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## Crop Pest Surveillance and Advisory Project of Maharashtra

A Role Model for an e-Pest Surveillance and Area Wide Implementation of Integrated Pest Management in India

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**Funded by**  
***Government of Maharashtra***

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## Foreword

Agriculture remains the largest source of livelihood in Indian economy. Maharashtra has about 55 per cent of its population dependent on farm income. The State grows varied crops of cereals, pulses, fibres, fruits and vegetables in its diverse agro climatic zones in 225 out of the 308 lakh hectares of the geographical area. The highly variable rainfall of 400 -6000 mm distributed across 40-100 rainy days besides the extreme weather events cause significant variability of crop yields. The low productivity of crops are also due to imbalanced input uses, gap in access to modern technologies and absence of technological breakthroughs post green revolution. Crop yield losses due to insect-pests, diseases, weeds, nematodes and rodents range from 15-25% in India, amounting to 0.9 to 1.4 lakh crore rupees annually. Although pesticide use per hectare (0.57 kg/ha) is lower in India and Maharashtra ranks third (0.73 kg/ha) after Andhra Pradesh and Punjab, pesticide residues in produce have been high mainly due to the indiscriminate use of chemical pesticides. In addition, lack of awareness on the label claims and waiting periods before harvest aggravates the problems. Farmers are also unaware of the environment friendly bio-pesticides that constitute 4.2% of the India's total pesticide market. Surveillance of crops to detect early signs of buildup of pests and diseases is crucial for the success of IPM. For timely and effective intervention in the face of an emerging pest/ diseases situation, it is necessary for the surveillance data to be interpreted by technical experts and advisories issued in real time. Delay in issuing an advisory could lead to a breach of the economic threshold level of the pest leading to loss in production and quality. *Rashtriya Krishi Vikas Yojana (RKVY)* launched by Government of India during XI Plan provided flexibility to choose innovative and pervasive use of Information and Communication Technology for reaching out to the farmers to assess the pest scenario in their fields, and for issue of real time pest management advisories through short message service (SMS). State Department of Agriculture, Maharashtra has piloted State level e-pest surveillance through ‘Crop pest surveillance and advisory project (CROPSAP)’ since 2009 involving extension functionaries and farmers with the help of institutions of Indian Council of Agricultural Research and State Agricultural Universities of Maharashtra that reduced the lead time between surveillance and pest management interventions. Awareness creation amongst farmers, structured and systematic pest surveillance and implementation of pest management at farmer fields are the focal points involving tools of ICT. Implemented from 2009, the CROPSAP has not only resulted in monetary dividends to the growers of cotton, soybean rice, pigeonpea and chickpea but also led to no pest outbreaks across the State. In the recent times e-CROPSAP is in the process of transforming itself to m-CROPSAP

(mobile based) with features of pest clinic and assistance in pesticide selection for its quality and judicious use. The larger canvas provided to extension with support of researchers for the farmers of Maharashtra using the tools of ICT, and the man power deployment following their skill development as pest scouts, pest monitors and data entry operators providing employment for the youth have brought accolades through “e-Governance” and “Prime Minister” awards for the project. Modern agriculture cannot be without the integration of the innovative and improved use of ICT. CROPSAP has already served as a role model for many other e- pest surveillance programs. I appreciate the present compilation “*Crop Pest Surveillance and Advisory Project of Maharashtra-A Role Model for an e - Pest Surveillance and Area Wide Implementation of Integrated Pest Management in India*”, that it serves as a success story to be replicated by many other locations and crops for improvement in their productivity levels that our country sustains food and livelihood securities for the present and future.



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Pune - 411 001

## Acknowledgements

The Crop Pest Surveillance and Advisory Project of Maharashtra is led by Shri Vikas Deshmukh (IAS), Commissioner of Agriculture (Maharashtra) since 2015 following the initiation by Shri Prabhakar Deshmukh (IAS), the then Commissioner of Agriculture (Maharashtra) from 2008 till 2011 and carried on by Shri Umakant Dangat (IAS) in 2011-14. Our sincere appreciations and gratitude to all the dignified civil servants for their unified vision of bridging of the gap between research and extension keeping farmers as the focal point. The proactive role played by Shri K.V. Deshmukh, Director Agriculture (Extension and Training) and Shri M.S. Gholap, Joint Director of Agriculture (Extension and Training 3), along with the support system of entire State Department of Agriculture, Maharashtra deserve all the appreciations for their facilitating role in capacity building and linking all the stakeholders of CROPSAP. The foundation and fillip provided by Dr. O.M. Bambawale, the ex-Director of NCIPM and Dr. P. Jeyakumar, Senior Scientist (Agricultural Entomology) during the start of CROPSAP in co-ordination with Shri Arjun Phule of State Department of Agriculture (Maharashtra) are always remembered with gratefulness. While NCIPM continues to co-ordinate and execute the ICT based pest surveillance, the technical knowledge and experience of the personnel of ICAR- crop based institutes across the nation, State Agricultural Universities and all levels of State Department of Agriculture of the Maharashtra involved as stakeholders in CROPSAP play a pivotal role by providing guidance and sustenance for the programme implementation. Efforts of the developmental personnel of the State Department of Agriculture (Maharashtra) who transmit and implement the pest management actions at field level amidst operationalisation of various other schemes are commendable and warrant greater appreciations. The farmers of Maharashtra merit the highest level of salutations for their participation and adoption of CROPSAP recommendations thus contributing to the programme success. The financial assistance by the Government of India through *Rashtriya Krishi Vikas Yojna (RKVY)* between 2009 and 2012, and the continued funding by the Government of Maharashtra through implementing authority of the Commissionerate of Agriculture, Pune since 2013 are gratefully acknowledged.

**Authors**



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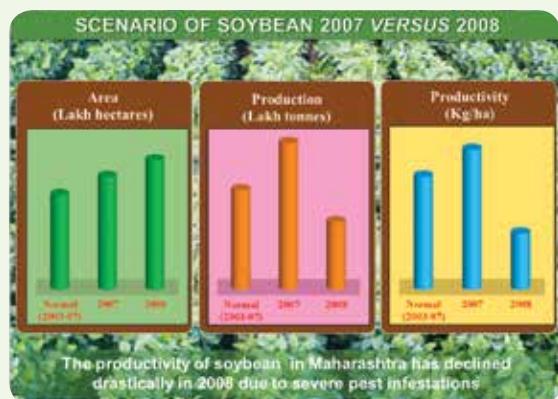
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## INTRODUCTION

The launch of World Wide Web in 1991 revolutionizing global information system<sup>1</sup>, and the National e-Governance plan of 2006<sup>2</sup> followed by Digital India project<sup>3</sup> of 2014 to transform India into a digitally empowered society facilitates wider dissemination of knowledge and technological products and processes for integral development of our nation. The approach to integrate Information and Communication Technology (ICT) depends on the objective of the programme undertaken. Monitoring of pests for their onset and intensity during the crop season is of utmost importance for an effective pest management. Integrated Pest Management (IPM) being holistic and knowledge intensive requires timely processing of temporal and spatial information gathered out of crop-pest surveillance for quicker need based management actions to be disseminated by the extension functionaries for adoption by farmers. ICT allows not only assimilation of data base on pests over time and space but also quickly processes data to facilitate a decision on pest management using the available knowledge base and critical inputs that can be mobilized and adopted for plant protection on an area wide basis<sup>4</sup>. The systematic and rigorous approach to pest surveillance using ICT, referred as e-pest surveillance, increases the pace of IPM implementation on a wider area through adoption of pre-emptive actions of pest management which could mitigate the impending pest outbreaks, and could showcase the minimisation of yield losses due to crop pests *vis a vis* success of IPM. ICT serves as a vehicle for launching area wide IPM.

## GENESIS AND CONCEPTUALIZATION OF CROPSAP

The rural economy of Maharashtra is predominantly based on rainfed agriculture. Cultivation of *kharif* crops such as cotton, soybean, rice and pigeonpea besides the major *rabi* crop of chickpea are the mainstay of the State. During 2008-09, there was a severe pest outbreak of *Spodoptera litura* (Fabricius) coupled with *Helicoverpa armigera* (Hubner) and other leaf eating caterpillars in cotton-soybean based cropping system wherein an area of 14.56 lakh ha of soybean was affected and losses to the tune of Rs. 1392 crores were encountered. Financial assistance of Rs. 450 crores was provided to the farmers. Despite the increased area under soybean during 2008, pest epidemics occurred mainly due to the lack of supervision on the buildup of the pests in the initial stages of attack.



[Source: SDA, Maharashtra)

A post epidemic scenario analysis by a central team<sup>5</sup> brought out the following points on the severity of the problem, and difficulties in its effective management.

- Paucity of information and manpower to know the pest appearance on soybean and management
- Lack of proactive role by different agencies involved in agricultural enterprises of the region
- Individualistic approaches by the agencies towards pest management in response to outbreak
- Multitasking of the State Department of Agriculture (SDA) personnel did not allow focus on a particular crop and specific problems that arise
- Lack of awareness on the type of pests defoliating the crop and their identification
- Lack of understanding of the necessity of IPM practices for better crop production
- Non-use of insecticides at proper time and required dosages
- *S. litura* is a polyphagous pest with wider dispersal capability and therefore the exact niches of development were unknown
- Use of *S. litura* pheromone traps in the cropping system has been deceptive with large number of moth catches caught with no incidence in the vicinity
- Drastic crop diversification from rice to soybean in Gadchiroli and Chandrapur tracts was seen that was always conducive for development of lepidopterous pests
- Areas isolated by jungles and growing of vegetables during off season aided in the survival of high population of *S. litura*
- Highly vegetative crop growth and heavy attacks of *S. litura* were also noticed in pockets due to congenial conditions that later spread to other places.

With the wide variety of factors responsible for onset and spread of the pest, it becomes essential to monitor pests continuously not to allow recurrences of outbreaks. Such a preventive action required a strong pest monitoring and advisory mechanism to be put in place. A series of meetings were held between March and May 2009 amongst the team of scientists of Indian Council of Agricultural Research (ICAR) crop based institutes and State Agricultural Universities (SAUs) of Maharashtra with SDA of Maharashtra to develop the modalities of the programme including the area of operation, roles and responsibilities of different stakeholders, and preparation of project document for funding under *Rashtriya Krishi Vikas Yojana (RKVY)* by the Commissionerate of Agriculture, Government of Maharashtra.

Although initially it was planned to develop surveillance program for four to five districts that could serve as potential foci for the pest spread, the facts such as increased area under soybean on equivalent scale with cotton, common pest status of *S. litura* on cotton as well as soybean and vulnerability of cotton to *S. litura* necessitated the program expansion for both the crops followed by inclusion of pigeonpea and the *rabi* crop of chickpea<sup>6</sup>. Since 2011, the rice grown as *kharif* crop was also included under the surveillance based pest management advisory programme. Creation of awareness among farmers of Maharashtra across all target crops under pest surveillance *vis a vis* issuing of real time pest management advisories using ICT tools are continuous. The SDA, Maharashtra is the CROPSAP implementation authority with the funding through RKVY of Central Government till 2012 followed by Government of Maharashtra from 2013 till date.

## OBJECTIVES

- ❖ Implementation of scientific pest surveillance approach for pest management
- ❖ Use of ICT for real time monitoring and management of target pests on chosen crops
- ❖ Mass awareness creation among field functionaries and farmers on IPM
- ❖ Pest status based hot-spot identification and issue of timely advisories
- ❖ Guidance for management of pests of selected crops by issuing appropriate advisories (village boards/short message services (SMS)/print media) to the farmers
- ❖ Ensuring timely availability of critical inputs with subsidy for pest management to keep the pest populations below economic threshold levels (ETL)

## STAKEHOLDERS

Implementing Agency	:	State Department of Agriculture, Commissionerate of Maharashtra
State Agricultural Universities of Maharashtra	:	Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri Dr. Panjabrao Deshmukh Krishi Vidyapeeth (PDKV), Akola Vasantrao Naik Marathwada Agricultural University (VNMAU), Parbhani Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth (BSKKV), Dapoli
ICAR Institutes	:	National Research Centre for Integrated Pest Management (NCIPM), New Delhi Directorate of Soybean Research (DSR), Indore, Madhya Pradesh Central Institute for Cotton Research (CICR), Nagpur, Maharashtra Indian Institute of Rice Research (IIRR), Rajendranagar, Hyderabad, Telangana (during 2012 - 2013)

National Rice Research Institute (NRRI), Cuttack, Odisha (from 2013)	
Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad, Telangana	
Indian Institute of Pulses Research (IIPR), Kanpur, Uttar Pradesh	
Department of Agriculture and co-operation :	National Institute of Plant Health Management (NIPHM), Hyderabad, Telangana (from 2013)
Farmers :	Target crop growers of Maharashtra

## ROLE OF STAKEHOLDERS

Stakeholder	Role
State Department of Agriculture	<ul style="list-style-type: none"> <li>• Coordination and monitoring the overall programme</li> <li>• Facilitation of infrastructure availability to stakeholders</li> <li>• Training of the field staff and farmers</li> <li>• Mass awareness on surveillance and advisories through media</li> <li>• Dissemination of advisories to farmers</li> </ul>
NCIPM, New Delhi	<ul style="list-style-type: none"> <li>• Technical nodal agency</li> <li>• Software for on-line pest monitoring/reporting/advisory system</li> <li>• Technical assistance in training for surveillance and pest monitoring teams</li> <li>• Maintenance of server and data base</li> <li>• Assistance in formulation of pest monitoring proforma and pest management advisory capsules for target crops</li> </ul>
DSR, Indore CICR, Nagpur IIPR, Kanpur IIRR, Hyderabad NRRI, Cuttack	<ul style="list-style-type: none"> <li>• e-coordination and upgradation of the programme</li> <li>• Formulation of crop specific IPM strategies</li> <li>• Development of pest specific advisory capsules</li> <li>• Visit to pest hot-spot areas for guidance of farmers and field functionaries</li> <li>• Getting feedback for future research and refinement of IPM strategies</li> </ul>
CRIDA, Hyderabad	<ul style="list-style-type: none"> <li>• Relating spatial and temporal weather data with pest population</li> <li>• Development of pest prediction/forecasting modules</li> </ul>

## ***CROPSAP: A Role Model for an e- Pest Surveillance***

NIPHM, Hyderabad	<ul style="list-style-type: none"> <li>• Training on pesticide application technologies</li> <li>• Training on assessment of pesticide residues</li> </ul>
SAUs (4)	<ul style="list-style-type: none"> <li>• Training of the master trainers and pest scouts</li> </ul>
MPKV, Rahuri	<ul style="list-style-type: none"> <li>• Development and validation of IPM modules</li> </ul>
PDKV, Akola	<ul style="list-style-type: none"> <li>• Data interpretation and issue of advisories</li> </ul>
VNMAU, Parbhani	<ul style="list-style-type: none"> <li>• Visit to hot-spots and guidance to farmers</li> </ul>
BSKVV, Dapoli	<ul style="list-style-type: none"> <li>• Provide technical feedback to State level committee</li> </ul>
Farmers	<ul style="list-style-type: none"> <li>• Implementation of the advisories of SAUs disseminated by SDA</li> </ul>

### **MONITORING OF THE CROPSAP**

<b>Level</b>	<b>Personnel</b>	<b>Functions</b>
State	Steering committee of all stakeholders	To assess the progress and constraints of programme implementation, and to finalize the pest surveillance data sheet modification, upgradation of software features and pest management advisory capsules for target crops for the ensuing season
	State level pest monitoring unit	To analyze the pest situation and its communication to Joint Directors of Agriculture (JDAs), State Agricultural Officers (SAOs) and Sub Divisional Agricultural Officers (SDAOs), and keep a watch on pest ETLs for issue of advisories
Division and district	JDAs at divisional level and SAOs at district level	Planning and monitoring of IPM practices and mobilizing inputs
Taluka	SDAOs	Execution of plant protection measures to keep the incidence below ETL

### **SALIENT FEATURES OF CROPSAP**

- e-pest surveillance and digital delivery of pest management advisories
- Awareness creation among farmers
- Implementation of IPM including the supply of critical inputs

## TARGET CROPS AND AREA OF OPERATION

Nearly 44000 villages across 348 talukas of 34 districts from among eight divisions of Maharashtra are being covered under the programme. The area under each crop fluctuates with seasons with soybean among *kharif* crops and chickpea of *rabi* showing marked increase in area under cultivation during 2014-15 (Table 1).

