

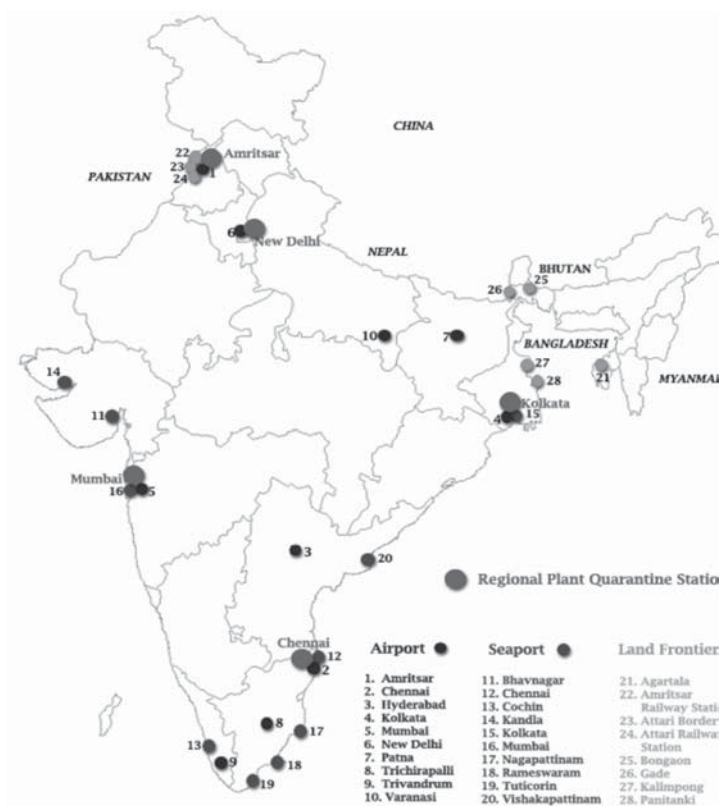
# PLANT QUARANTINE INCLUDING INTERNAL QUARANTINE STRATEGIES IN VIEW OF ONSLAUGHT OF DISEASES AND INSECT PESTS

## PREAMBLE

Over the past four decades, Indian agriculture has made rapid strides in augmenting food production. However, the liberalization of world trade in agriculture since the establishment of WTO in 1995 has brought in many challenges apart from opening up new vistas for growth and diversification of agriculture. We need to sustain food security along with the economic and environmental security. In the past, a number of plant and animal diseases and pests have been introduced inadvertently through import of seeds/ planting material/ livestock and livestock products of which several have become established and cause serious economic losses every year.

The Directorate of Plant Protection, Quarantine and Storage (DPPQS) of Ministry of Agriculture is the nodal agency in India for implementing plant quarantine regulations which have recently been revised and known as the **Plant Quarantine (Regulation of Import into India) Order 2003** (henceforth referred to as PQ Order). DPPQS deals with the commercial import of consignments of grains, plants and plant products for consumption through its network of 35 Plant Quarantine Stations spread across the country including seaports, airports and land frontiers as well as commercial imports of seeds/ plants for sowing or planting through five major stations at Amritsar, Chennai, Kolkata, Mumbai and New Delhi (Figure 1). Besides the twenty eight plant quarantine stations marked in the map, there are seven stations viz., Attari-Wagah Border- Railway Station, Attari-Wagah Border- LCS and Amritsar Railway Station (under RPQS Amritsar); ICD Tughlakabad, Air Cargo, Delhi Airport (under NPQS, Delhi), Air Cargo, Mumbai (under RPQS, Mumbai) and Air Cargo, Kolkata (under RPQS, Kolkata) as working units under the major stations.

National Bureau of Plant Genetic Resources (NBPGR) undertakes the quarantine processing of all germplasm including transgenic planting material under exchange for research purposes. NBPGR also deals with testing for absence of terminator technology which is mandatory as per national legislation. This authorization was vested upon NBPGR for germplasm vide Article 6 of PQ Order 2003 and for transgenic planting material vide Govt. of India Notification No. GSR 1067(E) dated 05.12.1989.



**Figure 1- Location of various plant quarantine stations in India**

For intra-country or internal quarantine of plants/ planting material, domestic quarantine regulations have been promulgated for regulating inter-state movement of agricultural commodities under the Destructive Insects and Pests (DIP) Act of 1914. Presently, there is a provision to restrict the inter-state movement of nine pests viz., fluted scale, San José scale, coffee berry borer, codling moth, *Banana bunchy top virus*, *Banana mosaic virus*, potato cyst nematode, potato wart and apple scab.

