

# Standard Operating Procedure (SOP) on National System for Pest Surveillance and Response Mechanism



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**Ministry of Agriculture & Farmers Welfare**  
**Department of Agriculture & Farmers Welfare**  
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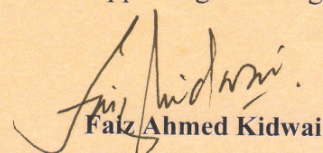
## FOREWORD

Agriculture forms backbone of Indian economy and playing a significant role in the Gross Domestic Product (GDP). However, pests and disease attacks on crops cause substantial economic losses to farmers. Generally, farmers apply large quantities of pesticides to control pests and diseases throughout various growth stages of crops, either on a predetermined schedule or upon observing damage symptoms. The Indiscriminate uses of chemical pesticides cause ecological imbalances, environmental pollution, pesticide resistance, pest resurgence and residual pesticide effects.

Integrated Pest Management (IPM) is a globally accepted strategy for promoting sustainable agriculture. IPM is a broad ecological approach that aims to keep pest population below economic injury levels by employing all the available methods of pest management such as cultural, mechanical, biological, legislative and lastly, chemical methods in a compatible manner. Initially IPM allows chemical pesticide application when pest population reached at economic threshold levels. This approach has shifted to more ecologically sustainable Agro-Eco System Analysis (AESA) based decision making for selection of IPM techniques. The IPM approach advocates the utilization of alternative pest management techniques like cultural, mechanical and biological methods prior to the use of chemical pesticides.

As part of the ongoing efforts to enhance pest surveillance in country, the Department of Agriculture & Farmers Welfare (DA&FW) is developing a National Pest Surveillance System (NPSS) incorporating AI/ML technologies to improve the efficiency and accuracy of pest monitoring/ surveillance for issuance of timely advisories. The Directorate of Plant Protection Quarantine & Storage (DPPQ&S) has prepared the Standard Operating Procedure (SOP) on the National System for Pest Surveillance and Response Mechanism to implement a uniform pest surveillance system across the country for pest and disease monitoring and timely issuance of advisories for pests and disease to the farming community and extension/field functionaries. This SOP also defining the roles and responsibilities of various stakeholders (DPPQS, State Agriculture/Horticulture Departments, ICAR Research Institutes, KVK's, SAU, etc.)

I hope this SOP will serve as a Ready Reckoner for all stakeholders involved in plant protection activities in India, ensuring effective implementation of pest surveillance activities across the country, thereby protecting crops from pest attacks and supporting farming community for their betterment.

  
Faiz Ahmed Kidwai

Additional Secretary (Plant Protection)

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## PREFACE

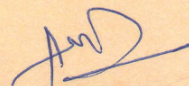
IPM is a science-based, decision-making process that integrates biological, cultural, physical, and judicious use of chemicals to minimize damage from pests in a way that minimizes overall economic, health and environmental risks.

During the late 1990s, FAO started advocating Agro-Ecosystem Analysis (AESA) based IPM practices. Experience across different countries has demonstrated that AESA, which incorporates ecological principles and relies on the balanced approach that is maintained by biotic factors in an ecosystem, has resulted in a reduction in the cost of production and increase in yield. AESA based IPM also emphasizes active participation of farmers and promotes experiential learning and discovery-based decision making by farmers. AESA based IPM, in conjunction with ecological engineering for pest management, promotes bio-intensive strategies against current chemical-intensive approaches, while retaining the option to apply chemical pesticides judiciously as a measure of last resort.

The National Pest Surveillance System is an innovative initiative of the DA&FW for pest and disease surveillance on important crops which enables pest identification and issuance of time bound advisories for pests/disease management. NPSS offers GIS-based pest information, mobile apps, and an advisory portal for timely pest management guidance to the farmers and field functionaries. To ensure effective nationwide implementation, the DPPQS has developed Standard Operating Procedures (SOP) for the **National System for Pest Surveillance and Response Mechanism for domestic, invasive and transboundary Locust pest.**

I appreciate the diligent efforts of resource persons of DPPQS in developing the SOP, which outlines stakeholder roles, responsibilities, pest response mechanisms, contingency plans for pests like locusts and timelines for surveillance activities. Also, I convey my sincere thanks to all the ICAR Research institutes and State Agriculture Departments for providing valuable inputs in the SOP.

I hope this SOP will serve as a ready reference/ comprehensive guide for all the stakeholders and support the effective implementation of pest surveillance activities and timely managing the pest incidence in the country.



Dr. J. P. Singh

Plant Protection Adviser

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# **National System for Pest Surveillance and Response Mechanism**

## **I. Objective**

To implement uniform pest surveillance system across the country for pest (insect pests, diseases, weeds, including locusts) monitoring, for forecasting pest outbreak and timely issuance of advisories to the farming community and extension/field functionaries for the pest management. Modern technologies like Artificial Intelligence (AI) and Machine Learning (ML) will be employed in the process in addition to expertise of various stakeholders such as Central Government, State Governments, ICAR Research Institutes, SAU, KVK's, Farmers etc. involved in plant protection in India.

Monitoring of invasive pest incursion and timely action on preventing spread of the pest and subsequent eradication programs.

## **II. Introduction**

Pest Surveillance refers to the constant watch on the population dynamics of pests, its incidence and damage on each crop at fixed intervals to forewarn the farmers to take up timely crop protection measures.

In India, the pest surveillance is being undertaken to monitor and forewarn the outbreak of insect pests, diseases, weeds, etc. During the process, evaluation of potential bio-control agents and their population buildup in relation to pest population is also being monitored in order to make decision on employment of various pest control methods.

Pest surveillance is one of the mandates of the DPPQS & ICAR, and State Agriculture/Horticulture Departments, KVK, SAUs, AICRP Centers is the with an aim to provide an early advisory/ warning to the farmers and other stakeholders involved in plant protection activities. All the stakeholders involved in plant protection activities keep regular watch on pest outbreaks and incursion of invasive pests.

Presently, the field surveys are being carried out physically on standing crops during growing seasons and further reports are being generated for taking plant protection activities. These are not only time consuming but also less effective. Therefore, there is an urgent need to develop contingency plans to forewarn the pest outbreak using modern technologies and clearly defined roles and responsibilities of different stakeholder for preventing spread of pests and subsequent eradication programs, where ever required to reduce their impacts on agricultural, environmental, cultural and social assets.

Developing contingency plans provides the opportunity to consider requirements for an emergency response and to prepare for an outbreak by having agreed procedures, roles, responsibilities, budgets, treatments, etc. in place. It also provides additional time for deliberation, evaluation and research necessary to ensure that an eradication programme is well designed and can be executed quickly and effectively. Knowledge gained from previous successful eradication programme can also be useful for developing contingency plans or judging the feasibility of eradication programme under consideration. The contingent plan for locusts warning and emergency response is **Appendix 1** to this SOP.

### **Important terms used in Pest Surveillance and Pest Monitoring**

**Pest survey:** Pest survey is a detailed collection of pest population information at a particular time in a given area or an official procedure conducted over a defined period of time to determine the characteristics of a pest population or to determine which pest species occur in an area.

**Pest Surveillance:** The regular surveys of same place or locality at consistent intervals to assess the changes in population dynamics of pest species, natural enemies over a time.

**Pest Monitoring:** Pest monitoring involves determining number and life stages of pest present in the location only. It is considered the first step helping you to know what is causing damage and when to act.

**Invasive Pests-**Invasive species, alien species, exotic pests, or invasive alien species, are common names that categorize non-native animals, insects, microbes, diseases, or plants (weeds) that are pests. Invasive Alien Species are non-native or exotic organisms that occur outside their natural adapted habitat and dispersal potential & they become established in natural or semi natural ecosystems or habitat and threaten native biological diversity.

### **Types of Survey**

There are various types of surveys

- A. **Qualitative Survey:** For pest detection.
- B. **Quantitative Survey:** Defined numerically in abundance of pest population in time and space to predict population trend.
- C. **Fixed Plot Survey:** Divide one-acre plot into five micro plots of meter square area and marked one each in four corners(one meter inside field from bund) and fifth in the centre. Periodical assessment is done in these chosen micro plots. These plots are to be kept free from chemical spray till pest count attains ETL status.
- D. **Rapid Roving survey:** It is conducted in every 7-10 days interval in randomly fields along the predetermined route. Survey observations are recorded from west corner to

diagonal walk. A minimum of 200-250 km or 20 to 25 spots are covered in a day (depend on the topography of area/route). Observations are done at least at every 10 km and on both sides of the road. The observations are performed after entering at least 100 meter inside the field. Forewarning if required is done on the same day during survey period.

- E. Random Survey for Invasive pest:** It is conducted near to major import point of entries as well as nearby post entry quarantine facilities to ascertain emergence of any new pest.

### Objectives of Pest Surveillance

Pest Surveillance is under taken for the following purposes: -

- To monitor regularly and forewarn the outbreak of pest (insect pests, diseases, nematodes, weeds, etc.) and assessing potential bio-control agents population buildup through Agro Eco System Analysis (AESA).
- To monitor the locust population in the Scheduled Desert Area (SDA) of Rajasthan and Gujarat States of India.
- To know the occurrence of pests and provide basis for pest identification, listing of pests, pest status, pest categorization, to conduct risk analysis and to earmark the pest prone and pest free areas as a pre-requisite for phytosanitary measures for safe global trade.
- Timely detection of invasive pest incursion, restriction on their spread and timely action on eradication of them.

### Advantages of Pest Surveillance

- To assess pest population dynamics and nature of damage at different growth stages of crops.
- To assess natural enemies' population dynamics and their build up at different growth stages of crops.
- To study the influence of weather parameters on pest & their natural enemies population build up.
- To study pest status change on a particular crop.
- To assess abundance of natural enemies and their influence in pest management on various crops.
- To evaluate effect of new cropping pattern and varieties on pest and natural enemy population.
- To determine effect of agricultural management practice on pest trends.

- To alert all stake holders on pest outbreaks.
- To develop IPM package of practices for the pest management.

### **Outcome of Pest Surveillance Action**

- Early detection of pest occurrence, outbreaks and upsurges.
- Quick response with suitable pest management strategy, before the pest causes economic loss.
- For earmarking of pest endemic, hot spots and pest free areas.
- For making forewarning and issuing of timely advisory to farmers and State Governments.
- Timely management of pest emergencies.
- Timely ascertaining the emerging pest problems.
- Checking further spread of pest in to the new areas.
- Adopting pro-active steps for expected pest problems.
- Ensuring availability of approved inputs for pest management/ control in to the requisite areas.
- Suggesting delimiting survey for new invasive pest incursion, regulation control and restrict movement & eradication plan.
- Monitoring and implementation of system approach as a phytosanitary measure to promote pest free trade

### **Mapping of pest/disease hotspots**

Pest hotspots are the area where any pest occurs regularly in each season on particular crop. The mapping of such hotspots in each major grown crop facilitates the stakeholders in planning and execution of suitable pest management strategy. Presently, the outcome of rapping roving survey is only on pest status on surveyed crop in particular season which is not enabling the stakeholders in understanding of pest incidence pattern every year on a particular crop. Hence, mapping of pest hotspots including that of locusts in SDAs will help in early warning to farmers about pest incidence thereby reducing pesticide consumption.

**Existing system of pest surveillance carried out by stakeholders DPPQS-CIPMC's, State Agriculture/Horticulture Departments, SAUs, KVK, ICAR Institutes, and AICRP Centre's**

**1. Planning and Route Identification:** Prior to the onset of the cropping season (Kharif or Rabi), based on pest history, crop pest survey routes are being finalized in the respective jurisdiction. These routes are planned to cover the major crops grown in the states and are planned to optimize efficiency and coverage. Similar surveys are being in the Scheduled Desert Areas of Rajasthan and Gujarat by the LCIPMC.



**2. Survey Team:** The survey teams are finalized for undertaking pest surveillance programs. These teams possess knowledge of pests & equipped to conduct pest surveillance activities as per requirement of the areas they assigned. Besides, joint pest surveillance team (s) comprising of DPPQS, ICAR, State Agriculture Department & SAU are also being constituted as and when need arises.

**3. Frequency and Coverage:** Presently, Pest Surveillance is conducted by CIPMCs periodically to cover the defined routes throughout the crop season, with a minimum interval of seven days between each survey. The survey routes aim to cover larger areas of major crops of the state and a minimum of 200-250 kilometers covered in a day. Efforts are being made to cover major crops and the hot spots.

**4. Observations:** During the survey, observations on pest incidence are recorded at every ten kilometers, on both sides of the route. The survey team enters fields to observe pest population and their damage to make comprehensive assessment. Broadly, four types of intensities are used for referring pest/disease situation i.e., trace (negligible pest intensity), low (below ETL), moderate (near ETL), and high (above ETL).

**5. Rapid Roving Survey:** It covers randomly selected spots and is performed at regular intervals to provide timely insights into pest dynamics. It is conducted during the season to cover hot spots in randomly selected fields along the predetermined route. A minimum of 200-250 Km. or 20 to 25 spots are covered in a day (depend on the topography of area/route). Survey observations are recorded from a corner to diagonal walk. Observations are done at least at every 10 kilometers distance and on both sides of the route. The observation is performed after entering at least 100 meters inside the field.

**6. Forewarning and Advisory Issuance:** Whenever necessary, forewarning is issued on the same day during the survey period based on observed pest incidence. These advisories provided to the farmers and respective state authorities with timely information to take necessary pest management/ control measures, as the case may be.

### III. Challenges in current pest surveillance system

- Present surveillance system is unable to cover entire cropping area due to insufficient numbers of pest surveillance scouts to cover the large area in the states.
- Lack of desired coordination & collaboration among various key stakeholders involved in pest surveillance and monitoring activities.
- Broadly 4 types of intensities are used for referring pest/disease situation i.e, trace (negligible pest intensity), low (below ETL), moderate (near ETL), and high (above

ETL) currently by CIPMCs. However, crop wise/pest wise scientific standards are to be outlined for pest surveillance.

- ETL for all pests are not available in the country. Existing ETLs are required to be updated in respect of many pests.
- Lack of validated and harmonized pest surveillance protocol to be followed by all the stakeholders for timely issuance of advisory.
- There is no nodal point at national level on pest surveillance. National Coordination point (Nodal) for pest surveillance will help in timely dissemination of information on pest outbreak and issuance of advisories on emergency action with inputs from all relevant stakeholders.
- Non-employment of latest digital technologies such as AI&ML in pest surveillance programs.
- Insufficient infrastructure w.r.t. technical manpower, infrastructure and budget for conducting pest surveillance activities.
- Unable to detect new invasive pest incursion on time.