**Table 1 : Area of cultivation (m.ha) of the target crops in Maharashtra under CROPSAP**

Crops	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Soybean	30.19	27.29	30.10	30.64	35.20	36.40
Cotton	33.92	39.42	41.67	41.87	41.60	41.90
Rice	14.50	14.86	15.16	15.28	15.68	15.08
Pigeonpea	10.93	13.02	12.33	12.14	11.41	12.10
Chickpea	12.91	14.38	10.75	11.35	18.20	14.27
<b>Total</b>	<b>102.45</b>	<b>108.97</b>	<b>110.01</b>	<b>111.28</b>	<b>122.09</b>	<b>119.75</b>

## PESTS UNDER SURVEILLANCE (QUANTITATIVE)

Crop	Target insect pests and diseases
Soybean	<i>Spodoptera</i> , Semilooper ( <i>Chrysodeixis acuta</i> ), <i>Helicoverpa armigera</i> , Girdle beetle ( <i>Obereopsis brevis</i> )
Cotton	<i>Spodoptera</i> , Jassids ( <i>Amrasca biguttula biguttula</i> ), Whiteflies ( <i>Bemisia tabaci</i> ), Thrips ( <i>Thrips tabaci</i> ), Mealybugs ( <i>Phenacoccus solenopsis</i> ) and Leaf reddening (disorder)
Rice	Yellow stem borer ( <i>Scirpophaga incertulas</i> ), Gall midge ( <i>Orseolia oryzae</i> ), Swarming caterpillar ( <i>Spodoptera mauritia</i> ), Leaf folder ( <i>Cnaphalocrosis medinalis</i> ), Planthoppers – White blacked planthopper ( <i>Sogatella furcifera</i> ) & Brown planthopper ( <i>Nilaparvata lugens</i> ), Blue beetle ( <i>Leptisma pygmaea</i> ), Bacterial leaf blight ( <i>Xanthomonas campestris</i> pv. <i>oryzae</i> ), Sheath blight ( <i>Rhizoctonia solani</i> ) and Blast – ( <i>Pyricularia oryzae</i> )
Pigeonpea	Pod borer ( <i>Helicoverpa armigera</i> ), Pod fly ( <i>Melanagromyza obtusa</i> ) and Pod damage (due to pod borer complex)
Chickpea	Pod borer ( <i>H. armigera</i> ), Wilt ( <i>Fusarium</i> ) disease

**The above pests under quantitative surveillance are recorded by the pest scouts**

## **PESTS UNDER SURVEILLANCE (QUALITATIVE)**

<b>Crop</b>	<b>Target insect pests and diseases</b>
Soybean	Hairy caterpillar ( <i>Euproctis</i> sp.), Stem fly ( <i>Melanogromyza sojae</i> ), Whiteflies ( <i>B. tabaci</i> ), Yellow mosaic virus, Rust ( <i>Phakopsora pachyrhizi</i> ) and Pod blight ( <i>Colletorictum truncatum</i> )
Cotton	Aphids ( <i>Aphis gossypii</i> ), <i>H. armigera</i> , <i>Earias</i> spp., Pink bollworm ( <i>Pectinophora gossypiella</i> ), Grey mildew ( <i>Ramularia areola</i> ) and Parawilt
Rice	Caseworm ( <i>Nymphula depunctalis</i> ), Brown spot ( <i>Helminthosporium oryzae</i> ) and Hispa ( <i>Dicladispa armigera</i> )
Pigeonpea	Mealybugs ( <i>Phenacoccus solenopsis</i> , <i>Paracoccus marginatus</i> and <i>Coccidohystrix insolita</i> ), Cowbugs ( <i>Oxyrachis tarandus</i> ), Podbugs ( <i>Clavigralla</i> , <i>Riptortus</i> and <i>Nezara</i> ), Termites ( <i>Odontotermes</i> sp), Stem weevil ( <i>Alcidodes</i> spp.), Blister beetle ( <i>Mylabris pustulata</i> ) and Sterility mosaic (transmitted by eriophid mite <i>Aceria cajani</i> )
Chickpea	Aphids ( <i>Aphis craccivora</i> , <i>Acyrthosiphon pisum</i> ), Cutworm ( <i>Agrotis ipsilon</i> ), Mealybugs ( <i>Paracoccus marginatus</i> ), Armyworm ( <i>Mythimna separata</i> )

***The above pests under qualitative surveillance (Low/Moderate/High) are recorded by pest monitors***

## **STRUCTURE OF ICT BASED PEST SURVEILLANCE AND ADVISORY SYSTEM**

The amalgamation of scientific and systematic pest surveillance at field level by trained pest scouts and pest monitors, design of sampling methodologies for field selection and pests, creation and printing of data books with guidelines, organisation of trainings and awareness campaigns for field staff of State agricultural machinery and farmers, creation of infrastructure (hardware - laptops for data entry, internet modems for connectivity and data uploads and server for data base management, SMS broadcaster) and development of information processing software (applications for off-line data entry and upload, on-line reporting, GIS application, advisory issuance) besides e-mail and mobile communication systems constitute general structure of ICT based pest surveillance and advisory system. Establishment of pest monitoring units (PMU) covering blocks based on cropped area, manpower deployment in terms of pest scouts (covering around 8-10 villages/week), pest monitors (one for every 10 scouts), one data entry operator per PMU and server supporters across the State, and engagement of contractual staff such as research associates and computer operators at the ICAR and SAUs formed the basis for implementation of CROPSAP.

## **FRAMEWORK OF FIELD LEVEL PEST SURVEILLANCE**

Pest surveillance programs require a cohesive mechanism for coordination<sup>7</sup>. Pest surveillance/monitoring units (PMU) have been established across the State based on the cropped area under each crop at the start of the season with allotment of required man power such as pest scouts, pest monitors and computer personnel (data entry operators and server supporters). The villages were clustered into 12000 ha area of target crops and those having maximum area under each target crop were selected for pest surveillance. For every 1500 ha area under the target crop two fixed (observations recorded from start to end of crop season from same field) and two random fields were selected for scouting. Fixed and random fields were selected from different directions of the village. During this process of field selection it was ensured that the selected villages represent the cluster of villages. In each block, the villages not covered under for pest scouting were considered for roving surveys done twice a week by pest monitors wherein 10–15 fields spread across a minimum 10 villages were observed in a single day. The unit of field observations was one acre. In roving survey, qualitative pest status was recorded from randomly selected fields of villages other than those selected for quantitative surveillance.

## **DATASHEETS AND GUIDELINES OF PEST SURVEILLANCE**

For each of the target crops *viz.*, soybean, cotton, rice, pigeonpea and chickpea two types of data sheets were prepared *viz.*, proforma for use by scouts (to record the quantitative data for the pests of surveillance from fixed and random fields) and pest monitor proforma (to record the qualitative information on the target and additional pests of importance). Guidelines to record each of the information and data are provided in the data books for pest scouts and monitors. Proforma of pest scout and pest monitor for all the target crops, and related guidelines for observations are presented in Annexures (I-IX). The data sheets are revised on need basis considering the importance and changing/emerging status of any particular pest(s) each year during steering committee meeting.

## **MANPOWER DEPLOYMENT**

Based on the cropped area under each of the crops across the State pest monitoring units and the pest scouts are deployed. Pest monitors and data entry operators are deployed at the rate of one for every 10 pest scouts. The number of personnel engaged for pest surveillance across crops among different districts is furnished in Table 2.

**Table 2 : Manpower engaged under CROPSAP**

Crop	No. of districts	Pest scouts (nos)	Pest monitors (nos)	Data entry operators (nos)
Soybean	27	823	84	84
Cotton	21			
Rice	17			
Pigeonpea	25			
Chickpea	29	469	47	47
<i>Number of personnel engaged vary across districts and seasons according to the area under each crop</i>				

## SCHEDULE OF PEST SURVEILLANCE AND PEST MANAGEMENT ADVISORIES

Data collection	Data entry and uploads	Data analysis & issue of advisories (SAUs)	Dissemination of advisories by SDAO
Monday & Tuesday	Wednesday	Thursday	Thursday
Thursday & Friday	Saturday	Monday	Monday

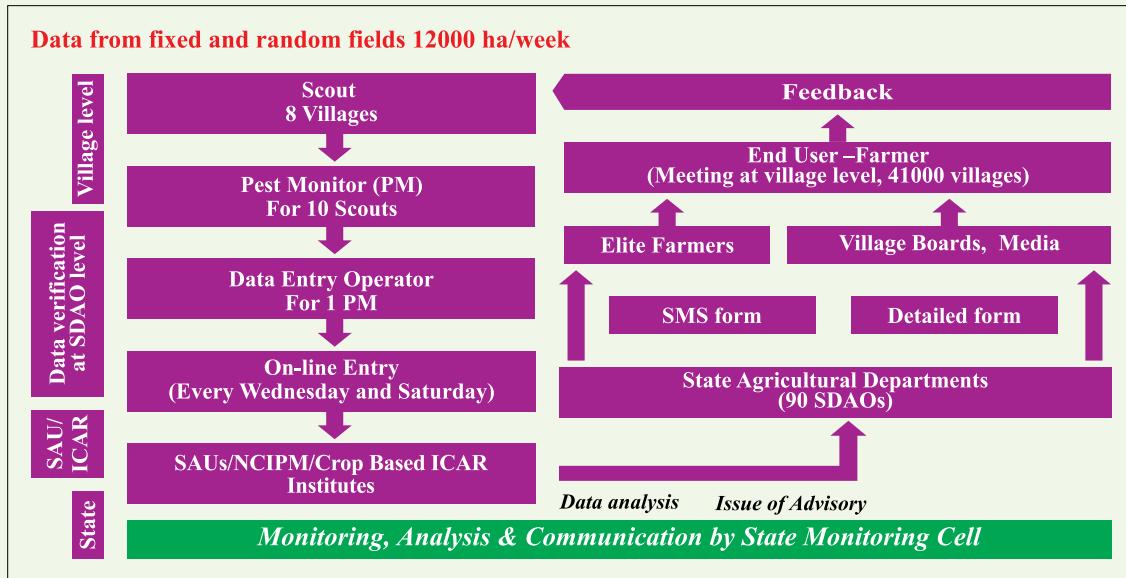
## IT TOOLS USED

- Laptops for off-line data entry
- Modems for internet connectivity for data uploads and issue of pest management advisories
- Geographical positioning system (GPS) device for recording co-ordinates of the surveillance fields
- Software for data entry, upload and reporting
- SQL server 2005 for data base storage and management
- SMS broadcaster for dissemination of advisories
- Use of e - mail communication system

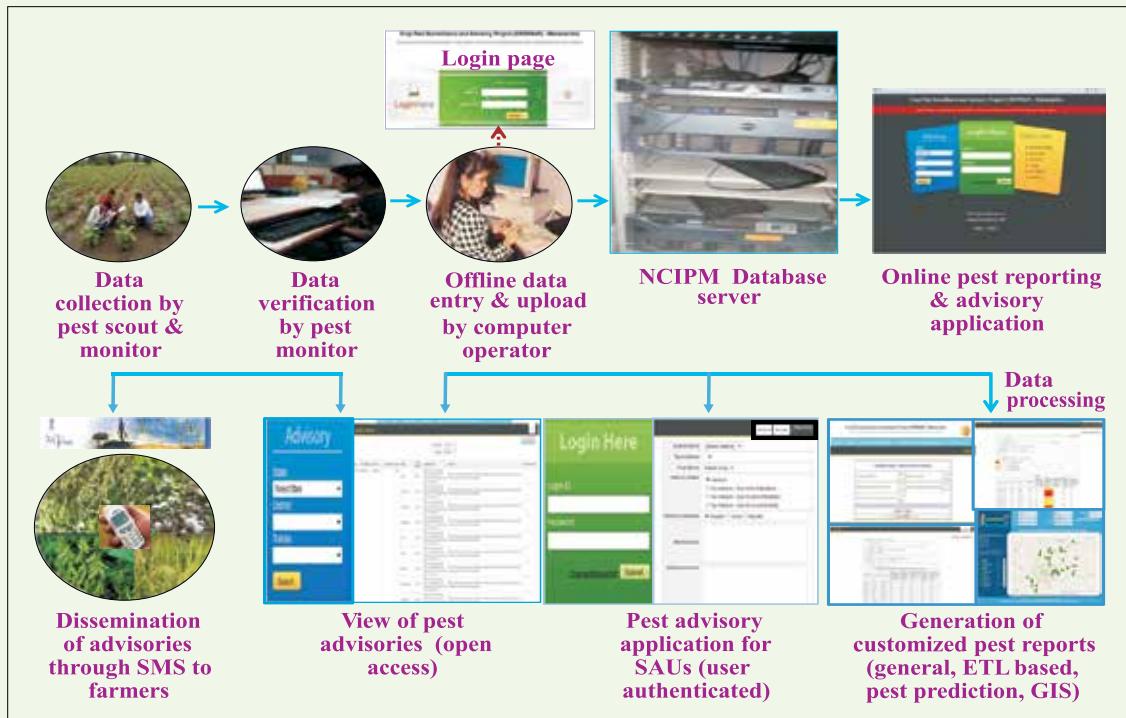
While ICT tools, viz. laptop, internet connection and GPS devices are under custody of the PMUs, the functionality of software for data entry, uploads and online reporting are maintained by ICAR-NCIPM, New Delhi.

## CROPSAP: A Role Model for an e- Pest Surveillance

### IMPLEMENTATION PROCESS OF CROPSAP



### ARCHITECTURE OF e- PEST SURVEILLANCE UNDER CROPSAP



## **PROCESS OF TECHNOLOGY DEVELOPMENT OF e- PEST SURVEILLANCE**

- ❖ Three tier architecture based system designed for pest surveillance consisting of off-line data management application, centralized data base and online pest reporting application
- ❖ Database having various tables for storage of information developed using SQL 2005
- ❖ Off-line data management application and online pest reporting application developed using ASP.net 2.0 technology
- ❖ XML format used for data transfer from off-line application to database.

## **FEATURES OF CLIENT SOFTWARE**

Client application is user authenticated ( Fig. 1 ) for use by the pest monitoring units to enter and upload the field collected data in respect of the fields from villages of selected talukas of districts of the State (Fig. 2). The quantitative and qualitative data collected from fields by pest scouts and pest monitors, respectively in respect of crops (soybean, cotton, rice, pigeonpea and chickpea) could be entered off-line (Fig. 3) and stored. While viewing and editing of field details and data could be made before uploads (Fig. 4), the upload option compiles and transfers the data to the server through internet.

The screenshot shows a web-based login interface. At the top, it displays the project name "Crop Pest Surveillance and Advisory Project (CROPSAP) - Maharashtra" and a note "Sponsored by Commissionerate of Agriculture, Government of Maharashtra". On the left, there is a button labeled "Login here" next to a lock icon. The central part of the screen is a green-themed form with the placeholder text "Please fill all the details". It contains two input fields: "LOGIN ID" with the value "123" and "PASSWORD" with three asterisks. Below these fields is a yellow "Submit" button with a right-pointing arrow. To the right of the form, there is a "Go to Home Page" link next to a house icon. At the bottom of the page, there is a copyright notice: "© 2015 NCPM. All Rights Reserved. Designed and Developed By : NCPM".

