

Regulatory methods – Plant Quarantine and Inspection – Quarantine Rules and Regulations

Plant Quarantine

The term 'Quarantine' means simply forty i.e., 40 days period. This was more commonly referred to the period of detention for ships arriving from countries subject to epidemic diseases such as the Bubonic plague, cholera and yellow fever. The crew and the passengers used to be compelled to remain isolated on board for sufficient period to permit the diseases to develop and be detected. The purpose of the health authorities was to establish adequate detention period. Later on, the term 'Quarantine' came to be only used for the detention and the practices connected with it. The term got associated from the human disease field to the animal disease field and later on adopted to cover protective methods for the exclusion of pests and diseases of agricultural and horticultural crops.

In strict sense 'Plant Quarantine' refers to the holding of plants in isolation until they are believed to be healthy. Now, broader meaning of the plant quarantine covers all aspects of the regulation of the movement of living plants, living plant parts/plant products between politically defined territories or ecologically distinct parts of them. Intermediate quarantine and post entry quarantine are used respectively to denote the detention of plants in isolation for inspection during or after arrival at their final destination.

Importance

The entry of a single exotic insect or disease and its establishment in the new environment continues to cause great, national loss (table) till such time it is brought under effective control. In certain cases a country has to spend a few million rupees before success in controlling the introduced insect pest or disease is achieved.

Losses caused by introduced plant diseases

Disease	Host	Country	Introduced from	Losses caused
Canker	Citrus	U.S.A	Japan	\$ 13 million; 19.5 million trees destroyed
Dutch elm	Elm	U.S.A.	Holland	\$ 25 million -\$ 50,000 disease million

Blight	Chestnut	U.S.A.	Eastern Asia	\$ 100-1000 million
Powdery mildew	Grapevine	France	U.S.A	80% in wine production
Downy mildew	Grapevine	France	U.S.A	\$ 50,000 million
Bunchy top	Banana	India	Sri Lanka	Rs.4 crores
Wart	Potato	India	Netherlands	2500acres infected
South American leaf blight	Rubber	Dutch – Brazil	Guiana	40,000 trees destroyed
do	-do-	North Columbia	Brazil	78% trees destroyed
Blue mould	Tobacco	Europe	U.K	.\$ 50 million
–do	--do-	Sweden	U.K.	1.2 million Kroner

History

The first plant quarantine law was promulgated in Rollen, France in 1860 to suppress and prevent the spread of common barberry, the alternate host for wheat stem rust. Among other countries, the first few to establish plant quarantine services were Germany, France, Australia and the U.S.A. In India, legislative measures against crop pests and diseases was initiated under the Destructive Insects and pests Act of 1914 (DIP act) and it was passed by Governor General of India on 3 rd February, 1914. Under this Act, rules governing the import and movement of plants and plant materials, insects and fungi are framed. The Act provides

- It authorizes the Central Government to prohibit or regulate the import into India or any part there of any specific place therein, of any article or class of articles.
- It authorizes the officers of the Customs at every port to operate, as if the rules under the D.I.P. Act is made under the Sea Customs Act.

1. It authorizes the Central Government to prohibit or regulate the export from a State of the transport from one State to another State in India of any plants and plant materials, diseases or insects likely to cause or infestation. It also authorizes the control of transport and carriage and

gives power to prescribe the nature of documents to accompany such plants and plant materials and articles.

2. It authorizes the State Governments to make rules for the detention, inspection, disinfection or destruction of any insect or class of insects or of any article or class of articles, in respect of which the Central Government have issued notifications. It also authorizes the State governments for regulating the powers and duties of the officers whom it may appoint on this behalf.

3. It provides penalty for persons who knowingly contravene the rules and regulations issued under the Act.

4. It also protects the persons from any suit or prosecution or other legal proceedings for anything done in good faith or intended to be done under the Act. Consequent to Bengal famine 1943, a Central Plant Protection organization was established in 1946 under the then Ministry of Food and Agriculture. Often a new pest, disease or weed has accidentally entered a country where it did not exist before and has multiplied, spread and caused enormous damage to the crops of that country.