#### **IV. National Committee for Pest Surveillance and Response Mechanism**

Keeping in view the current challenges faced in pest surveillance system there is need to constitute national level committee for strengthening of pest surveillance system in the country.

##### **Proposed National Committee on Pest Surveillance and Response Mechanism.**

1. Additional Secretary, Plant Protection, DA&FW, Krishi Bhavan, New Delhi- **Chairman**
2. Joint Secretary, Plant Protection, DA&FW, Krishi Bhavan, New Delhi- **Vice Chairman**
3. Agriculture Commissioner, DA&FW, Krishi Bhavan, New Delhi- **Member**
4. Plant Protection Adviser, DPPQ&S, Faridabad- **Member**
5. Deputy Director General (Agri. Extension) ICAR, New Delhi- **Member**
6. Assistant Director General, PP&BS, ICAR, New Delhi- **Member**
7. Additional Plant Protection Advisor (IPM),DPPQ&S, Faridabad- **Member Secretary**
8. Horticulture Commissioner, DA&FW, Krishi Bhavan, New Delhi- **Member**
9. The Director General, NIPHM, Hyderabad
10. Representative, ICAR-NCIPM, New Delhi- **Member**
11. Representative, ICAR-IASRI, New Delhi- **Member**
12. Director, ICAR-NBAIR, Bengaluru- **Member**
13. Director, ICAR-NBAIM, Mau, U.P- **Member**
14. Director, ICAR- Directorate of Weed Research, Jabalpur, M.P-**Member**

15. Director, ICAR-NCIPM, New Delhi- **Member**
16. Agriculture Production Commissioner/Director of Agriculture -All States/UT Government.
17. Director of Horticulture - All States/ UTs Government
18. Vice Chancellors/ Director (Extension) of All Agriculture/Horticulture Universities in the country.
19. Project Coordinators, all AICRPs related to various pest/bio-control agents/ honey bees
20. Representatives nominated by Director of Crop specific ICAR Research Institutes.
21. Representatives from crop specific Boards like Coffee Board, Tea Board, Rubber Board, etc.
22. Representative of Private IT Partners

### **Mandates of the National Committee for Pest Surveillance and Response Mechanism**

The committee will be the Apex body to provide link between Central Government, State Governments, Research Organizations, Policy Makers, Extension functionaries, Administrators and Farmers in the country and shall be functional with the following mandates: -

1. Advice suitable provisions in the NPSS portal to ensure relevant contribution of the stakeholders on pest incidence related inputs, inputs on natural enemies and timely issuance of advisory.
2. Seek response from the States and other stakeholders on specific pest reports through NPSS.
3. Determine if the specific pest incidence required formation of response teams to verify the situation on the ground.
4. Advise the response team for preparation of plan and give recommendation for further action.
5. Recommend budget provision for execution of response work plan.
6. Prepare strategy to tackle the new pest introduction in the country.
7. Issue recommendation on pest eradication programme if required in case of any specific pest.
8. Exchange of information on plant protection activities in the country with various stakeholders and strengthen networking on effective crop/ pest specific Integrated Plant Health Management (IPHM) strategies.
9. Regularly suggest for improvement/strengthening of NPSS.
10. Progress review of National Pest Surveillance System and Response Mechanism at half yearly interval.
11. Develop mechanism for periodical impact assessment Pest Surveillance and Response Mechanism.

12. Act as supervisory body to coordinate with state level committees in planning all the activities in case of pest emergency.
13. Advisory legislation and restricting movement of new invasive pest incursion.
14. Advisory for eradication plan for new invasive pest incursion.

## **V. Roles and responsibilities of various Stakeholders**

For effective implementation of surveillance & response mechanism for across the country, the roles and responsibilities of various stakeholders involved in plant protection activities in India is very crucial for timely action to manage pest and restrict spread of invasive pest by coordinating with each other. The role and responsibilities of various stakeholders are as follows

### **1. Plant Protection Division, DA&FW**

- Overall monitoring of the National Pest surveillance System& Response Mechanism at the National level.
- Conducting periodic reviews and evaluations of the systems progress.
- Administrative and financial assistance for implementation of the system.

### **2. DPPQ&S**

- **Establishment of Pest Surveillance & Response Mechanism Cell** at DPPQ&S, Headquarters, Faridabad, which will monitor the implementation of SOP.
- To coordinate with the PP Division, DA&FW and other stakeholders for effective implementation of National Pest Surveillance System & Response Mechanism in the country.
- Identify space and manpower requirement to station the hardware/software/ infrastructure requirements and subsequent maintenance work to run the NPSS in long run.
- Preparation of master registries of various crop pest combinations to be added in to NPSS and their approved management/ control practices.
- Assessment and advice on National Pest Surveillance System as per functional requirement from time to time.
- Provide information for updating master database for pest surveillance to IT partners.
- Organizing of monthly review meeting with all stakeholders.
- Deployment and training of progressive farmer/Krishi Sakhis for pest surveillance through NPSS.
- Promotion of IPM latest technologies at national level through organizing various HRD programmes.

- Data analysis and creation of pest incidence repository.
- Communicate to State for ensuring availability of approved plant protection inputs.
- Issuance of pest alert on new invasive pest incursion.
- Planning delimiting survey & eradication plan.
- Notification of regulation & restrict spread of invasive pest.

### **3. Regional Central IPM Centers (RCIPMCs)/Central IPM Centers (CIPMCs) and Locust Regional Central IPM Centers/ Locust Central IPM Centers**

- Act as a nodal point in the State for implementation of NPSS in coordination with all stakeholders.
- To carry out pest surveillance through trained scouts.
- To monitor pest surveillance data uploaded by scouts (progressive farmers, CIPMC's officials, State Agriculture/Horticulture Department functionaries, KVK's etc.) in the state for planning of plant protection activities.
- Coordination with State Agriculture/Horticulture Departments, SAU's, KVK for strengthening and creating awareness on NPSS activities in the state.
- Conducting weekly review of pest surveillance data through NPSS web portal and issuance of advisories through portal and further awareness in the affected areas.
- Training to progressive farmers/Krishi Sakhis for deployment in NPSS.
- Creation of login credentials of trained State Agriculture/Horticulture Department functionaries, progressive farmers/Krishi Sakhis.
- Preparation of master registries of pests for additional crops to be added in NPSS to cover more crop/area under pest surveillance.
- Maintenance of database on active scouts of NPSS in the state and modification of such database time to time.
- Coordinate State Advisory Group engaging experts of SAU, Crop based ICAR Institutes, KVK & State Agriculture/Horticulture Department for issuance of advisories time to time.
- Conduct monthly review meeting on current issues related to pest incidence and outbreaks, and planning on plant protection activities with all stakeholders.
- Act as focal point for dissemination on any pest alert in the state which requires extensive survey and constitution of central team for further course of action.
- Promote and implement IPM programmes that emphasize sustainable and environmentally friendly pest control methods. Provide guidance to farmers on the integrated use of biological control, cultural practices, and judicious use of chemical control measures.

- Establish and maintain surveillance systems to monitor the presence and spread of invasive pests in agricultural and horticultural areas. Conduct regular surveys to assess the severity of pest infestations and identify new threats.
- Implement mechanisms for early detection of invasive pests, encouraging farmers and the community to report any unusual pest activity promptly. To develop communication channels and reporting systems to ensure timely information flow between farmers, extension workers, and the related State Government departments.
- Disseminate information and guidelines to farmers on identifying, monitoring, and managing invasive pests. Organize training programs, workshops, and awareness campaigns to educate farmers on pest control measures and best practices.

#### **4. ICAR-NCIPM**

- Preparation of critical master data, formats and registries
- Design and Development of ICT based pest surveillance and advisory system.
- Development of Pest management knowledgebase.
- Implementation and functional maintenance of the system.
- Imparting training to the project staffs.
- Development of CNN model of pest identification.
- Maintain data retrieval mechanism and data security issues and access to concerned stakeholders.
- Sharing of latest IPM techniques among stakeholders

#### **5. ICAR-IASRI**

- Develop AL&ML based pest identification models for NPSS sorting of image downloaded from NPSS portal for developing pest identification models.
- Image preprocessing and preparation of datasets.
- Development, training and testing of AI-based models of pest detection.
- Preparation APIs to be integrated into NPSS so as to access the AI-based models of pest detection.
- Technical guidance on AI/ML

#### **6. Other ICAR Institutes**

- ICAR Institutes plays a vital role in research, development and promotion of pest smart bio-intensive IPM technologies and making linkages with commodity based crop research Institutes, AICRP/ AINP.
- To support NPSS stakeholders in Information and Communications Technology (ICT) based surveillance, monitoring and management of crop pests including insect

pest, mites, weeds and diseases caused by plant pathogens with due consideration to the contribution of natural enemies in managing the agro ecosystem.

- Play active role in crop/ pest specific advisory committee group for decision making in plant protection activities.
- Contribute to pest surveillance system through NPSS by ICAR sub centers situated across the country.
- Exchange of latest validated IPM technologies as well as information on resistant varieties to all other stakeholders for immediate implementation.
- Input and coordination with all AICRP centers for providing real time pest incidence data.

**6.1 NBAIR:-** The National Bureau of Agricultural Insect Resources (NBAIR) is a premier institute under the Indian Council of Agricultural Research (ICAR) that focuses on research and management of agricultural insect pests. The role of NBAIR in dealing with pests would likely involve several key activities:

- **Identification of pest:** This includes the identification of new and emerging pest threats, tracking their spread, and assessing their impact on crops.
- **Research and Documentation:** Conduct research to understand the biology, ecology, and behavior of pests including invasive pest. This information is essential for developing effective management strategies against important insect pests utilizing their bio control potential.
- **Risk Assessment:** The institute might be involved in assessing the risk posed by invasive pests to agricultural systems. This involves evaluating the potential economic and ecological impacts of these pests and recommend risk management strategy.
- **Management of invasive pest's:** NBAIR may contribute to the development and promotion on management strategies of the invasive pest species. This approach typically involves a combination of biological, cultural, mechanical, and chemical control methods to minimize the impact on the environment.
- **Classical Biological Control:** In case of incursion of exotic pests, may employ classical biological control in the country. All the necessary efforts and coordination with the respective country, PEQ for imported natural enemy, mass production, field release and necessary training on mass production to other stake holders.
- **Looming threats:** Develop a database on looming threats with respect to insects.

- **Capacity Building:** NBAIR may provide training and extension services to farmers, agricultural professionals, and policymakers on the identification, monitoring, and management of invasive pests.

**6.2 NBAIM:** The National Bureau of Agriculturally Important Microorganisms (NBAIM) in India is an institution under the Indian Council of Agricultural Research (ICAR) that focuses on research and development related to agriculturally important microorganisms. While NBAIM's primary emphasis is on microorganisms, it may have a role in addressing invasive pests indirectly through microbial-based approaches. Here are some potential roles that NBAIM might play in relation to invasive pests:

- **Identification of Pathogens:** This includes the identification of new and emerging pathogen threats, tracking their spread, and assessing their impact on crops.
- **Research and Documentation:** Conduct research to understand the biology, ecology, and behavior of new invasive pathogens. This information is essential for developing effective management strategies against important diseases utilizing their bio control potential.
- **Risk Assessment:** The institute might be involved in assessing the risk posed by invasive pests to agricultural system. This involves evaluating the potential economic and ecological impacts of these pests and recommend risk management strategy.
- **Management of invasive pest's:** NBAIM may contribute to the development and promotion on management strategies of the invasive pest species. This approach typically involves a combination of biological, cultural, mechanical, and chemical control methods to minimize the impact on the environment.
- **Looming threats:** Develop a database on looming threats with respect of pathogens.
- **Capacity Building:** NBAIM may provide training and extension services to farmers, agricultural professionals, and policymakers on the identification, monitoring, and management of invasive pest.

**6.3 Directorate of Weed Research:** A premier institute under the Indian Council of Agricultural Research (ICAR) that focuses on conduct research for developing viable weed management technologies in crop and non-crop situations, Coordinate network research in weed management in different agro-ecological regions, Repository of information in weed science and act as a vital role identification of invasive weeds and their management.

- **Identification of weed species:** This includes the identification of new and emerging weed threats, tracking their spread, and assessing their impact on crops.



- **Research and Documentation:** Conduct research to understand the biology, ecology, and behavior of new invasive weeds. This information is essential for developing effective management strategies against important weed.
- **Risk Assessment:** The institute might be involved in assessing the risk posed by invasive weeds to agricultural system. This involves evaluating the potential economic and ecological impacts of these weeds and recommend risk management strategy.
- **Management of invasive weeds:** DWR may contribute to the development and promotion on management strategies of the invasive weed species. This approach typically involves a combination of biological, cultural, mechanical, and chemical control methods to minimize the impact on the environment.
- **Looming threats:** Develop a database on looming threats with respect to weeds.
- **Capacity Building:** DWR may provide training and extension services to farmers, agricultural professionals, and policymakers on the identification, monitoring, and management of invasive weed species.

**7. State Agriculture and Horticulture Departments:** State Agriculture and Horticulture Departments play a pivotal role in effective implementation of NPSS in the state

- To carry out pest surveillance through trained scouts.
- To monitor pest surveillance data uploaded by scouts (progressive farmers, State Agriculture/Horticulture Department functionaries,) in the state for planning of plant protection activities.
- Conduct regular surveys to assess the severity of pest infestations and identify new threats in coordination with CIPMC's.
- Implement mechanisms for early detection of invasive pest, encouraging farmers and the community to report any unusual pest activity promptly. To develop communication channels and reporting systems to ensure timely information flow between farmers, extension workers, and the department.
- Establish and maintain surveillance systems to monitor the presence and spread of invasive pests in agricultural and horticultural areas. Conduct regular surveys to assess the severity of pest infestations and identify new threats.
- Organize training programs, workshops, and awareness campaigns to educate farmers on pest control measures and best practices.
- Promote and implement IPM programs that emphasize sustainable and environmentally friendly pest control methods. Provide guidance to farmers on the integrated use of biological control, cultural practices, and judicious use of chemical control measures.

- Collaborate with farmers, agricultural cooperatives, industry associations, and non-governmental organizations to create a collaborative and coordinated approach to pest management. Facilitate partnerships with private sector entities for the development and distribution of pest-resistant seeds and other control measures.
- Expert from State Agriculture and Horticulture Departments will play important role in advisory group for dissemination of advisories time to time.
- Encouraging the State Agriculture and Horticulture Departments functionaries for implementation pest surveillance through NPSS.
- Encourage farmers to provide feedback for further improvement of NPSS.
- Coordination for strict action on restricting spread of invasive pest and awareness among state functionaries on

**8. State Agriculture Universities:-** State agriculture universities play a crucial role in supporting sustainable agricultural practices.

