



Plant Health News Letter

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From the Director General's Desk

Pest Surveillance plays a significant role in promoting plant health which has become a trade policy issue. Pest Surveillance provides insights into the health status of a country's agriculture and strengthens the stakeholder's preparedness for preventive action both in addressing the problems due to domestic pests of serious concern as well as in protecting native agricultural biosecurity from incursion of exotic pests. Pest Surveillance also provides vital information for development of robust quarantine policies for management of endemic pests as well as to prevent invasion of alien and alien invasive species. Pest surveillance programmes facilitate early detection of invasive alien species which is very essential for eradication of invasive alien species; Pest Surveillance also plays a vital role in strengthening the efforts of a country in gaining market access for different agricultural commodities. Establishment of pest free areas and areas of low pest prevalence can be achieved only through proper Pest Surveillance programmes.

Many plant pests of economic significance have entered into our country either through the Germplasm exchange/ commercial trade or from the neighbouring countries due to porous nature of the borders. The need for Pest Surveillance has thus gained importance and the surveillance for exotic pests will help to initiate timely action for preventing the entry, establishment and eradication of exotic pests. Since India has land contiguity with Bangladesh, Bhutan, Myanmar, Nepal, Pakistan and close proximity to the Island nations of Sri Lanka and Maldives, any new pest incursion into these neighbouring countries may eventually enter into India. The incursion of exotic pests such as, coconut eriophid mite, spiralling whitefly, papaya mealybug, sunflower downy mildew etc. have caused serious economic losses impacting livelihood of the farmers, dependent industries and International trade of agricultural commodities. Early detection through regular surveillance programmes could have prevented establishment of these pests in our Country.

Public awareness of stakeholders (importer, exporters, food processing industry, extension officials, research scientist & farmers) and regular official surveillance are vital for eradication & containment




Dr. K. Satyagopal IAS, Director General - NIPHM

programmes. Protection and conservation of native agricultural biosecurity plays a vital role in economic progress of a country.

Biosecurity of Indian Agriculture cannot be attained by the efforts of a single department/sector in view of the nature of the threats which cuts across boundaries. The Central & State Agricultural/Horticultural departments should be actively involved in Pest Surveillance & made part of the emergency preparedness/rapid response network. The above officials should be trained to organize regular surveys and surveillance for detection of alien & alien invasive species.

To create awareness and build expertise among stakeholders, NIPHM is regularly organising exclusive 8 days duration Pest Surveillance programme.

I hope officials of Directorate of Plant Protection, Quarantine & Storage, State Agriculture/ Horticulture Departments, Scientists of ICAR Institutes, teaching faculty of State Agriculture/Horticulture Universities, Agricultural Extension functionaries will take advantage of these capacity building programmes.



(K. Satyagopal)
Director General

Theme Article Pest Surveillance

Dr. N.V. Kulkarni and Dr. N. Sathyanarayana

Pest, ideally, refers to those biological species which impair ecosystems, productivity, diversity and stability. The species causing harm and loss to health and vigour of humans themselves and to other entities endeared by humans include animals and birds –domesticated and wild; plants - crop, forest, orchard, ornamental, aromatic, industrial, fresh water, sea water and wild; fishes and marine organisms; and microorganisms and insects. *Surveillance* is the monitoring of the behaviour, activities or other changing information. It implies close and regular vigilance over the development of population/incidence of pests in an area / ecosystem. Thus, Pest Surveillance includes Health Surveillance and Disease Surveillance in relation to pests of human, plants and animals as well as birds, fishes and marine entities and a range of microbes having industrial, veterinary and medical importance.

The Plant Pest Surveillance has the potential to address the far reaching consequences in context of plants, animals and human health and life. The International Plant Protection Convention (IPPC) is focussing much of its attention on standardising and harmonising pest surveillance in plant protection arena.

Plant Pest Surveillance:

Pest (of plants) is defined as 'any species, strain or biotype of - plant, animal, or pathogenic agent injurious to plants or plant products'; whereas Surveillance is defined as an official process which collects and records data on pest occurrence or absence by survey, monitoring or other procedures (ISPM-6). Plant pests are those categories of biological entities which cause various types of damages. These categories may be broadly identified as insects; mites; nematodes, weeds and pathogens like bacteria, fungi, viruses. Many pests pose a serious threat due to probability of their likely spread and establishment in hitherto new areas.