For instance powdery mildew of grapevine (*Plasmopara viticola*), introduced into France from America, was responsible for the destruction of the vine industry of that country until hybridization with resistant American stock offered a solution. The blight disease of chestnut (*Endothia parasitica*) which was introduced into U.S.A. from Asia in 1904, completely wiped out chestnut trees. Coffee rust (*Hemileia vastatrix*) which came into India in 1879 from Sri Lanka is now widespread in all coffee growing areas. Fire blight (*Erwinia amylovora*) of pear and other pomes which was introduced from England in 1940 is well established in Uttar Pradesh. Late blight (*Phytophthora infestans*) of potato introduced into India in 1889 from Europe is now present in many parts of the country. Flag smut (*Urocystis tritici*) of wheat introduced from Australia is now well spread in Madhya Pradesh, Punjab, Rajasthan and Uttar Pradesh. Rubber powdery mildew (*Oidium heavea*), which was introduced from Malaysia in 1938, is also causing great concern in Kerala. Black rot of crucifers (*Xanthomonas campestris* pv.*campestris*) believed to have been introduced to India with seeds imported from Holland, and other European countries after World War II, prevailed for some years on the hills and then spread to the plains and became established in Indian seed stocks, especially in West Bengal. Among the more important plant disease introductions, mention may be made of bunchy top virus of banana introduced from Sri Lanka in 1940 which has since spread widely in Kerala, Orissa, West Bengal

and Assam. The wart disease (*Synchytrium endobioticum*) of potato was first noticed in Darjeeling district of West Bengal having been introduced with seed potatoes from Holland. By 1962, the disease spread over nearly 1000 ha and has recently been reported from Nepal also. The mosaic disease of banana is another introduced disease which is only confined to Gujarat and Maharashtra states. Recently the apple scab (*Venturia inaequalis*) which was only confined to small area in Jammu and Kashmir has now appeared in severe form in many locations in Himachal Pradesh, and is posing a problem to apple industry. The establishment of a plant quarantine regulation should rest on the following fundamental pre-requisites.

- i. The pest/disease under consideration must be one that will offer actual or expected threats to substantial interests (Agricultural and / or commercial)
- ii. The quarantine regulation or decree must represent a measure for which no substitute action involving less interference with normal activities is available.

Diseases believed to have been introduced into India from foreign countries

Disease	Host	Date of first record	Introduction from
Leaf rust(<i>Hemileia vastatrix</i>)	Coffee	1879	Sri Lanka
Late blight (<i>Phytophthora infestans</i>)	Potato	Tomato 1883	Europe
Rust (<i>Puccinia carthami</i>)	Chrysanthemum	1904	Japan or Europe
Flag smut(<i>Urocystis tritici</i>)	Wheat	1906	Australia
Downy mildew(<i>Plasmopara viticola</i>)	Grapevine	1910	Europe
Downy	Cucurbits	1910	Sri Lanka

mildew(<i>Pseudoperonospora cubensis</i>)			
Downy mildew(<i>Sclerospora philippinensis</i>)	Maize	1912	Java
Foot rot (<i>Fusarium moniliforme</i> var. <i>majus</i>)	Rice	1930	South East Asia
Leaf spot(<i>Phyllachora sorghi</i>)	Sorghum	1934	South Africa
Powdery mildew(<i>Oidium heveae</i>)	Rubber	1938	Malaya
Black shank (<i>Phytophthora parasitica</i> var. <i>nicotianae</i>)	Tobacco	1938	Dutch East Insides
Fire blight Pear and other(<i>Erwinia amylovora</i>	pomes	1940	England
Crown-gall and hairy root (<i>Agrobacterium tumefaciens</i> A. <i>rhizogenes</i>)	Apple, Pear	1940	England

1. Bunchy top Banana 1940 Sri Lanka
2. Canker Apple 1943 Australia(*Sphaeropsis malorum*)
3. Wart Potato 1953 Netherlands(*Synchytrium endobioticum*)

Despite every precaution of inspection, certification and treatment, it is not always possible to guarantee that a consignment is completely free from pathogens. In doubtful cases it is advisable to subject plants to a period of growth in isolation under strict supervision in the importing country (post-entry quarantine). The plants are grown at a quarantine station. When direct importation of plants to a country's own quarantine station is considered very dangerous, quarantine during transit from the country of origin (intermediate quarantine) may be required.

The requirements of an intermediate station are similar to those for a post-entry station. Intermediate quarantine inspection must always be followed by post-entry quarantine after arrival of the consignment at its final destination. During post-entry or intermediate quarantine plants must be kept under close supervision, so that any pest or disease which appears may be immediately detected and grown under optimum conditions, so that symptoms are not marked by physiological disturbances.

International plant protection convention the first effort towards international agreement on Plant Protection was made in 1914 under the auspices of the International Institute of Agriculture in Rome. This was followed by an International Convention of Plant Protection by over 50 member countries of the Institute in 1919 and certain Agreements regarding the issue and acceptance of phytosanitary certificates were finalized. The project received a set back due to Second World War and was later on revived by the FAO. In post-war period International action in Plant Protection and particularly in plant quarantine was encouraged by FAO with the establishment in 1951 of the International Plant Protection Convention. This agreement was constituted with the purpose of securing common and effective action to prevent the introduction and spread of pests and diseases of plants and plant products as to encourage Governments to take all steps necessary to implement its prevention (Ling, 1953).