In mid 2007, the Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, began a process of consultation on improvement of the plant protection/ quarantine activities in the country. Five major areas viz., pest surveillance, human resource development, phytosanitary capacity building, quality control and registration of pesticides and developing modules for integrated pest management, were identified to bring substantial improvement in its services. The Task Force undertook gap analysis for each of the areas to develop implementation plans for its respective area.

Keeping in view the recommendations of the Task Forces and the present status of quarantine, the areas which need special attention in order to upgrade our quarantine system are broadly categorized as follows:

#### **International Quarantine**

- Strengthen pest risk analysis (PRA) for import of agricultural commodities, be it plant or animal and other risk factors associated with GMOs, biocontrol agents and other microorganisms.
- Upgrade Plant Quarantine Stations in terms of trained manpower and infrastructure.
- Continue the review of the national quarantine legislation in the light of Agreement on Application of Sanitary and Phytosanitary (SPS) Measures of WTO and the status of our compliance with SPS/ WTO.
- Initiate pre-import inspection and strengthen the post-entry quarantine (PEQ) growing and inspection of imported material.
- Establish a National Biosecurity Centre to deal with biosecurity in a comprehensive manner to achieve food safety, protect animal and plant life and health and also protect the environment.

#### **Domestic Quarantine**

- Review the status of existing domestic quarantine for establishment of interstate quarantine check-posts to monitor movement of pests of significance.
- Review the national regulatory framework and develop a mechanism for distribution or sale of pest-free seeds/ plants/ planting material within the country, be it seed distribution for multilocation testing under All India Coordinated Research Projects, inland supply of germplasm by NBPGR or seed distribution by the National/ State Seed Corporations/ private organizations.
- Strengthen state certification mechanism to ensure the supply of pest-free nursery material.
- Develop an early warning system and rapid response team to curtail spread/ eradicate the recently introduced pests in an area so as to avoid their further spread and establishment.
- Amend the Biological Diversity Act 2002 for making provisions to check international/ interstate movement of invasive pests and to harmonize the Act with the quarantine and Export-Import (EXIM) regulations for implementation.

## Research and HRD

- Reprioritize research in areas that need immediate emphasis such as survey and surveillance of diseases/ pests, development of digitized keys, development of diagnostic protocols using serological and molecular techniques for detection of exotic pests/ transgenes.
- Develop a strong programme of awareness generation on importance of biosecurity for various stakeholders such as academia, policy makers, custom officials, students and general public.

## Deliberations made during the Brainstorming Session

The Brainstorming Session on ***Plant Quarantine including Internal Quarantine Strategies in View of Onslaught of Diseases and Insect Pests*** was organized on November 4, 2008 for assessing the current situation and to deliberate on the course of action to meet the future challenges. The Session was attended by 25 participants from ICAR institutes, State Agricultural Universities and private sector including some senior experts. This policy paper is an outcome of the deliberations and discussions during the Session.

The gaps to be addressed in National Plant Quarantine System were identified and emphasis was laid on the need to strengthen/ upgrade infrastructure and expertise; training for Phytosanitary Certificate issuing authorities, seed health testing technicians and pest control operators and development of post-entry quarantine facilities. Emphasis was also laid on the need for hastening the process of developing more National Standards in tune with International Standards for Phytosanitary Measures (ISPMs) to comply with the Agreement on Application of Sanitary and Phytosanitary Measures. Besides, the need to develop Standard Operating Procedures (SOPs) and develop/ update the laboratory manuals for use by quarantine personnel was also emphasized. The various issues related to quarantine procedures were highlighted and discussed.

## Issues concerning Plant Quarantine in India

There are a number of issues related to quarantine in exchange of plant/ planting material. The legislative issues are specific to material being exchanged in bulk or as small samples meant for research, whereas technical issues on quarantine processing and methodology are applicable to both.

## Legislative issues

The national quarantine legislation needs to be in harmony with the international norms laid down by the International Plant Protection Convention (IPPC) and most of the countries

are in the process of trying to gear up their activities to comply with it. India has attempted to do so by bringing out the PQ Order 2003.