- Develop close coordination with CIPMC in effective implementation of NPSS in the state
- Conduct research on the biology, ecology, and behavior of various pests to better understand their characteristics and vulnerabilities. Explore innovative and sustainable pest management strategies, including biological control, resistant crop varieties, and cultural practices
- Train agricultural professionals, researchers, and extension workers in the latest technologies and methodologies related to pest management. Build the capacity of farmers to implement sustainable and environmentally friendly pest control measures.
- Develop area and crop specific IPM package of practices.
- Encourage farmers to use only approved pesticides, if required.

**9. KVKs:** Krishi Vigyan Kendra's (KVKs) are agricultural extension centers established by the Indian Council of Agricultural Research (ICAR) to bridge the gap between researchers and farmers.

- **Farm Advisory Services:** Provide timely and location-specific advice to farmers regarding the identification, monitoring, and management of pest including invasive pest.
- Disseminate information on integrated pest management (IPM) practices to reduce reliance on chemical pesticide.
- **Demonstrations and Trainings:** Conduct on-farm demonstrations to showcase effective pest management techniques and technologies.

- Organize awareness programs and workshops for farmers on use of NPSS for pest identification, monitoring, and sustainable pest management measures.
- **Surveillance and Monitoring:** Collaborate with local farmers and communities to monitor the presence and spread of the various pests. Establish community-based surveillance systems and encourage farmers to report pest incidents promptly through NPSS.
- **Community Mobilization:** Mobilize local communities and farmers to form groups or cooperatives to report pest incidence through NPSS and collectively address pest challenges. Facilitate community-based initiatives for pest control and sustainable agriculture.
- **Feedback Mechanism: Encourage farmers to contribute to the** feedback mechanism so as to continuously assess the effectiveness of pest management advice and technologies provided to farmers.

## 10. Private Partners

- Image preprocessing and preparation of datasets on specific crop pest combinations
- Development, training and testing of AI-based models of pest detection
- Preparation APIs to be integrated into NPSS so as to access the AI-based models of pest detection.
- Preparation of pest management content to be approved by DPPQ&S
- Diagnosis and sorting of image downloaded from NPSS portal
- Further training and testing of their AI-based models of pest detection
- Providing APIs to be integrated into NPSS so as to access their AI-based models of pest detection.

## VI. Constitution of State level & District level committee

For effective implementation of pest surveillance system at state and district level the followings committees will play major role in coordination with all stakeholders for pest management as well as to coordinate with DA & FW:

### State Level Pest Surveillance Committee

The state level committee comprises the followings members

1. APC/ Principal Secretary (Agriculture), State Government - **Chairman**
2. Directors of Agriculture/Horticulture Departments
3. Director (Extension) of All Agriculture/Horticulture Universities
4. Representatives nominated by Directors Crop specific ICAR research Institutes
5. Zonal Head KVK

6. Representative from ATMA
7. Officer In-charge, CIPMC/LCIPMC

### **District Level Committee**

The district level committee comprise followings member

1. District Collector - **Chairman**
2. Joint Director of Agriculture/Horticulture
3. Director (Extension) of All Agriculture/Horticulture Universities
4. Head KVK
5. Representative from ATMA
6. Officer In-charge, CIPMC/LCIPMC.

### **Role and responsibilities of State level & District level committee**

- Act as coordinator with National committee in finalization of response mechanism in case of pest epidemics/invasive pest incursion.
- Receive major pest incidence reports from all input providers and will take suitable plant protection activities in the state
- Determine if the incidence required formation of response team and same to be communicated to National committee
- Progress review of National Pest Surveillance System and Response Mechanism at monthly interval.
- Sensitization to farming community on current pest issues.
- Support from State research organizations (SAU, ICAR, KVK etc.) for planning pest management practices.
- Coordinate in surveillance activity by integrating all the stakeholders.

**Civic Administration Role:** The role of a District Collector in managing the invasion of pests is crucial for ensuring the well-being of the agriculture sector and the overall economy of the district. Here are some key responsibilities and actions that a District Collector might undertake in the context of a pest invasion:

- ✓ **Information Dissemination:** Communicate information about the pest invasion to farmers, local communities, and relevant stakeholders through various channels, such as public announcements, social media, and local newspapers. Provide guidelines on pest identification, reporting mechanisms, and preventive measures.
- ✓ **Coordination with Agricultural Departments:** Collaborate closely with agricultural departments to access expertise, resources, and guidance on pest control measures.

Mobilize resources for the procurement and distribution of pesticides, insecticides, or biological control agents.

- ✓ **Resource Mobilization:** Work with higher authorities to secure additional resources, both financial and logistical, to support pest control efforts. Advocate for state and national-level support to address the pest invasion on a larger scale.
- ✓ **Community Engagement:** Foster community involvement in pest control efforts by encouraging collaboration among farmers, local leaders, and community-based organizations. Promote the sharing of best practices and successful pest management strategies within the community.
- ✓ **Eradication:** The role of a District Collector or Civic Administration is crucial to run the control measures and eradicate the invasive pest.

## VII. Response Mechanism for pest management

### 1. Sources of information on pest incidence

Followings are the main sources of information on pest incidence which provide first indication of pest incidence on daily basis/weekly basis which further require extensive survey for issuance of advisories and coordination in between respective stakeholders for planning plant protection activities.

- a. NPSS surveillance database
- b. CIPMC's pest specific survey
- c. Kisan Call Centre calls
- d. Media reports/Print media
- e. ICAR-AICRP database
- f. SAU's survey reports
- g. KVK's survey reports
- h. State e-pest surveillance system
- i. Research publications

### 2. Recording Pest Incidence

Pest incidence recording/observation will be carried out regularly both in Kharif as well as Rabi crops through NPSS mobile application through followings ways by trained scouts of CIPMC's, State Agriculture/Horticulture Departments, ICAR institutes, SAU's and progressive farmers enrolled by CIPMC's in NPSS.

The National Pest Surveillance System (NPSS) is an initiative of the Ministry of agriculture and farmers welfare, Government of India with the aim to provide the instantaneous solution

to the farming community to overcome the destruction caused by the pest attack by use of latest AI/ML technologies for pest forecasting. It also aims to make sure that the advisory reaches all the concerned regions where the pest attack is prevalent. NPSS collaborates with experts from various organizations and provides GIS-based pest information, mobile apps, and a portal for pest-related advisories. The system aids farmers in managing pest issues through AI and ML tools, and data is stored digitally for tracking pest trends. NPSS is developed by ICAR-NCIPM with the support of DPPQ&S and IT partners from DA & FW.

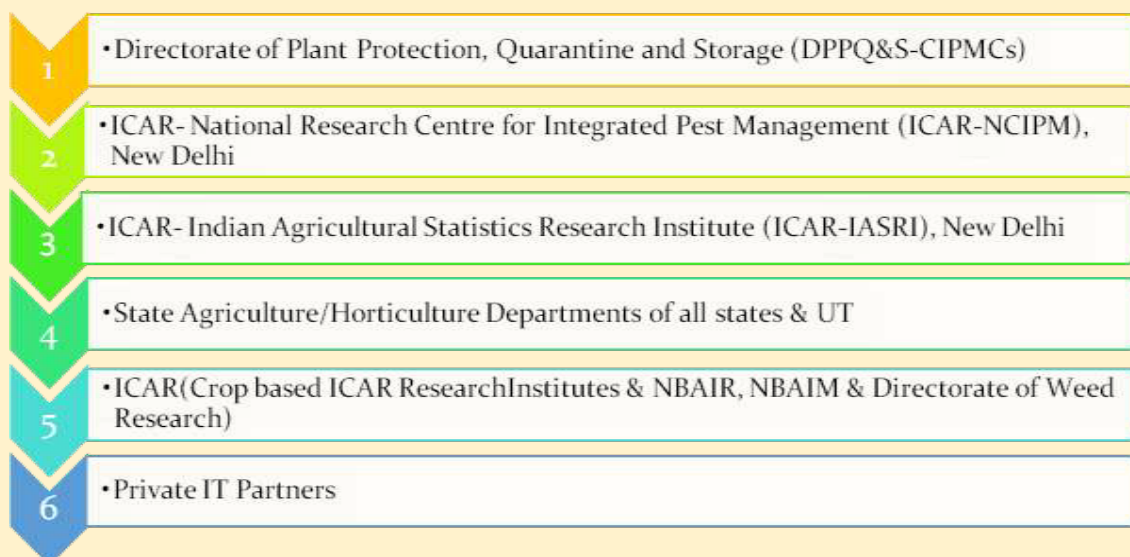
### **Benefits of NPSS**

- Early detection of pest incidence and emergency action contains the pest.
- Easy and timely access to expert support for pest identification and pest surveillance-based pest management advice to the farmers
- Minimizing the crop loss due to pest by using real-time data submitted by field functionaries, trained resources & lead farmers
- This will assist in avoidance of pest epidemics
- Availability of repository of national pest scenario to various public agencies, working in the field of plant protection to identify the pest hotspots and thus to formulate effective plant protection policies
- Help in developing AI based solutions for more crop pest combinations based on large amount of data being collected.

### **Key features of NPSS**

- **AI-Based Pest Identification module:** Enabling accurate and efficient pest/disease identification.
- **Surveillance module:**
  - a) Quantitative surveillance (Scientific based):** To be used by scientific staff and need to be logged in through credentials for scientific surveillance. The methodology for surveillance is incorporated in NPSS data base by utilizing expertise of NCIPM & DPPQS.
  - b) Qualitative surveillance:** For farmer/layman who need not give extensive information & to choose among 3 levels of infestation (i.e. among Severe, Moderate, and Low) and login ID & Password are not needed
- **Advisory module:** Subject experts would issue crop/pest/area specific advisory through web portal will be made available to farmers and recommend CIB&RC approved chemical pesticides on the basis of level of infestation.

## Partners/Stakeholders working for development of NPSS



To implement national pest surveillance system in the country the pest incidence observation will be taken through Quantitative surveillance (Scientific based) module of NPSS mobile application which provides real time pest incidence data on daily basis.

### Plan of action for Surveillance

- i. Login credentials for quantitative surveillance is already distributed all CIPMC's, trained progressive farmers and State Agriculture/Horticulture Department
- ii. Surveillance will be initiated from seedling stage of each crop and will remain in force up to maturity stage of crop
- iii. Two Nodal officers has been nominated in each district and their Scout IDs and Passwords has been circulated among them by Experts from State Department of Agriculture/Horticulture which will conduct surveillance.
- iv. CIPMC scouts will regularly survey the standing crop for monitoring of pests and for implementation of NPSS.
- v. Social media group comprising of trained progressive farmers including scouts of State Agriculture Department has already been created by each CIPMC's for regular dissemination of information w.r.t. pests or diseases of various crops. Forewarnings and advisories related to various pests, literature w.r.t. different crops are regularly being distributed through this group.
- vi. Survey routes for rapid roving survey is already defined by each CIPMC in states based on major pest hotspots and surveillance will be conducted accordingly.
- vii. Being a nodal agency for implementation of NPSS in the country, the experts from each CIPMC will coordinate for monitoring of scout entries in NPSS for pest

incidence, analyzing of weekly data, issuance of forewarning/advisories based on ETL, coordination with state NPSS experts for dissemination of pest status through print media/social media and incursion on invasive pest if any.

- viii. The NPSS cell at DPPQS Headquarters will monitor the pest incidence data will present to DA & FW on weekly basis.
- ix. Need based/real time-based advisories will be issued on NPSS portal by experts of CIPMC, State Agriculture Department and ICAR etc.
- x. Followings are the major pest incidence in various crops across the country during last three years which give idea to all stakeholders regarding the pests which need more attention during surveillance and plant protection activities.

Sr. No.	Crop	Pest	States in which occurred
1.	Paddy	Yellow stem borer	Bihar, Tamil Nadu, Odisha, West Bengal, Uttar Pradesh, Mizoram, Telangana, Goa, Chhattisgarh, Jharkhand, Andhra Pradesh, Assam, Karnataka
		Brown plant hopper	Madhya Pradesh, Tamil Nadu, Odisha, Maharashtra, Uttar Pradesh, Jharkhand, Bihar, Andaman & Nicobar, Haryana, Mizoram, Chhattisgarh, Telangana, Punjab, Uttarakhand, West Bengal, Karnataka
		Leaf folder	Odisha, Haryana, Maharashtra, Uttar Pradesh, Andaman & Nicobar, Assam, West Bengal, Tamil Nadu, Madhya Pradesh, Karnataka
		Case worm	Andaman & Nicobar, Goa, Karnataka
		Blast	Madhya Pradesh, Jharkhand, Odisha, Maharashtra, Meghalaya, Goa, Nagaland, Uttar Pradesh, Jammu & Kashmir, Mizoram, Telangana, Karnataka
		Gundhi bug	Uttar Pradesh, Andhra Pradesh, Tamil Nadu, Meghalaya, West Bengal, Odisha, Jharkhand
		Sheath rot	Chhattisgarh
2.	Cotton	White fly	Punjab, Karnataka, Haryana, Rajasthan, Gujarat
		Pink Boll worm	Maharashtra, Telangana, Andhra Pradesh, Haryana, Punjab, Karnataka
		Thrips	Karnataka, Maharashtra, Haryana
		Jassids	Punjab, Karnataka
3.	Maize	Fall army worm	Karnataka, Bihar, Telangana, Andhra Pradesh, Odisha, Tamil Nadu, Gujarat, West Bengal, Maharashtra, Andaman & Nicobar, Mizoram, Assam, Manipur, Nagaland, Rajasthan, Uttar Pradesh, Himachal Pradesh, Chhattisgarh, Jammu & Kashmir, Punjab, Madhya Pradesh, Uttarakhand, Jharkhand, Sikkim, Meghalaya
		Stem borer	Haryana, Telangana, Chhattisgarh
4.	Wheat	Yellow rust	Punjab, Haryana, Jammu & Kashmir, Himachal Pradesh, Uttarakhand
5.	Mango	Fruit fly	Telangana, Uttar Pradesh, Andaman & Nicobar, Goa, Karnataka



		Mango hopper	Goa , Uttarakhand , Tamil Nadu, Karnataka
6.	Sugarcane	Red rot	Uttar Pradesh , Haryana , Punjab , Uttarakhand , Odisha
		Top shoot borer	Uttarakhand, Haryana , Uttar Pradesh , Gujarat , Punjab
7.	Coconut	Rugose spiraling whitefly	Goa , Tamil Nadu , Kerala , Karnataka , Telangana
		Rhinoceros beetle	Andaman & Nicobar , Kerala , Goa , Karnataka
8.	Chilli	<i>Thrips parvispinus</i>	Andhra Pradesh , Karnataka , Telangana
9.	Potato	Late blight	Uttar Pradesh , Karnataka , Assam , West Bengal
10.	Brinjal	Fruit & shoot borer	West Bengal , Madhya Pradesh , Maharashtra , Uttar Pradesh , Telangana , Andaman & Nicobar , Assam , Gujarat , Chhattisgarh, Karnataka
11.	Banana	Sigatoka	Kerala , Tamil Nadu, Andaman & Nicobar, Karnataka
12.	Chickpea	Wilt, Pod borer	Maharashtra, Karnataka
13.	Sugarcane	White grub	Maharashtra, Karnataka
14.	Soybean	Girdle beetle , Semi looper , Stem fly , <i>Spodoptera litura</i>	Maharashtra, Karnataka

The above pest incidence information is the guide for surveillance team to plan and conduct survey across the country for timely management of pests.