**Fig. 1 : Login page of client application**

## CROPSAP: A Role Model for an e- Pest Surveillance

**Crop Pest Surveillance and Advisory Project (CROPSAP) - Maharashtra**  
 Sponsored by Commissionerate of Agriculture, Government of Maharashtra under Sandhya Krishi Vikas Yojana

Village Scout | Field Details | Scout Data Entry | Village Monitor | Monitor Data Entry | View | Upload | Logout

**Field Details**

New Save Reset Cancel

Taluka Name:	Allbag	Village Name:	Dhadco
Field Type:	Flood	Crop Name:	Orton
Canor as Broken:	No	Indicator Crop:	Yes
Farmer Name:			
Latitude:	23° 22' 33"	ex. 23° 22' 33"	
Longitude:	22° 22' 22"	ex. 22° 22' 22"	
Soil Type:			
Season:	Kharif		
Variety:			
Sowing Date:			
Seed Rate:	0.00 Kg / Acre		
Row Spacing:	0.00 m		
Plant Spacing:	0.00 cm		
PFT:	0.00 Qs / Acre		

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 Designed and Developed By: NCAPM

Fig. 2 : Field registration

Village Scout | Field Details | Scout Data Entry | Village Monitor | Monitor Data Entry | View | Upload | Logout

**Data Entry Scout**

New Save Reset

State Name:	Maharashtra	District Name:	Raiagad	Taluka Name:	Allbag
Village Name:	Dhadco	Crop Name:	Soybean	Field Type:	Flood
Season:	Kharif	Variety:		Observation Date:	

**Soybean**

\* Required Field \*\* Insert Only \*\*\* Selected part value must be == total plants

Row No.	Spodoptera no of plants with Greg Lenthth no of lengths	Spodoptera - Sol Lenthth no of lengths	Sesbania no of plants with Greg Lenthth no of lengths	Melolontha no of plants with Greg Lenthth no of lengths	Grind Bettle ( damaged no of plants with Greg Lenthth no of lengths)	Grind Bettle ( total no of plants with Greg Lenthth no of lengths)
1						
2						
3						
4						
5						

**Spodoptera Trap Catch**

Row No	Trap Name	Recorded	No of Adults/Trap/Week	Date
1	Trap1	Recorded		

Fig. 3 : Scout data entry

## CROPSAP: A Role Model for an e- Pest Surveillance



Fig. 4 : Feature of view and edit data

### FEATURES OF ONLINE REPORTING SYSTEM

The technical inputs viz., the economic threshold levels and the pest management advisories formulated in detailed and brief formats for the target pests of target crops by the SAUs and ICAR institutes formed the basis for developing reporting applications. The online reporting application accessible to authenticated users through <http://www.ncipm.org.in/cropsap2015/login.aspx> (Fig. 5) produces general (Fig. 6) and ETL (Fig. 7) based pest reports with additional options for tracking pest scout, monitor



Fig. 5 : Login page of online reporting

## CROPSAP: A Role Model for an e-Pest Surveillance

**Crop Pest Surveillance and Advisory Project (CROPSAP) - Maharashtra**  
 Sponsored by Government of Maharashtra Under Rashtriya Krishi Vikas Yojana

**Pest Report**

Report Type:  Quantitative  Qualitative

Crop: Cotton  All Crop

Pest:  Select Pest  All Pest

Report Area:  District Wise  Taluka Wise  Village Wise

Field Type:  All Combined  All Field

Report Period:  Date Wise  Standard Meteorological Date Wise

Date Wise: From: 02/11/15 To: 02/11/15

DNC: Note: Data Not Correct

District wise Pest Scenario All Pest in Cotton on from -02/Mar/2015 to -03-Nov-2015

Observation Date	District Name	District Name	Spodoptera- Soil Larva/number of plants with 5 or more larvae out of 20 plants)	Jassids soybean/number of plants with 5 or more larvae out of 20 plants)	Whitefly/Number of plants with 10 or more whiteflies out of 20 plants)	Moths/ Rug/Number of plants with Grade 2 or higher of 20 plants)	Red Leaves/Number of plants with red leaves out of 20 plants)
02/11/15	Pune	Ahmednagar	0.00	2.65	0.00	6.00	2.20
02/11/15	Pune	Ahmednagar	0.00	2.65	0.00	6.00	1.80
02/11/15	Ameraud	Arota	0.00	1.40	0.00	6.00	0.60
02/11/15	Ameraud	Arota	0.00	2.00	0.00	6.00	1.20
02/11/15	Ameraud	Arota	0.00	0.80	4.30	6.00	1.40
All							

Fig. 6 : General pest report

**ETL Based Pest Report**

Crop: Cotton  All Crop

Pest:  Select Pest  All Pest

Report Area:  District Wise  District Wise  Taluka Wise

District Name: Ameraud  All District

District Name: Arota  All District

Date Wise: From: 04/10/15 To: 03/11/15

Note: Required Attention

Note: Bearing ETL

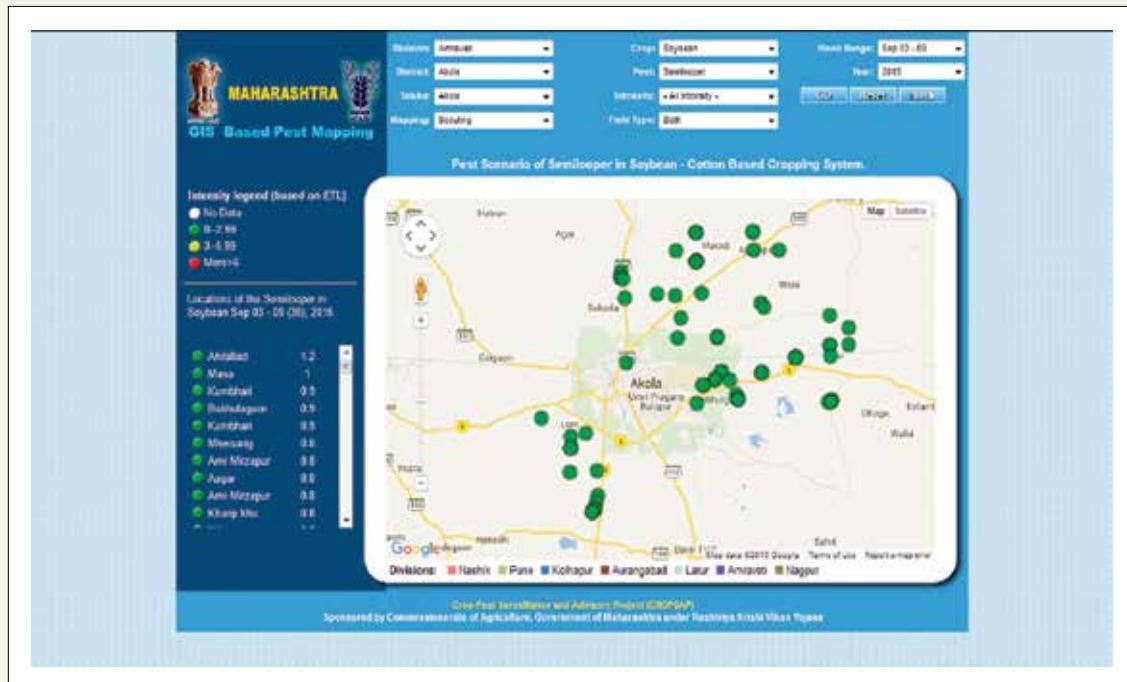
Note: Data Not Correct

District District Taluka Village Observation Date Spodoptera-  
Soil Larva/number  
of plants with 5  
or more larvae  
out of 20 plants) Jassids  
soybean/number  
of plants with 5  
or more  
larvae out of  
20 plants) Whitefly/Number  
of plants with 10  
or more  
whiteflies out of  
20 plants) Moths/  
Rug/Number  
of plants  
with Grade 2  
or higher of  
20 plants) Red  
Leaves/Number  
of plants with  
red leaves  
out of 20  
plants)

Ameraud	Arota	Arota	AVOT	00/10/15	0.00	0.00	0.00	0.00
Ameraud	Arota	Arota	EDHAN	03/11/15	0.00	0.00	0.00	0.00
Ameraud	Arota	Arota	EDHMLA	00/10/15	0.00	2.00	0.00	0.00
Ameraud	Arota	Arota	FBPML_HDUTA	00/10/15	0.00	0.00	0.00	0.00
Ameraud	Arota	Arota	PCPATNED	00/10/15	0.00	0.00	0.00	0.00
Ameraud	Arota	Arota	AGL_SAWARA	20/10/15	0.00	2.00	0.00	1.00
Ameraud	Arota	Arota	SURAT	00/10/15	0.00	0.00	0.00	0.00
Ameraud	Arota	Arota	TANDALWADI	30/10/15	0.00	0.00	0.00	0.00

Fig. 7 : ETL based report

and advisory uploads, besides GIS mapping indicating the severity levels (Fig. 8) of anyone target pest of the target crop across the State. The data reporting can be analyzed for different combinations based on user selections, and data displayed in the form of tables can also be exported to MS excel for further analysis. The advisories in brief and detailed forms relevant to the crop(s) pertaining to the current period are also accessible to any user at taluk level through <http://www.ncipm.org.in/cropsap2015/login.aspx>.



**Fig. 8 : GIS based pest mapping**

#### **REPORTING FEATURE OF PREDICTION OF PEST OUTBREAK FOR S. LITURA**

Considering the onset of monsoon (normal or delayed), planting of crop (before June end or not), rainfall (mm) of > 60 mm, <50 mm and 10 mm in respect of 29 SMW (16-22 July), 30 SMW (23-29 July) and 31 SMW (30<sup>th</sup> Jul- 5<sup>th</sup> Aug) or not, severity predictions were evolved. A module was developed for this and was incorporated into CROPSAP application. While delayed onset of monsoon and delayed planting with rainfall >60 mm, <50 mm and <10 mm in respect of 29, 30 and 31 SMWs predicted the outbreak, normal monsoon with normal planting dates with rainfall events not meeting the conditions of outbreak predicted low to moderate severity or no outbreak situation. Such rules have been deduced based on

the population dynamics of *S. litura* during the outbreak year, and the estimation of critical rainfall for emergence of moths from pupae from soil done using rainfall simulator at Central Research Institute for Dryland Agriculture, Hyderabad<sup>8</sup>. Prediction module is user authenticated and is available through the online reporting application (Fig. 9).

The screenshot shows a web-based application for pest surveillance. At the top, it displays the project name "Crop Pest Surveillance and Advisory Project (CROPSAP) - Maharashtra" and its sponsorship by the "Commissionerate of Agriculture, Government of Maharashtra Under Rashtriya Krishi Vikas Yojana". A logo for "CROPSAP" is also present. Below the header, there is a navigation bar with links for "Pest Report", "Tracking", "Summary Tracking", "Summary Report", "Spodoptera Prediction", and "GIS Based Pest Mapping". The main content area is titled "Prediction Of Severity/ Outbreak" and specifically focuses on "Spodoptera Soybean : Prediction of Severity/ Outbreak". It contains three rows of input fields for rainfall and planting information, each with two radio button options ("Yes" or "No"). The first row is for "Normal Onset of Monsoon", the second for "Rain Fall in 29th SMW(16-22 July)(>60 mm)", and the third for "Rain Fall in 31st SMW (30 July - 5 August)(<10 mm)". Below these rows is a "Submit" button and a "Reset" button. At the bottom of the form, there is a status indicator bar labeled "Moderate to High".

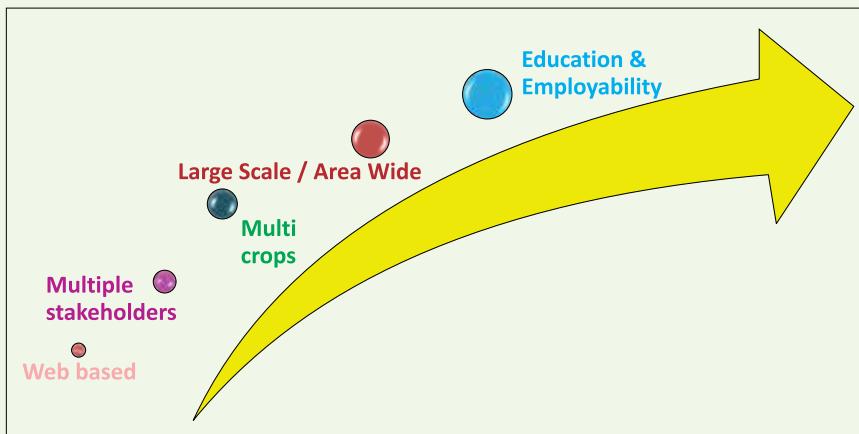
**Fig. 9 : Prediction of outbreak of *S. litura* on soybean**

## IMPACT OF CROPSAP

CROPSAP provided a larger canvas for pest management implementation in terms of technological use, number of stakeholders, number of crops, area covered, skill imparted and employment generated<sup>9</sup>. The pest affected areas across of soybean, cotton, rice, pigeonpea and chickpea are implemented with scientifically based pest management practices across Maharashtra.

- Web Based** : Quicker access to pest status and advisory for pest management
- Multi-stakeholders** : Robust crop specific technical and financial support
- Multi-crops** : Five crops covered under surveillance
- Area wide** : Larger areas under scientific pest management
- Education** : Awareness on pests to extension functionaries and farmers through trainings
- Employability** : Generated employment through engagement of pest scouts, pest monitors, data entry operators, server supporters, young professionals and research associates

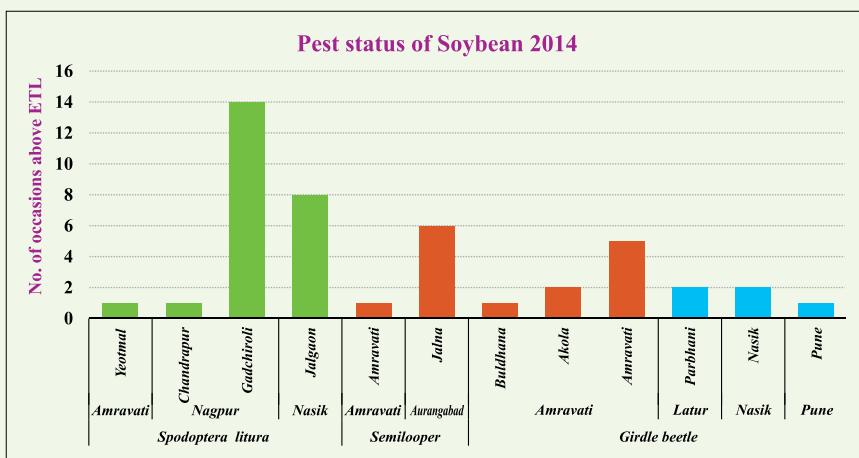
### **CROPSAP: A larger canvas for IPM**



### **GLIMPSES OF PEST SCENARIO**

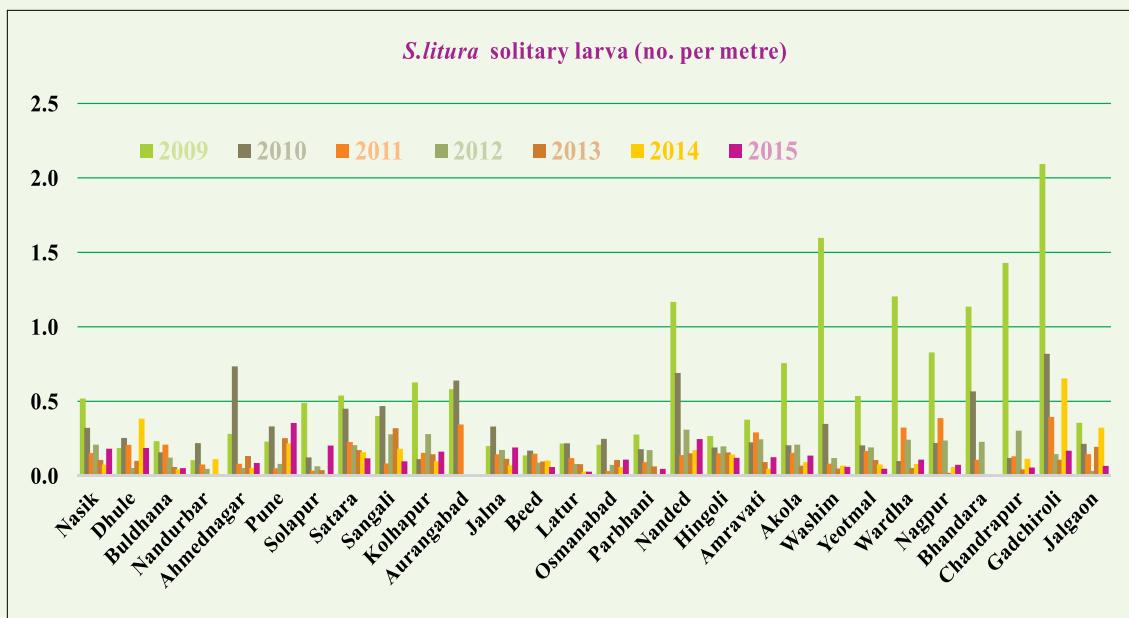
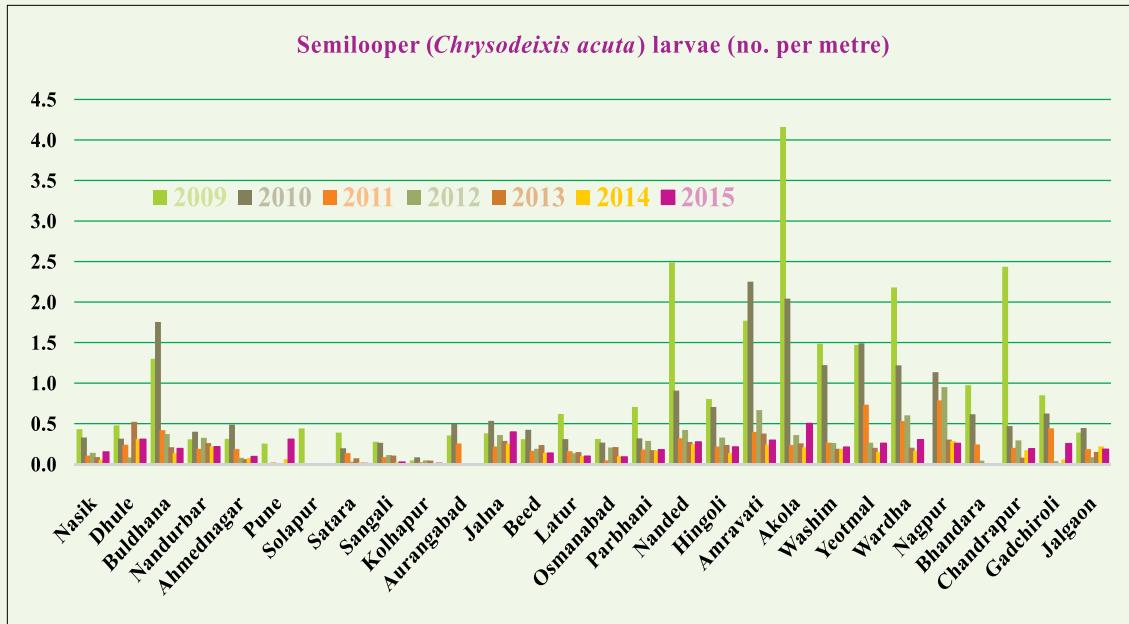
#### **Soybean**

During 2014-15, *S. litura* assumed pest status often at Gadchiroli followed by Jalgaon, Jalna and Chandrapur districts. Semilooper *Chrysodeixis acuta* incidence too was low during the 2014 throughout Maharashtra with above ETL population only in the districts of Jalna, Satara, Sangli and Amravati. Girdle beetle (*Oberea brevis*) damage was greater than ETL (3%) only at Agikhed village of Patur taluka. Neipingah of Chandur bazar, and Amdapur of Varud taluk of Amravati, Sunegaon and Navki of Parbhani district of Latur division besides Kelzar village of Satana (Baglan) taluka of Nasik.