#### **Issues specific to germplasm exchange**

- The various schedules viz., V (Restricted species where import is permitted only by authorized institutions), VI (Restricted species whose import is permitted only with additional declarations of freedoms from quarantine/ regulated pests and subject to specified treatment certifications) and VII (Plant material whose import for consumption / industrial processing is permitted with a normal Phytosanitary Certificate) of the PQ Order give lists of crops for which a generic PRA is given and detailed PRA is not required. In case of germplasm, a large number of species of cultivated crops (and their wild relatives/ land races) with useful traits are imported but may not find mention in any of the schedules. Hence, a PRA becomes obligatory for them and the modalities of its preparation have been developed by Department of Agriculture and Cooperation (DAC), Ministry of Agriculture. Since, 2007, Director, NBPGR is empowered to issue Import Permit for germplasm after undertaking PRA to facilitate import of planting material. The PRA undertaken for germplasm needs to be considered case-by-case for listing the pests under additional declarations at the time of issue of Import Permit. This would greatly help the indenters in procuring germplasm of their interest from varied sources.

#### **Issues specific to bulk material in trade**

- In India, the quarantine officials at ports of entry do not have the authority to search and seize the personal baggage of the incoming travelers, and the powers are vested only with custom officials who are not professionally trained to understand the importance of pests. The customs officials need orientation programmes for appreciating the importance of quarantine.
- The provisions under the DIP Act, 1914 and its amendments for domestic quarantine to restrict the inter-state movement of nine invasive pests need to be reviewed for their current distribution and regulatory measures implemented to check their further spread into neighbouring states within the country. Establishment of inter-state barriers or check-posts on the movement of seeds and planting materials of their host species could be a possible solution. Besides, some of the recently introduced pests like sunflower downy mildew (*Plasmopara halstedii*) in 1984, American serpentine leaf miner (*Liriomyza trifolii*) in 1991, spiraling white fly (*Aleurodicus dispersus*) in 1993 and biotype 'B' of white fly *Bemisia tabaci* in 1999, etc. also need to be considered for inclusion under domestic quarantine.

## Technical issues

The quarantine laboratories adopt various general and specific detection techniques for different pests based on the nature and the volume of the material imported. The imported material generally includes seeds (true seed), grains, vegetative propagules, seedlings, root stocks, stem cuttings, whole plants, fruits and *in-vitro* cultures. The quarantine procedures integrate various methodologies of Pathology, Entomology, Nematology and Plant Taxonomy for detection of pests and also for salvaging the infected/ infested samples.

Over the years, a large number of pests have been intercepted in imported bulk consignments and in germplasm and other research material during quarantine processing. The intercepted pests can be divided into the following categories:

- (i) Pests not known to occur in India
- (ii) Pests with different races/ biotypes/ strains not known to occur in India
- (iii) Pests intercepted on a new host or are from a country from where they have never been reported before
- (iv) New pest species hitherto unreported in science
- (v) Pests reported to be present in India but with a wide host range

These interceptions, especially of pests and their variability not yet reported from India [Category (i) and (ii)] signify the importance of quarantine in preventing the introduction of destructive exotic pests. The categories (iii) and (iv) pests are not expected in the sample as per the PRA, which is literature-based and since no records are available on the pest/ host, their presence is unexpected and hence, important from quarantine view point. The last category (v) - pests with a wide host range are critical and could become invasive in case they find suitable biotic and abiotic environment.

The significant interceptions made, which are yet not reported from India, include insects like *Acanthoscelides obtectus* in *Cajanus cajan* and *Phaseolus vulgaris* from Brazil, Colombia, Italy and Nigeria, *Anthonomus grandis* in *Gossypium* spp. from USA, *Ephestia elutella* in *Macadamia* nuts and *Vigna* spp. from USA, *Quadrastichodella eucalyptii* in *Eucalyptus* from Australia, nematodes like *Heterodera schachtii* from Denmark, Germany and Italy, *Ditylenchus dipsaci*, *D. destructor*, *Rhadinaphelenchus cocophilus*, etc. in soil clods and plant debris, fungi like *Claviceps purpurea* in seeds of wheat, barley, etc. and, *Peronospora manshurica* on soybean from several countries, *Fusarium nivale* on wheat barley and *Aegilops* sp. from Germany, Italy, Hungary, Sweden and UK, *Uromyces betae*

on sugarbeet from Belgium, Germany, Italy, UK and USA, bacteria like *Xanthomonas campestris* pv. *campestris* on *Brassica* spp. from Canada, France, Pakistan, Sweden, Taiwan, UK and USA and viruses like *Barley stripe mosaic virus* on wheat from USA, *Cowpea mottle virus* on cowpea from Philippines, *Raspberry ring-spot virus* on soybean from AVRDC (Taiwan), Sri Lanka, Thailand, USA etc. Such interceptions signify the success of quarantine as otherwise these pests could have entered the country and played havoc with the plant biodiversity and agriculture had they not been detected and stopped during quarantine processing.