Pest Surveillance is a basic requirement of any Biosecurity system. Plant Biosecurity aims at protecting life and health of plants and associated environment. Biosecurity Continuum is provided for Pre-border, At Border and Post Border Pest Surveillance thereby advocating application of Phytosanitary Measures in order to satisfy the Appropriate Level of Protection (ALOP) simultaneously facilitating least restrictive but safe trade. In a way, Pest Surveillance serves a tool for safe trade.

Pest Surveillance and Plant Biosecurity

Pest Surveillance serves as foundation for effective and efficient and foremost requisite in any and every biosecurity system. Biosecurity implies human health and life, animal health and life and plant health and life in addition to the environmental concerns pertaining to the biodiversity of the given ecosystem. Biosecurity is a holistic concept having direct relevance to (a) sustainability of agriculture, (b) wide ranging aspects of public health and (c) environmental protection including biological diversity. The exponential expansion of trade in agricultural material both in terms of quantum and variety has invariably raised a concern for Agricultural and Environmental biosecurity. Agricultural biosecurity involves agricultural production systems and those dependent on these systems; and implies protection of human health and consumer confidence in agricultural products and protection of the environment while promoting the sustainable production. The systematic surveillance strategies serve for an adequate preparedness and as an action guide in the events of plant pest incursions.

The invasive aliens, in case of incursions – accidental, negligent or deliberate –may establish themselves in certain areas and times. The surveillance mechanism rather proactive surveillance mechanism comes in handy to stop these onslaughts at the first place. The advanced and proactive surveillance starts even before any actual pest incursion is possibly foreseen. This implies pre-border surveillance and monitoring. This can be done either physically by visiting and surveying relevant areas in offshore countries or by monitoring the reports and publications if the condition of being science based and transparent is fulfilled as envisaged in various international agreements and conventions. This indicates the essentiality of Pest Database in relation to particular crop and / or

geographical area. Pest Databases cannot be established unless systematic pest surveillance activities are undertaken, reported and recorded.

The next vigilant stage in the threat of alien invasive species is at the border where the quarantine inspections aim to nullify incursion possibilities. However, even with the best task force and skill sets, there always remain a chance of incursions of pests of concern and invasive alien species due to factors like human error, sheer size of consignments, a thrust of imports and also the intelligent adaptations of such species themselves. Developing countries like India are more vulnerable to such occurrences because of the drawbacks like; Porous and large borders sea and land borders, borders surrounded by hostile countries, weak quarantine enforcement laws, inadequate infrastructure, lack of adequate expertise, little awareness in organisations like Customs, lack of awareness in public and in tourists, unscientific attitude in general, vested interests in trade and general liking for imported items.

Thus, in an event of an incursion, which at times is inevitable, an early detection holds the key and is the second best available chance to avoid further complexities. For this, a sound surveillance system is a must, the components of which viz. awareness, infrastructure, methodology, expertise, co-ordination, harmonization, legal mandate and funding shall be put in place together with proper reporting and responding mechanism that must be rapid by its very nature. Methodologies like blitz surveys shall be considered at least once a while. This consideration – following periodicity instead of continuous surveillance – is required in countries like India since the costs involved are very high. Similarly, targeted surveillance and full sampling surveys shall also be given a due share in some pockets which are high risk prone. HRSS (High Risk Site Surveillance) often is the best practiced plant pest surveillance and the pockets / sites shall be selected carefully after observing the pathways, possible entry locations and plausible dissemination and the direction, speed, location and intensity of spread of concerned pests.

The Pest Surveillance – need of the hour

The pest surveillance, speaking broadly, provide the basis for pest listing, identification of pest status, pest categorization and the conduct of pest risk analyses. The various inter-related purposes served are; to establish presence or absence of a pest, preparation of pest and host lists of area, establish and maintain areas / sites / places of pest freedom or low pest prevalence, to determine spatial distribution of pests, to identify endemic areas and pest hot spots, for management decisions, for bio-ecological and ethological research, to calculate pest resistance, to delimit the pests and for early detection of pests etc.

The basic requisite for all these concepts to implement is gathering, recording, retrieving and using the pest information and there comes the need of surveillance.