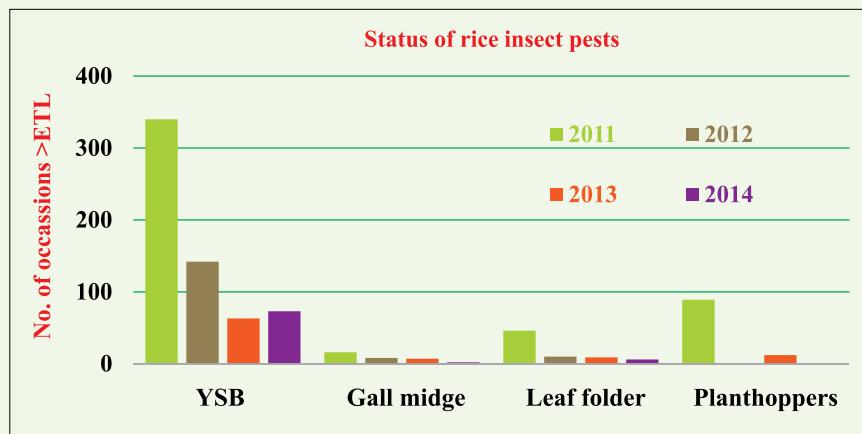
## CROPSAP: A Role Model for an e-Pest Surveillance

A glimpse of the pest scenario indicated that the semilooper, *C. acuta* and *S. litura* had been the relatively lower across almost all districts during 2015 over the past five years of soybean cultivation.



## Rice

Yellow stem borer (*Scirpophaga incertulas*) has been the dominant and regular pest across all rice growing districts and the major insect pests had declining trend of abundance over years.

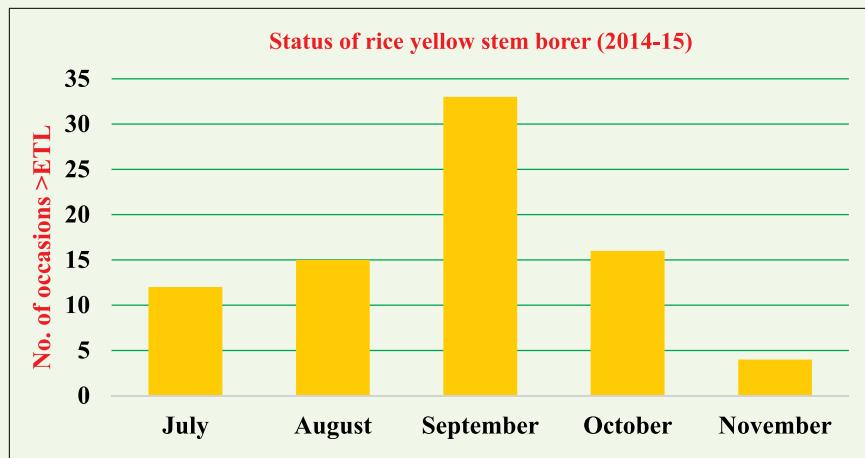


The frequency of YSB infestations above ETL has been high at Gondiya>Ratnagiri>Pune>Thane>Bhandara and Chandrapur districts (Table 3) during kharif 2014.

**Table 3 : Pest status of YSB in Maharashtra (2014-15)**

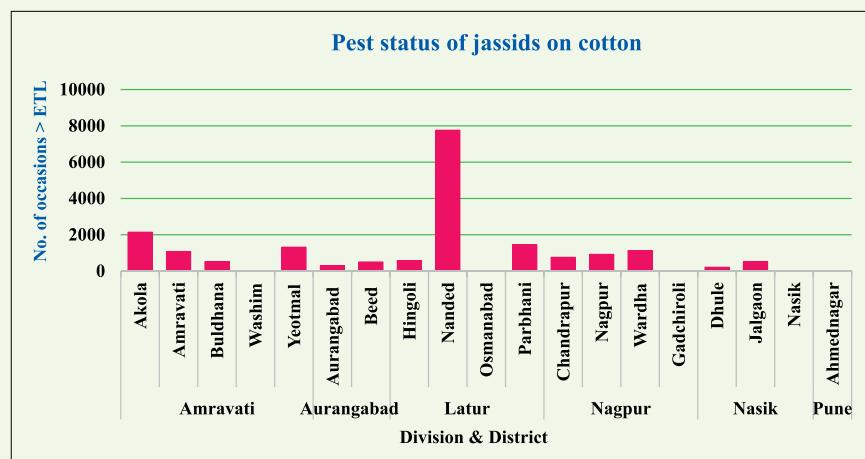
Division	District	No. of occasions YSB above ETL (5 % dead hearts)
Nagpur	Bhandara	5
	Chandrapur	5
	Gadchiroli	1
	Gondiya	15
	Nagpur	1
Nasik	Nandurbar	3
Thane	Raigad	4
	Ratnagiri	14
	Sindhudurg	2
	Thane	7
Kolhapur	Kolhapur	4
Pune	Pune	12

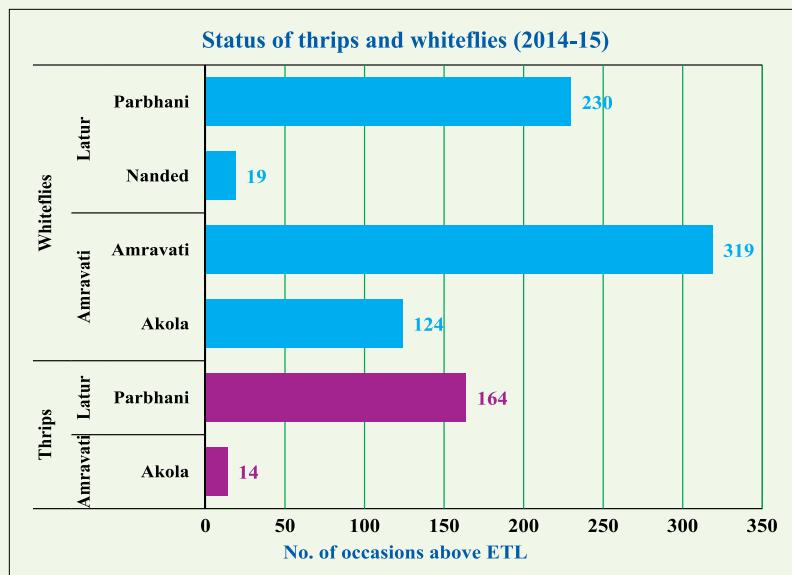
YSB attained pest status between July and November with its peak severity in September.



## Cotton

The importance of sap feeders was: Jassids (*Amrasca biguttula biguttula*) > Whiteflies (*Bemisia tabaci*) > Thrips (*Thrips tabaci*). While jassids were pests across all districts of the State, whiteflies at Akola, Amravati, Nanded and Parbhani, and thrips at Akola and Parbhani had above ETL status. *S litura* attained pest status only at Nanded, Chandrapur and Amravati. Leaf reddening was at its high at Nanded followed by Parbhani where as jassids were also at their high level of incidence (Table 4). Sporadic occurrence of mealy bug was seen at Aurangabad.

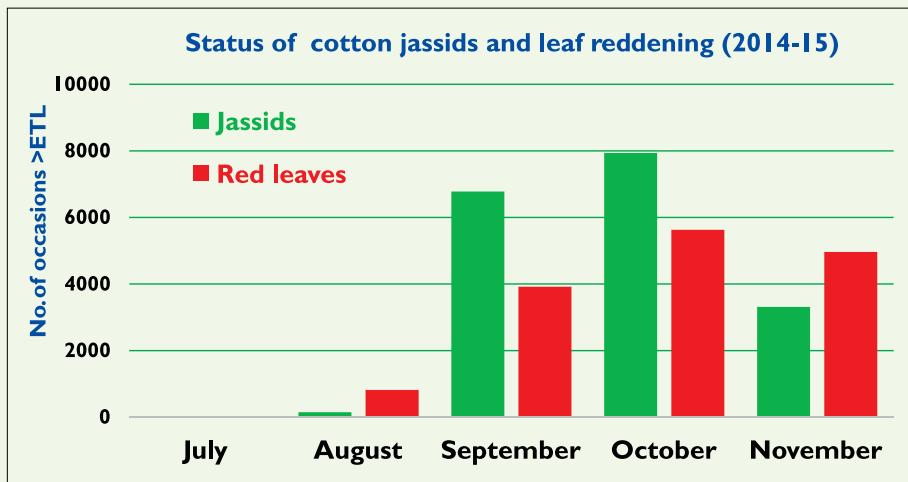




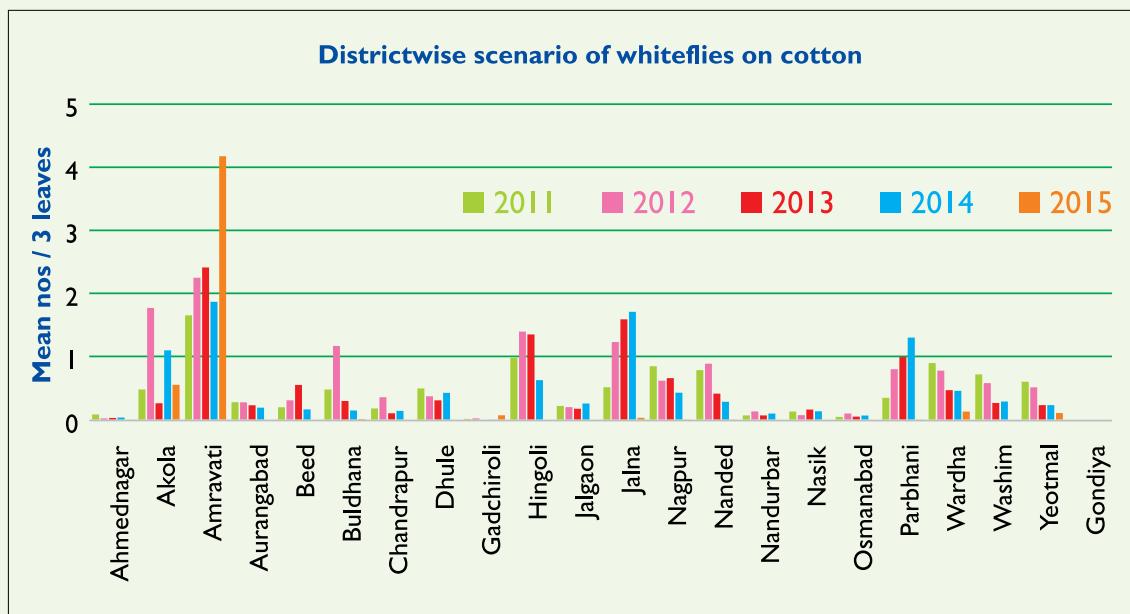
**Table 4 : Leaf reddening across districts of Maharashtra (2014-15)**

Division	District	No. of occasions above ETL(10% incidence)
Amravati	Akola	49
	Amravati	182
	Buldhana	5
	Washim	7
	Yeotmal	170
Aurangabad	Aurangabad	86
	Beed	361
Latur	Hingoli	2
	Nanded	11305
	Parbhani	1394
Nagpur	Chandrapur	219
	Gadchiroli	2
	Nagpur	292
	Wardha	144
Nasik	Dhule	636
	Jalgaon	235
	Nasik	132
Pune	Ahmednagar	30

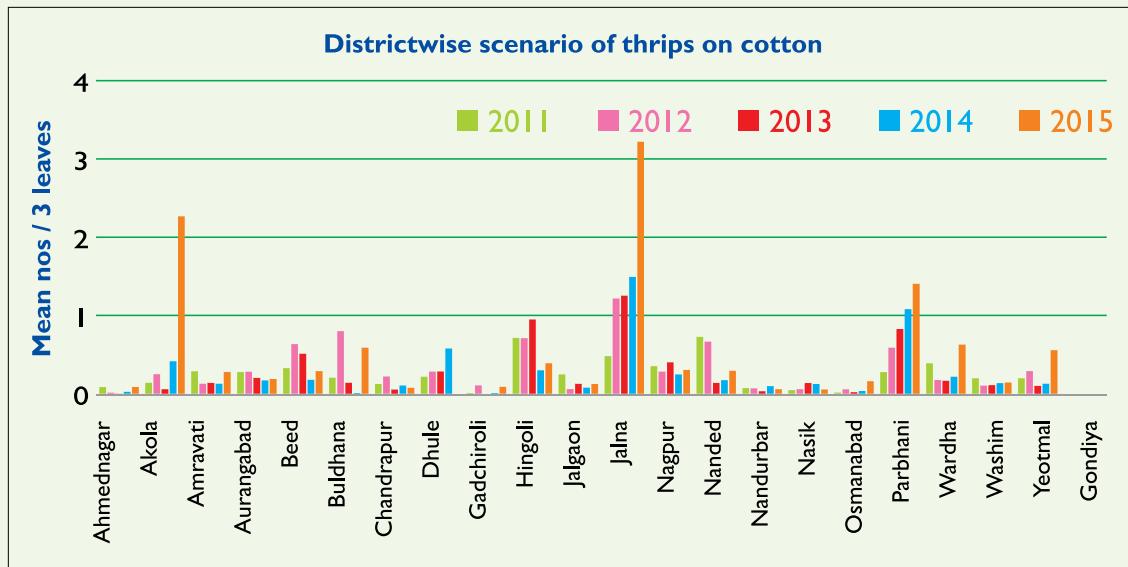
The status of jassids and leaf reddening above ETL across the State during different months indicated interventions from September for jassids and October for leaf reddening on need basis were essential for their management.



Comparative scenarios indicated increasing whiteflies at Jalna and Parbhani, and thirps at Akola, Dhule, Jalna and Parbhani in 2014 over 2011-2013 seasons was obvious. Amravati was the whitefly hotspot in 2015.

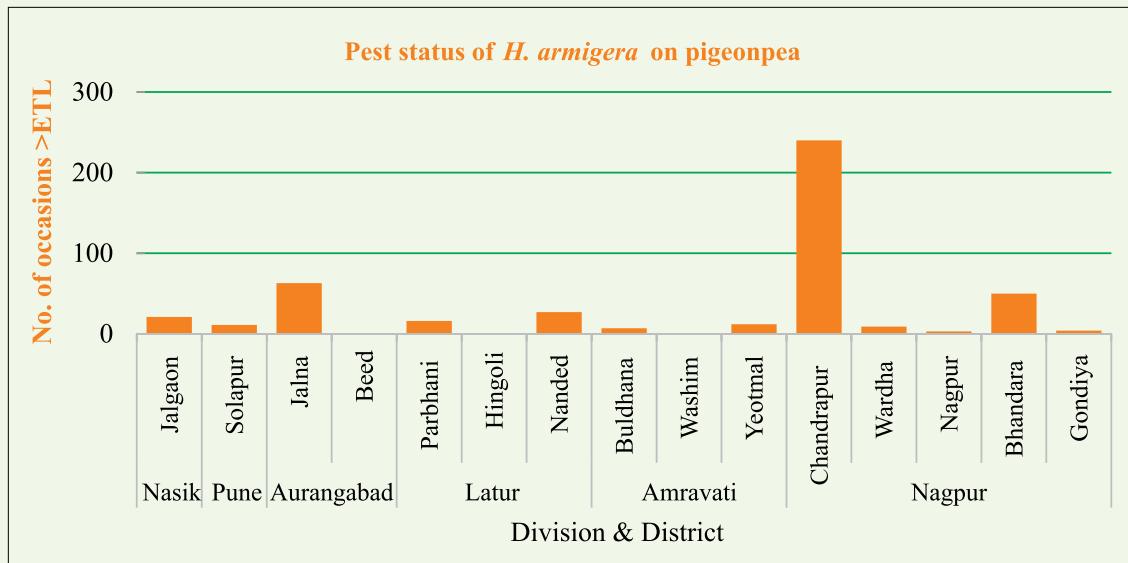


Thrips abundance was the highest during 2015 over the previous four seasons across districts of Jalna, Akola, Parbhani, Wardha and Yeotmal.