The following regional Plant Protection Organizations are now in operation.

1. The European and Mediterranean Plant Protection Organization (EPPO)
2. The Inter-African Phytosanitary Council (IAPSC)
3. Organismo International Regional de Sanidad Agropecuario (OIRSA)
4. The Plant Protection Committee for, the South East Asia and Pacific region.
5. Comité Interamericano de Protección Agrícola. (CIPA)
6. The Caribbean Plant Protection Commission (CPPC)
7. The North American Plant Protection Organization (NAPPO).

Under article 3 of that International Plant Protection Convention, the Plant Protection Agreement for South East Asia and Pacific Region was sponsored by F.A.O in 1956, and India became in party to this Agreement in the same year along with Australia, Sri Lanka, the U.K., Laos, Netherlands, Indonesia, Portugal and Vietnam. Our Government agreed to adopt

legislative measures specified in the Convention for the purpose of securing common and effective action to prevent the introduction and spread of pests and diseases of plants and plant products and to promote measures for their control and also agreed to assume all responsibilities for the fulfillment within its territories of all requirements under the Convention. It was agreed that the Government shall make provision for:

- a. An official plant protection organization, with the following main functions:
 1. The inspection of growing plants, of areas under cultivation and of plants and plant products in storage and in transportation with the object of reporting the existence, outbreak and spread of plant diseases and pests and of controlling those pests and diseases.
 2. The inspection of consignments of plants and plant products moving in international traffic, the inspection of consignments of other articles or commodities moving in international traffic under conditions where they may act incidentally as carriers of pests and diseases of plants and plant products and the inspection and supervision of storage and transportation facilities of all kinds involved in international traffic whether of plants and plant products or other commodities, with the object of preventing the dissemination across national boundaries of pests and diseases of plants and plant products.
 3. The disinfection or disinfestation of consignments of plants and plant products moving in international traffic, and their containers, storage places, or transportation facilities of all kinds employed.
 4. The issue of certificates relating to phytosanitary condition and origin of consignments of plants and plant products (Phytosanitary certificates).
- b. The distribution of information within the country regarding the pests and diseases of plants and plant products and the means of their prevention and control
- c. Research and investigation in the field of plant protection. A revised text of convention was approved in 1979. As of December 1980, the number of states party to the convention is 81. Besides this world-wide convention, other regional agreements and organizations have been created to safeguard the interests of groups of neighbouring countries with similar plant protection problems.

Regional action is needed to prevent a pathogen or pest absent from a whole area from being introduced into any part of the area, as its entry into one territory will endanger neighbouring countries.

Plant quarantine methods

There are number of plant quarantine methods which are used separately or collectively to prevent or retard the introduction and establishment of exotic pests and pathogens. The components of plant quarantine activities are:

1. Complete embargoes

It involves absolute prohibition or exclusion of specified plants and plant products from a country infected or infested with highly destructive pests or diseases that could be transmitted by the plant or plant products under consideration and against which no effective plant quarantine treatment can be applied or is not available for application.

2. Partial embargoes

Partial embargoes, applying when a pest or disease of quarantine importance to an importing country is known to occur only in well defined area of the exporting country and an effectively operating internal plant quarantine service exists that is able to contain the pest or disease within this area.

3. Inspection and treatment at point of origin

It involves the inspection and treatment of a given commodity when it originates from a country where pest/disease of quarantine importance to importing country is known to occur.

4. Inspection and certification at point of origin

It involves pre-shipment inspection by the importing country in cooperation with exporting country and certification in accordance with quarantine requirements of importing country.

5. Inspection at the point of entry

It involves inspection of plant material immediately upon arrival at the prescribed port of entry and if necessary subject to treatment before the same related.

6. Utilization of post entry plant quarantine facilities

It involves growing of introduced plant propagating material under isolated or confined conditions.

Plant quarantine organizations in India

The first recorded plant quarantine measure in India dates back to 1906 when perceiving the danger of introducing the Mexican boll weevil, the Government of India directed that all cotton imported from the New World should only be admitted to India after fumigation with

carbon disulphide at the port of entry. In India two categories of regulatory measures are in operation for controlling pests, diseases and weeds. In the first category regulatory measures are aimed to prevent the introduction of exotic pests and diseases into the country or their spread from one State or Union Territory to another (Plant Quarantine).