### 3. Data monitoring

Pest incidence data which are generated on daily basis on NPSS web portal will be monitored by experts from CIPMC's, State Agriculture/Horticulture Departments officials and NPSS team at DPPQS and further process the data as follows

#### 3.1 Monitoring by experts from CIPMC's and State Agriculture/Horticulture Departments

**Data monitoring:** -The designated experts from CIPMC's and State Agriculture/Horticulture Departments will monitor the pest incidence data on daily basis based on pest incidence entries in NPSS and also issues advisories to concerned village/block/ district depends on intensity of pest incidence and also alert the respective locality farmers as well as State Agriculture/Horticulture Departments functionaries to keep constant watch on further progress of pest. Also designated experts

Being the nodal agency in the state, the designated experts of CIPMC will provide the data by incorporating all the sources pest incidence data to DPPQS Headquarters for further action on weekly basis. The designated experts from State Agriculture/Horticulture Departments will submit the pest incidence data on weekly basis to designated experts of CIPMC's and the compiled information of the state will be forwarded to DPPQS Headquarters Faridabad by CIPMC.

**Data monitoring on Pest Epidemics:** -Some pest and disease are to be regularly monitored by considering current environmental conditions after their appearance and for such incidence management practices to be adopted in affected areas at a same time to avoid economic losses such as yellow rust in wheat, pink bollworm in cotton, blast in rice, fall armyworm in maize, late blight in potato etc. Such pest/disease needs intensive survey as well as timely plant protection activities to avoid crop losses. Hence role of experts is very much essential for timely monitoring as well as sensitizing farmers to manage such incidences in short period.

In such cases experts should issue alert and sensitize farming community through all available media to start plant protection activities at same time and such alerts should be displayed on NPSS portal.

### **3.2 Monitoring by NPSS Cell at DPPQS, Headquarters Faridabad.**

The expert team of DPPQS will monitor the pest incidence data submitted by experts of CIPMC's as well as recorded on NPSS web portal on weekly basis for either issuance of advisory at national level or recommend to National Committee for formation of response team to tackle the pest issue in time bound manner. The expert's team of DPPQS will also gather information on pest incidence generated through various sources such as Kisan Call Centers/Print media pest report to merge with NPSS database and will present to National Committee on weekly basis at DA & FW level/Crop Weather Watch Group (CWWG) meetings.

## **4. Data Collection & Analysis**

Data collection, analysis and creation of its repository are the key functions of NPSS Cell at DPPQS, Headquarters Faridabad. Formation of such repository will help in availability of information of national pest scenario to various public stakeholders working in the field of plant protection to identify the pest hotspots and thus to formulate effective plant protection policies as well as management practices.

If the pest incidence is in form of epidemics the support of ICAR research institutes and SAU will play major role in data analysis, forecasting the pest/disease progress and formulating real time management practices.

## **VIII. Response Mechanism for Invasive Pest Incursion**

### **Diagnosis/Identification of Invasive Pest**

The process of confirming “not seen before” or “this is new” is absolutely critical for effective quarantine management. Diagnosis is not just the science of isolation and identification. It involved the capability to recognize symptoms in the field and an

understanding of how to get the situation confirmed as soon as possible. During incursion response, Diagnostic science is used to absolutely confirm the identity of the introduced pest their Biology, Ecology, dispersal characteristics and eradication/management strategies. Selected tests are also applied to samples collected during survey operations and the information is used to back up observations on presence of symptoms of pest damage. This information is used to meet two requirements:

1. For defining the boundaries of pest distribution for the establishment of quarantine zones and movement controls.
2. For confirming that the pest is not detected. This “known not to occur” principle is critically important for trading partners.

Flow chart is devised to identify whether a given species can be considered as invasive or not is given in **Fig. 1**

### **Formation of Response team**

After confirming the threat of an incursion of an invasive pest through the General Surveillance System, an expert response will be formulated. Response team play a vital role in assessing and mitigating potential threats. They monitor safety protocols, ensure compliance, and provide guidance on protective measures. An invasive pest response team plays a crucial role in managing and mitigating the impact of invasive pests on agriculture, ecosystems, and communities. The responsibilities of such a team often involve a coordinated effort to address the outbreak swiftly and efficiently. Here are key roles and functions of an invasive pest response team:

- ✓ **Emergency Response Planning:** To develop and implement emergency response plans to address immediate threats posed by the invasive pest outbreak. Establish a rapid response team to deploy resources quickly to areas in need.
- ✓ **Rapid Assessment:** Conduct rapid assessments to determine the extent of the pest infestation, identifying affected areas and vulnerable crops. Evaluate the economic and environmental impact of the invasive pest on local agriculture.
- ✓ **Pest Risk Analysis:** A PRA provides the rationale for phytosanitary measures for a particular species or a group of species and evaluates scientific evidence to determine whether an organism is a quarantine pest. If so, the analysis evaluates the probability of introduction, establishment and spread of the pest and the magnitude of potential economic, environmental and social consequences in a defined area, using biological or other scientific and economic evidence

- ✓ **Coordination and Communication:** Establish effective communication channels among team members, relevant government agencies, local authorities, and agricultural stakeholders. Coordinate efforts with other response teams, research institutions, and extension services to share information and resources.
- ✓ **Surveillance and Monitoring:** Implement surveillance programs to monitor the spread of the invasive pest and assess the effectiveness of control measures. Utilize technology, such as remote sensing and data analytics, to enhance surveillance capabilities. The facilities of space technology have to be harnessed to maximum level so as to draw conclusion at larger scale.
- ✓ **Data Management: Collect, analyze, and manage** data related to the invasive pest outbreak, including pest population dynamics, affected crop types, and control measures implemented. Use data to inform decision-making and adjust response strategies as needed.
- ✓ **Integrated Pest Management (IPM):** To develop and implement integrated pest management strategies that incorporate a combination of biological, cultural, mechanical, and chemical control methods. Provides guidance to farmers and communities on adopting sustainable and effective pest control practices.
- ✓ **Capacity Building:** Train response team members, extension workers, and farmers on effective pest management techniques. Conducts awareness programs to educate communities about the invasive pest, its impact, and preventive measures.
- ✓ **Resource Mobilization:** Identify and secure the necessary resources, including funding, equipment, and personnel, for the response efforts. Collaborate with government agencies, non-governmental organizations, and the private sector to mobilize additional support.
- ✓ **Quarantine and Bio-security Measures:** Implement quarantine measures to prevent the spread of the invasive pest to unaffected areas. To enforce bio-security protocols to regulate the movement of potentially infested materials and equipment.
- ✓ **Community Engagement:** To engage with local communities to enlist their support and cooperation in pest control efforts. Provide training for personnel involved in pest management, including early detection, identification, and eradication efforts. Equip local communities with the knowledge and tools to participate in pest management activities.
- ✓ **Research and Innovation:** Collaborate with research institutions to stay updated on the latest scientific developments in pest management. Invest in research to

understand the biology, behavior, and ecology of potential invasive pests. Monitor the effectiveness of control measures and adjust strategies based on real-time data.

- ✓ **Post-Event Evaluation:** Conduct a post-event evaluation to assess the effectiveness of the response efforts and identify areas for improvement. Document lessons learned and best practices for future invasive pest outbreaks. Post release assessment of any introduced bio-control agents and its evaluation to manage invasive pest and in case of failure alternative contingency plan needs to be prepared.
- ✓ **Review and Update:** Establish a regular schedule for reviewing and updating the SOPs to incorporate new information, technologies, or lessons learned from each incident.

An effective invasive pest response team requires a multidisciplinary approach, strong collaboration, and a proactive strategy to address the challenges posed by invasive pests and protects agriculture, ecosystems, and the livelihoods of communities.

### **Demarcate the affected zone**

The NPPO may develop a pest eradication programme to prevent establishment or spread of a pest following its recent entry or as a measure to eliminate an established pest. The extent of the buffer zone and the nature of the phytosanitary measures will depend on the biology of the pest and the intrinsic characteristics of the place of production or production site.

One of the functions of the NPPO is to have regulations in place that will be used to demarcate a quarantine area and the measures to be taken to prevent the spread of the pest. A quarantine area is “an area within which a quarantine pest is present and is being officially controlled”. A quarantine area should be defined by the NPPO by using information from initial surveillance activities, the biology of the pest, the size and density of the pest population, the length of time the pest has been present, the local climatic, meteorological and environmental conditions, and the density of host plants.

The early investigations will provide data that is used to identify plants, plant products or other articles whose movement out of the quarantine area needs to be regulated to prevent the spread of the pest. The quarantine area consists of two main types of demarcation: an infested/infected zone and a buffer zone:

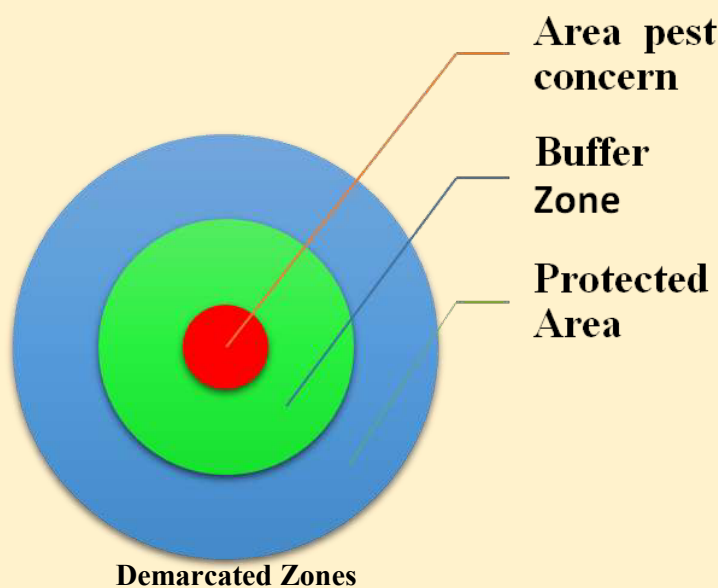
#### **Infested/infected zone**

- All plants known to be infested by the pest concerned.
- All plants showing signs or symptoms indicating possible infestation by the pest;

- All other plants liable to have been or become contaminated or infested by the pest, including plants liable to be infested due to their susceptibility to the pest and their close proximity to infested plants or common source of production with infested plants or plants grown from the soil, water courses or other elements infested, or liable to be infested, by the pest concerned.

### **Buffer zone**

- A buffer zone is “an area surrounding or adjacent to an area officially delimited for phytosanitary purposes in order to minimize the probability of spread of the target pest into or out of the delimited area, and subject to phytosanitary or other control measures.
- The objective of a buffer zone in this case is to prevent pest spread from the quarantine area. The buffer zone should be determined by the NPPO on the basis of the distance over which the pest is likely to spread naturally during the course of the growing season.
- Monitoring surveys should be conducted at adequate frequency over one or more growing seasons. Access for surveys or control measures should be verified in advance. If the pest is detected in the buffer zone, the demarcated area should be adjusted accordingly.



### **Strategy for eradication**

The strategy for undertake an eradication programme results from an evaluation of the circumstances of detection of a pest, its identification, the risk identified by a pest-initiated PRA, estimation of the present and potential distribution of the pest, and assessment of the feasibility of conducting an eradication programme. PRA provides a scientific basis for this estimate possible eradication options and cost-benefit factors should also be considered.

## **Conducting cost-benefit analysis for eradication programmes**

One of the first actions to be taken is the preparation of a list of the most feasible eradication techniques. The total cost and the cost-benefit ratio for each strategy should be estimated over the short and long term. The option to take no action, or to take a pest management approach, should be considered as well as eradication options. All feasible options should be described or discussed with decision-makers. Anticipated advantages and disadvantages, including cost-benefit should be outlined to the extent possible. One or more options should be recommended, recognizing that the ultimate decision requires consideration of the technical options, cost-benefit, the availability of resources, and political and socio-economic factors.

## **Eradication Process**

The Response Team conducts the eradication process programme, which should, where possible, follow an established plan. Three main activities are included in the programme:

- **Surveillance:** to fully investigate the distribution of the pest
- **Containment:** to prevent the spread of the pest
- **Treatment:** to eradicate the pest when it is found.

Direction and coordination should be provided by an official management authority, ensuring that criteria are established to determine when eradication has been achieved and that appropriate documentation and process controls exist to provide sufficient confidence in the results.

## **Responsibility of Response Team in eradication programme**

- Ensuring that the eradication programme meets the agreed criteria for successful eradication
- Formulating, implementing, and modifying as necessary an eradication plan
- Ensuring programme operators have appropriate authority and training to undertake their duties
- Financial and resource management
- Appointing and defining duties of operators, ensuring operators understand their responsibilities, and documenting their activities
- Managing communication, including a public relations programme
- Communicating with affected parties, e.g. growers, traders, other government departments and non-governmental organizations
- Implementing an information management system, including programme documentation and appropriate record-keeping
- Daily management of the programme

- Continuous monitoring and evaluation of critical elements
- Periodic overall programme review.

### **Treatment and/or control measures**

Measures to eradicate pests may include:

- Host destruction
- Disinfestation of equipment and facilities
- Chemical or bio pesticide treatment
- Soil sterilization & Leaving land fallow
- Host-free periods
- The use of cultivars that suppress or eliminate pest populations
- Restriction of subsequent cropping
- Trapping, lures or other physical control methods
- Inundative release of biological control agents
- Use of sterile insect technique
- Processing or consumption of infested crop.

Eradication will involve the use of more than one treatment option. The selection of treatment and/or control options may be limited by legislative restrictions or other factors.

### **Verification of pest eradication**

The official management authority should verify that the criteria for successful pest eradication established at the beginning of the programme have been achieved. The criteria may specify the intensity of the detection method and how long the survey must continue to verify the absence of the pest. The minimum period of time of pest freedom to verify eradication will vary according to the biology of the pest, but should take into consideration factors such as:

- Sensitivity of detection technology
- Ease of detection
- Life cycle of the pest
- Climatic effects
- Efficacy of treatment.

The eradication plan should specify the criteria for a declaration of eradication and steps for the withdrawal of regulations.