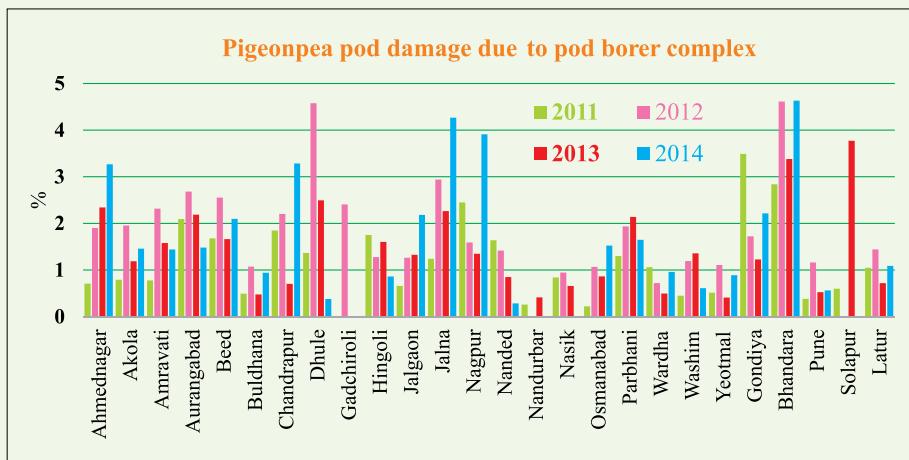


### Pigeonpea

*H. armigera* occurrence was the highest at Chandrapur. The districts of Jalna, Bhandara, Nanded and Jalgaon had moderate instances of *H. armigera* above ETL.

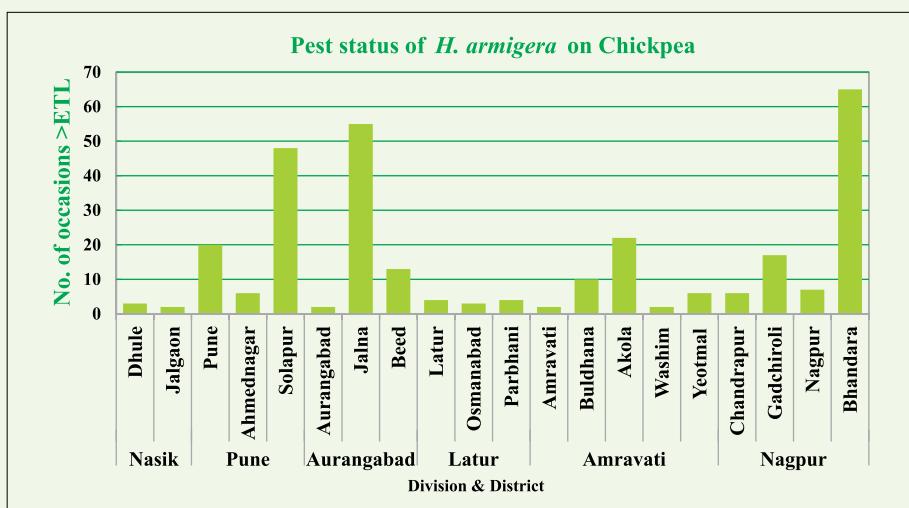


Pod damage due to the pod borer complex was higher at Jalna, Nagpur and Nandurbar, and moderate at Chandrapur, Nanded, Gondiya and Aurangabad districts. Pune, Parbhani, Buldhana and Washim had *H. armigera* as well as pod damage above ETL, however on a lesser number of occasions. Increasing pod damage due to pod borer complex was observed during 2014 at Ahmednagar, Chandrapur, Jalna, Nagpur, Wardha and Bhandara districts over the previous three seasons. Reduced pod damage was noticed at Dhule and Hingoli during 2014.

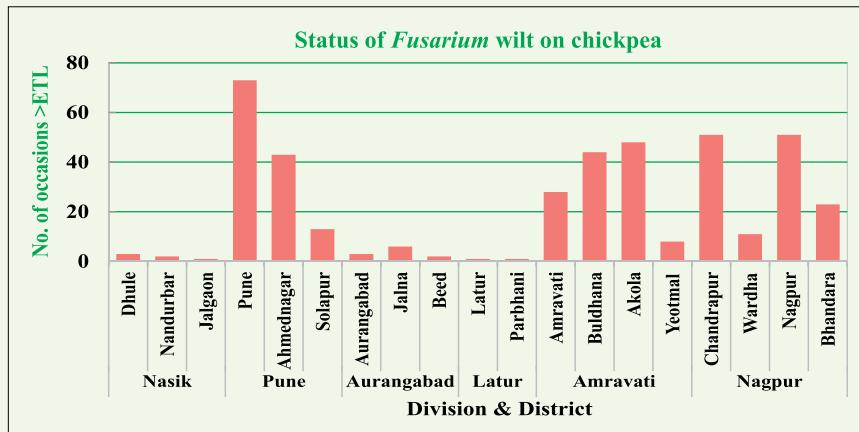


## Chickpea

*Helicoverpa armigera* on chickpea attained pest status to a higher frequency at Bhandara>Jalna>Solapur>Akola>Pune. Most other districts had lower level of *H. armigera* incidence.



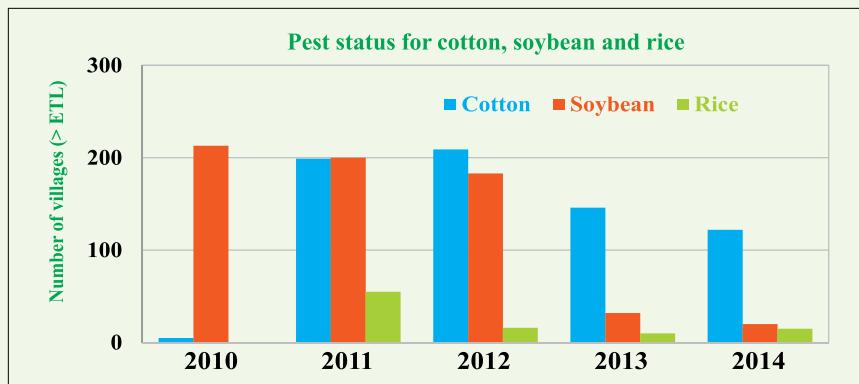
Wilt due to *Fusarium* was greater at Pune division followed by Amravati and Nagpur. Nasik, Aurangabad and Latur divisions had the lowest wilt incidence.



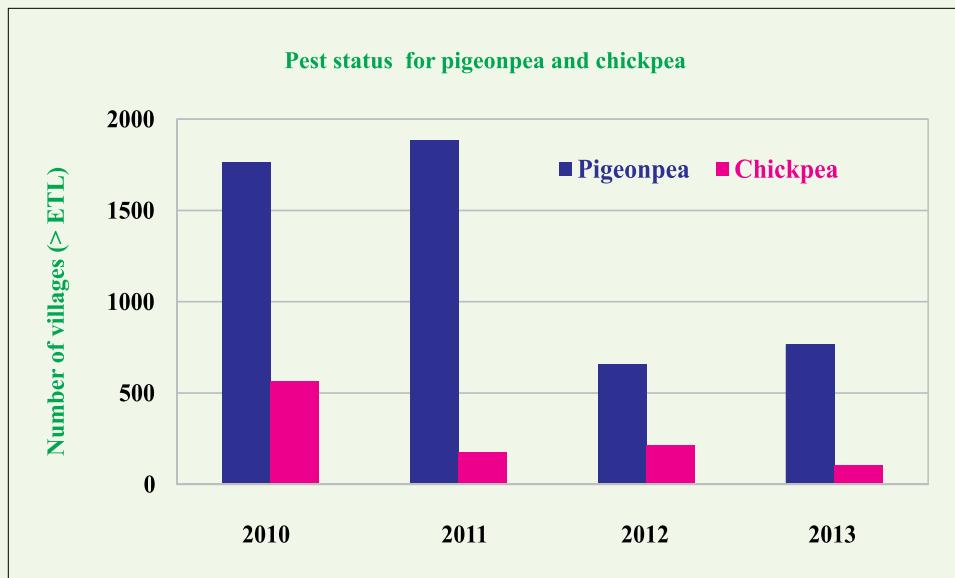
The number of occasions above ETL indicated in the pest scenarios is a relative estimate equivalent to the number of fields having pest status in respect of the target insect pest or disease over time accounted on weekly basis.

### STATE LEVEL PEST STATUS AMONG THE TARGET CROPS OF CROPSAP

The implementation of the CROPSAP over five seasons had indicated highly reduced frequency of pest status on soybean during 2013 and 2014 over the previous three seasons (2010-2012). On the contrary, pest status on cotton was more between 2011-2014 over 2010 mainly due to the gaining importance of sucking pests viz., jassids, whiteflies and thrips across many districts. Nevertheless there is general declining trend of pest status at the State level among all three crops viz., cotton, soybean and rice.



The pest status on pigeonpea was higher than all other crops due to the long duration of the crop besides the fact that pod damage caused by pod borer complex (lepidopterans, pod bugs, pod fly and bruchids) remain on the plant once the damage occurs. As the terminal crop stage/late season pest management on pigeon pea is not undertaken, the relatively higher pest status is of less significance in pigeon pea. The reduction in pest status on chickpea over the progressive seasons was also obvious.



## **YIELD LEVELS**

Considering 2008-09 as the problematic year in terms of two dry spells of two weeks in June-July that had delayed the crop sowing followed by three weeks of dry spell in August resulting in severe pest infestation on soybean, the observed productivity was less with soybean, cotton and pigeonpea crops. Although seasons of 2009-10 to 2011-12 witnessed 2-3 dry spells despite timely onset of monsoon, and pest incidences were there after dry spells, they were detected timely with corrective measures taken appropriately through supply of critical pest management inputs. As such, State of Maharashtra had the highest pulse production of 31.44 lakh tons during 2010-11 (an increase of 4%) against earlier highest production of 30.24 lakh tons recorded in 2007-08. Since 2010-11 productivity of all crops under the project has never declined to the level of pest outbreak season 2008-09 due to continuous vigil kept through e-pest surveillance (Table 5).

**Table 5 : Area and productivity of target crops of e- pest surveillance during project period**

Crop	Particulars	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Soybean	A	30.63	30.19	27.29	30.10	30.64	35.20
	P	601	728	1581	1319	1531	1214
Cotton	A	31.46	33.92	39.42	41.67	41.87	41.60
	P	257	256	322	278	276	361
Rice	A	14.99	14.5	14.86	15.16	15.28	15.68
	P	1496	1474	1766	1836	1964	1925
Pigeonpea	A	10.08	10.93	13.02	12.33	12.13	11.41
	P	600	841	750	706	829	906
Chickpea	A	11.43	12.91	14.23	10.75	11.35	18.20
	P	677	863	914	797	765	891
(A=Area in lakh ha, P=Productivity in kg/ha)							

### ICT BASED DISSEMINATION OF PEST MANAGEMENT ADVISORIES

The participatory response of farmers for SMS enrollment, advisories issued by SAUs, SMSs sent by SDA demonstrates the growing subscribers and awareness on pest management generated under the programme during *kharif* and *rabi* season across five crops (Table 6).

**Table 6 : Status of issue of ICT based pest management advisories**

Year	No. of subscribers (lakhs)	No. of SMSs sent (lakhs)
2009-10	1.63	31.93
2010-11	2.40	112.00
2011-12	3.11	199.06
2012-13	3.40	360.83
2013-14	3.90	479.14
2014-15	15.0	550.27

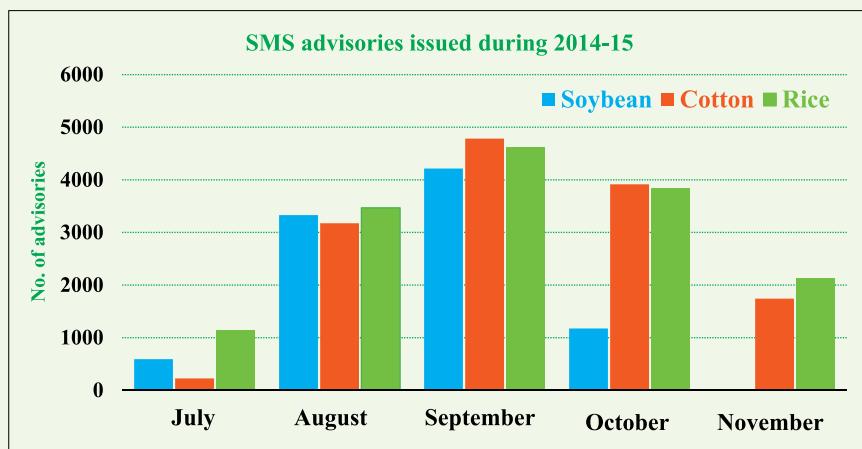
Dissemination of pest management advisories through short message services (SMSs) across the crops of soybean, cotton, rice, pigeonpea and gram, respectively based on ETLs of different pests since the inception of CROPSAP (Table 7) indicate the need based and effective functioning of plant protection extension across Maharashtra.

**Table 7 : Status of dissemination of ICT based pest management advisories**

Season	Soybean	Cotton	Rice	Pigeonpea	Chickpea	Total
2014-15	9310	14171	15193	8097	10594	57365
2013-14	15170	24846	20959	13364	10759	85098
2012-13	10043	17177	13720	13120	16017	70077
2011-12	11935	16668	15528	11502	8537	64170
2010-11	12077	17289	**	15768	10996	56130
2009-10	2583	2212	**	3061	5661	13517

\*\* : Rice crop was included for e- pest surveillance from 2011 season

The dissemination of pest management advisories through along the crop season during 2014-15 indicated August and September to be critical for soybean and August to October for rice and cotton pest management.



The number of pest management advisories for the pod borer complex on pigeonpea and *H. armigera* and *Fusarium* wilt on chickpea issued during 2014-15 is furnished in Table 8. Despite the short duration of chickpea during *rabi*, the quantum of pest management advisories was higher over the long duration pigeonpea in respect of all districts across the seven divisions of the State. However, it is to be understood that the number of advisories need not be the direct indicators of the magnitude of the pest status but conveys more on the regularity of the issue of pest management advisories for the dissemination to the farmers.

**Table : 8 Districtwise pest management advisories for pigeonpea and chickpea**

Division	District	Pigeonpea	Chickpea
Nasik	Nasik	152	468
	Dhule	85	144
	Nandurbar	57	94
	Jalgaon	460	428
Pune	Ahmednagar	271	471
	Pune	117	374
	Solapur	72	471
Kolhapur	Satara	22	266
	Sangli	20	249
	Kolhapur	26	127
Aurangabad	Aurangabad	459	459
	Jalna	428	409
	Beed	570	560
Latur	Latur	507	507
	Osmanabad	412	406
	Parbhani	468	450
	Hingoli	258	252
	Nanded	838	817
Amravati	Amravati	364	356
	Buldhana	301	335
	Akola	182	186
	Washim	157	158
	Yeotmal	413	419
Nagpur	Chandrapur	498	610
	Gadchiroli	80	114
	Wardha	218	391
	Nagpur	327	531
	Gondiya	106	185
	Bhandara	229	357

Ever since the inception of CROPSAP till date there has been no outbreak of any major pest on the study crops due to the consistent pest monitoring, timely guidance received by farmers through SMS and adoption of appropriate pest management strategies. Bio-control options were facilitated wherever and whenever possible before recommendation of the chemical pesticides. Application of only the recommended pesticides at right dosages using proper application equipment and techniques have brought in judicious use of chemicals and reduced the occupational hazards.

## **PROJECT EVALUATION**

CROPSAP has been evaluated on several occasions since its inception. NCIPM estimated a production increase of 23.8% in soybean during 2009 as compared to 2008 with a gross monetary benefit of Rs.1047.5 crores accrued in 2009<sup>10 & 11</sup>. The acreage under pest status (above economic threshold level) was reduced by three fold during 2009 over 2008 season (4.8 and 14.64 lakh ha in 2009 and 2008, respectively). CROPSAP was described as an innovative study that strengthened the information delivery mechanism for efficient agricultural knowledge management system including the control of pest incidence besides its need for replicability for other crops<sup>12</sup>. National Institute of Rural Development, Hyderabad in 2013 recommended that the project should be extended for other crops in the State considering its positive impact in terms of reduction in crop losses with less expenditure on pest management with better returns to farmers through use of IT tools<sup>13</sup>. Agricultural Finance Corporation, Mumbai (2013) also recommended CROPSAP's greater level of utility after its project evaluation<sup>5</sup>. An average yield increase of 580, 287,151 and 297 kg/ha in respect of cotton, soybean, pigeonpea and chickpea with CROPSAP over non project farmers was estimated with 69.14% of the pest management advisories sent as SMS were adopted by farmers across crops.