(Plant) Pest Surveillance Components

Pest Surveillance components may be considered at two levels i.e. components of surveillance and components of pests. Components of surveillance act independently, interdependently, intra-dependently and may all be acting at a same time or in a loop with each other. The dividing line between a component and the other is often vague; a stage may merge with the next seamlessly. Survey; either general or specific one and again of the specific type; sampling methodology, specimen collection, identification and preservation, reporting and data storage and data retrieval system are the major components. Besides this; considering the history of area, pest & hosts there could be other important components; e.g. Awareness creation, Campaigns, Trainings, Identification and Diagnostic services etc. Transparency, documentation and harmonization of the activities are yet other important components.

One or more components assume significance depending upon the purpose of survey and type of pests encountered i.e. domestic pests or invasive aliens and management or eradication or containment or suppression or risk assessment and regulation. Survey in itself again may

contain some or many of these components. Again all these are associated with the various categories of pests.

The survey and surveillance are two terms which are loosely used to indicate same or similar meaning. However, they differ in their very perspective. Similarly, monitoring, surveillance, survey, and vigilance are the terms used in place of each other. It is, therefore, necessary to clearly understand the concept of Surveillance.

Pest, if not present in a given area, does not indicate its absence. The absence of a pest is to be proved for; by conducting systematic surveillance thereby establishing the particular pest freedom in a geographically defined area. The negative results of Pest Surveillance are of immense importance in international trade of plants and plant products. This also may mitigate the risk of pest incursions and may also reduce the costs involved in long term. The concept of Pest Free Area, in certain situations; has a potential strong enough to put the entire economy and livelihood back in track as documented in a country like Belize. The Pest Surveillance is a powerful tool in both negotiating market access in WTO-SPS regime and in safeguarding country's biodiversity.

Survey is an official procedure conducted over a defined period of time to determine the characteristics of a pest population or to determine which species occur in an area. Surveillance indicates an official process which collects and records data on pest occurrence or absence by survey, monitoring or other procedures and monitoring is defined as an official ongoing process to verify phytosanitary situations. Thus, survey is the integral part of the surveillance system and is done over a defined period of time and the procedure may be repeated. This procedure varies with the purpose. General surveillance is a process whereby information on particular pests which are of concern for an area is gathered from many sources, wherever it is available and provided for use by the NPPO. Specific surveillance indicates survey procedures by which NPPOs obtain information on pests of concern on specific sites in an area over a defined period of time. General surveillance components are - identifying the sources of information, collection of information, storage of information and data retrieval. The outcomes of this type of surveillance are useful in; early detection of new pests, to support NPPO declarations of pest freedom, to report to other organizations such as RPPOs and IPPC and to compile host and commodity pest lists and distribution records. The specific surveillance aims at specific purpose surveys and is designed accordingly. Specific purposes may be Pest Free areas, Areas of Low Pests Prevalence, Pest Free Production Sites, Pest Free Production Places, Ear-marking spread of a pest, Specific Monitoring, Early Detection of Exotic Pests and such other reasons.

The surveillance is since a system of survey and allied activities; it addresses the issues of awareness, pest identification and diagnostics, pest preservation, pest reporting and ultimately the use of the data so generated. Awareness generation among all stakeholders and general public is an important aspect of surveillance. The awareness campaign conducted in recent past for rice pests in Thailand is an example of this kind of activity. Such campaigns facilitate the involvement of even the remotely connected or non-connected people. The success of any surveillance lies in early detection and to achieve this; observations and reporting by as many people as possible are welcome. Many a pests are sighted just fortuitously and by the people not involved actively in surveillance.

Recording the pest data properly is an important aspect in pest surveillance for which a proper sampling plan is to be devised depending upon the purpose and also the degree of confidence required. Statistical based sampling gives reliable estimates in comparison to random ad-hoc sampling. Pest Recording shall consider all factors related to the pest environment and the pest information sheets may be prepared. Specimen collection is another important component and at times utmost essential. Specimens need to be collected as per approved protocols. Specimen backed pest surveillance data is readily accepted and it is essential for demonstrating the plant health status of a given area / country. Pest Reporting also is of prime importance as these reports are the key for the action that needs to be initiated in different scenarios at national, regional and global level. Detailed analysis of proper pest reporting together with good reporting practices has been given in ISPM-17.

Once a cycle of surveillance is completed, the records / reports shall be

published which gives an edge in future negotiations in international trade. The importance of negative data is underlined here if the same is established by following the relevant methodology. Documentation of surveillance activities is the next important and contiguous step. This refers to documenting all activities including survey plans, locations, procedures and methods followed, outcomes, chronology of events, basis of specific observations and recommendations if any etc. This leads to the transparency and the surveillance becomes reliable and trustworthy.