### **Declaration of eradication**

A declaration of eradication by the NPPO follows the completion of a successful eradication programme. The status of the pest in the area is then “**absent: pest eradicated**”. It involves



communication with affected and interested parties, as well as appropriate authorities concerning the fulfillment of programme objectives. Programme documentation and other relevant evidence supporting the declaration should be made available to other NPPOs upon request.

### **Programme Review**

Throughout the eradication, the programme should be subject to periodic review to analyze and assess information gathered, to check that objectives are being achieved, or to determine if changes are required. Reviews should take place at:

- Any time when unforeseen circumstances are encountered that could affect the programme
- Pre-set intervals
- Termination of the programme.

Where the criteria for eradication are not met, the eradication plan should be reviewed. This review should take into account any newly gained knowledge that might have contributed to that result. Cost benefit factors and operational details should be reviewed to identify inconsistencies with initial predictions. Depending on the outcome, a new eradication plan may be developed or altered to become a pest suppression or pest management programme.

### **Documentation/Record maintenance**

NPPOs should ensure that records are kept of information supporting all stages of the eradication process. It is essential that NPPOs maintain such documentation in case NPPOs of importing countries request information to support claims of pest freedom.

### **Sensitizing the Stakeholders**

An effective communication strategy is essential and should keep stakeholders well informed through accurate, comprehensive and timely communication. The NPPO should solicit regular feedback and make provision for a constant flow of information between all parties. Communication can be passive (designed to inform stakeholders and sometimes receive information in response) and active (involving stakeholders in discussions and decision-making input)

### **Funding and Compensation**

When seeking funding for emergency pest incursions, it's essential to clearly articulate the urgency of the situation, the potential impact of the pest on agriculture or the environment, and the proposed strategies for containment and eradication. Developing a comprehensive project proposal that outlines the budget, timeline, and expected outcomes can increase your chances of securing the necessary funding.

Funding for emergency pest incursions can come from various sources, including government allocations and grants from relevant organizations. When dealing with emergency pest incursions, it is crucial to act swiftly and efficiently to prevent the spread of the pest and minimize the potential damage to crops, ecosystems, and public health.

- ❖ **Government grants:** Governments often allocate funds for emergency pest management through departments responsible for agriculture, environment, or public health. These funds may be available at the federal, state, or local levels, depending on the scale and severity of the pest incursion.
- ❖ **Research institutions:** Research institutions or universities may have grant programs that support research on pest management and control. These grants can be used to develop innovative and effective strategies for dealing with pest incursions.
- ❖ **Private sector partnerships:** Partnering with private companies, especially those in the agriculture or biotechnology sectors, can provide access to additional funding and resources. Private sector collaborations can also bring expertise and technology to the table, enhancing the effectiveness of pest management efforts.
- ❖ **International funding organizations:** International organizations, such as the United Nations Food and Agriculture Organization (FAO) or the World Bank, may offer financial support for initiatives aimed at preventing and controlling pest incursions, particularly in developing countries.

**DPPQ&S:** The Directorate of Plant Protection, Quarantine, and Storage (DPPQ&S) may receive funds through Government for managing pest incursions and ensuring the safety and security of plants and agricultural produce. The specific funding allocations for this division can vary depending on the policies and budgetary decisions of the relevant government department or agency.

Typically, funds allocated to the DPPQ&S may be used for the following purposes:

- ❖ **Pest surveillance and monitoring:** This includes the deployment of personnel and resources to actively monitor and detect any potential pest incursions in plants and agricultural products.
- ❖ **Research and development:** Funds may be allocated for research initiatives aimed at developing innovative pest management strategies, including the study of pest behavior, the development of resistant crop varieties, and the creation of effective pest control measures.
- ❖ **Infrastructure development:** Budgetary allocations may be earmarked for the enhancement of infrastructure, such as the construction of quarantine facilities,

laboratories, and other essential facilities required for pest identification and containment.

- ❖ **Training and education:** Some portion of the funds may be dedicated to training programs for personnel involved in plant protection and quarantine activities, ensuring that they are equipped with the necessary skills and knowledge to effectively manage pest incursions.

**Emergency response and containment:** Allocations may be made to facilitate rapid response activities in the event of a pest incursion, including the deployment of specialized teams, the purchase of necessary equipment, and the implementation of containment measures to prevent the spread of pests.

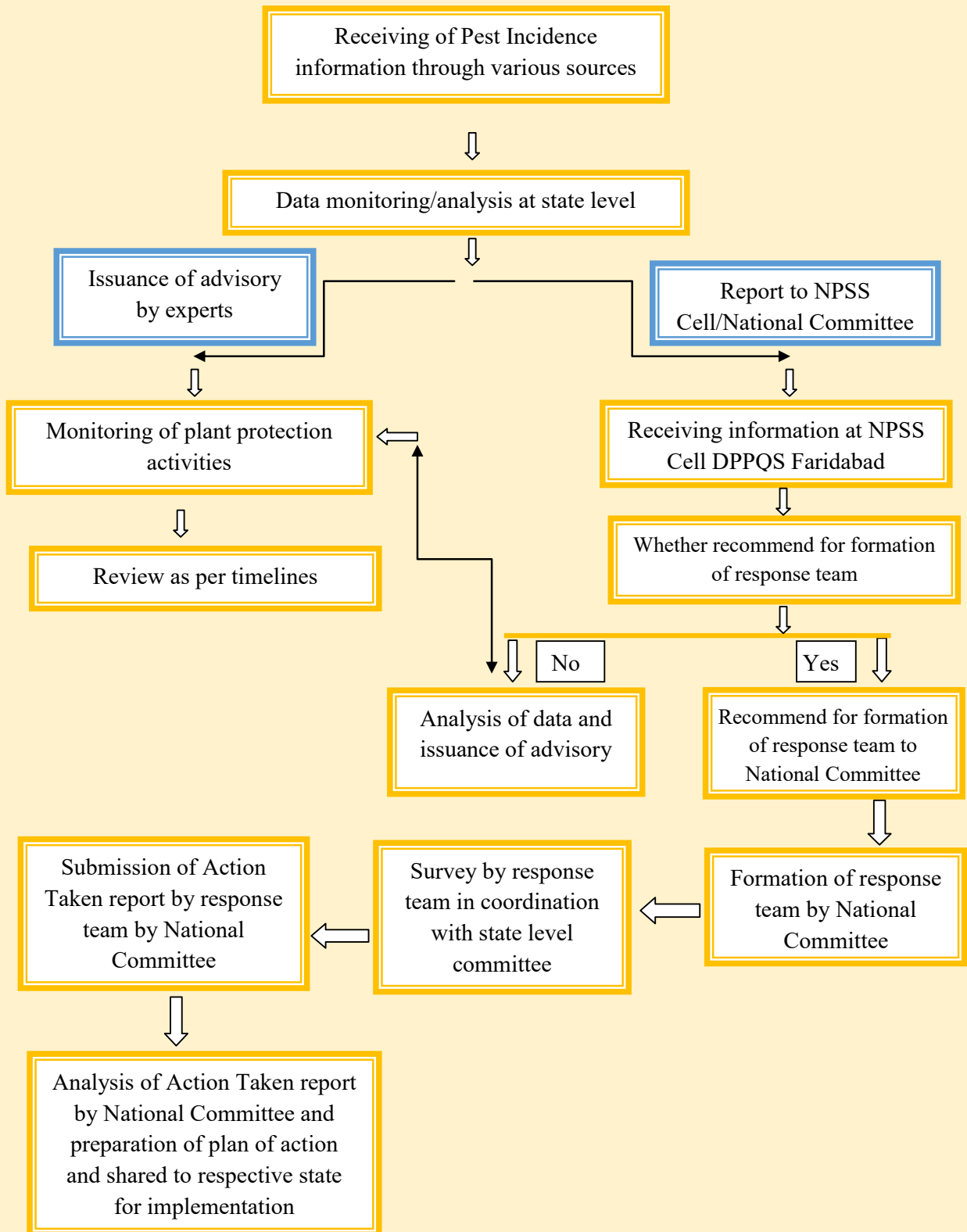
### IX. Timeline of activities in Pest Surveillance & Response Mechanism

Category	Activity	Stakeholder	Timeline (in Days)
<b>AI based Pest Identification and Management</b>	Identification of Pests through AI module in app and issuance of pest management practices for known pest problem	Field scouts of CIPMC, State Dept. officials, KVK scouts, progressive farmers or any mobile app user	T+0
	Monitoring of unidentified photos or issues by AI module and reporting	CIPMC	T+1
	Identification of uploaded but not recognized issues and advisory to app user	NPSS Cell (DPPQ&S), NCIPM	T+2
	Reporting of any pest identification issue to module developers	NPSS Cell (DPPQ&S), NCIPM	T+3
	Review of AI based model for image processing	ICAR-IASRI, Private IT Partners	Weekly basis
	Image processing validation and further improvement w.r.t. those pest whose model is not available in NPSS	Private IT Partners	Fortnightly
<b>Pest Reporting (Qualitative)</b>	Pest Reporting and app response for management practices	Farmers or any mobile app user (crowd-sourced)	T+0
	Monitoring of data and photos uploaded through Qualitative module	CIPMC and State-Nodal Officer	T+1

	Reporting of new or unknown pest issues and National Technical/Monitoring Team	CIPMC and State-Nodal Officer	T+3
	Intervention on any pest scenario reported through qualitative module if required	CIPMC and State-Nodal Officer, KVK, ICAR Institutes, SAU	T+2
	Field visit and issuance of advisory in consultation with other stakeholders	CIPMC and State-Nodal Officer, KVK, ICAR Institutes, SAU	T+3
<b>Pest Surveillance and management (Quantitative)</b>	Scouting and uploading of data and photos through mobile app from field	Field scouts of CIPMC, State Dept. officials, KVK scouts, progressive farmers etc.	T+0
	Monitoring and validation of uploaded data and photos by Expert	CIPMC and State-Nodal Officer	T+1
	Issuance of advisories through web-portal for known pest management scenario	CIPMC and State-Nodal Officer	T+1
	Reporting of unknown or new pest issues to technical team and SAU	HO-CIPMC, State Nodal Officer, KVK	T+2
	Processing or identification of new pest issues reported by CIPMC or State Nodal Officer	IPM Division (DPPQ&S), ICAR Institutes, KVK and SAU of concerned state/s	T+4
	Issuance of initial advisory for new pest issues reported through system and recording database for the same	NPSS Cell (DPPQ&S) and SAU for concerned state/s	T+3
	Field visit and implementation of pest management protocol as per advisory	CIPMC and State-Nodal Officer, KVK, ICAR Institutes, SAU	T+4
	Formulation of detailed advisory or SOP or manual for new pest scenario	ICAR Institutes (crop based), DPPQ&S, SAU for concerned state/s	T+7

<b>Application / System Improvement (IT or AI-ML)</b>	Review on uploaded image processing for improvement of AI based Pest Identification module & System developer and technical team meeting	ICAR-IASRI, Private IT Partners, NPSS Cell (DPPQ&S), NCIPM	Monthly
<b>Overall System Monitoring, Implementation and Improvement</b>	Conducting weekly review of pest surveillance data through system web portal	CIPMC and State-Nodal Officer	Weekly basis
	Conducting periodic review meeting with stakeholders at state-level	HO-CIPMC, State-Nodal Officer, SAU and KVK	Every 30 days interval
	Assessment of pest surveillance system as per functional requirement	NPSS Cell (DPPQ&S)	Every 15 days interval
	Organizing of monthly review meeting with all stakeholders	NPSS Cell (DPPQ&S)	Every 30 days interval
	Conducting periodic reviews and evaluations of the systems progress	Plant Protection Division	Every 30 days interval
	Issuance of advisory at national level or recommend to National Committee for formation of response team	NPSS team at DPPQS	T+2
	Compilation of information on pest incidence from all sources and present to DA & FW/CWWG meeting	CIPMC's, NPSS team at DPPQS	Weekly basis
	Formation of response team to tackle pest emergency and coordinate with State level committee for further action	National Committee	T+2
	Review meeting on Pest Surveillance activity	National Committee	Half yearly
Review meeting among all stakeholders for planning latest plant protection activities	All stakeholders	Yearly	

## X. Flowchart depicting pest surveillance activity and response mechanism



## XI. Outcome of National System for Pest Monitoring and Response Mechanism

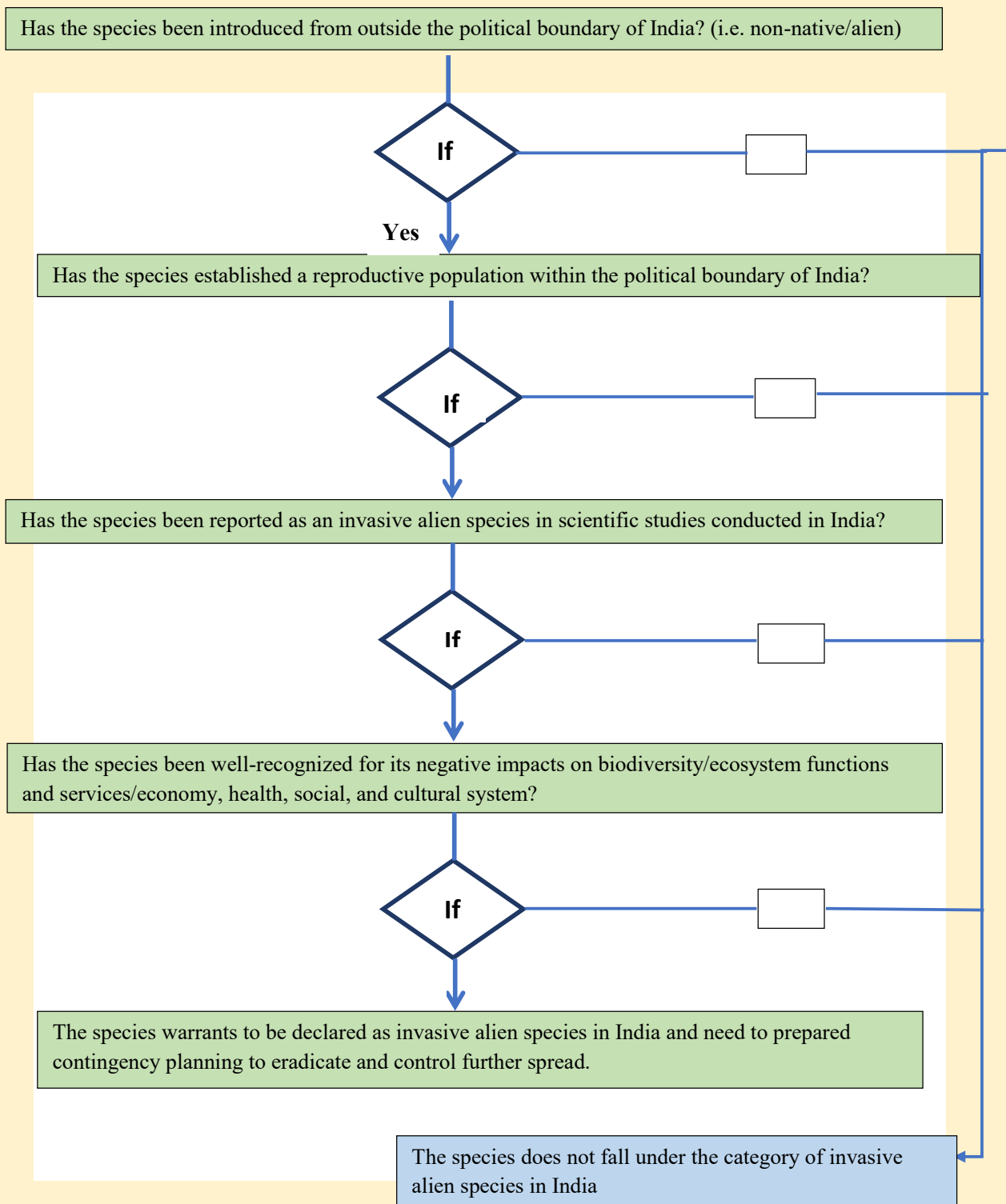
- Helps in timely management of pest attacks thereby save the economic losses
- Formation of pest incidence repository at national level
- Strengthen coordination in stakeholders involved in plant protection activities
- Helps in pest/disease forecasting
- Judicious use of pesticides thereby protecting environment.
- Timely detection resulting in restricting spread and eradication of new invasive pest