The second pertains to suppression or prevention of spread of pests and diseases in localized areas within a State or Union Territory. The former derives its authority from the Destructive Insects and Pests (DIP) Act 1914 of the Central Government and the latter from Agricultural Pests and Diseases Acts of the various States. The legislative measures against crop pests and diseases were initiated under the DIP Act of 1914 which was passed by the then Governor General of India in Council on 3 February 1914. Prior to the establishment of the Directorate of Plant Protection, Quarantine and Storage in 1946, under the Ministry of Food and Agriculture, the various rules and regulations of the DIP Act were enforced by the customs department. The quarantine regulations are operative through The Destructive Insects and Pests Act, 1914 (which has been revised 8 times from 1930 to 1956 and amended in 1967 and 1992).

The provisions of the DIP Act are

1. It authorizes the Central Government to prohibit or regulate the import into India or any part thereof or any specific place therein of any article or class of articles.
2. It authorizes the officers of the Customs at every port to operate, as if the rules under DIP Act are made under the Sea Customs Act.
3. It authorizes the Central Government to prohibit or regulate the export from a State or the transport from one State to another State in India of any plants and plant material, diseases or insects, likely to cause infection or infestation. It also authorizes the control of transport and carriage and gives power to prescribe the nature of documents to accompany such plants and plant materials and articles.
4. It authorizes the State Governments to make rules for the detention, inspection, disinfection or destruction of any insect or class of insects or any article or class of articles, in respect of which the Central Government has issued notification. It also authorizes the State Governments for regulating the powers and duties of the officers whom it may appoint on its behalf.
5. It provides penalty for persons who knowingly contravene the rules and regulations issued under the Act.

6. It also protects the personnel from any suit or prosecution or other legal proceedings for anything done in good faith as intended to be done under this Act.

The quarantine regulations are operative through “The Destructive Insects and Pests Act, 1914 (which has been revised and time from 1930 to 1956 and amended in 1967 and 1992. The Act also empowers the State Governments to frame suitable rules and issue notifications for inter-state movement of plant and plant material. Those rules are known as plant quarantine rules. Under the Act, Central Government frames rules prescribing the seaports, airports and land frontiers through which plants and specified plant material can enter India, and the manner in which these can be imported. The DIP Act operates under the National Sea Customs Act and the points of entry are located within the jurisdiction of State on the advice of Central Government, the State frames rules for detention, inspection, disinfection and destruction (as against entry) of material, if required, and delegates powers in this regard to concerned authorities with the enforcement of rules.

The plant quarantine service is centrally organized and administered through the Directorate of Plant Protection, Quarantine and Storage established under the Ministry of Agriculture (Department of Agriculture and Co-operation) which is headed by the Plant Protection Adviser to the Government of India and having its headquarters at N.H. IV, Faridabad, Haryana State. Import regulations When plants are imported the following principles should be followed. Some plant pathogens and pests are generally distributed in most parts of the world but others are more or less restricted in their occurrence.

In some cases this limitation is due to such factors as unsuitable environmental conditions or lack of the required host plant, but in many other cases the absence of a pathogen. Most countries are aware of the desirability of delaying for as long as possible the arrival of exotic pathogens and take action to prevent their spread by introducing legislation and setting up organizations to prevent their entry. Plant quarantine legislation varies from country to country but in most cases it restricts or prohibits the importation of the pests or pathogens themselves, plants on which they might be living, soil which might be infested, foodstuffs which might carry them, and packing materials, particularly those of plant origin. Good legislation is as brief and clear as possible, at the same time being easy to interpret, gives adequate protection without interfering more than is essential with trade, and contains only restrictions which are

scientifically justifiable. When plants are imported there are certain principles which, if followed ensure that as few risks as possible are taken.

1. Import from a country where, for the crop in question, pathogens which are particularly to be guarded against are absent.
2. Import from a country with an efficient plant quarantine service, so that inspection and treatment of planting material before despatch will be thorough, thus reducing the likelihood of contaminated plants being received.
3. Obtain planting material from the safest known source within the selected country.
4. Obtain an official certificate of freedom from pests and diseases from the exporting country. Treatment of the material in the country of origin may be done; this should be noted on the certificate.
5. The smaller the amount the less the chance of its carrying infection, and inspection as well as post-entry quarantine.
6. Inspect material carefully on arrival and treat (dust, spray, fumigate, heat treat) as necessary.
7. Import the safest type of planting material, e.g. seeds are usually safer than vegetative material, unrooted cuttings than rooted. The use of axenic cultures of meristem tip tissues (micropropagation) for the international exchange of germplasm material has outstanding advantages, as such tissues can be expected to be free from latent infections by viruses, phytoplasmas etc., as well as other pathogens which are more readily detectable by visual means.
8. If other precautions are not thought to be adequate, the consignment for import should be subject to intermediate or post-entry quarantine. Such quarantine must be carried out at a properly equipped station with suitably trained staff.