Harmonization of the surveillance is the very important aspect. Various agencies and personnel may undertake surveillance in different areas and for different purposes. Aligning these activities on a common platform not only saves duplication and monetary losses, it also pools the data across the area and the resulting reports and analyses can be put to grater use with increased efficiency and confidence. Harmonization must be carried out step by step i.e. in a state, in a country, in a region and then global harmonization. Harmonization is especially important in a country like India where a number of stake-holding institutions are involved and the roles and responsibilities are not yet well defined in activities of Plant Pest Surveillance.

Components of surveillance need to work in sync with the components or categories of pests likely to be encountered. The components of pests can be distinctively categorised into insects, nematodes, pathogens etc.

Plant Pest Surveillance in India

In India, Department of Agriculture and Cooperation under Union Ministry of Agriculture is the apex governmental organization in the matters related to Pest Surveillance and it serves as the National Plant Protection Organization or NPPO. The surveillance responsibilities of any NPPO are supposed to include quarantine pests and endemic pests of national concern. However, the emphasis largely appears to be on endemic pests of national concern. Only recently some of the biosecurity concerns are being addressed and efforts are being made on policy level to have an appropriate surveillance structure and mechanism. Initiation has been made in establishment of Pest Free Area (PFA) to boost the export and to address the issues of market access. Though the India's slate on account of Specific Surveys appears dull, the recent efforts in conducting pest surveillance for establishing the PFAs for fruit flies and for mango pulp and nut weevil are the steps taken in right direction. However, much needs to be done in areas of surveillance for new pest incursions and early detection as well as preparedness. At present; mostly the General Pest Surveillance is conducted by undertaking Monitoring Surveys routinely in different states.

At present 31 Central Integrated Pest Management Centres, mostly one each in a state are mandated to conduct monitoring survey of standing crops on pre-determined routes. Agriculture being a state subject; state departments of agriculture conduct surveys in isolated pockets in a need based and as a reaction to certain population build-up or spread of pests as the case may be. Crop specific ICAR institutes and State Agriculture universities also conduct some limited survey activities. Thus, whatever activities that are seen in India on account of Pests Surveillance may be classified as surveys but it would be courageous to call it "Surveillance". In addition; there is no linkage among these organizations; let apart the harmonization and data sharing. Further, these surveys aim only in reporting about endemic pests. There lacks even awareness on the necessity for a look out for potential quarantine pests and invasive alien species.

Pest Surveillance in India is mostly of Genreal Surveillance type though some cases of Specific Surveillance are reported. It is high time that India gears herself to give Pest Surveillance a legal mandate and define the roles and responsibilities of stake-holding institutions. Threats of pest incursions like Coconut hispid beetle and UG₉₉ are hovering on the country and the scenario of preparedness of country's polity and technocracy appears bleak at least as of now. The failure to detect early incursions is likely to culminate into unprecedented catastrophes.

Pest Surveillance in the domain of Plant Biosecurity and / or Plant Quarantine is almost a non-entity in India. Few isolated surveys are conducted now and then if there is a demand from the importing country for a certified export of the produce that shall originate from areas free from specified pests. However, much is needed to be done to put a system in place to sync the field inspections and seed certification while defining

the exact role, responsibilities and accountability of the personnel and organizations involved. A statutory mechanism to deal with the incursion of pests also needs to be established.

Pest Surveillance needs to be popularized and local public must be involved in biosecurity surveillance. Awareness campaigns shall be conducted to facilitate the involvement of even the remotely connected or non-connected people. The success of any surveillance lies in early detection and to achieve this; observations and reporting by as many people as possible are welcome.

Some efforts are however worth mention off late are; Ramses for Locust Surveillance (2004), E-pest surveillance (very limited) (2008), dacnet/pdmis System, dacnet/iipm System etc. All these systems are working with some success but much remains to be done. Further; a three tier Pest Surveillance System working at national, state and district level is on the anvil and the efforts are being made to put it in place.

National Institute of Plant Health Management (NIPHM) is conducting Pest Surveillance Training Programmes for creating awareness and capacity building in Officers of Central & State Departments of Agriculture / Horticulture, Scientists of ICAR Institutes and State

Agricultural Universities. With the commencement of new approach on Pest Surveillance 211 personnel are so far trained in various aspects of Biosecurity Surveillance.