## XII. NPSS Action plan for Three years

Target (FY 2024-25)	Timelines	Target (FY 2025-26)	Timelines	Target (FY 2026-27)	Timelines
Launch of NPSS App	July 2024	Inclusion of additional crops for surveillance	November 2025	Inclusion of additional crops for surveillance	November 2026
		Inclusion of additional crops for surveillance	March 2026	Inclusion of additional crops for surveillance	March 2027
AI/ML modeling	August 2024	Impact assessment through third party evaluation	July 2025	Maintenance of App	-
Training to more farmers/ State Agriculture Officers	August 2024	Training to more farmers/ State Agriculture Officers	August 2025		
Inclusion of additional crops (Soybean, Banana Sugarcane, Pigeon pea & Green Gram) for surveillance	November 2024	Maintenance of App	-		
Inclusion of additional crops (Chickpea, Citrus, Mustard, Okra, Potato, Cole crops) for surveillance	March 2025				
Maintenance of App	-				

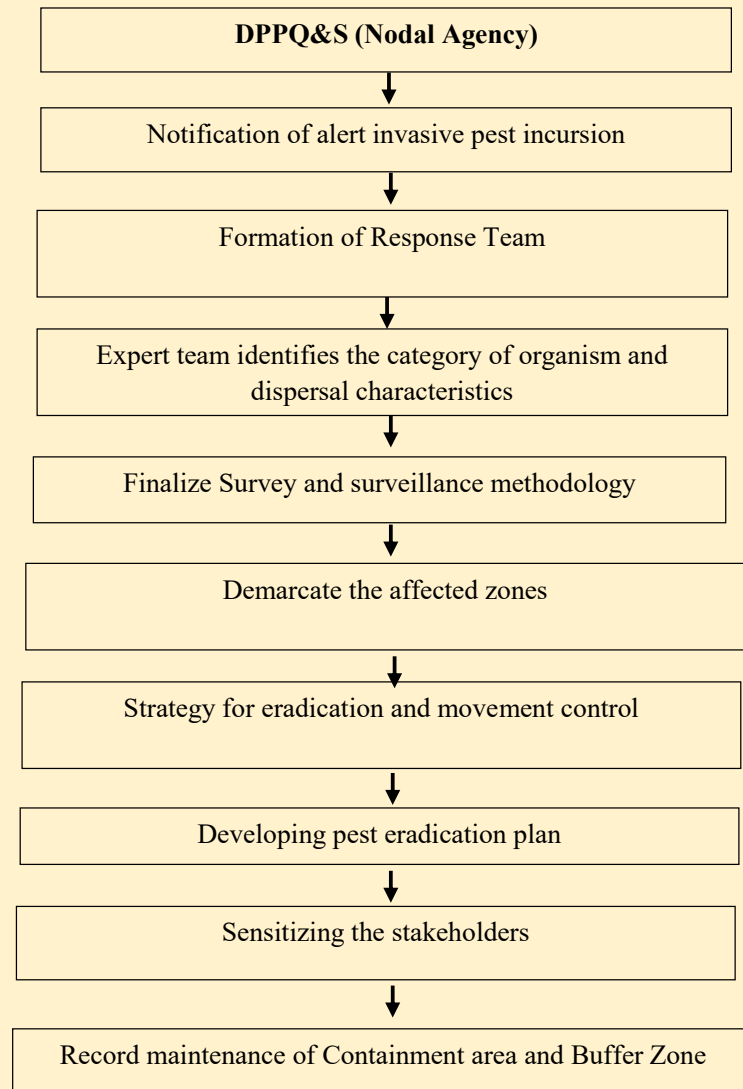
### XIII. Flow charts to identify invasive pests

**Fig 1: Flow chart devised to identify whether a given species can be considered as invasive or not**





## Flow Chart for invasive pest response



# Contingency Plan for Desert Locust Outbreaks, Invasions and Upsurges



2024



भारत सरकार

Government of India

कृषि एवं किसान कल्याण मंत्रालय

Ministry of Agriculture & Farmers Welfare

कृषि एवं किसान कल्याण विभाग

Department of Agriculture and Farmers Welfare

वनस्पति संरक्षण, संगरोध एवं संग्रह निदेशालय,

Directorate of Plant Protection, Quarantine & Storage

एन.एच.4, फरीदाबाद NH-IV, Faridabad-121001

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## **Contingency Plan for Desert Locust Outbreaks, Invasions and Upsurges**

### **Regional Locust cum IPM Centre (RLCIPMC) – India**

#### **Introduction and back ground**

This contingency plan is meant to guide RLCIPMC in responding to a Desert Locust emergency (outbreak, invasion and upsurge). It includes the assistance required from different stakeholders and their contribution and role, a calendar of activities, the type of strategy to be adopted, formation of teams, available resources, short fall and ways and means of obtaining additional resources and deployment of resources and required actions.

#### **Ministries and other agencies involved**

Apart from Ministry of Agriculture and Farmers Welfare, Department of Agriculture and Farmers Welfare, other ministries such as Ministry of Home Affairs, Ministry of Defence, Ministry of External Affairs, Ministry of Civil Aviation, Ministry of Communication, State departments and other relevant stakeholders are to be involved for their role and responsibilities during the locust control/locust emergency. The role and responsibilities of these stakeholders has been defined in implementation part of the plan.

#### **Desert Locust threat and past history**

Historically, the Desert Locust has always been a major threat to man's well-being. The Desert Locust is mentioned as curse to mankind in ancient writings viz., locust problems in Southwest Asia have a long history and probably began when crops were first cultivated. Several species of locust occur in the region but the Desert Locust (*Schistocerca gregaria*) is by far the most important. Locusts are mentioned in Sanskrit literature in particular in the epic poem Mahabharata where Karna includes locusts in a "poetically beautiful" speech when he encounters his rival Arjuna on the battlefield. The earliest known Sanskrit text dates to about 400 BCE but the poem is thought to have existed as early as 750 BCE. Equally ancient mention is made in the Iranian Zoroastrian Vendidad where the locust is one of the xrafstra or evil creations of Angra Mainyu. Locusts are mentioned in the Al-Araf chapter 7 of the Koran. The magnitude of the damage and loss caused by the locusts is very gigantic beyond imagination as they have caused the starvation due to its being poly phagous feeder, and on an average small locust swarm eats as much food in one day as about 10 elephants, 25 camels or 2500 people. Locust do cause damage by devouring the leaves, flowers, fruits, seeds, bark and growing points and also by breaking down trees because of their weight when they settle down in masses.

It has been estimated that in India damage to crops caused by locusts was about Rupees 10 crore during 1926–31 plague cycle. During 1940–46 and 1949–55 locust plague

cycles, the damage was estimated at Rs. 2.00 crore each and it was Rs. 50.00 lakhs during the last locust plague cycle (1959–62). Although no locust plague cycles were observed after 1962 but large scale upsurges were reported during 1978, 1993, 2019 and 2020.

### **Locust Biology**

The Desert Locust has three distinct stages: (i) egg (ii) hopper and (iii) adult.

#### **Egg**

Eggs are laid in pods in moist sandy soil at a depth of about 10-15 cm at an interval of 7–10 days. Gregarious females usually lay 2-3 egg pods having an average of 60-80 eggs/pod. Solitarious females lay 3-4 times having 150-200 eggs in average. The rate of development of eggs depends on soil moisture and temperature, but in general it is about two weeks. No development takes place below 15°C. The incubation period is 10–12 days when the optimum temperature is between 32–35°C.

#### **Hopper**

After incubation is complete, the eggs hatch and wingless nymphs (hoppers) emerge. There are 5 instars in gregarious and 5-6 in stars in solitarious hoppers. In each in star, there is a growth and change in characteristic coloration.

<b>Hopper</b>	<b>Appearance</b>
1 <sup>st</sup> Instar	Newly hatched are white but turns black in 1-2 hours
2 <sup>nd</sup> Instar	Head is larger and pale color pattern is conspicuous.
3 <sup>rd</sup> Instar	Two pairs of wing buds projects on each side of thorax
4 <sup>th</sup> Instar	Color is conspicuously black and yellow.
5 <sup>th</sup> Instar	Color is bright yellow with black pattern.

The rate of development of hoppers depends on temperature. It takes 22 days when the mean air temperature is hot say about 37°C and may be delayed up to 70 days when the mean temperature is below 22°C. In general, it takes about six weeks from hatching to fledging, or about one week per instars.

#### **Adult**

The 5<sup>th</sup> instar nymph molts into adult stage. This change is called 'fledging' and the young adult is called a 'fledgling' in which its wings are still soft and cannot fly. After a few days, the wings harden and sexually 'immature adult' is capable of flight. The immature adult stage is most injurious and capable of long distance travel. Under optimal conditions, the adult may mature in 3 weeks and under cooler and drier conditions, it may take up to 8 months. In general, however, it usually takes about 4 weeks before an adult is ready to reproduce. If vegetation dries out, the adults will leave the area and fly with the wind

(downwind) in search of green vegetation and favorable breeding conditions. Solitarious adults fly for only a few hours at night while gregarious adults (swarms) fly during daylight.

Young immature gregarious adults are pink in color but older ones become dark red or brown in cold condition. On maturation, gregarious adults become bright yellow. Males mature before females. Oviposition commences within two days of copulation.

**Correlation of locust biology with field operations**

The timing of field operations, both survey and control, must be correlated with the development rate and behavior of locusts.

Stage	Weeks	Comments
Egg (laying – hatching)	2	10-15 cm under the surface in sand
Hopper (hatching – fledging)	6	5-6 instars one week/instar
Adult (fledging – egg laying)	4	Fledgling, immature, mature
<b>Total lifecycle</b>	<b>12</b>	

Gregarious adults (swarms) migrate in the direction of the wind (downwind) at the wind speed and can cover a maximum distance of up to about 150 km/day. The direction and speed of the wind determine the displacement of adults and swarms.

Before they can take off, a settled swarm must warm up in the early morning shortly after sunrise by basking in the sun. Swarms then fly throughout the day until just before sunset when they land and remain settled on the ground throughout the night.

Hoppers are active throughout the day and will not move more than about 500m or 1 km in a single day. They can be treated throughout the day; whereas, swarms can only be treated in the early morning before take-off or in the late afternoon once they have landed.

A control campaign mounted against hopper bands that resulted from local breeding is likely to last about 4–6 weeks and a subsequent campaign against the adults may be required for a further 4 weeks. A control campaign against invading swarms is likely to be very short in duration because the adults will quickly mature and lay eggs. As it may not be possible to prevent egg-laying completely, a subsequent campaign will be required for controlling hopper bands.

**Preventive control strategy**

All countries affected by desert locust have adopted a preventive control strategy for the management of desert locust in order to reduce the frequency, duration and intensity of plagues. This strategy consists of regular surveys to provide early warning and contingency planning to allow early and effective response before the situation becomes out of control.

RLCIPMC (comprising of all field units) undertakes regular surveys in the Scheduled Desert Area (SDA) of Rajasthan and Gujarat to monitor the presence of desert locust and

ecological conditions. During the survey, an assessment is made to determine if locust numbers have crossed the so-called economic threshold level (ETL) in which there are more than 10,000 adults/km<sup>2</sup> and 5-6 hoppers/bush that may require control.

The constant watch and surveys are undertaken in sandy areas with green vegetation and about two weeks after rain has fallen. These surveys are done regularly during the entire year, but most importantly from May to November when desert locust activity is considered at its peak due to congenial breeding conditions. This coincides with the monsoon season in Rajasthan and Gujarat. During this time, the frequency of surveys is doubled from May to November as compared to December to April. The surveys are undertaken from sunrise to midday and for a few hours in the evening before sunset in the temperature range of 20–38°C. Whenever and wherever the population of desert locust is found exceeding the economical threshold level, immediate control measures are pressed into operation. Control operations are not conducted when locust numbers are low, isolated and scattered because this would not be efficient and it would not be harmful to the environment. In addition to RLCIPMC, concerned state authorities are requested to keep constant watch over the development of locust activities and inform to the nearest LCIPMC if any development is seen for further action if required.

### Previous control campaigns

India witnessed several locust plagues and upsurges since 1812 to 2020. Several control campaigns were conducted and recent upsurge and control campaign conducted was during 2023- 2024.