Seed was not originally included in the DIP Act, but because of the changing situation and to meet the current requirements, the Government of India passed the Plants, Fruits, Seeds (Regulation of Import into India) Order 1984 which came into effect in June 1985. The conditions for the import of 17 crops are stipulated in this order. The main features of the order are:

1. Seed has been brought under the purview of the DIP Act.
2. No consignment can be imported into the country without valid import permit issued by the Plant Protection Adviser to the Government of India.

3. No consignment can be imported without an official phytosanitary certificate issued by the plant quarantine agency of the exporting country.

4. Post-entry growth of the specified crops at approved locations.

A. Conditions for import

In India, there are general and specific conditions for the import of plants (including bulbs, tubers, rhizomes, corms, cuttings, buddings, grafts, layers, suckers, roots and flowers) and plant materials (including plant products such as ginned cotton, unmanufactured tobacco etc.).

General conditions

1. Import permits are essential for :

- a. Seeds and fruits for consumption,
- b. Seeds and plants for sowing or planting,
- c. Soil, earth clay for microbiological, soilmechanics or mineralogical investigations
- d. Peat for horticultural purposes
- e. Live insects and f. Living fungi in pure culture, including *Rhizobium cultures*.

2. All plants should be accompanied by Phytosanitary certificate from the country of origin.

3. All plants on arrival at port, shall be inspected and if necessary fumigated, disinfested or disinfected by Plant Protection Adviser to the Government of India or any other officer authorized by him on his behalf.

4. Plants and seeds which require post-entry quarantine inspection shall be grown in post-entry quarantine facilities approved by the Plant Protection Adviser to the Government of India.

5. Import of hay or straw or any material of plant origin used for packing is prohibited.

6. Import of soil, earth, compost, sand, plant debris along with plants, fruits and seeds is prohibited.

Note: Cut flowers, garlands, bouquets, fruits and vegetables weighing less than 2 kg for personal use may be imported without a permit or phytosanitary certificate, but are subject to inspection.

Special conditions In addition to the general conditions, there are special conditions for certain notified plants as follows.

1. Prohibition from certain areas

Name of the plant	Countries from where prohibited
Cocoa and all species of Sterculiaceae	Africa, Sri Lanka, West Indies and Bombaceae
Coffee beans	Africa, South America, Sri Lanka
Rubber	South America, West Indies
Sugarcane	Australia, Fiji, Papua New Guinea
Sunflower	Argentina, Peru

1. Prohibited for general public: Coconut plants and seeds, coffee plants and seeds, cotton seeds and unginned cotton, forest tree seed (*Castanea*, *Pinus*, *Ulmus*), groundnut seeds and cuttings, potato, sugarcane, tobacco seeds and wheat seeds.
2. Plants/seeds which require post entry quarantine: Cocoa, citrus, coconut, groundnut, potato, sugarcane, sunflower, tobacco and wheat.
3. Additional declarations required for notified plants (see Table below)

Plant/seed Additional declarations for freedom of pests

All species of <i>Allium</i> (onion, garlic, leek, chive, shallot, etc.).	Smut (<i>Urocystis cepulae</i>)
Cocoa and all species of the family Sterculiaceae and Bombaceae	Pod rot (<i>Monilia rorei</i>), Mealy pod (<i>Trachysphaeria</i> and <i>fructigena</i>), Witches' broom (<i>Crinipellia perniciosus</i>) Swollen shoot virus
All species of <i>Citrus</i> (lemon, lime, orange etc.,)	Mal Secco (<i>Deuterophoma tracheiphila</i>)
Coconut seeds and all species of <i>Cocos</i>	Lethal yellowing, Cadang, Bronze leaf wilt, Guam ,Coconut disease, Leaf scorch
Coffee – plants, seeds	American leaf spot (<i>Omphali flavidia</i>), virus diseases