CROPSAP is one of the 13 good governance practices identified by Department of Administrative Reforms and Public Grievances (DARPG) (<http://www.darpg.gov.in/>), Government of India based on the Prime Minister awards for research and evaluation by Indian Institute of Development Management (IIDM) (<http://www.iidmindia.com/>, <http://infoiidm.blogspot.in/>), Bhopal with an objective to understand the impact, utility, user satisfaction, sustainability, scalability and replicability of the initiative, and to develop a model practice suggesting on the improvements in the good practices incorporating the technological advancements and the changed requirements of the clients. Already a workshop has been held at Bhopal during January 2016 for finalizing the tools and methodologies based on the project specific questionnaire developed.

## **UNIQUENESS OF CROPSAP**

- Transparency and stakeholders' participation
- Innovativeness of the initiative and its replicability
- Increased efficiency of outputs/processes
- Increased effectiveness of outcomes
- Display of leadership/team work
- Transformation and positive impact of production/productivity
- Sustainability of the initiative

## **CROPSAP – A SUCCESS STORY. WHY?**

- On-line pest monitoring and real time advisory dissemination system is the need of the hour for minimisation of yield losses under the fast changing pest scenario under changing weather/climate
- Implementation of CROPSAP has bridged the gap between research and extension mechanism
- Awareness creation about the programme through radio jingles, TV broadcasts, jingles in bus stations and print media (newspapers/folders/leaflets/bulletins) to the public, in general and through village level meetings to the farmers, in particular made it popular
- Multi stakeholder involvement brought in harmony to the technicalities of pest surveillance and management
- Advisory capsules are highly scientific as they have been formulated in consultation with SAU experts, which in turn improved the implementation of pest management recommendations
- Engagement of contractual staff exclusively for pest surveillance, data feeding and advisory dissemination ensured continued implementation of e-pest surveillance and need based pest management amongst farmers
- Regular trainings to staff (departmental staff of department of Agriculture, pest scouts, pest monitors and data entry operators) to impart the do-how of pest surveillance and pest management empowered capacity building
- Exposure visits to the department officials and farmers updated their knowledge and enhanced the vision and skills on crop production and protection
- The real time pest status based on ETL and management advisories have resulted in the judicious use of pesticides

- Possession of mobiles by farming community and their enrolment for free SMS advisory facilitated large scale dissemination of pest management advisories
- Programme monitoring at various levels (State to village levels) facilitated information and action flow on timely basis based on the responsibilities of stakeholder
- Need based pesticide supplies to the villages on subsidy based on the real time pest status facilitated by convergence of different schemes operated by State Department of Agriculture (Maharashtra)
- Positive mind set, sustained enthusiasm and dynamism of all stakeholders in upholding their respective roles make the programme a great success.

### **CROPSAP: AN e-KRANTI IN CROP PROTECTION. HOW?**

electronics and IT	: Used in CROPSAP to play a dominant role in socio-economic development of farmers through proper plant protection
e-governance	: Fulfils the policy adoption by our Government viz., Digital India
evolving programme	: Allows for expansions into diverse areas and crops
elaborative	: Software allows to accommodate all possible features/updates
enhancement	: Additional reporting features possible through customization
easily replicable	: Repeatability of the program is possible over space and time
effectiveness	: Effective use of scientific and technological resources
efficient	: Timely implementation saves energy and resources
employment	: Engages manpower for infrastructure development and program implementation
extensive	: Wider area coverage/scaling up at quicker pace
enormous	: Extremely robust and dynamic
equity support	: Information for all

## **AWARDS**

The uniqueness, innovativeness, replicability and sustainability of CROPSAP have fetched higher levels of awards from the Government of India on various occasions.

### **Krishi Karman Award (2010)**

The State of Maharashtra won the *Krishi Karman* award during 2010-11 for the highest pulse production wherein Government of India has specifically recognized the impact of CROPSAP initiative including soybean, pigeon pea and chickpea under pest surveillance<sup>14</sup>.



### **e-Governance Gold Medal (2011-12)**

Crop Pest Surveillance and Advisory Project (CROPSAP) – Maharashtra was an award winner for exemplary reuse of ICT based solutions at the 15<sup>th</sup> National Conference on e-governance held during February 9-10, 2012 at Bhubaneshwar, Odisha<sup>15</sup>.



**Prime Minister's Award for Excellence in Public Administration (2012-13)**

Crop Pest Surveillance and Advisory Project (CROPSAP) - for pest management in major crops in Maharashtra was awarded 'Prime Minister's Award for Excellence in Public Administration' for the year 2012–13' Shri Prabhakar Deshmukh, then commissioner of Agriculture, Maharashtra received the award<sup>16</sup> on the ninth Civil Services Day held on April 21, 2015 organized by the Department of Administrative Reforms and Public Grievances<sup>17</sup>.



**END NOTE AND WAY FORWARD**

The success of CROPSAP has served as a model for replication across crops and locations in the country. The programme for horticultural crops, HORTISAP (Maharashtra) [<http://www.ncipm.org.in/Horticulture15-16/>], and real time pest dynamics (RTPD) under NICRA (National Innovations on Climate Resilient Agriculture) [<http://www.ncipm.org.in/nicra/>] stand as follow up initiatives of CROPSAP<sup>18</sup>.

Officials of the State Department of Agriculture of Rajasthan, Manipur and Haryana have visited to understand the 'do-how' of the CROPSAP for a feasible replication in their respective States. Shri Ramchandra Lokare has been a part of the mid-term training programme for innovations in public administrations to train the IAS officers of the Government of Madhya Pradesh and Uttar Pradesh.

Use of ICT in plant protection has obviated the drawback of non-availability of complete data sets on pests at one or few many places that make the spatial and temporal pest scenario compilations and exchanges highly difficult for anyone crop. Considering that large amount of pest data that gets lost in the note books of the persons who recorded the data, carefully

designed ICT based pest surveillance not only brings convergence in measuring pests essential for comparison purposes but also fastened the pest scenario known on real time basis for instant recommendations of need based pest management through advisory notifications. The spatial distribution of pests with a ‘click of a button’ for any given level of space (village/taluk/district/division/State) is known through geographical information systems (GIS). Further research using data base could result in multispecies interactions operating at field level, and combined with weather can result in development of prediction models for use in forewarning. It is also well known that changes in technology are continuous and the sophistication levels of surveillance/ reporting tools are dynamic. Development of mobile applications for *m*-pest surveillance with add-on in built features of pest diagnosis, protocols of surveillance and decision support system would elevate the effectiveness and efficiency, in principle. Electronic gadgets and networking make pest surveillance and monitoring a commercial enterprise however with the continuous trainings and skill development made available with execution plans carved out in simple ways. ICT would continue to play a greater role in effective use of data gathered over time and space in understanding changing pest scenario, effects and efficacy of pest management methods, effects of weather/climate change on crop-pest interactions and in development of forecasts and policies of plant protection. Evolving instant feedback mechanisms from farmers for aiding alternate pest and crop management planning during crop and off seasons, respectively, linking farmers with public and private input suppliers with their quality certified by government agencies, and facilitating marketing of the harvested produce by growers with or without value additions/ certifications could form a high level of integrated crop management using ICT.

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**ANNEXURE - I**

**Crop Pest Surveillance and Advisory Project (CROPSAP) - Maharashtra**

**SOYBEAN - SCOUT PROFORMA**

Name of Scout Centre : \_\_\_\_\_

Village Name : \_\_\_\_\_

Field : Fixed 1 / Fixed 2 / Random 1 / Random

Date of observation : \_\_\_\_\_

Crop Condition : Very Good / Normal / Poor

Variety : \_\_\_\_\_

**SOYBEAN**

Row No.	<i>Spodoptera litura</i> (No. / Metre row length)		No. of larvae / Metre row length		Girdle beetle (No. of plants / Metre row length)		Other Pests / Remarks if any
	No. of plants with gregarious larvae	Solitary Larvae	Semilooper	<i>Helicoverpa armigera</i>	Total plants (including infected plants)	Infected Plants	
1							
2							
3							
4							
5							
Pheromone Trap Catches of		<i>Spodoptera litura</i>		<i>Helicoverpa armigera</i>			
No. of adults / trap in Trap 1							
No. of adults / trap in Trap 2							

**Other Activities:**

Spray: \_\_\_\_\_

Fertilizer: \_\_\_\_\_

Irrigation: \_\_\_\_\_

Intercultural: \_\_\_\_\_

**CASTOR (Indicator crop for *Spodoptera*)**

Plant No.	<i>Spodoptera litura</i> (No. / plant)		
	Egg mass	No. of cluster of gregarious larvae	Solitary larvae
1			
2			
3			
4			
5			

Collected By: Name & Signature of Scout with Date \_\_\_\_\_

Data Verified By: Name & Signature of Agril. Supervisor I/C with Date \_\_\_\_\_

Off-line Data Feeding By: Name & Signature of Data Entry Operator with Date & Time \_\_\_\_\_

Final Verification and Uploading of Data: Name & Signature of SDAO I/C with Date & Time \_\_\_\_\_

**GUIDELINES FOR FILLING UP THE PROFORMA (PEST SCOUT)**

**Name of Scout Centre:** Write allotted name of Scout centre (Name of Taluka-1 e.g. Haveli-1, Haveli-2 etc)

**Village Name:** Write the name of the village as mentioned in Panchayat records

**Field:** Tick the name of the field as assigned in the beginning for Fixed 1 or 2 and for random tick Random 1 or 2 as per the sequence.

**Crop Condition:** Tick the appropriate one as per the following guidelines

**Very Good:** If the plant population is full with a good and healthy crop condition with maximum growth / flowering / fruiting stage. Weed free with proper agronomic practices.

**Normal:** Field with optimum plant population and normal growth characters.

**Poor:** Field with poor plant stand and growth conditions.

**Variety:** Note the variety / hybrid of Soybean as informed by the cultivator in case of fixed field.

**Pest Incidence:** The unit of observation should be one acre field. Select one metre row length at random from 5 places preferably four at four sides (inner rows leaving border five rows) and one at the centre. Then observe each plant for the following pests.

***Spodoptera litura:*** Count the number of gregarious larvae (number of plants infested with cluster of small larvae) / big solitary larvae separately in all the plants in one metre row length. Note down the number of gregarious larvae infested plants and solitary larvae in the respective column.

**Semilooper:** Count the number of semilooper larvae in all the plants in one metre row length.

***Helicoverpa armigera:*** Count the number of *Helicoverpa armigera* larvae in all the plants in one metre row length.

**Girdle beetle:** Count the total number of plants (including damaged and healthy plants) and note them in total plants column then count the number of gridled plants / dried plants due to girdle beetle in one metre row length and note them in the damaged plants column in same one metre row length.

**Other Pests / Remarks:** In soybean observe for any other pest and note down if found in serious proportions. The same should be alerted to the Pest Monitor immediately.

**Pheromone trap catches of *Spodoptera litura* and *Helicoverpa armigera:*** Install the pheromone traps in such a way that the funnel of the trap is around 1 feet higher than the plant height. Apply some insecticide dust or cotton swab soaked with dichlorvos inside the polyethylene bag attached to the bottom of the trap. Care should be taken so that the insecticide dust / solution is not fallen on the plastic funnel, which may mask the pheromone smell. Install them at least 80-100 feet apart from each other and 30-50 feet inside from the bunds. Kill the surviving trapped moths and open the polyethylene bag and take all the dead moths out of the trap on the clean paper or cloth surface, count them and note down the number of adults / trap separately for each trap in the respective column. Again tie the polyethylene bag and install the trap properly as mentioned above. Use two pheromone traps each for *Spodoptera litura* and *Helicoverpa armigera* per fixed plot. A gap of around 10-20 feet may be given between *Spodoptera* and *Helicoverpa* traps.

**IMPORTANT: NEVER HANDLE THE LURE / SEPTA WITH NAKED HANDS, ALWAYS USE CLEAN COTTON.**

**Other Activities:** Note down the spray (insecticide / weedicide / fungicide, etc.), fertilizer application, carried out with name of the chemical and dose. Mention whether any irrigation was given during the week and if so the source of irrigation. Also note down any intercultural operation and methodology for the same.

**Castor:** Select five plants at random distributed throughout the border of the fixed field only or the plants found in the vicinity of the fixed field. Then observe in each plant for the number of *spodoptera litura* egg mass / cluster of gregarious larvae / solitary larvae and note down them in respective column.

**ANNEXURE - II**

**Crop Pest Surveillance and Advisory Project (CROPSAP) - Maharashtra**

**COTTON - SCOUT PROFORMA**

Name of Scout Centre : \_\_\_\_\_  
 Field : Fixed 1 / Fixed 2 / Random 1 / Random  
 Crop Condition : Very Good / Normal / Poor

Village Name : \_\_\_\_\_  
 Date of observation : \_\_\_\_\_  
 Variety : \_\_\_\_\_

**COTTON**

Plant No.	<i>Spodoptera litura</i> (No. / Plant)		Jassids Grade (1 to 4)	Mealy bug Grade (1 to 4)	Reddening (Write '1' for plant showing leaf reddening or '0' for absence)	No./Plant (Total of 3 leaves)		Other Pests/ Remarks if any
	No. of Gregarious Larvae	Solitary Larvae				White fly	Thrips	
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

Pheromone Trap Catches of *Spodoptera litura*

No. of adults / trap in Trap 1	Other Activities:
No. of adults / trap in Trap 2	Spray: ..... Fertilizer: ..... Irrigation: ..... Intercultural: .....

**CASTOR (Indicator crop for *Spodoptera*)**

Plant No.	<i>Spodoptera litura</i> (No. / plant)		
	Egg mass	No. of cluster of Greg. Larvae	Soli Larvae
1			
2			
3			
4			
5			

Collected By: Name & Signature of Scout with Date \_\_\_\_\_

Data Verified By: Name & Signature of Agril. Supervisor I/C with Date \_\_\_\_\_

Off-line Data Feeding By: Name & Signature of Data Entry Operator with Date & Time \_\_\_\_\_

Final Verification and Uploading of Data: Name & Signature of SDAO I/C with Date & Time \_\_\_\_\_

**GUIDELINES FOR FILLING UP THE PROFORMA (PEST SCOUT)**

**Name of Scout Centre:** Write allotted name of Scout centre (Name of Taluka-1 e.g. Haveli-1, Haveli-2 etc)

**Village Name:** Write the name of the village as mentioned in Panchayat records

**Field:** Tick the name of the field as assigned in the beginning for Fixed 1 or 2 and for random tick Random 1 or 2 as per the sequence.

**Crop Condition:** Tick the appropriate one as per the following guidelines

**Very Good:** If the plant population is full with a good and healthy crop condition with maximum growth / flowering / fruiting stage. Weed free with proper agronomic practices.

**Normal:** Field with optimum plant population and normal growth characters.

**Poor:** Field with poor plant stand and growth conditions.

**Variety:** Note the variety / hybrid of Soybean as informed by the cultivator in case of fixed field.

**PEST INCIDENCE:** The unit of observation should be one acre field. Select 20 plants at randomly. Then observe each plant for the following pests.

***Spodoptera litura:*** Count the number of gregarious larvae (cluster of small larvae) and big solitary larvae in each plant.

**Jassids:** Observe each selected plant for symptoms of Jassids injury and write the grade number as per the following 1 to 4 grade.

**Grade 1:** Upper shoot of the plant is free from crinkling and curling or upper shoot showing crinkling and curling without yellowing.

**Grade 2:** Crinkling and curling of few leaves in the lower portion of plant + marginal yellowing of leaves

**Grade 3:** Crinkling and curling of all leaves near about whole plant, stunted growth of the plant.

**Grade 4:** Crinkling and curling of all leaves of plant, yellowing, browning and drying of leaves

**Mealy bug:** observe each selected plant for mealy bugs and write the grade number as per following 1 to 4 grade.

**Grade I:** About 1-10 mealy bugs scattered over the plant.

**Grade II:** One branch infested heavily with mealy bugs.

**Grade III:** Two or more branches infested heavily with mealy bugs, up to 50% plant affected.

**Grade IV:** Complete plant affected

**Reddening:** Observe 10 leaves from upper canopy of each plant for reddening and write '1' if plant shows leaf reddening or '0' for absence.

**White Flies:** Count the number white flies from under side of leaves which are selected for counting the jassids.

**Thrips:** Count the number thrips on the leaves which are selected for counting the jassids.

**Other Pests / Remarks:** In soybean observe for any other pest and note down if found in serious proportions. The same should be alerted to the Pest Monitor immediately.