Year	Period	Type and stage of locust	Area treated (ha)	Quantity of Pesticides used (l)	Name of the Pesticide
2002-03	02.07.2002-07.07.2002	Loose swarms of desert/ Migratory locust population	42	42	Malathion 96% ULV
2005-06	09.05.2005-05.12.2005	Loose pink swarm and hoppers	16,640	10,476 1,883	Malathion 96% ULV Fenitrothion 96% ULV
2007-08	24.04.2007-30.09.2007	Loose pink/ yellow swarm and hoppers	536	536	Malathion 96% ULV
2010-11	04.10.2010 - 08.11.2010	Hoppers/ fledgling	4,700	4,700	Malathion 96% ULV
2016-17	June, 2016	Migratory Locust etc.	1,205	1,928	Chloropyriphos 20% EC
2016-17	4.11.2016	Tree locust etc.	40	40	Malathion 96% ULV
2017-18	28.10.2017	Tree locust etc.	40	40	Malathion 96% ULV
2019-20	22.05.2019-17.02.2020	Desert Locust swarms mature (yellow), immature (pink)& hopper bands, groups	4,03,488	3,14,646	Malathion 96% ULV

2020-21	11.04.2020-26.08.2020	Desert Locust swarms mature (yellow), immature (pink)& hopper bands, groups	2,87,986	2,45,590	Malathion 96% ULV Lamdacyhlothrin 5% Deltamethrin 2.8 % EC Chlorpyriphos 50 % EC Imidacloprid 6%
2023-24	10.08.2023-17.08.2023	Solitary, Transient, Gregarious, solitary hoppers	836	418	Malathion 96% ULV

**Resources: Available in the RLCIPMC**

Manpower	Sanctioned	Filled	Vacant
Officers	16	11	4
Trained Technical	90	40	50
Assistants	98	31	67
Drivers	46	29	17

Three nos. of Desert Locust Information Officers are posted in various schemes.

Transport	Recession	Outbreak	Upsurge*
Survey vehicles	11	11	-
Control vehicles	56	56	-
Heavy vehicles for supply of pesticides and control equipment	02	02	-
Vehicles for transporting essential items (food, water, misc)	-	-	-
<b>Total</b>	<b>69</b>	<b>69</b>	<b>-</b>
Sprayers		Functioning	Under repair
Handheld (Micro Ulva, Ulva+)		43	17
Vehicle-mounted (Micronair AU8115)		46	2
Vehicle-mounted (UlvaMast)		31	15

Other equipment	
eLocust3	35 (09 Activated)
eLocust3g	55 (to be activated during outbreak, upsurge)
Walkie-talkies	4
Camping	Provision to hire when needed (see Annex 4)
Protective	available

Teams	Recession	Outbreak	Upsurge**
<b>Survey</b>			
Technical officer	1	1	1
Assistant	1	1	1
Driver	1	1	1
Vehicle	1	1	1
Number of teams (regular)	11	22	33
Number of teams (special border)	5	10	15
Number of teams (special monitoring)	2	4	6
<b>Control</b>			
Technical officer	1	1	2
Assistant	1	1	2
Driver	1	1	1
Vehicle	1	1	1
Number of teams	11	22	33

\* Vehicle numbers must be strengthened during the upsurge.

\*\*No of teams will be redeployed from another scheme of the Directorate after orientation training.



### **Pesticides used for Desert Locust control**

Malathion 96% ULV is registered for use in Desert Locust control in India. Presently, 4,185 Litres of Malathion 96% ULV is available at various LCIPMCs. In addition to this a buffer stock of 10,000 Litres of Malathion 96% ULV is available at L&IPMRC Bikaner under preparedness plan. An agreement with **HIL (India) Ltd.** has been finalized under which the company will supply the required quantity of pesticide as per the requirement. M/s HIL will keep ready stock of 20,000 litres of Malathion 96% technical reserve and on receiving demand from the Directorate of PPQ&S, it will supply the desired quantity of Malathion 96% ULV formulation to the LCIPMCs within 7-10 days of the supply order.

### **Aircraft for locust control**

Government of India does not possess its own aircraft for locust control operation. Ministry of defense has given assurance to the Ministry of Agriculture for deployment of 5 nos. of Mi-17 Helicopters for aerial spray of pesticide in the event of any locust outbreak, upsurge. Purchase order for procurement of 5 nos. of Helicopter mounted aerial spray kits (CDA atomizer AU 6539 with GPS tracker) is placed with M/s Micron Sprayer Limited, UK. Two nos. of atomizers have already been imported and are under installation. Other three will be supplied in due course of time after successful installation and trial of already imported two kits.

### **Emergency fund**

Provision of fund is always kept in the annual budget of Locust Scheme. At the time of locust emergency, the funds are diverted immediately from other schemes of the Department of Agriculture & Farmers Welfare, Ministry of Agriculture & Farmers Welfare to meet the expenditure. This emergency fund is released once an emergency has been declared by Plant Protection Adviser, Dte. of PPQ&S in consultation with FAO Desert Locust Information Service (DLIS) in Rome.

### **Resource and team mobilization**

There are 12 LCIPMCs, adequate manpower, vehicles; control equipment and personal protective equipment are available. However, during locust emergency additional manpower and vehicles are mobilized from various field officers of Directorate of PPQ&S for locust control activity.

The following teams will be constituted to organize control operations.

- i. Survey Team
- ii. Control Team
  - a) Micro Ulva Team
  - b) Ulva Mast Team

- c) Micronair AU 8115 Team
- d) Aerial spraying Team (if required)
- iii. Supply Team
- iv. Maintenance Team

The airstrips have been identified at Barmer and Jaisalmer, in Rajasthan and Bhuj in Gujarat to be used for aerial operations and reconnaissance during locust emergency, if required.

All field officers involved in locust control are provided with internet facility and computer peripherals for e-communication. The use of eLocust3m pro is being encouraged by officials involved in locust survey and control. Due to development of irrigation facilities and economic activities there is a considerable improvement of mobile network in the Scheduled Desert Area, which helps in increased use of eLocust3mPro. In areas closer to Pakistan border and areas having mobile network deficiency, eLocust3g will be deployed.

#### **Routine activities of RLCIPMC**

- Keep constant vigil through field surveys to prevent crop losses due to locust attack in approximately 2.05 lakh sq. km. Scheduled Desert Area (SDA) in the States of Rajasthan and Gujarat.
- Indo-Pak Border meetings for exchange of locust situation information between two countries to effectively monitor the situation and ensure preparedness to tackle the emerging locust threat, if any.
- Advise state functionaries, BSF personnel, Panchayat Raj Institutions to inform the nearest RLCIPMC office if any locust activity is observed in their areas for needful action.
- Avoid upsurge of locust population in SDA and entry of locust swarms into India through prompt control operations in bordering areas.
- Train the farmers, State functionaries, locust staff and other stake holders on latest locust control technologies.
- Issuance of Desert Locust Situation Bulletin at fortnightly intervals to inform all concerned stakeholders about prevailing locust situation in India.
- Conduct research at Locust & IPM Research Centre (L&IPMRC) at Bikaner on bio-efficacy of pesticides and bio-pesticides for locust control.

#### **Advanced planning and preparedness**

- State Governments of Rajasthan, Gujarat, Haryana and Punjab are kept informed about the probable locust threat well in time. They are advised to keep their field functionaries in readiness to cope up with the situation.
- Training programme for State functionaries, BSF and RLCIPMC staff.
- Contingency plan to be updated regularly.
- Meeting with other stakeholders are held for planning the survey and control strategy as and when required.
- Permission for holding monthly meetings between the locust officers of India and Pakistan (June–November) to be obtained from Ministry of External Affairs.
- Procurement of pesticides to maintain buffer stock.
- Conducting Cholinesterase test for the staff engaged in locust control work to see any adverse effects of pesticides.
- Locust Unit at Directorate's Headquarter, Faridabad and RLCIPMC, Jodhpur monitor the global ecological conditions and locust situation along the Red Sea coast and winter /summer breeding areas of Southwest Asia region (Pakistan, Iran and Afghanistan) which can cause possible threat to India. National Locust situation is also monitored and reviewed periodically.
- Provision of funds to be kept for dealing locust emergency as per the situation.
- Provision of stand by aircrafts/ helicopter for control operation if the situation so warrants.

#### **Preparation of survey schedule**

- An annual meeting of officers and officials of Regional Locust cum IPM Centre (RLCIPMC) is held usually in April or May wherein the locust survey schedule and contingency plan is discussed and finalized to combat the impending locust threat by undertaking the survey and surveillance work in Schedule Desert Area of Rajasthan and Gujarat.
- The surveys are conducted in the entire border/ coastal areas along with Indo-Pak border in the States of Gujarat and Rajasthan.

#### **Updating of contingency plan**

- The contingency plan is updated to ascertain the requirement and availability of the resources required for locust control e.g. emergency fund, pesticides, communication equipment, vehicles, aircraft, trained manpower, survey and control equipment, protective clothing, first-aid kits, etc.

- Review of available resources with RLCIPMC is done in every six months so that nothing could remain unnoticed for effective control campaign in case of locust threat. The contingency plan is updated based on the resources and locust threat perception obtained through field surveys and FAO forewarning.
- If any shortcoming is observed during updating of the contingency plan, higher authorities are made aware of the matter and immediate steps are taken to resolve the same. The updating is done by a team consisting of Joint Director (E) and Plant Protection Adviser at Directorate H.Q. Faridabad, Officer In charge, RLCIPMC Jodhpur, In-charges of LCIPMCs.

### **Testing of the contingency plan**

Mock drill exercise in full scale is organized in the beginning and ending of the summer breeding seasons i.e. in the months of May/June, November & December every year to test the practically ground implementation of the prepared contingency plan and to plug the gaps if any. The said mock drill will be organized by RLCIPMC, Jodhpur and at all 9 LCIPMC's every year.

### **Actions taken before locust high alert or swarm incursion**

- All the plant protection equipment's are checked for their working conditions. If required, repairing of the same is done to make them fully operational.
- Similarly, all the vehicles are tested for their working conditions and needful is done.
- Mock drill to be organized before commencement of the locust season to ensure the capability of all infrastructures required at the time of Desert locust control operation.
- Refresher trainings to the locust staff and staff of State Department are organized.
- An emergency meeting among the State Chief Secretaries and Senior Officers of DA&FW/ Directorate of PPQ&S is organized to finalize immediate deployment of resources in the threat prone areas.
- Telephonic discussions with the State agriculture authorities like Secretary Agriculture, Director of Agriculture and District Collectors of threat prone districts for arranging immediate assistance and cooperation to fight with locust emergency.
- Intensify the Desert Locust surveys in threat prone areas to detect any locust swarm invasion.
- Regular liaison with FAO through e-mail or telephone/whatsapp.
- In-charges of RLCIPMC, Jodhpur and other field functionaries are instructed to take stock of the situation by deploying the teams in threat prone areas for conducting survey and control operation.

- Control rooms to be established at district level.
- Meetings with District Collectors to be organized to discuss the prevailing locust situation and steps taken to control the locust infestation.
- Indian Air force to be sensitized on requirement of Helicopters for undertaking the aerial spraying against locust swarms.
- Meteorological Department is approached to provide daily wind pattern during locust emergency.
- Public awareness is created through electronic and print media.
- District and Village level committees are formed to monitor progress of the locust control programme.

### **Triggering of the plan**

The Officer-in-charge, RLCIPMC Jodhpur is fully responsible for triggering the plan in case of locust invasion, outbreak and upsurge after getting the administrative approval and financial sanction from the competent authority of Ministry of Agriculture & Farmers Welfare, Department of Agriculture & Farmers Welfare, Government of India. The plan is triggered based on the information of the current locust situation and expected developments as indicated by the results of national surveys and assessment by the RLCIPMC Desert Locust Information Officers, duly supplemented and confirmed by FAO.

Execution of contingency plan will start after thorough consideration of locust situation and getting feedback from the locust information officers and the surveying teams. The plan will be executed within 24 hours of its trigger.

### **Implementation of contingency plan in case of outbreak, invasion or upsurge**

#### **Outbreak**

- There are 9 LCIPMCs, and one RLCIPMC Jodhpur, each circle has control potential for treating about 300 ha/day. In case of emergency, pesticide from the storage site can be mobilized within 6–10 hours and technical manpower from other schemes can be mobilized for undertaking control operations.
- At present there is stock of around 14,185 liters of Malathion 96% ULV is available against minimum buffer stock of 10,000 liters.
- Memorandum of Agreement is made with **M/S HIL (India) Ltd.** to supply pesticide on emergency requirement.

#### **Invasion**

- India is most at risk of a swarm invasion just before the onset of the seasonal monsoon in Rajasthan and Gujarat during June and July by swarms originating in the Arabian Peninsula and Horn of Africa.

- In case of a swarm invasion, RLCIPMC should follow the relevant contingency plan, including the provision of availing five Mi-17 helicopters from Indian Air force for aerial control.

### **Upsurge**

- In case of upsurge, extra staff and vehicles from other divisions of Directorate of PPQ&S and from State Govt. will be deployed. The said practice has already been applied in past operations. Staff to be seconded should be trained in locust control operations from time to time. Any remaining untrained staff may be given short training on control operations before deploying them to the field. The time required for such arrangements is about one week.
- Funds for this activity will be transferred from other Schemes of the Ministry of Agriculture & Farmers Welfare, Department of Agriculture & Farmers Welfare as stated earlier.

### **Implementation and execution of locust control campaign**

With the onset of locust season, an alert is issued to the State Agriculture/Horticulture authorities of Rajasthan, Gujarat, Haryana and Punjab. Other stakeholders like Ministry of Home Affairs, Defence, Science and Technology, Civil Aviation, Communication, Aircraft Companies and Pesticides Manufacturing Firms etc. are also requested for providing needful assistance during locust emergency, if required. Different steps involved are as under:

- Locust reporting – reporting of swarm movement or their settling spot etc.
- Conduction of surveys to confirm the presence of Locust swarm / hopper bands.
- Tracking of locust swarm to ascertain the swarm settling site.
- Deployment of control teams for controlling the settled swarm.
- Evaluation of control operation/ mortality in the afternoon.
- Recording of the control data in e-Locust3 & eLocust3m pro.
- Planning for locust control and survey work for next day.

### **Daily activity during control operations**

The following types of activities are performed daily during control operations:

- Report of swarm movement / hopper bands/ settled swarm.
- Deployment of ground/ aerial control teams.
- Earmarking of infested area/ site on map.
- Positioning of control teams/ pesticides/ aircrafts/ POL at control sites.
- Issue of pesticides, control equipment, protective clothing, POL and other store items required for control operation.

- Reporting/receiving of control data from field.
- Compilation of field data like area treated and mortality achieved.
- Compilation of control data, pesticides consumption and review of remaining stock position and additional requirement in respect of vehicles/ pesticides/ POL.
- Preparation of daily locust situation report and appraising the locust situation to the competent authorities of State Government and Central Government as well as FAO
- Briefing to Pilot/ ground crew/ aerial parties/ ground control teams regarding control operation to be taken.
- Daily review of progress of campaign and planning for next day operation.

The item wise financial requirement for the activities like expenditure on aerial control, pesticides purchase, POL, labour charges, daily paid workers, stationary, general store, motor parts, TA and DA, protective clothing, telephone bills and job works etc. are assessed in advance and the provision is made as an emergency fund to combat the locust threat in advance.

When aerial control operations are required, Joint Secretary (Plant Protection), Government of India is authority for execution of contingency plan on the recommendation of Plant Protection Adviser, Directorate PPQ& S, Faridabad.