Cotton seeds	Bacterial blight (<i>Xanthomonas axonopodis</i> pv. <i>malvacearum</i> and <i>Glomerella gossypii</i>)
Forest tree seeds (all species <i>Cronartium ribicola</i> , <i>Endothea</i> of <i>Pinus</i> , <i>Ulmus</i> , <i>Castanea</i>)	<i>parasitica</i> , <i>Ceratocystis ulmi</i> , <i>Dothistroma pini</i> .
Groundnut seeds (all species of <i>Arachis</i>)	i. production of seeds in areas free of <i>Puccinia arachidis</i> and <i>Sphaceloma arachidis</i> . ii. Inspection of parent crops in active growing seasons and certification for freedom from peanut mottle, peanut stunt, marginal chlorosis and peanut stripe viruses
Lucerne (all species of <i>Medicago</i>)	Bacterial wilt (<i>Corynebacterium incidiosum</i>)
Potato (all species of <i>Solanum</i>)	Wart (<i>Synchytrium endobioticum</i>) and freedom of parent crop from virus diseases
Rubber (all species of <i>Hevea</i>)	South American leaf blight (<i>Microcyclus ulei</i> , <i>Sphaerostilbe repens</i>)
Sugarcane (all species of <i>Saccharum</i>)	Leaf scald (<i>Xanthomonas albineans</i>), Gummosis (<i>Xanthomonas vasculorum</i>), Sereh, downy mildew, chlorotic streak and Fiji disease.

Agencies involved in plant quarantine

The authority to implement the quarantine rules and regulations framed under DIP Act rests basically with the Directorate of plant Protection, Quarantine & Storage, under the Ministry of Agriculture. This organization handles bulk import and export of seed and planting material for commercial purpose. Under this organization 9 seaports, 10 airports and 7 land frontiers are functioning. These are the recognized ports for entries for import of plant and plant material. The names and places of the ports and stations are as follows.

A. Seaports - Place State / Union territory

1. Bhavnagar - Gujarat
2. Calcutta - West Bengal
3. Chennai - Tamil Nadu
4. Cochin - Kerala
5. Mumbai - Maharashtra
6. Nagapattinam - Tamil Nadu
7. Rameswaram - Tamil Nadu
8. Tuticorin - Tamil Nadu
9. Visakhapatnam - Andhra Pradesh

B. Airports

1. Amritsar - Punjab
2. Calcutta - West Bengal
3. Chennai - Tamil Nadu
4. Hyderabad - Andhra Pradesh
5. Mumbai - Maharashtra
6. New Delhi - New Delhi
7. Patna - Bihar
8. Tiruchirappalli - Tamil Nadu
9. Trivandrum - Kerala
10. Varanasi - Uttar Pradesh

C. Land frontiers

1. Amritsar Railway Station - Punjab
2. Attari Railway Station - Punjab
3. Attari-Wagah Border- Punjab
4. Bangaon Benapol Border - West Bengal
5. Gede Road Railway Station - West Bengal
6. Kalimpong - West Bengal
7. Sukhia Pokhri - West Bengal

The Government of India has also approved three other national institutions to act as official quarantine agencies, especially for research material.

1. National Bureau of Plant Genetic Resources (NBPGR)

The NBPGR in New Delhi and its regional station at Hyderabad in the agency involved in processing of germplasm, seed, plant material of agricultural, horticultural, and silvicultural crops of all the institutions of Indian Council of Agricultural Research (ICAR) functioning in the country. It is also responsible for quarantine clearance of seed and plant material received from International Agricultural Research Centers *viz.*, ICRISAT, ICARDA, CIMMYT, etc. ICRISAT was established in 1972 at Patancheru (near Hyderabad) to work on improvement of sorghum, pearl millet, chickpea, pigeonpea and groundnut. The quarantine clearance of all its exchanges was handled by Central Plant Protection Training Institute of Directorate of Plant Protection, Quarantine & Storage, until July 1986. This authority was later passed on to NBPGR in August 1986.

2. Forest Research Institute (FRI), Dehra Dun, for forestry plants and

3. Botanical Survey of India (BSI) for other plants.

Quarantine inspection, treatment and certification procedures Inspection: Inspection of plant material is an important part of plant quarantine procedure, and may be done both in the exporting country, before issue of a health certificate and after arrival to detect any pest or disease which may have become evident during transit. Publications like manuals, hand books on individual organisms of quarantine importance are prepared with illustration by each country / region to help inspectors. The following series published by Commonwealth Mycological Institute will be useful for all countries.

1. CMI descriptions of pathogenic fungi and bacteria
2. CMI/AAB descriptions of plant viruses and
3. CMI distribution maps of plant diseases.