**Other Pests / Remarks:** Observe for any other pest and note down if found in serious proportions. The same should be alerted to the Pest Monitor immediately.

**Bollworms (American & spotted):** In Non-Bt count the No. of plants having one or more flared up square.

**Pink bollworm:** In Non-Bt take 20 Pink bollworm infested bolls and count bolls having live larva in it.

**Pheromone trap catches of *Spodoptera litura:*** Install the pheromone traps in such a way that the funnel of the trap is around 1 feet higher than the plant height. Apply some insecticide dust or cotton swab soaked with dichlorvos inside the polyethylene bag attached to the bottom of the trap. Care should be taken so that the insecticide dust / solution is not fallen on the plastic funnel, which may mask the pheromone smell. Install them at least 80-100 feet apart from each other and 30-50 feet inside from the bunds. Kill the surviving trapped moths and open the polyethylene bag and take all the dead moths out of the trap on the clean paper or cloth surface, count them and note down the number of adults / trap separately for each trap in the respective column. Again tie the polyethylene bag and install the trap properly as mentioned above. Use two pheromone traps for *Spodoptera litura* per fixed plot.

**IMPORTANT: NEVER HANDLE THE LURE / SEPTA WITH NAKED HANDS, ALWAYS USE CLEAN COTTON.**

**Other Activities:** Note down the spray (insecticide / weedicide / fungicide, etc.), fertilizer application, carried out with name of the chemical and dose. Mention whether any irrigation was given during the week and if so the source of irrigation. Also note down any intercultural operation and methodology for the same.

**Castor:** Select five plants at random distributed throughout the border of the fixed field only or the plants found in the vicinity of the fixed field. Then observe in each plant for the number of *spodoptera litura* egg mass / cluster of gregarious larvae / solitary larvae and note down them in respective column.

## ANNEXURE - III

## Crop Pest Surveillance and Advisory Project (CROPSAP) - Maharashtra

## SOYBEAN AND COTTON - PEST MONITOR PROFORMA

Name of Monitor Centre : \_\_\_\_\_ Taluka: \_\_\_\_\_ District: \_\_\_\_\_

Village Name: \_\_\_\_\_ Field Location - Latitude: \_\_\_o \_\_\_' \_\_\_"N Longitude: \_\_\_o \_\_\_' \_\_\_"E

Date observation: \_\_\_\_\_ Crop Condition : Good / Normal / Poor

Crop : Soybean Variety : \_\_\_\_\_ (if available)      Crop : Cotton Variety : \_\_\_\_\_ (if available)

Row No.	<i>Spodoptera</i>	
	Greg. Larvae	Soli. Larvae
1		
2		
3		
4		
5		

Semiloopers : Low/Moderate/High

Gram pod borer : Low/Moderate/High

Hairy caterpillar: Low/Moderate/High

Girdle beetle : Low/Moderate/High

Stem fly : Low/Moderate/High

Soybean rust : Low/Moderate/High

Yellow mosaic : Low/Moderate/High

Pod blight : Low/Moderate/High

Row No.	<i>Spodoptera</i>	
	Greg. Larvae	Soli. Larvae
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

Aphids	: Low/Moderate/High
Jassids	: Low/Moderate/High
Thrips	: Low/Moderate/High
Mealy bug	: Low/Moderate/High
<i>H. armigera</i>	: Low/Moderate/High
<i>Earias</i> spp.	: Low/Moderate/High
Pink bollworm	: Low/Moderate/High
Grey mildew	: Low/Moderate/High
Para wilt	: Low/Moderate/High
Red leaf	: Low/Moderate/High

Any other observations : \_\_\_\_\_

\_\_\_\_\_

Collected By : Name &amp; Signature of Pest Monitor with Date \_\_\_\_\_

Data Uploaded By : Name &amp; Signature of Data Entry Operator with Date &amp; Time \_\_\_\_\_

Counter Signed By : Officer In charge - State Agriculture Department \_\_\_\_\_

**GUIDELINES FOR FILLING UP THE PROFORMA (PEST MONITOR)**

**Name of Monitor Centre:** Write allotted name of Monitor centre (Name of Subdivision-1 e.g. Pune-1, Pune-2 etc)

**Village details:** Write the name of the village / Taluka / District as mentioned in office records

**Field:** Stand in the centre of the field with GPS system and note down latitude and longitude.

**Crop Condition:** Tick the appropriate one as per the following guidelines

**Very Good:** If the plant population is full with a good plant stand and crop is healthy with maximum growth / flowering / fruiting stage. Weed free with proper agronomic practices.

**Normal:** Field with optimum plant population and normal growth characters.

**Poor:** Field with poor plant stand and growth conditions.

**Variety:** Note the variety of Soybean / Cotton / Bt Cotton as the case may be.

**Pest Incidence:** A proforma should be used separately for Soybean and for Cotton for the selected field. The unit of observation should be one acre field.

**Soybean:** Select one metre row length at random from 5 places preferably four at four sides (inner rows leaving border rows) and one at the centre. Then observe in each plant for the following pests.

**Spodoptera:** Count the number of gregarious larvae (cluster of small larvae) and big solitary larvae in all the plants in one metre row length.

**Cotton:** Select twenty plants at random distributed throughout the one acre field. Then observe in each plant for the following pests.

**Spodoptera:** Count the number of gregarious larvae (cluster of small larvae) and big solitary larvae in each plant.

For all other insect pests and diseases as mentioned in the proforma; make a zig-zag walk in the field and assess the situation of the pests and diseases then grade them as follows and tick accordingly.

**Low:** Presence of the pest at low level causing no considerable damage.

**Moderate:** Pest is present and it is nearing ETL and requires constant monitoring and implementation of any of biorational IPM strategies.

**High:** Pest is causing a severe damage and warrants immediate interruption with insecticides.

If the particular pest or disease as mentioned above is not present in the field strike out all the three options mentioned against the pest.

**ANNEXURE - IV**

**Crop Pest Surveillance and Advisory Project (CROPSAP) - Maharashtra**

**RICE - PEST SCOUT PROFORMA**

Name of Scout Centre: \_\_\_\_\_

District: \_\_\_\_\_

Taluka: \_\_\_\_\_

Village Name: \_\_\_\_\_

Field: Fixed \_\_\_\_\_ / Random \_\_\_\_\_

Date of observation: \_\_\_\_\_

Crop Stage: Tillering/Reproductive

Variety: \_\_\_\_\_

Date of sowing: / / 201 \_\_\_\_\_

Date of planting: / / 201 \_\_\_\_\_

Square meter No.	Hill No.	Total No. of Tillers	Total No. of Leaves	INSECT PESTS						DISEASE			
				Blue Beetle	Yellow Stem Borer		Gall Midge	No. of Swarming and other caterpillars	Leaf folder	No. of Plant Hoppers/hill	Blast / Neck Blast	Bacterial Blight	Sheath Blight
				No. of infested leaves/hill	No. of Dead Hearts/White Ear heads	No. of Egg masses	No. of Silver Shoots	No. of folded/damaged leaves			Grade (0,1,3,5,7,9)		
1	1												
	2												
	3												
	4												
2	5												
	6												
	7												
	8												
3	9												
	10												
	11												
	12												
4	13												
	14												
	15												
	16												
5	17												
	18												
	19												
	20												

No. of Yellow Stem Borer adults in a Pheromone trap / week

Pheromone Trap no.	No. of Yellow Stem Borer adults

Comments about any other insect pest / disease: \_\_\_\_\_

**Other Activities:**

Spray: \_\_\_\_\_

Fertilizer: \_\_\_\_\_

Irrigation: \_\_\_\_\_

Intercultural: \_\_\_\_\_

Collected By: Name & Signature of Scout with Date \_\_\_\_\_

Data Verified By: Name & Signature of Agril. Supervisor I/C with Date \_\_\_\_\_

Off-line Data Feeding By: Name & Signature of Data Entry Operator with Date & Time \_\_\_\_\_

Final Verification and Uploading of Data: Name & Signature of SDAO I/C with Date & Time \_\_\_\_\_

### GUIDELINES FOR FILLING UP THE PROFORMA (PEST SCOUT)

**Name of Scout Centre:** Write allotted name of Scout centre (Name of Taluka-1 e.g. Haveli-1, Haveli-2 etc]

**Village Name:** Write the name of the village as mentioned in Panchayat records

**Field:** Tick the name of the field as assigned in the beginning for Fixed 1 or 2 and for random tick Random 1 or 2 as per the sequence.

**Crop Stage:** Tick the stage of the crop as tillering during vegetative crop growth and as reproductive after panicle emergence

**Variety:** Note the name of the variety/hybrid of paddy as informed by the cultivator.

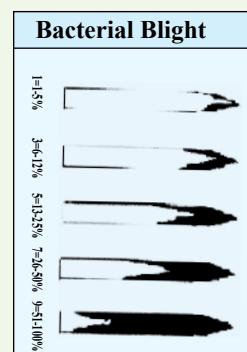
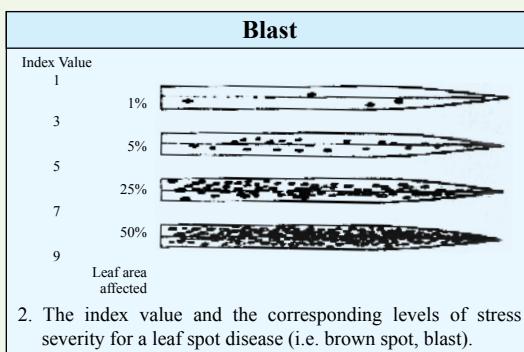
**Date of sowing & Date of planting:** Write the date of sowing & date of planting as informed by the cultivator.

#### INSECT PESTS/DISEASES

- Record observations in the main field at weekly intervals starting from 20 days after transplanting (DAT)
- Select 1 square meter area at random from 5 places preferably four at four sides (5 meter inside the border) and one at the centre. Select 4 hills in each square meter and observe for pests and plant parameters.
- First, record the pest/disease/natural enemies and then plant parameters such as tillers, leaves, dead hearts etc.
- **Blue beetle:** From each hill Count number of leaves infested by blue beetle.
- **Yellow stem borer (YSB):** Count dead hearts (dried tillers) at tillering stage and white ear head after panicle emergence in each hill. Count total number of YSB egg masses from each square meter.
- **Swarming caterpillar or other caterpillar:** Count total number of caterpillars from each square meter.
- **Brown Plant Hoppers and White Backed Plant Hoppers (BPH/WBPH):** Record total number of plant hoppers (both nymphs and adults) on tillers in each hill. While recording the observation always start counting from the base above the water level.
- **Leaf folder:** Count the number of folded leaves and damaged leaves (damaged leaf means more than 1/3<sup>rd</sup> (30%) portion of the leaf should be damaged) in each hill.
- From each square meter area count total No. of leaves of first hill only while, count total number of tillers of all selected hill from same square meter area.
- For diseases, one should look for leaf drying/disease spots from tip to downward on the leaf margin to calculate the leaf area covered by disease (0-100%) and score as per the following grades:



Grade	Incidence
0	No incidence
1	Less than 1%
3	1-5 %
5	6-25%
7	26-50%
9	51-100%



$$\text{Disease severity (\%)} = \frac{\text{Sum of all disease rating} \times 100}{\text{Total No. of rating} \times (\text{Maximum disease grade})}$$

**Pheromone trap catches of Yellow Stem Borer:** Install the pheromone traps for Yellow Stem Borer in such a way that the funnel of the trap is around 1 feet higher than the plant height. Apply some insecticide dust or cotton swab soaked with dichlorvos inside the polyethylene bag attached to the bottom of the trap. Care should be taken so that the insecticide dust / solution is not fallen on the plastic funnel, which may mask the pheromone smell. Install them at least 80-100 feet apart from each other and 30-50 feet inside from the bunds. Kill the surviving trapped moths and open the polyethylene bag and take all the dead moths out of the trap on the clean paper or cloth surface, count them and note down the number of adults / trap separately for each trap in the respective column. Again tie the polyethylene bag and install the trap properly as mentioned above.

**IMPORTANT: NEVER HANDLE THE LURE / SEPTA WITH NAKED HANDS, ALWAYS USE CLEAN COTTON.**

**Other Pests:** If there is any other insect pest / disease is observed in a severe stage, it should be written in the comments and brought to the notice of Pest Monitor, who in turn shall verify and report during his roving survey.

**Other Activities:** Note down the spray (insecticide / weedicide / fungicide, etc.), fertilizer application, carried out with name of the chemical and dose, Mention whether any irrigation was given during the week and if so the source of irrigation. Also, note down any intercultural operation and methodology for the same.

**ANNEXURE - V**

**Crop Pest Surveillance and Advisory Project (CROPSAP) - Maharashtra**

**RICE - PEST MONITOR PROFORMA**

Name of Pest Monitor Centre: \_\_\_\_\_ District: \_\_\_\_\_ Taluka: \_\_\_\_\_  
 Village Name: \_\_\_\_\_ Field Location - Latitude: \_\_\_\_ ° \_\_\_\_ ' \_\_\_\_ "N Longitude: \_\_\_\_ ° \_\_\_\_ ' \_\_\_\_ "E  
 Date of observation: \_\_\_\_\_ Crop Condition: Very good / Normal / Poor  
 Variety: \_\_\_\_\_ (if available) Crop Stage: Tillering / Reproductive

Quantitative Information										Qualitative Information			
Square meter No.	Hill No.	Total No. of Tillers	Total No. of Leaves of first hill from each m <sup>2</sup>	INSECT PESTS				DISEASE	Pest/ Disease	Low	Medium	High	
				Blue Beetle	Yellow Stem Borer	No. of Egg masses	No. of Swarming and other caterpillars						
1	1								Leaf folder				
	2								Blast				
	3								Case worm				
	4								Sheath Blight				
2	5								Brown spot				
	6								Hispa				
	7								Any other pest or disease				
	8												
3	9												
	10												
	11												
	12												
4	13												
	14												
	15												
	16												
5	17												
	18												
	19												
	20												

**Any other observations:**

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Collected By: Name & Signature of Agri. Supervisor I/C with Date \_\_\_\_\_

Data Uploaded By: Name & Signature of Data Entry Operator with Date & Time \_\_\_\_\_

Counter Signed By: Officer In charge - State Agriculture Department \_\_\_\_\_

### GUIDELINES FOR FILLING UP THE PROFORMA (PEST MONITOR)

**Name of Monitor Centre:** Write allotted name of Monitor centre (Name of Subdivision-1 e.g. Pune-1, Pune-2 etc)

**Village details:** Write the name of the village / Taluka / District as mentioned in Panchayat records

**Field:** Stand in the centre of the field with GPS system and note down latitude and longitude.

**Crop Condition:** Tick the appropriate one as per the following guidelines

**Very Good:** If the plant population is full with a good and healthy crop condition with maximum growth / flowering / fruiting stage. Weed free with proper agronomic practices.

**Normal:** Field with optimum plant population and normal growth characters.

**Poor:** Field with poor plant stand and growth conditions.

**Variety:** Note the name of the variety / hybrid of paddy as informed by the cultivator.

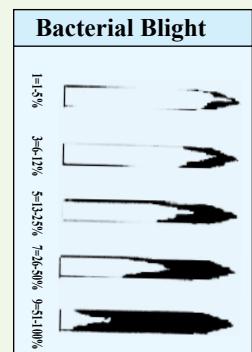
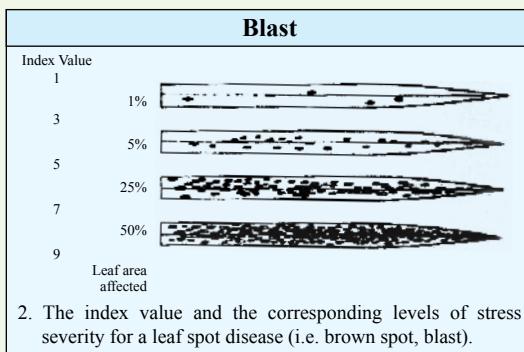
**Crop Stage:** Tick the stage of the crop as tillering or reproductive

#### INSECT PESTS/DISEASES OR NATURAL ENEMIES

- Record observations in nursery at 10 and 20 days after sowing (DAS)
- Record observations in the main field at weekly intervals starting from 20 days after transplanting (DAT)
- Select one square meter area at random from 5 places preferably four at four sides (5 meter inside the border) and one at the centre. Select 4 hills in each square meter and observe for pests and plant parameters.
- First, record the pest/disease/natural enemies and then plant parameters such as tillers, leaves, dead hearts etc.
- **Blue beetle:** From each hill Count number of leaves infested by blue beetle.
- **Yellow stem borer (YSB):** Count dead hearts (dried tillers) at tillering stage and white ear head after panicle emergence in each hill. Count total number of YSB egg masses from each square meter.
- **Swarming caterpillar or other caterpillar:** Count total number of caterpillars from each square meter.
- **Brown Plant Hoppers and White Backed Plant Hoppers (BPH/WBPH):** Record total number of plant hoppers (both nymphs and adults) on tillers in each hill. While recording the observation always start counting from the base above the water level.
- From each square meter area count total No. of leaves of first hill only while, count total number of tillers of all selected hill from same square meter area.
- For diseases, one should look for leaf drying/disease spots from tip to downward on the leaf margin to calculate the leaf area covered by disease (0-100%) and score as per the following grades:



Grade	Incidence
0	No incidence
1	Less than 1%
3	1-5 %
5	6-25%
7	26-50%
9	51-100%



$$\text{Disease severity (\%)} = \frac{\text{Sum of all disease rating} \times 100}{\text{Total No. of rating} \times (\text{Maximum disease grade})}$$

## ***CROPSAP: A Role Model for an e- Pest Surveillance***

For all other insect pests and diseases as mentioned in the proforma; make a zig-zag walk in the field and assess the situation of the pests and diseases then grade them as follows and tick accordingly. The detailed pestwise guidelines issued separately may be taken in to account for the grading system.

