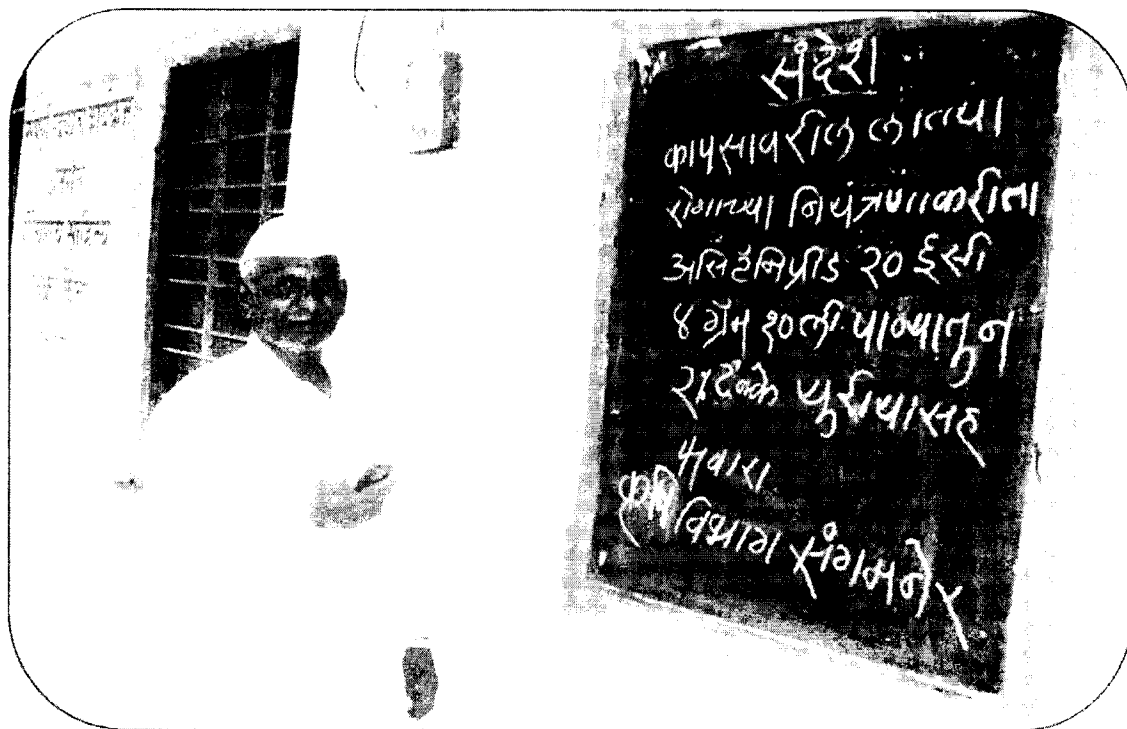
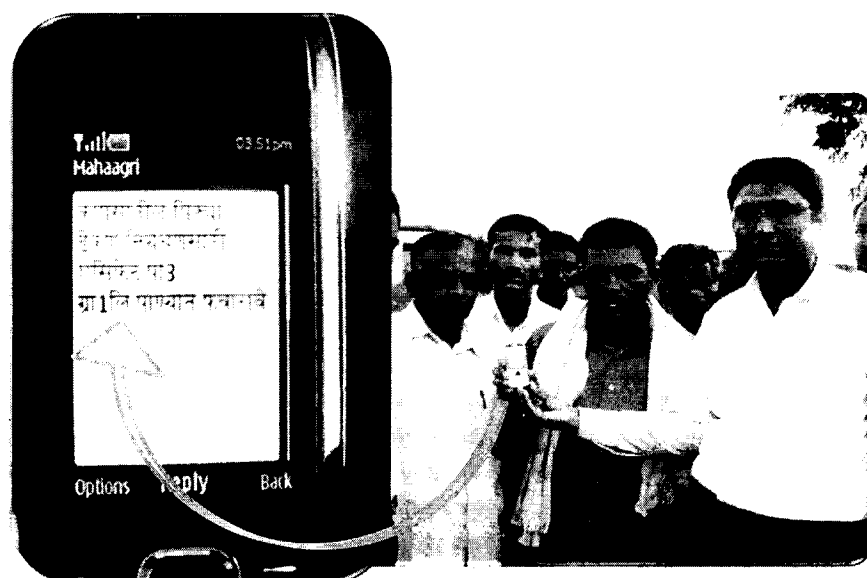


Exhibit-6: Advisories displayed on Gram Panchayat Notice Board



## ADVISORY DISSEMINATION THROUGH SMS



<sup>1</sup> This is a real-life case. The names of the places are real. However, names of persons have been changed.