NIPHM is working in the direction of brining cohesiveness in pest surveillance activities in India and in the region as well. In the process; it would be the endeavour of NIPHM to identify the gaps and work-out a policy for further strides in larger areas of plant biosecurity and plant health management. To begin with; the Institute is conducting pest surveillance training programmes to create awareness and to impart updated knowledge and to enhance the skills in related areas together with enriching the overall understanding of the participants in pest surveillance. So far 211 numbers of professionals are trained from various national and international organizations. A collaboration of USDA-APHIS is also aiding efforts of NIPHM in this area among others. A comprehensive policy recommendation is on the anvil which will support the NPPO in formulating and executing the appropriate legislation, guidelines, planning, reporting, harmonization and funding activities of Pest Surveillance

Special Events

Training programme for Nurserymen of Kadiyam on Phytosanitary requirements for the export of ornamental

Kadiyam nurseries having spread over 3,500 acres in 11 villages of Kadiyam mandal in East Godavari district are involved in supply of quality ornamental plants throughout the country. The nurseries though generate huge revenue tolling up to crores per annum have not tapped the avenues of export. Realizing the huge export opportunities and potential of the association, the Confederation of Indian Industries (CII), Green Initiative, Hyderabad approached NIPHM for exposing nurserymen of kadiyam to the export procedure and requirements. In view of this, based on the request by CII a training program on Phytosanitary requirements to nursery men of Kadiyam Accordingly a training programme on "Phytosanitary requirement for the export of ornamental plants" was organized at NIPHM from 19th to 21st March, 2014.



Dr. K. Satyagopal, IAS, Director General inaugurated the programme. Mr. K S Venkatagiri, Deputy Executive Director, CII, Hyderabad briefed about the involvement of CII in creating awareness among Nurserymen of Kadiyam on Export of Ornamental Plants. The programme provided



exposure about (i) export procedures for plants, cut foliage & cut flowers (ii) importance of growing pest and disease free plants and (iii) potential international market for export of plants / plant materials.

Phytosanitary certification is an important aspect in exports of Agricultural commodities. The training was tailored for Kadiyam Nurserymen in the area of Sanitary and Phytosanitary Measures and requirements for Phytosanitary certification in line with International Standards of Plant Quarantine. They were explained on various aspects of Phytosanitary certification and export procedures such as international conventions, agencies involved in Exports of plants/plant products and their role in export promotion and Standard Operating Procedures for export of live plant material etc.

Mr. T. Sudhakar, DGM, APEDA, Hyderabad explained the "Role of APEDA in Export Promotion", Dr. K. P. Sastry, Scientist, Central Institute for Medicinal and Aromatic Plants, Hyderabad elaborated on export potential of medicinal and aromatic plants and Dr. Joswa Fenn Suresh, Chennai gave a demonstration on production of soil less potting media on large scale using various machineries. Nineteen participants attended the programme.

In the training, demonstrations were conducted on "how to make plants ready for export" and hands on practice for packaging and processing of plants for export. In this exercise, each participant actively participated and had the hands on experience about processing of plants for export.

Dr. K. Satyagopal, IAS, Director General stressed the need for promoting export opportunities for nursery men and assured to help in promoting biointensive production systems, technical support so as to enable nursery men realize their aspirations to export ornamental plants from Kadiyam. D.G. NIPHM hoped that NIPHM along with CII & APEDA will be able to provide necessary guidance & technical support on a long term basis and expressed his desire of Kadiyam becoming a major Export hub in Agricultural commodities by expanding the scope of their products.



Special Events : Demonstration of Bio-intensive IPM strategies in Tobacco Cultivation

Based on the initiative of Dr.K.Satyagopal, IAS DG, NIPHM and Dr.K.Gopal, IAS Chairman, Tobacco Board, a programme was launched to promote bio intensive pest management strategies among tobacco farmers. The programme aims to demonstrate use of non-chemical pesticide based strategies which includes enhanced adoption of microbial biopesticides and other biocontrol agents in Tobacco cultivation. NIPHM is extending technical assistance, in collaboration with Tobacco board, to the tobacco farmers to demonstrate biointensive strategies for managing the insect pest and diseases.

Field demonstration was carried out on 400 acres of Tobacco cultivation through the Tobacco board as part of the demonstration programme. NIPHM produced and supplied 1000kg of *Trichoderma* and *Pseudomonas* each. The application of *Trichoderma* and *Pseudomonas* for seed (10 gm/kg) and nursery treatment (2.5 kg/acre) and soil application (2.5 kg/acre) were demonstrated jointly by NIPHM and Tobacco board officials to manage the soil borne diseases of Tobacco.