The other technical issues pertain to quarantine processing i.e. methodology for detection and salvaging of pests and are enumerated as follows:

- In case of bulk consignments, a proper sampling of the lot is to be done as per the norms for ensuring an effective processing of the material. However, due to stacking of containers of bulk material or inaccessibility, proper sampling procedures are not followed leading to oversight during quarantine processing.
- Despite the fact that the five major Plant Quarantine Stations have been modernized, they remain poorly staffed. There is a need for trained personnel to deal effectively with the quarantine processing of huge amount of samples received annually. Besides, the stations especially those seaports that deal with timber log imports need a complete revamping in terms of space, expertise and facilities to ensure pest-free timber imports.
- The material known/ suspected to carry viruses needs to be grown in isolation and the seedlings showing symptoms should be tested for viruses by a combination of biological/ physical/ serological/ molecular tests. The inspection authorities authorized under the PQ Order need to follow the SOPs notified in 2007 for post-entry quarantine inspection. Although this might delay the release and use of the material but would ensure its healthy status.
- For accurate diagnostics the reagents such as antisera for viruses/ bacteria are often not easily available especially for exotic pests for which a repository of antisera needs to be established. Also, there is a need to establish a repository of seeds of indicator hosts. Expertise is also required to identify new pathogens or strains unknown to a region.
- The identity of the pest, when intercepted in quarantine, needs to be established speedily to determine the quarantine risk posed by the pest and suitable disinfestation procedure to be applied. For example, identification of quarantine insect pests is

difficult because few institutions have an insect reference collection especially for exotic insect pests and identification keys are not readily available. Moreover, even if information on the species is available, it is scattered in various journals and quick retrieval is a problem. Therefore, there is a need to consolidate the taxonomic information through the preparation of digitized keys for quick and accurate identification of intercepted pests.

- Research prioritization in quarantine would involve :
  - (i) Generation of comprehensive epidemiological data on important pests/ diseases to determine their *tolerance limits*. This would also help in developing PRA.
  - (ii) Development of sensitive and non-destructive detection techniques to detect low levels of infections especially in case of small samples of germplasm.
  - (iii) Development of suitable alternatives to methyl bromide (MB), a widely used quarantine fumigant being phased out due to its adverse environmental impacts. India is legally committed to phase out the use of MB and is allowed (by virtue of being a developing country) to use MB only for pre-shipment and quarantine purposes till 2015.
  - (iv) Development of molecular techniques for detection of races/ biotypes/ strains also needs to be intensified as they are also considered as pests under the IPPC definition of pest, which should be sensitive enough to detect even low levels/ concentrations of pests.
  - (v) Studies on factors affecting likelihood of survival of pest under different conditions of transport, mode of dispersal, distribution of hosts/ alternate hosts at destination, potential for establishment, reproductive strategy and method of pest survival, potential vectors and natural enemies of the pest in the area etc. need to be urgently undertaken to authentically prepare a PRA during exchange.
  - (vi) Development of pest eradication strategies for recently introduced pests and also for pests with limited distribution.
- At present the bulk imports of seeds/ grains of transgenic crops are not allowed. It is expected that they may be allowed on case-to-case basis in near future after the biosafety issues are addressed satisfactorily. Therefore, the DPPQS needs to develop infrastructure and expertise to handle the transgenics in quarantine.

### Recommendations

The recommendations pertaining to upgradation of international quarantine system, implementation of domestic quarantine system, researchable issues and HRD are presented below:



## Policy

- Establish a National Agricultural Biosecurity System (NABS) comprising of an autonomous Plant Quarantine Authority. The NABS would regulate all the issues related to agri-horticultural crops, livestock, poultry, aquatic resources including GMOs. The system should forge functional networking to promote research consortia among the existing institutions in the public, private, academic and civil society sectors engaged in monitoring, biosafety testing, quarantine and other biosecurity programmes.

*(Action: Department of Agriculture and Cooperation)*

- Strengthen pest risk analysis, the components of research that support it and review the PQ Order periodically in the light of new developments.