The various steps involved in import quarantine clearance of seed and propagating plant material is outlined below

- i. Securitization of import application filed along with attached documents such as phytosanitary certificate (original), permit (importer's copy), shipping bill, invoice, packing list and customs bill of entry etc., to ensure the import is in order and that no prohibited plant material is imported.
- ii. Assessment of inspection fees and registration of application.

iii. Inspection and sampling of the consignment at port warehouses or container terminal. Sampling of seed usually carried out as per the provisions of ISTA Rules and Regulations. Whereas in case of bulk import of vegetative planting material such as cuttings/saplings/ bud woods/bulbs/tubers etc., at least a minimum of 0.1% of propagules are sampled variety and examined to ensure free from exotic pests or pathogens. In case of quarantine pests suspected, 100 per cent inspection is carried out for critical assessment of the risk.

iv. Detailed laboratory testing

a. Visual inspection: The samples of seed/ propagating plant material is examined with the help of illuminated magnifier to record live insect infestation, contamination by soil and weed seeds, nematode galls, sclerotia, smut/bunt balls etc. Sometimes inspections are carried out under U.V. lamp to facilitate detection of specific seed-borne inspection by characteristic fluorescence.

b. X-Ray test for detecting hidden insect infestation such as bruchids and weevils that bore into seed.

c. Washing test to detect surface-borne oospores of downy mildew/smut spores/ bunt spores etc. and nematode cysts. Seed samples of onion, clover and lucerne are soaked for 24 to detect stem and bulb nematode and also root washings are examined for ectoparasitic nematodes.

d. Incubation tests such as blotter test or agar plate test carried out for detecting seed-borne pathogens such as fungi. Fluorescent pseudomonas agar used for selective detection of seed-borne bacteria.

e. Grow-out test coupled with indicator inoculation tests for detecting seedborne viruses and bacteria. Besides this, special diagnostic tests such as Electron Microscopy (dip method), Enzyme Linked Immunosorbent Assay (ELISA) are used for detection of specific viruses in the imported seed / planting material pencillnase based DAC-ELISA is widely used for the detection of virus in imported seed/plant material. The detailed testing procedures for the detection of seed-borne pathogens are outlined in the seed health testing chapter.

v. Fumigation and treatment techniques

Fumigation is the versatile technique used for eliminating insect infestation. Methyl bromide is the most commonly employed for controlling insect infestation and readily adopted in quarantine programmes as the exposure time involved is short and affect all stages of insect pests and high penetrating power. Two types of fumigation *viz.*, i. atmospheric fumigation under gas-proof sheets or chambers and ii. vacuum fumigation in vacuum chamber is widely employed. The other

chemical treatments include insecticidal/fungicidal drippings or spraying or seed dressings are invariably associated with growing under post-entry quarantine conditions. The temperature treatments such as hot water treatment/ hot air treatment or vapour heat treatment are carried out to control internally borne infection/infestation and the latter particularly employed to control fruit fly infestation.

Cold treatments such as refrigeration to control insect infestation in fresh fruits and vegetables. Of late, irradiation is used to control insect infestation and spoilage of food products during storage and as well as application of high intensity electronic beams through an accelerator is under experimentation.

Certification

Phytosanitary or health certificate is a certificate which should accompany a plant or plant material or seed which is to be moved from one place to another place. This certificate indicates or certifies that the material under transit is free from pests or diseases. A model phytosanitary certificate proposed at the Government consultation on the International Plant Protection convention at Rome in 1976 (Chock, 1977) and approved by F.A.O. in 1979 is given below.

MODEL PHYTOSANITARY CERTIFICATE

(to be typed or printed in block letters)

Plant Protection Organization No. _____ of _____

To: Plant Protection Organization(s) of _____

DESCRIPTION OF CONSIGNMENT

Name and address of exporter _____ Declared

name and address of consignee _____ Number and

description of packages _____ Distinguishing marks

_____ Place of origin

_____ Declared means of

conveyance _____ Declared point of entry

_____ Name of produce and quantity

declared _____ Botanical name of plants

This is to certify that the plants or plant products described above have been inspected according to appropriate procedures and are considered to be free from quarantine pests and practically free from injurious pests; and that they are considered to conform to the current phytosanitary regulations of the importing country.

DISINFESTATION AND/OR DISINFECTION TREATMENT

Date _____ Treatment _____

_____ Chemical (active ingredient) _____

Duration and temperature _____ Concentration _____

_____ Additional information _____

Additional declaration:

(Signature)

Note: No financial liability with respect to this certificate shall attach to..... (name of plant protection organization)... or to any of its officers or representatives.