Three field day cum demonstrations on tobacco seed & nursery treatment were conducted on August 19th 2013 in which 50 farmers from different auction platforms i.e. Rajavarum (Koyyalagudem), Cherukumalli (Devarapalli), and Vellachinthlagudem (Gopalpuram) were trained. Further, six field demonstrations on soil application were conducted between 30th September to 1st October, 2013 in Gavaravaram, Kannapuram, Bodigudem, Yerrampet villages (Koyyalagudem), Vellachinthlagudem (Gopalpuram) and Cherukumilly villages (Devarapalli).

A total of 150 farmers and field officers actively participated in all field demonstrations. NIPHM officers provided hands-on practices on biopesticide application and advised about safe pest management options for Tobacco cultivation.

Additionally, from 11 to 13 December 2013 NIPHM and Tobacco Board Officers made visits to West Godavari & Prakasham districts for providing advisory service on further use of biopesticides, ecological engineering, pheromone & light traps, sticky traps for management of pests like *Spodoptera*, *Helicoverpa*, sucking pests etc. The technologies demonstrated for managing the insect pests through biointensive approaches i.e. use of *Trichoderma harzianum* and *Pseudomonas fluorescens* through seed, nursery and soil treatment and green manuring had shown reduced incidences of black shank & damping off diseases even after cyclone effect and increased plant growth in tobacco growing areas of Koyyalagudem, Gopalpuram, Deverpalli and Ongole.

The tobacco farmers were eagerly sharing their experience of biopesticides application benefits in tobacco nursery and crop production among the fellow farmers. By using *Trichoderma* and *Pseudomonas* farmers were able to reduce soil borne diseases and 3-4 chemical pesticide applications in tobacco nursery. Around 80-90% reduction in the incidence of black shank & wilt diseases and 30-40% increase in plant vigour and yield was observed in the field conditions while 2-3 chemical pesticide sprays were also reduced. On an average each farmer saved Rs.

5,000-7,000 per acre.

Farmers expressed their satisfaction on performance of biopesticides performance and assured about use of this practice in the next season in larger area.



Capacity building programmes

Pest Surveillance

A training programme on Pest Surveillance which serves as basis for Pest Risk Analysis, identify Pest Free Area (PFA) and Areas of Low Pest Prevalence (ALPP) to promote export of agricultural commodity was conducted from 3rd to 10th January, 2014. Participants were trained in the concept, methodology and types of survey and surveillance in relation to biosecurity, market access and pest risk analysis. Topics relevant to pest surveillance viz., sampling procedures, detection, identification and reporting of pests, and forecasting were also covered in the programme.



Phytosanitary treatments

A Phytosanitary treatments training programme was conducted from 9th to 23rd January, 2014. The participants were provided hands-on training in MBr and ALP fumigation, handling of equipments involved in fumigation, their specifications, calibrations, maintenance and other safety precautions. In addition, the trainees were exposed to various other intricacies pertaining to fumigation.



Plant Quarantine Procedures for Import & Export

Two training programmes on Plant Quarantine Procedures for imports and exports were conducted from 20th to 24th January, 2014 and from 24th to 28th February, 2014. The training programme covered various aspects of international conventions, national standards and procedures to be followed while importing & exporting of plants & plant materials for propagation & consumption, germplasm, biocontrol agents, soil, peat and sphagnum. Trainees were imparted hands-on experience in on-line registration through PQIS.



Pest Risk Analysis

A training programme on Pest Risk Analysis was conducted from 17th to 22nd February, 2014. PRA is the key element in international trade and in this training, various aspects viz. international conventions, standards and national regulations were dealt with major thrust on the process involved in pest risk analysis for the import of the agricultural commodities.

Forced Hot Air Treatment

A training programme on Forced Hot Air Treatment was conducted from 10th to 14th February, 2014. The programme was tailored for Phytosanitary treatment service providers in the area of Heat Treatment in line with ISPM 9 and NSPM 15. The participants were trained on various basic requirement and aspects for establishment and operation of FHAT facilities in meeting the requirements of ISPM 9 and NSPM 15.

Analysis of New Molecules of Pesticides

A training program on "Analysis of New Molecules of Pesticides" from 2nd to 11th January 2014 was conducted. Participants were trained on analysis of new molecules of pesticides using advanced techniques and equipments.