### **Role of additional stakeholders**

#### **Ministry of Home Affairs**

To advise BSF authorities to extend help and to provide facilities in border surveys, arranging Indo-Pak border meetings and extend help in reporting of locust population/swarm through BSF staff.

#### **Ministry of Defence**

To provide wireless sets (High Frequency and Very High Frequency), trained manpower during locust emergency.

#### **Ministry of Earth Sciences**

India Meteorological Department to provide relevant meteorological data.

#### **Ministry of Civil Aviation**

To grant permission from Air Traffic Control (ATC) for flying aircraft during locust control operation.

#### **Ministry of External Affairs.**

Permission to participate in Indo-Pak locust officer's border meeting along with BSF.

#### **Ministry of Information and Broadcasting**

To collaborate with Regional Locust cum IPM Centre concerning media and news coverage of the locust emergency. The designated and appropriate spokespersons from RLCIPMC will do the needful.

## **Departments of State Government**

The State Departments are sensitizing to report following:

- To report locust information to RLCIPMC.
- To provide assistance in form of vehicles and manpower during locust control campaign.
- To conduct survey, surveillance and control of locust in cropped areas.
- To create awareness among public and farmers about locust.
- To provide facilities to RLCIPMC staff during locust survey and control campaign.

### **State Department of Health**

- To administer baseline ChE tests of pesticide spray operators at the beginning of the campaign.
- To follow during the campaign, the health of these operators and administer final ChE test.

### **Pesticide manufacturing firms**

- To arrange supply of required quantity of pesticides on short notice during locust emergency.

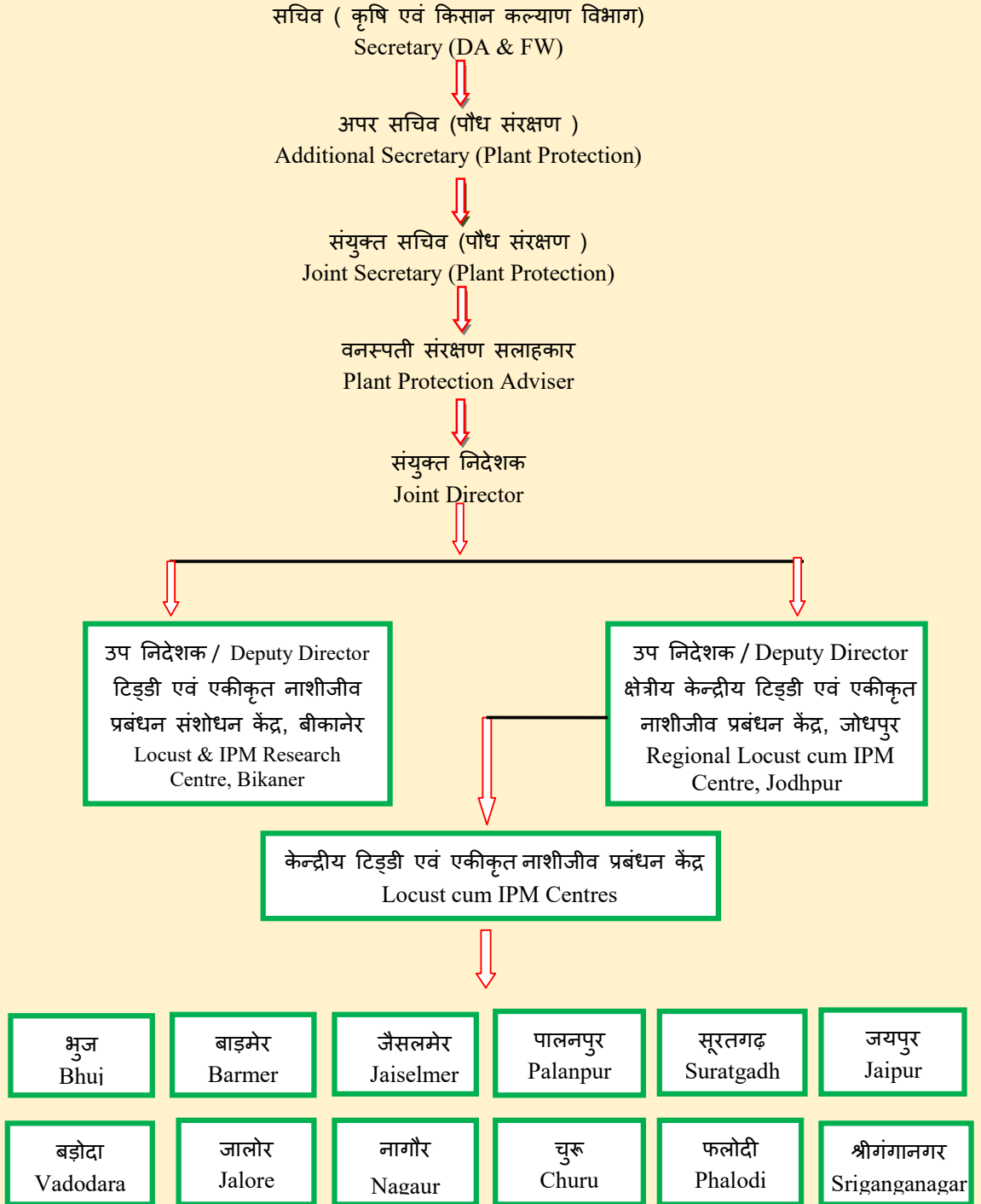
## **Mopping up and post-control operations**

- Control teams on return to their HQ deposit the leftover pesticides and non-consumable store items to In-Charge of the office.
- In-Charges of control operation are to ensure that all the control equipments are properly cleaned by the mechanics before relieving the control team officials for their respective headquarters.
- In-Charges of control teams have to prepare a consolidated report on operations conducted and submit the same to Field HQ for further action.
- In-Charges of control teams have to ensure that all the bills pertaining to locust control operations must be properly documented, verified and passed.
- A meeting should be organized with all persons involved in the control campaign to identify and discuss any shortcomings and difficulties.
- The contingency plan should be updated to address the shortcomings to avoid reoccurrences in future campaigns.

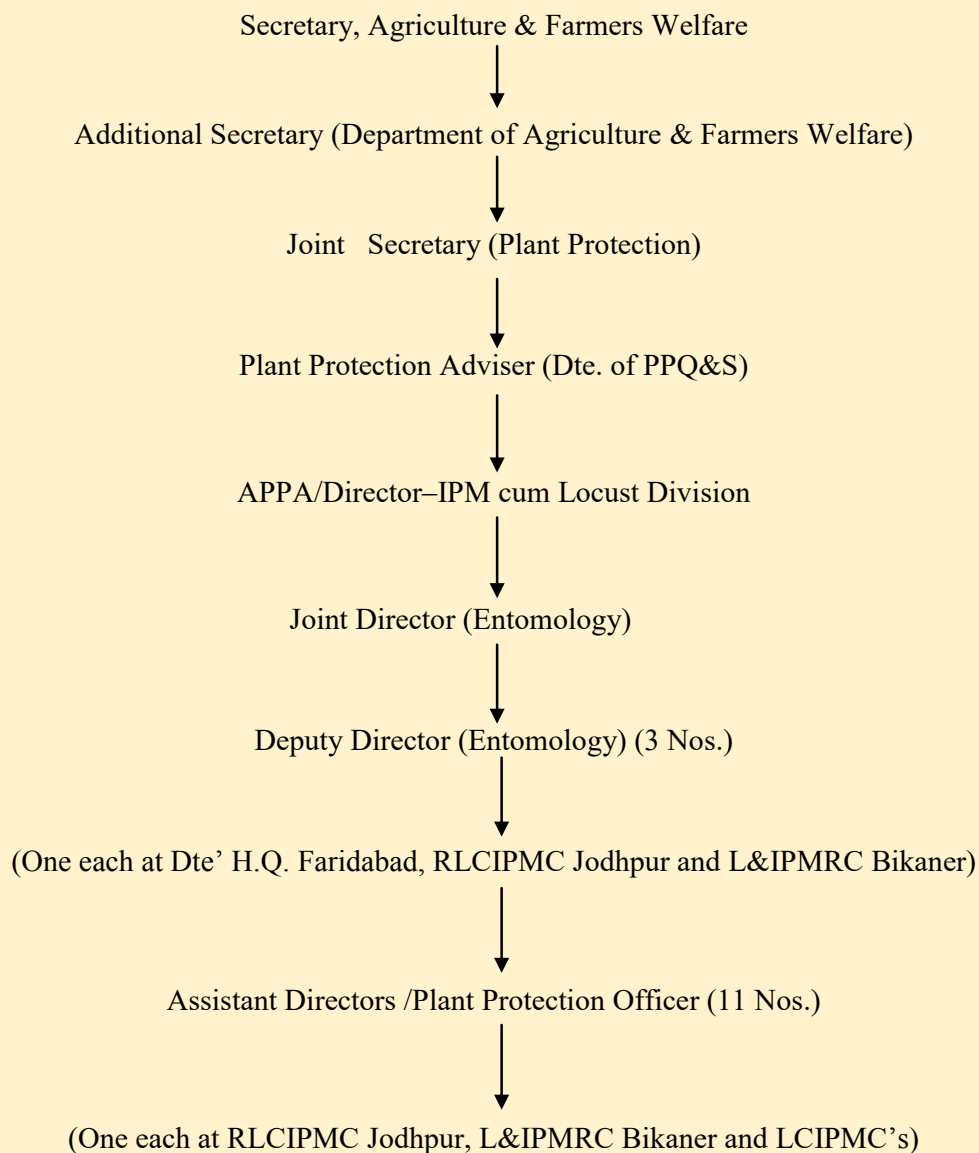


## Annexure 1. Setup of RLCIPMC

### क्षेत्रीय केन्द्रीय टिड्डी एवं एकीकृत नाशीजीव प्रबंधन केंद्र का विभागीय प्रारूप Organizational set up of RLCIPMC



## **Annexure 2. Administrative structure of Locust Control and Research**



### Annexure 3. Definitions of technical terminology

Locust is generally found in two phases:

- i) **Solitary:** When it is inactive and individual locust live scattered.
- ii) **Gregarious:** When it is very active, the individuals tend to remain together, breed rapidly and form swarms which leave the breeding grounds and invade far distant tracts and even cross many countries. In addition to difference in behavior, the two phases can generally be distinguished by color and some anatomical and morphological features. The two phases run into each other, as there are some individuals which are intermediate in habits and physique and are therefore considered to be in *transient* phase. Other terms generally used in locust are as under:

#### **ISOLATED (Few)**

- i) Very few present and no mutual reaction occurring.
- ii) 0-1 adult/400 m foot transect (or less than 25/ha.).

#### **Scattered (Some, Low numbers)**

- i) Enough present for mutual reaction to be possible but no ground or basking groups seen:
- ii) 1-20 adults/400 m foot transect (or 25-500/ha).

#### **Group**

- i) Forming ground and basking groups;
- ii) 20+ adults/400 m foot transect (or 500+/ha).

#### **Adult Swarm and Hopper band sizes**

**Very Small:** swarm: less than 1km<sup>2</sup>/ band: 1 - 25 m<sup>2</sup>

**Small:** swarm: 1 - 10 km<sup>2</sup>/ band: 25 - 2,500 m<sup>2</sup>

**Medium:** swarm: 10 - 100 km<sup>2</sup>/ band: 2,500 m<sup>2</sup>-10 ha

**Large:** swarm: 100 - 500 km<sup>2</sup>/ band: 10 - 50 ha

**Very large:** swarm: 500+ km<sup>2</sup> / band: 50+ ha

#### **Rainfall:**

**1. Light:** 1 – 20 mm of rainfall.

**2. Moderate:** 21 – 50 mm of rainfall.

**3. Heavy:** more than 50 mm of rainfall.

#### **Other reporting terms**

**Breeding:** the process of reproduction from copulation to fledging.

**Summer rains and breeding:** July – September/October

**Winter rains and breeding:** October – January/February

**Spring rains and breeding:** February – June/July

**Decline:** A period characterized by breeding failure and/or successful control leading to the dissociation of swarming populations and the onset of recessions: can be regional or major.

**Outbreak:** A marked increase in locust numbers due to concentration, multiplication and gregarisation which, unless checked, can lead to the formation of hopper bands and swarms.

**Upsurge:** A period following a recessions marked initially by a very large increase in locust numbers and contemporaneous outbreaks followed by the production of two or more successive seasons of transient-to-gregarious breeding in complimentary seasonal breeding areas in the same or neighboring Desert Locust regions.

**Plague:** A period of one or more years of widespread and heavy infestations, the majority of which occur as band or swarms. A major plague exists when two or more regions are affected simultaneously.

**Recession:** Period without widespread and heavy infestations by swarms.

**Remission:** Period of deep recession marked by the complete absence of gregarious populations.

**Warning levels:**

- **Green**

**Calm:** No threat to crops. Maintain regular surveys and monitoring.

- **Yellow**

**Caution:** Potential threat to crops. Increased vigilance is required: control operations may be needed.

- **Orange**

**Threat:** Threat to crops. Survey and control operations must be undertaken.

- **Red**

**Danger:** Significant threat to crops. Intensive survey and control operations must be undertaken.

#### Annexure-4: List of approved pesticides for control of Desert Locust

##### A. Pesticides approved used for control of Desert Locust in Scheduled Desert Area only

S.No.	Name of pesticides	Dosage	
		a.i.(gms)/ha	Formulations (gm/ml) / ha
1	Malathion 96% ULV	925	1000
2	Malathion 5%DP	925	20000
3	Fenvalrate0.4%DP	80-100	20000-25000
4	Quinalphos 1.5%DP	375	25000

##### B. Pesticides approved used for control of Desert Locust on crops, Acacia& other trees.

S.N o.	Name of pesticides	a.i.(gms)/ha	Formulations (gm/ml)/ha
1	Chloropyriphos 20%EC	240	1200
2	Chloropyriphos 50%EC	240	500
3	Deltamethrin 2.8%EC	12.5	500
4	Deltamethrin 1.25% ULV	12.5	1000
5	Diflubenzuron 25%WP	60*	240
6	Fipronil 5%SC	6.25	125
7	Fipronil 2.92%EC	6.25	220
8	Lamdacyhalothrin5%EC	20	400
9	Lamdacyhalothrin10%WP	20	200
10	Malathion 50% EC	925	1850
11	Malathion 25% WP	925	3700

\*Only for hoppers control



**Government of India**  
**Ministry of Agriculture & Farmers Welfare**  
**Department of Agriculture & Farmers Welfare**  
**Directorate of Plant Protection, Quarantine & Storage**  
**NH-IV, Faridabad -121001 (Haryana) India**