

To develop information base on all aspects of pest management and to advise on related national priorities and pest management policies

E-pest surveillance and Advisory: NCIPM has pioneered the e-pest surveillance and advisory system based on Information and Communication Technology (ICT). The technology has been used for collection and transfer of field data on insect pests and diseases in different crops from remote villages of the country to the NCIPM server through internet followed by compilation of data for display of information on www.ncipm.org.in which is accessible by SAUs for issue of advisory through SMS to farmers and extension workers for implementation on farmers' fields. The technology has been successfully implemented under the following programmes:

- i. **National Information System for Pest Management (NISPM) (*Bt* Cotton):** Under NISPM project sponsored by DOCD, on-line pest monitoring of pests and diseases in *Bt* cotton has been carried out in 1120 fields spread over 280 villages in 13 districts in nine states.
- ii. **Awareness-cum-Surveillance programme for management of major pests of soybean-cotton based cropping system (CROPSAP):** The programme was successfully implemented in 271 talukas, 30,000 villages, 29 districts in Maharashtra covering 2.5 million ha of soybean, 3.9 million ha of cotton, 1.3 million ha of chickpea and 1.3 million ha of pigeonpea. Training had been imparted to the surveillance team and pest monitoring team in all 29 districts. During 2009-10, a total of 3.2 million SMSs were sent to 1.62 lakh registered farmers as pest advisory which resulted in a decline in area above ETL from 14.64 lakh ha in 2008-09 to 4.8 lakh ha in 2009-10. The production of 22.77 lakh MT of soybean was achieved from 30.75 lakh ha of area in 2009-10 compared to that of 18.40 lakh MT (Table 6) from 30.90 lakh ha area during 2008-09 despite prolonged dry spell that prevailed during August, 2009 in Maharashtra and 10.12 million SMSs were sent in 2010-11. During 2011-12, 255.6 SMSs were sent to 3.4 lakh registered farmers (Table 7).

Table 6: Production comparison of crops in CROPSAP project (lakh MT)

Crop	2008-09	2009-10	% Increase over 2008-09	2010-11	% Increase over 2009-10
Soybean	18.4	22.8	+23.7	41.9	+ 84.0

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Cotton (Lakh bales)	47.5	58.8	+23.7	77.0	+ 31.0
Pigeonpea	6.0	9.3	+53.5	10.2	+ 9.8
Chickpea	7.7	11.9	+53.5	13.0	+ 9.2

Table 7: Number of farmers registered and number of SMS advisories issued

S.No.	Crop season (In lakh)	Farmers registered (In lakh)	SMS advisories (In lakh)
1.	2009-10	1.6	31.9
2.	2010-11	2.4	112
3.	2011-12	3.4	255.6

iii). **Crop pest surveillance and advisory in fruit crops (Mango, pomegranate and banana):** Under the project ICT-based pest surveillance system was implemented in nine districts of Maharashtra for mango (Sindhudurg, Raigarh, Ratnagiri and Thane), pomegranate (Solapur, Nashik, and Sangli) and banana (Jalgaon) covering 1,84,643 ha (Table 8). Important pests such as hopper, thrips, fruit fly, powdery mildew and anthracnose in mango, thrips and Sigatoka diseases in banana, bacterial blight, wilt, thrips and fruit borer in pomegranate were monitored in collaboration with Department of Horticulture, Government of Maharashtra.

Table 8: Data entries and pest management advisories for banana, mango and pomegranate (2011-12 and 2012-13)

Crop	District	Data entries (Nos.)		Advisories issued by SAUs (Nos.)	Advisories sent by SMSs (Nos.)
		Pest scouts	Pest monitors		
2011-12					
Banana	Jalgaon	1591	343	3	2382
Mango	Thane	422	648	226	139958
	Raigarh	1993	140	265	80125
	Ratanagiri	3502	296	124	140283
	Sindhudurg	927	133	157	3344
Pomegranate	Nashik	1177	112	244	68465
	Ahmednagar	284	174	36	0
	Solapur	1459	39	211	898
	Sangli	308	23	201	4891
Total		11663	1908	1467	440346
2012-13					
Banana	Jalgaon	3734	310	223	67923
Mango	Thane	711	636	249	46481
	Raigad	2598	139	292	102256
	Ratnagiri	8149	487	270	268586
	Sindhudurga	1968	185	213	35667
Pomegranate	Nashik	4467	427	615	135499
	Ahmednagar	542	121	68	532689
	Solapur	9310	48	441	70101
	Sangli	734	191	320	352594
Total		32213	2544	2691	1611796

iv. E-pest surveillance in Odisha in rice: Surveillance and advisory programme for rice was implemented in Odisha under *RKVY* during *kharif* 2010 and 2011 seasons in 13 districts covering more than 1700 villages. Based upon the pest status location-specific weekly advisories were issued for each block by Odisha University of Agriculture and Technology (OUAT) for managing the emerging pests. Swarming caterpillar and other pests were successfully managed in all the 13 rice growing districts of Odisha.

v. Real Time Pest Surveillance (RTPS): Under National Initiative on Climate Resilient Agriculture (NICRA), real time pest surveillance (RTPS) using standard data recording formats and sampling methodology for pests and weather, across thirty six

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centres from 12 States representing 11 agro-climatic zones (3-13) and 14 agro-ecological regions (R2-12 and R15, 18 and 19) of the country for five target crops viz., rice (7), pigeonpea (10), groundnut (6), tomato (7) and mango (6) have been put in place integrated with ICT for development of centralised data base through <http://www.ncipm.org.in/nicra/>. Based upon the weather and pest information collected, the following location-specific rules have been developed for predicting pest attack:

- Location-specific weather-based criteria and rules predicting yellow stem borer (Aduthurai, TN; Pattambi, KL; and Raipur, CH), gall midge, case worm and green leaf hopper (Raipur) of rice, *S. litura* of groundnut (Dharwad, KA) and *H. armigera* of pigeonpea (Gulbarga, AP) were developed and validated with prediction accuracy more than 85%.