Inspection, Sampling and Prosecution

A training programme for the Insecticide Inspectors of State Department of Agriculture was conducted from 10th to 15th February, 2014 for imparting the procedures for inspection, sampling & prosecution procedures under Insecticides Act- 1968.

Pesticide Formulation Analysis

A 66 days training which is a mandatory training under the Insecticide Act 1968 and Rules 1971 for the Analysts of Government Pesticide Testing Laboratories was organized from 17th February to 22 April, 2014. Participants were trained in the techniques involved in both volumetric and instrumental analysis method of pesticide formulation.



Integrated Soil Nutrient and Weed Management and Rhizosphere Engineering

Two training programs on Integrated Soil Nutrient & Weed Management (ISNWM) and Rhizosphere Engineering were organized from 12th to 18th January and 19th to 24th January, 2014. Participants were trained in AESA, Ecological Engineering for pest management, Rhizosphere Engineering for soil health, Integrated Nutrient Management, VAM and microbial inoculants for sustainable agriculture, integrated weed management in different crops, weed surveillance, weed identification and weed vegetation analysis.



Biointensive IPM for Rice including SRI

A 15 days training programme was organized from 26th December, 2013 to 9th January 2014. Participants were trained in system of rice intensification, and in hands-on practice on planting ecological engineering flowering plants in rice field, AESA in rice and vegetable fields etc. Trainees were also provided hands-on practice on mass production of biopesticides. Trainees have comprehensively learned the Farmers Field School methodology, structure, curriculum, implementation etc.

Integrated Vertebrate Pest Management (IVPM)

A 21 days training programme on IVPM was organized from 4th to 24th February, 2014 at NIPHM. Six University scientists from AP, Punjab and Orissa were trained on several aspects of biology, and integrated management of rodents, wild boar, Monkeys, black buck etc., through class room lectures and fields level practical's.



Refresher Training on Rodent Pest Management

One on-campus training on Refresher training programs on rodent pest management was held from 21st to 27th January, 2014 and two off campus training were organized, one at Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu from 03 to 07 March, 2014, and another at Assam Agricultural University, Jorhat, Assam from 10-16 March, 2014.

The participants were given exposures on distribution of major rodent pest species, breeding profiles of rodent pests in relation to their management, crop rodent seasonal calendar and ethological parameters in relation to their management.



Capacity Building

Crop specific AESA and Ecological Engineering for pest management in Rice

NIPHM is pioneering in Agro-Eco System Analysis (AESA) based Plant Health Management (PHM) and Ecological Engineering (EE) for Pest Management. Keeping in view the importance of sustainable pest management in rice crop, NIPHM organized crop specific season long training programme on AESA, Ecological Engineering for pest management in Rice from 4/12/2013 to 3/3/2014 (90 days). Twenty six participants from Tamil Nadu and Andhra Pradesh attended this training programme. NIPHM adopted non formal education, learner centered discovery process, participatory training methodologies and group dynamics exercises for imparting the skills to the trainees.



In this process the participants gained hands on experience by raising rice crop with different management practices with Ecological Engineering approaches, System of Rice Intensification (SRI), Modified SRI, using drumseeder for sowing etc. Participants were also imparted skills in On-Farm production of biocontrol agents viz., *Bracons*, *Spiders*, *Reduviid*, *Trichogramma*, *Trichoderma*, *Pseudomonas*, *entomopathogenic fungi* and *nematode*.



The participants conducted various short term experiments and they observed insect damage compensation potential of rice upto 25% with in vegetative stage. The participants maintained insect zoo, on Aphids Vs Lady beetle (12: 1), *Corcyra* Vs *Reduviid* (4:1) and Green leaf hopper vs jumping spider (6:1). They recorded 13 types of insect pests and their corresponding 16 types of natural enemies and 3 types of neutrals in rice eco-system accounting P : D ratio was 1:1.07. The high abundance of Lady bird beetles, spiders, wasps, syrphid flies, etc. are due to presence of sunflower, cow pea, okra, onion, maize and marigold raised on the bunds as ecological engineering approach. The participants also studied the affect of systemic chemical pesticide on crop defenders by simulation experiment with red dye.

It was observed that by adopting SRI the reduction in seed rate, irrigation water and fertilizers was realised. However, the plant growth attributes like plant height, number of leaves, root length, no. of grains per panicle, etc. were significantly high in SRI and MSRI compared with drumseeder and farmers practice.