Domestic Quarantine

Under the DIP Act, the Directorate of Plant Protection, Quarantine and storage has the responsibility to take the necessary steps and regulate the inter-state movement of plants and plant material in order to prevent the further spread of destructive insects and diseases that have already entered the country. The sole object of enforcing domestic quarantine is to prevent the spread of these diseases from infected to non-infected areas. Currently, domestic plant quarantine exists in four diseases, wart (*Synchytrium endobioticum*) of potato from 1959, bunchy top (virus) of banana from 1959, mosaic (virus) of banana from 1961 and apple scab (*Venturia inaequalis*) from 1979. Most of the states in India have plant quarantine laws to avoid entry of plant pests and diseases

1. Bunchy top of banana: The export and the transport from the States of Assam, Kerala, Orissa, West Bengal, Tamil Nadu to any other State of Banana plant or any other plant of the genus *Musa*, including sucker, stem, leaf, flower, and any other part thereof which may be used for propagation, or the materials of banana plant or any other plant of the genus *Musa*, which are used for packing and wrapping, excluding the banana fruit is prohibited.

2. Banana mosaic : The export and transport from the States of Maharashtra and Gujarat of any plant of Banana or any other plant of genus *Musa* including the sucker, stem, flower and any

other part thereof, but excluding leaf and fruit thereof is prohibited; vide Government of India notification No.F. 6-10-PPS dated the 11th April, 1961.

3. Potato wart: The export to potato tubers from the State of West Bengal to any other State or territory of India is prohibited.

4. Apple scab: The Directorate of Horticulture, Himachal Pradesh worked out a detailed scheme for the eradication of scab, and also issued a notification No.NIC.20/76 dated 28 December 1978, prohibiting the export of planting material of apple outside the State.

In Tamil Nadu as per Madras pests and Diseases Act of 1919, quarantine regulations are periodically enforced. e.g., cardamom mosaic prevalent in Anamalai area of Coimbatore District and is free from Nelliampatti area. Hence the movement of diseased plant material from Anamalai to Nelliampatti area is prevented.

Limitations

There are many limitations to implementing domestic plant quarantine in India due to the vastness of the country and the unrestricted movement of plant material from one state to another. As a result the diseases like bunchy top and mosaic of banana have spread to several other states. However, the wart disease, golden nematode of potato, and scab of apple are restricted in the states where they were initially noticed.

Export regulations

In India the plant quarantine measures for exporting plants and material including seeds have been streamlined and rigid inspections are enforced before the material is allowed to be landed into the country. At present plant quarantine regulations differ with different countries for major agricultural commodities that are being exported out of India. The Central Government has authorized officers of the Directorate of Plant Protection, Quarantine & Storage, ICAR Research Institutes, National Institutes like Forest Research Institute, Botanical Survey of India, and the Directorates of Agriculture of all States.

The quarantine authorities have also framed terms and conditions pertaining to inspection, fumigation or disinfection of the exportable plants and plant material in India including the following schedule/or fee for inspection and issue of phytosanitary certificate, and/or fumigation or disinfection in respect of plants, plant material, seeds, and plant products to issue phytosanitary certificate. All the plants and plant material are subjected to inspection by

officials issuing certificate. Infested materials are given necessary treatment with chemicals and fumigated if necessary.

The list of plant quarantine and fumigation stations in India is given below.

Punjab

1. Plant Quarantine and Fumigation Station, Hussainiwala, Ferozepur District.
2. Plant Quarantine and Fumigation Station, Attari – Wagah Border, near Attari Bus Stand, Attari, Ferozepur District.
3. Plant Quarantine and Fumigation Station, Civil Aerodrome, Rajasansi, Amritsar.

New Delhi

1. Plant Quarantine and Fumigation Station, Palam Airport, New Delhi – 10.
2. Plant Quarantine and Fumigation Station, Garden Reach Road, Calcutta–24.
3. Plant Quarantine and Fumigation Station Sukhiapokri, Darjeeling District.

Gujarat

1. Plant Quarantine and Fumigation Station, Haryana Plot No.75, Behind Yusuf Bagh. Bhavnagar.

Maharashtra

1. Plant Quarantine and Fumigation Station, Haji Bunder Road, Sewri, Mumbai

Andhra Pradesh

1. Plant Quarantine and Fumigation Station, The Harbour, Visakhapatnam – 1.

Tamil Nadu

1. Plant Quarantine and Fumigation Station, 6, Clive Battery, Chennai – 1.
2. Plant Quarantine and Fumigation Station, 335, Beach Road, Tuticorin – 1.
3. Plant Quarantine and Fumigation Station, Tiruchirappalli Airport, Tiruchirappalli.
4. Plant Quarantine and Fumigation Station, 110, Railway Feeder Road, Rameswaram.

Kerala

1. Plant Quarantine and Fumigation Station, Willingdon Island, Cochin – 3