Crop	Location	Insect pest	Prediction accuracy* (%)		
			2011-12	2012-13	2013-14
Rice	Aduthurai (TN)	Yellow stem borer	96.2	86.5	85.5
			96.0	96.0	85.5
	Raipur (CG)	Gall midge	100	100	-
		Case worm	100	100	100
Groundnut	Dharwad (KA)	Green leaf hopper	100	98.7	86.5
		<i>S. litura</i> (weekly)	77.7	84.2	100
		<i>S. litura</i> (fortnightly)	84.2	100	100
	Kadiri (AP)	<i>S. litura</i> (weekly)	100	90.5	100

*** Figures in parentheses are prediction accuracies based on model for combined pests; Weather based criteria and pest severity and rules are available at <http://ncipm.org.in/nicra>**

- Non-linear model [$Y_t = ae^{-bt} / (1 + de^{-bt})^2 + e$], where Y_t is count of thrips at time t , captured the developmental dynamics of thrips in cotton more accurately.
- Fulfilling >5, four and <3 of the six weather-based criteria viz., maximum temperature > 31°C, minimum temperature between 21 and 24°C, relative humidity (morning) >85%, relative humidity (evening) between 30-70%, rainfall < 25 mm and rainy days between 2 and 4 days on weekly basis predicting the severity of mirids (*Campylomma livida*) on *Bt* cotton at Central India as to high (>4), moderate (>2-4) and low (0-2), respectively was developed, and validated with 92% prediction accuracy.
- Weather-based criteria viz., mean temperature of 25-28°C, mean humidity of 65-85%, total rainfall of 50-80 mm and rainy days between 2 and 4 days of any

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standard meteorological week predicting the severity of jassids, and mean temperature of 25-29°C, mean humidity of 67-86%, total rainfall of 30-80 mm and rainy days between 3 and 6 days of any standard meteorological week predicting the severity of thrips on cotton in Central India were validated with 76 and 70% prediction accuracy, respectively.

- Trend analysis of historical pest data indicated decrease in stem borer and leaf folder on rice across locations of differing trends of climate, decreased *H. armigera* moth emergence with increased larval survival on pigeon pea due to increasing rainfall, dynamic trends of *S. litura* and climate relations in groundnut and decreasing powdery mildew and increasing hoppers and fruit flies with decreasing maximum temperature and rainfall and increasing minimum temperature and humidity on mango.
- Auto-regressive integrated moving average (ARIMA) models predicting population levels of mealybug based on seasonal incidence for eight districts of Punjab indicated potential of the fitted models in predicting the mealy bug incidence at least one week in advance.

vi. Technical Assistance Programme for Cotton in Malawi (Africa):

Implementation of ICT based Pest Surveillance in Malawi (Africa): Based upon the baseline information collected during the visit of NCIPM team to Malawi (27/11/2013 to 4/12/2013) on pests and agriculture infrastructure, software has been developed for recording insect pests, diseases and beneficial in cotton crop. Initially only two districts will be covered but the provision has been made in the software to cover all the 28 districts in Malawi. A field guide has also been developed for extension and field workers for identification of cotton pests prevailing in the country.

vii. Development of web-based data base: A web-based database of plant protection research workers was developed using ASP.net technology as a front end and SQL server 2005 as a back end. In AGROWEB project funded by NAIP, crop pest database of 65 crops including horticultural crops, plantation crops have been developed, which can be accessed by browsing the Centre's website. Centre's Website has been redesigned as per the uniformity guidelines devised for ICAR institutes. Centre's own Web server and exchange server have also been launched, in which new website and databases have been hosted.

viii. Development of expert system for pest management in okra and brinjal:

An expert system has been designed integrating a user-friendly interface, an inference engine and knowledge-base for transferring expert knowledge instantly at the

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farmer's level. User interface too have been designed and programme writing is in progress.

- ix. GIS based automated crop pest mapping:** GIS-based automated mapping for major insect pests and diseases in soybean-cotton based cropping system, chickpea and pigeon pea have been successfully carried out for the entire Maharashtra state for more than 28 districts and associated *talukas* and village-level geo-referenced points using GPS receivers on weekly basis throughout the crop seasons. The ETL and GIS-based pest mapping has also been implemented using the new colour codes and the methodology for the population of the concerned pests.
- x. Development of plant protection personnel information system (P3IS)-I:** A Plant Protection Personnel Information System (p3is) was developed with online database of profiles of scientists/researchers/ private organization personnel/ NGO personnel working in the area of plant protection in the country.