*(Action: Department of Agriculture and Cooperation in collaboration with ICAR)*

- Strengthen post-entry quarantine and the Inspection Authorities should be given adequate support in terms of manpower and funds for effectively undertaking the work.

*(Action: Department of Agriculture and Cooperation in collaboration with ICAR and SAUs)*

- Establish and strengthen linkages among the various government agencies such as NDMA, NBA, APEDA, etc. to share the resources for a coordinated action for pest/disease exclusion or containment at local, regional and national levels.

*(Action: Concerned Stakeholder Ministries)*

- Develop a Task Force on Domestic Quarantine to review and revise list of pests to be regulated to prevent inter-state spread of new and emerging indigenous pests and diseases.

*(Action: Department of Agriculture and Cooperation in collaboration with State Agricultural Departments)*

- Develop rapid response teams to deal with epidemic situations.

*(Action: Department of Agriculture and Cooperation in collaboration with State Agricultural Departments)*

- Develop a national mechanism to ensure pest-free movement of vegetatively propagated material and tissue culture-raised plants across the states for trade and research.

*(Action: Department of Agriculture and Cooperation in collaboration with State Agricultural Departments/ ICAR/ SAUs)*

## Technical

- Regular survey and surveillance is required to map the distribution of pests and to identify pest hotspots. To achieve this, there is a need to develop specific need-based survey and surveillance programmes. Since SAUs, State Departments of Agriculture need to play a major role in this activity, special budget outlay should be given for survey and surveillance programmes. This would enable identification of pest-free areas (PFAs) for which a Special Task Force may be constituted.
- A database on survey and surveillance reports of pests of significance needs to be prepared.
- Comprehensive data on epidemiology for predicting the disease development especially in the context of global warming needs to be generated.
- Simulation models for developing an early warning system to predict outbreaks of pests and diseases need to be used. Remote sensing may also be used for the same.
- Simple, reliable quick and non-destructive diagnostics for detection and identification of pests/ pathogens/ races/ biotypes/ strains using digitized keys and molecular techniques and promote use of nanotechnology in rapid detection and identification of pests need to be developed. Also, methodology for detection of transgenes in bulk samples needs to be developed. Digitized keys/ pest libraries to include images of symptoms/ pests/ their identifying characters for ease in identification.
- Accreditation of diagnostic laboratories at central and state level including some well-equipped laboratories in private sector for quick and accurate identification of pests is required.
- There is a need for National Certification Programme for Seed Health.
- Eco-friendly alternatives to synthetic pesticides for disinfestation/ disinfection of pests need to be developed.
- SOPs with special reference to import inspection and quarantine clearance; hot air treatment facilities for wood packaging; irradiation; hot water immersion treatment facilities; vapour heat treatment facilities need to be developed. Laboratory manuals for use in Plant Quarantine Stations must be revised/ updated.
- Lists of potential quarantine pests related to all forestry species (besides those covered under the PQ Order) in consultation with Indian Council of Forestry Research and Education (ICFRE) need to be developed.

- An Advanced Centre of Pest Diagnostics working in network mode with DPPQS, ICAR, ICFRE, SAUs etc should be established.
- Proper authenticity for reports of new pests/ geographical distribution and deposition of reference cultures in the National Repositories should be made mandatory.
- Publication of research papers in scientific journals on surveys reporting non-occurrence of pests may be encouraged.
- Potential economic and environmental losses in the event of accidental introduction of important quarantine pest(s) into the country to mobilize resources for research and management need to be established.
- The web-based information portal for management of phytosanitary information and regulations including database on taxonomists and quarantine personnel should be strengthened.

#### **Capacity Building/ Awareness**

- Upgradation of Plant Quarantine Stations in terms of manpower, infrastructure (laboratories, treatment facilities and greenhouses) and expertise with special emphasis on advanced techniques for detection of pests, their strains/ biotypes, detection of genetically modified organisms (GMOs) in bulk samples and PRA through regular trainings needs to be strengthened.
- Training to Inspection Authorities on plant quarantine issues with special emphasis on post-entry quarantine requirements and methodology as per the notified SOPs be imparted.
- Rapid response teams at state level to deal with the sudden outbreak of pests need to be developed.
- Increased awareness on plant quarantine issues among custom officials, other airport officials, travelers and other stakeholders with diverse kind of teaching material both print and audio-visual for wider use is needed.

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