**Low:** Presence of the particular pest at low level causing no considerable damage.

**Moderate:** Pest is present and it is nearing ETL and requires constant monitoring and implementation of any of bio rational IPM strategies.

**High:** Pest is causing a severe damage and warrants immediate interruption with insecticides.

If the particular pest or disease as mentioned above is not present in the field strike out all the three options mentioned against the pest.

**Any Other Observations:** If there is any other insect pest / disease apart from the listed pest is observed in a severe stage, or any other abnormality is noticed, it should be noted in this part and brought to the notice of concerned SDAO / SAU representative, who in turn shall verify and report to the near by Steering Committee Members viz., respective Head, Department of Entomology, SAU and JDA for further necessary advice and action.

**ANNEXURE - VI**

**Crop Pest Surveillance and Advisory Project (CROPSAP) - Maharashtra**

**PIGEONPEA - SCOUT PROFORMA**

Village Name : \_\_\_\_\_

Field : Fixed \_\_\_\_\_ / Random \_\_\_\_\_

Date of observation : \_\_\_\_\_

Crop Condition : Very Good / Normal / Poor

Crop : Pigeonpea Variety) : \_\_\_\_\_

Sl. No.	No. of <i>Helicoverpa armigera</i> larvae / 3 branches (Plant)	No. of plume moth larvae / 3 branches (Plant)	No. of webbed leaves + flowers / 3 branches (Plant)	No. of damaged pods out of 50 pods	No. of podfly stages/ 50 pods	
					Maggot	Pupa
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
No. of <i>Helicoverpa armigera</i> adults/pheromone trap /week						
Pheromone Trap no. 1						
Pheromone Trap no. 2						
<b>Comments about any other insect pest / disease</b>						
<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>						

**Other Activities :**

Spray : \_\_\_\_\_

Fertilizer : \_\_\_\_\_

Irrigation : \_\_\_\_\_

Interculturai : \_\_\_\_\_

Collected By : Name & Signature of Scout with Date \_\_\_\_\_

Data Verified By : Name & Signature of Agrl. Supervisor I/C with Date \_\_\_\_\_

Off-line Data Feeding By : Name & Signature of Data Entry Operator with Date & Time \_\_\_\_\_

Final Verification and Uploading of Data : Name & Signature of SDAO I/C with Date & Time \_\_\_\_\_

### **GUIDELINES FOR FILLING UP THE PROFORMA**

**Village Name :** Write the name of the village as mentioned in Panchayat records

**Field :** Tick the name of the field as assigned in the beginning for Fixed 1 or 2 and for random tick Random 1 or 2 as per the sequence.

**Crop Condition :** Tick the appropriate one as per the following guidelines

**Very Good :** If the plant population is full with a good and healthy crop stand with maximum growth / flowering / fruiting stage. Weed free with proper agronomic practices.

**Normal:** Field with optimum plant population and normal growth characters.

**Poor :** Field with poor plant stand and growth conditions.

**Variety :** Note the name of the variety / hybrid of pigeon pea as informed by the cultivator.

**Pest Incidence :** The unit of observation should be one acre field either sole cropped or inter cropped. Select 10 plants randomly from one plot for observation. In each plant select three branches located in different directions in middle portion of the plant. Also collect fifty pods randomly from the whole field.

***Helicoverpa armigera / Plume moth :*** Observe for the number of larvae of *Helicoverpa armigera* and plume moth in 3 branches from each selected plant and note them separately.

***Maruca vitrata :*** Count the number of webbed leaves + flowers in 3 branches from each selected plant and note the number per plant. No need to open the web for presence or absence of larvae.

**Pod Damage :** Observe the 50 pods (collected randomly from one acre plot) for any external damage / holes by any of the pest in pod borer complex and note down only the total number of pods damaged.

**Pod fly :** Open all the same 50 pods and observe for the presence of maggots and pupae of pod fly. Note down total number of maggots and pupae of pod fly separately in 50 pods.

**Pheromone trap catches of *Helicoverpa armigera* :** Install the pheromone traps for *Helicoverpa armigera* in such a way that the funnel of the trap is around 1 feet higher than the plant height. Apply some insecticide dust or cotton swab soaked with dichlorvos inside the polyethylene bag attached to the bottom of the trap. Care should be taken so that the insecticide dust / solution is not fallen on the plastic funnel, which may mask the pheromone smell. Install them at least 80-100 feet apart from each other and 30-50 feet inside from the bunds. Kill the surviving trapped moths and open the polyethylene bag and take all the dead moths out of the trap on the clean paper or cloth surface, count them and note down the number of adults / trap separately for each trap in the respective column. Again tie the polyethylene bag and install the trap properly as mentioned above.

**IMPORTANT : NEVER HANDLE THE LURE / SEPTA WITH NAKED HANDS, ALWAYS USE CLEAN COTTON.**

**Other Pests :** If there is any other insect pest / disease is observed in a severe stage, it should be written in the comments and brought to the notice of Pest Monitor, who in turn shall verify and report during his roving survey.

**Other Activities :** Note down the Spray (insecticide / weedicide / fungicide, etc.), fertilizer application, carried out with name of the chemical and dose. Mention whether any irrigation was given during the week and if so the source of irrigation. Also note down any intercultural operation and methodology for the same.

**ANNEXURE - VII**

**Crop Pest Surveillance and Advisory Project (CROPSAP) - Maharashtra**

**PIGEONPEA - PEST MONITOR PROFORMA**

Village Name : \_\_\_\_\_

Taluka : \_\_\_\_\_ District : \_\_\_\_\_

Field Location - Latitude : \_\_\_\_ ° \_\_\_\_ ' \_\_\_\_ "N

Longitude : \_\_\_\_ ° \_\_\_\_ ' \_\_\_\_ "E

Date observation : \_\_\_\_\_

Crop Condition : Very Good / Normal / Poor

Crop : Pigeonpea Variety : \_\_\_\_\_ (if available)

**Quantitative Data**

Sl. No.	No. of <i>Helicoverpa armigera</i> larvae / 3 branches	No. of plume moth larvae / 3 branches	No. of webbed leaves+flowers / 3 branches
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

**Qualitative Data**

Pest	Low	Moderate	High
Mealybug			
Cow bugs			
Pod bugs			
Termites			
Stem weevil			
Blister Beetle			
Will			
Sterility mosaic			

Other Pests / Remarks if any


Collected By : Name & Signature of Agricultural Supervisor with Date \_\_\_\_\_

Data Uploaded By : Name & Signature of Data Entry Operator with Date & Time \_\_\_\_\_

Off-line Data Feeding By : Name & Signature of Data Entry Operator with Date & Time \_\_\_\_\_

Final Verification and Uploading of Data : Name & Signature of SDAO I/C with Date & Time \_\_\_\_\_

### **GUIDELINES FOR FILLING UP THE PROFORMA**

**Village details :** Write the name of the village / Taluka / District as mentioned in Panchayat records

**Field :** Stand in the centre of the field with GPS system and note down latitude and longitude.

**Crop Condition :** Tick the appropriate one as per the following guidelines

**Very Good :** If the plant population is full with a good plant and healthy crop condition with maximum growth / flowering / fruiting stage. Weed free with proper agronomic practices.

**Normal:** Field with optimum plant population and normal growth characters.

**Poor :** Field with poor plant stand and growth conditions.

**Variety :** Note the variety / hybrid of the pigeonpea as informed by the cultivator (if available).

**Pest Incidence :** The unit of observation should be one acre field sole cropped with pigeon pea. Select 10 plants randomly from one plot for observation. In each plant select three branches located in different directions from middle portion of the plant.

***Helicoverpa armigera/Plume moth :*** Observe for the number of larvae of *Helicoverpa armigera* and plume moth in 3 branches from each selected plant and note them separately.

***Maruca vitrata :*** Count the number of webbed leaves + flowers in 3 branches from each selected plant and note the number per plant. No need to open the web for presence or absence of larvae.

For all other insect pests and diseases as mentioned in the proforma; make a zig-zag walk in the field and assess the situation of the pests and diseases then grade them as follows and tick accordingly. The detailed pestwise guidelines issued separately may be taken in to account for the grading system.

**Low :** Presence of the particular pest at low level causing no considerable damage.

**Moderate :** Pest is present and it is nearing ETL and requires constant monitoring and implementation of any of biorational IPM strategies.

**High :** Pest is causing a severe damage and warrants immediate interruption with insecticides.

If the particular pest or disease as mentioned above is not present in the field strike out all the three options mentioned against the pest.

**Any Other Observations :** If there is any other insect pest / disease apart from the listed pest is observed in a severe stage, or any other abnormality is noticed, it should be noted in this part and brought to the notice of concerned SDAO / SAU representative, who in turn shall verify and report to the near by Steering Committee Members viz., respective Head, Department of Entomology, SAU and JDA for further necessary advice and action.

**ANNEXURE - VIII****Crop Pest Surveillance and Advisory Project (CROPSAP) - Maharashtra****CHICKPEA - SCOUT PROFORMA**

Village Name : \_\_\_\_\_

Field : Fixed 1 / Fixed 2 / Random 1 / Random 2

Date of observation : \_\_\_\_\_

Crop Condition : Good / Normal / Poor

Crop : Chickpea Variety : \_\_\_\_\_

Sl. No.	No. of <i>Helicoverpa armigera</i> larvae / metre row length	Wilted plants		Comments about any other insect pest / disease
		No. of wilted plants / metre row length	Total no. of plants / metre row length	
1				
2				
3				
4				
5				

*No. of Helicoverpa armiger a adults pheromone trap/week*

Pheromone Trap no. 1	
Pheromone Trap no. 2	

**Other Activities :**

Spray : \_\_\_\_\_

Fertilizer : \_\_\_\_\_

Irrigation : \_\_\_\_\_

Intercultural : \_\_\_\_\_

Collected By : Name &amp; Signature of Scout with Date \_\_\_\_\_

Data Verified By : Name &amp; Signature of Pest Monitor with Date \_\_\_\_\_

Data Uploaded By : Name &amp; Signature of Data Entry Operator with Date &amp; Time \_\_\_\_\_

Counter Signed By : Officer Incharge - State Agriculture Department \_\_\_\_\_

### **GUIDELINES FOR FILLING UP THE PROFORMA**

**Village Name :** Write the name of the village as mentioned in office records

**Field :** Tick the name of the Held as assigned in the beginning for Fixed 1 or 2 and for random tick Random 1 or 2 as per the sequence.

**Crop Condition :** Tick the appropriate one as per the following guidelines

**Very Good :** If the plant population is full with a good plant stand and crop is healthy with maximum growth / flowering / fruiting stage. Weed tree with proper agronomic practices.

**Normal :** Field with optimum plant population and normal growth characters.

**Poor :** field with poor plant stand and growth conditions.

**Variety :** Note the variety of pigeon pea as informed by the cultivator.

**Pest Incidence :** The unit of observation should be one acre field sole cropped with chickpea. Select one metre row length randomly at five places (four at four inner corners and one at centre of the field) from one acre plot for observation.

***Helicoverpa armigera* :** In each one metre row length observe for the number of larvae of *Helicoverpa armigera* in all the plants within that small plot.

**Wilt :** In each one metre row length count the total number of plants and note them. Also count the number of wilted plants and note them separately in another column.

**Pheromone trap catch :** Install the pheromone trap with a six feet high bamboo stick and the pheromone trap should be placed in such a way that the lure is at a height of two feet above the crop canopy. Apply any insecticide dust slightly on the walls of polyethylene bag in the pheromone trap to ensure the death of the trapped adult and avoid repetitive trapping of the same adult. Care should be taken so that the insecticide dust / solution is not fallen on the plastic funnel, which may mask the pheromone smell. During weekly-observation collect all the adults on the surface of a paper / cloth and then count them per trap / week separately.

**Other Pests :** If there is any other insect pest / disease is observed in a severe stage, it should be written in the comments and brought to the notice of Pest Monitor, who in turn shall verify and report during his roving survey.

**Other Activities :** Note down the spray (insecticide / weedicide / fungicide, etc.), fertilizer application, carried out with name of the chemical and dose. Mention whether any irrigation was given during the week and if so the source of irrigation. Also note down any intercultural operation and methodology for the same.

## ANNEXURE - IX

## Crop Pest Surveillance and Advisory Project (CROPSAP) - Maharashtra

## CHICKPEA - PEST MONITOR PROFORMA

Village Name : \_\_\_\_\_ Taluka : \_\_\_\_\_ District: \_\_\_\_\_

Field Location - Latitude : \_\_\_\_ ° \_\_\_\_ ' \_\_\_\_ "N Longitude : \_\_\_\_ ° \_\_\_\_ ' \_\_\_\_ "E

Date observation : \_\_\_\_\_ Crop Condition : Good / Normal / Poor

Crop : Chickpea Variety : \_\_\_\_\_ (if available)

Sl. No.	No. of <i>Helicoverpa armigera</i> larvae / metre row length	Wilted plants	
		No. of wilted plants / metre row length	Total no. of plants / metre row length
1			
2			
3			
4			
5			

Aphids : Low/Moderate/High	Mealy bug : Low/Moderate/High
Cutworm : Low/Moderate/High	Army worm : Low/Moderate/High
( <i>Agrotis ipsilon</i> )	( <i>Mythimna separate</i> )

Any other observations : \_\_\_\_\_

\_\_\_\_\_

Collected By : Name &amp; Signature of Pest Monitor with Date \_\_\_\_\_

Data Uploaded By : Name &amp; Signature of Data Entry Operator with Date &amp; Time \_\_\_\_\_

Counter Signed By : Officer Incharge - State Agriculture Department \_\_\_\_\_

### **GUIDELINES FOR FILLING UP THE PROFORMA**

**Village details :** Write the name of the village / Taluka / District as mentioned in office records

**Field :** Stand in the centre of the field with GPS system and note down latitude and longitude.

**Crop Condition :** Tick the appropriate one as per the following guidelines

**Very Good :** If the plant population is full with a good plant stand and crop is healthy with maximum growth / flowering / fruiting stage. Weed free with proper agronomic practices.

**Normal:** Field with optimum plant population and normal growth characters.

**Poor :** Field with poor plant stand and growth conditions.

**Variety :** Note the variety of Soybean / Cotton / Bt Cotton as the case may be.

**Pest Incidence :** The unit of observation should be one acre field sole cropped with chickpea. Select one square metre area (One metre X One metre) randomly at five places (four at four inner corners and one at centre of the field) from one acre plot for observation.

***Helicoverpa armigera:*** In each one metre row length area observe for the number of larvae of *Helicoverpa armigera* in all the plants within that small plot.

**Wilt :** In each one metre row length area count the total number of plants and note them. Also count the number of wilted plants and note them separately in another column.

For all other insect pests and diseases as mentioned in the proforma; make a zig-zag walk in the field and assess the situation of the pests and diseases then grade them as follows and tick accordingly. The detailed pestwise guidelines issued separately may be taken in to account for the grading system.

**Low :** Presence of the particular pest at low level causing no considerable damage.

**Moderate :** Pest is present and it is nearing ETL and requires constant monitoring and implementation of any of biorational IPM strategies.

**High :** Pest is causing a severe damage and warrants immediate interruption with insecticides.

If the particular pest or disease as mentioned above is not present in the field strike out all the three options mentioned against the pest.

**Any Other Observations :** If there is any other insect pest / disease apart from the listed pest is observed in a severe stage, or any other abnormality is noticed, it should be noted in this part and brought to the notice of concerned SDAO / SAU representative, who in turn shall verify and report to the near by Steering Committee Members viz., respective Head, Department of Entomology, SAU and JDA for further necessary advice and action.