As a result of the training programme the participants developed their skill and knowledge in AESA based PHM and EE for PM as well as on-farm production of biocontrol agents.

**Fundamentals of Plant Health Management for Plant Health Doctors**

In view of the importance of Plant Health Management, NIPHM organized 21 days Training Programme from 17.01.2014 to 06.02.2014 on "Fundamentals of Plant Health Management for Plant Health doctors" to create a pool of master trainers on various issues of Plant Health Management. The trainees were exposed to Agro-Ecosystem Analysis based plant health management in conjunction with ecological engineering for pest management, detection and diagnosis of pests, integrated disease management, integrated nematode management, integrated weed management, etc., They were trained in mass production of biocontrol agents and microbial biopesticides.



The participants visited the field and adapted the Agro-Ecosystem Analysis procedures in different crops such as rice and vegetables. They also worked out the pest: defender ratio, plant compensation ability, insect zoo studies, etc. They visited the Ecological Engineering models in Rice and Cabbage at NIPHM farm and also worked out the models of Ecological Engineering for different crops in their region based on the literature available on attractant/repellent plants.



They were trained in differentiating biotic and abiotic damage symptoms as well as detection and diagnosis of damage by insects, diseases, nematodes, etc., They were trained on mass production of host insect *Corcyra* and parasitoids viz., *Trichogramma*, *Chelonus*, *Goniozes* etc., and predators such as *Chrysoperla*, *Reduviids* and spiders. They also learnt the on-farm production of microbial biopesticides viz., *Trichoderma*, *Pseudomonas*, EPF by using low cost inoculation chamber. They learnt the techniques of mass production of EPN as well as VAM and AM which aids in Rhizosphere Engineering and in turn promotes the Plant Health. Thus the participants were made experts in various aspects of Plant Health Management so as to serve them as an effective plant health doctors and train others to get expertise in Plant Health Management.





Republic Day was celebrated by NIPHM Officers with great enthusiasm. Dr. K. Satyagopal IAS Director General NIPHM hoisted the National Flag.

Appropriate Pesticides Application Techniques and Farm Level Storage Structures

A training programme was conducted from 2nd to 9th January, 2014. Topics on role of AESA based PHM in safe and judicious use of pesticides, principles of pesticide application techniques, high, low & ultra low volume techniques, nozzles and its classification, calibration, weed control techniques, pesticide formulation and compatibility, judicious use of rodenticides, use of Bio-pesticides in pest management, storage problems of food grains and their management technologies etc. were covered. Hands-on practices on selection of suitable equipment and operation of the equipment, selection of suitable nozzles and calibration of the sprayers were also provided to the trainees.

Sanitary and Phytosanitary (SPS) Awareness workshop for the Officials of Sri Lanka

Department of Agriculture, Forest Fisheries (DAFF), Australia in collaboration with NIPHM has been building the capacity of Plant Quarantine functionaries in South Asian region. As a follow up to the programme held in New Delhi during May, 2013, DAFF, Australia requested NIPHM to collaborate in organizing SPS Awareness Workshop



at Colombo, Sri Lanka during 11-13th March, 2014. Dr. K. Satyagopal, Director General, and Dr. N. Sathyanarayana, Director (Plant Biosecurity) represented NIPHM in organizing SPS Awareness Workshop at Sri Lanka. Twenty two Officials participated in the workshop, which

focused on Plant health, Animal health and Food Safety in the Global Trading Environment, Risk Management options along the biosecurity continuum, Sampling, Systems Approach in pest management and Phytosanitary Treatments.



Safe and Judicious Use of Pesticides

Training on safe and judicious use of pesticides was conducted from 3rd to 10th March 2014. Participants were trained in AESA based PHM in safe and judicious use of pesticides, principles of pesticide application techniques, high, low & ultra low volume application techniques, nozzles & its importance, calibration, farm based production techniques on *Trichoderma* and *Pseudomonas*, 3 Reductions and 3 Gains theory, mass rearing of *Chrysoperla*, *Trichogramma*, spiders and Redvids, pesticide formulation and their classification, quality control of pesticides, judicious use of rodenticides and pesticides safety precautions were covered. Practicals were organized on application techniques, selection, calibration & operation of suitable pesticide application equipment and their parts, biocontrol agents production and ecological engineering etc.



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