CAHFSA
CARIBBEAN AGRICULTURAL HEALTH & FOOD SAFETY AGENCY

CARIBBEAN DEVELOPMENT BANK

LEGUMES

GUIDELINE TO FACILITATE INTRA-REGIONAL TRADE IN THE CARIBBEAN

This page is intentionally left blank

REGIONAL GUIDELINES FOR
PHYTOSANITARY MEASURES

GUIDELINE TO FACILITATE INTRA-REGIONAL TRADE IN LEGUMES

Produced by the Caribbean Agricultural
Health and Food Safety Agency (RPPO)
Adopted 2022; published 2022

Publication history
This is not an official part of the guideline
2022-07 COTED Adopted the guideline

Contents

Adoption 6
INTRODUCTION 6
Scope 6
Definitions 6
OUTLINE OF REQUIREMENTS 6
BACKGROUND 7
Description of legumes 7
Phaseolus spp. 8
Identity 10
Taxonomic Tree 10
Intended Use 10
Vigna species 10
Identity 10
Taxonomic Tree 11
Intended Use 11
Pigeon Peas 11
Identity 11
Taxonomic Tree 11
Intended Use 12
Lentils 12
Identity 12
Taxonomic Tree 12
Intended Use 13
REQUIREMENTS 13
Pest risk analysis 13
Pests of phytosanitary significance affecting trade in legumes 13
General Procedures 15
Production 15
Packaging and grading 15
Treatment facilities 15
Sanitary (Food Safety) Measures 16
Phytosanitary Measures 16
Pest Free Areas (PFA) 17

Pest Free Places of Production (PFPP) and Areas of Low Pest Prevalence (ALPP)..... 18
Pre-Harvest and Harvest Management..... 18
Pre-harvest management..... 18
Harvesting..... 18
Post-harvest handling and treatments..... 19
Handling and sorting..... 19
Cleaning..... 19
Storage..... 19
Treatments..... 19
Irradiation..... 20
Fumigation treatment..... 20
Chemical treatment..... 20
Temperature treatment..... 21
Packing, packaging and labelling..... 21
Transportation..... 21
Systems Approaches..... 21
Verification of compliance..... 22
Sampling and phytosanitary inspection..... 22
Phytosanitary certification..... 22
Phytosanitary security..... 23
Secure packaging..... 24
Container level security..... 24
Pallet level security..... 24
Isolation requirements..... 24
Isolation by physical barriers..... 25
Isolation by distance..... 25
Isolation by insect-proof spaces..... 25
Loading procedures..... 25
Consignments in transit..... 26
Audit and compliance of the export pathway..... 26
REFERENCES..... 26
APPENDICES..... 29
Appendix 1. List of pests found on legumes in the Caribbean region..... 29
Appendix 2. List of pests of legumes regulated by countries in the Caribbean region..... 33

Adoption

This guideline was adopted by the Council of Trade and Economic Development (COTED) in June 2022.

INTRODUCTION

Scope

This guideline provides assistance to national plant protection organisations (NPPOs) within the Caribbean region in managing the risk of introduction of specific pests associated with cross-border movement of legumes intended for consumption or processing by providing clear guidance and protocols for intra-regional trade of the commodity in the Caribbean region. The guideline applies to all varieties of edible legumes (in pods or shelled) of the genera *Phaseolus*, *Vigna* and *Lens* as well as *Cajanus cajan* (pigeon peas) to be used for green vegetables.

The major pests of the legumes of focus as well as the pests of regional priority and pests regulated by countries in the Caribbean region, and phytosanitary measures to manage these pests, are included in this guideline. Recommended measures include those that have been adopted as International Standards for Phytosanitary Measures (ISPMs) as well as those that are used in trade amongst Caribbean countries.

This guideline does not address issues related to living modified organisms, climate change, quality of the commodity, or diversion from intended use; trade in the whole plant, cuttings, leaves or other plant parts is not covered in this document. It does not apply to legumes that have been dried for use as pulses.

Definitions

Definitions of phytosanitary terms used in the present guideline can be found in ISPM 5 (*Glossary of phytosanitary terms*).

OUTLINE OF REQUIREMENTS

The issue of pest risk varies within and between countries. It is therefore important for importing NPPOs to apply pest risk analysis (PRA) (see ISPM 2: *Framework for pest risk analysis*

and ISPM 11: *Pest risk analysis for quarantine pests*) in the process of identifying quarantine pests and providing the technical justification for the imposition of phytosanitary import requirements. The importing country should consider equivalence of phytosanitary measures if the country of export is unable to conduct specific requests for phytosanitary measures. Such a process should be in keeping with ISPM 24 (*Guidelines for the determination of equivalence of phytosanitary measures*).

Phytosanitary certification and import regulatory systems should be in accordance with ISPM 7 (*Phytosanitary Certification System*), ISPM 12 (*Guidelines for Phytosanitary Certificates*) and ISPM 20 (*Guidelines for a phytosanitary import regulatory system*). Inspections and sampling of consignments should be in keeping with ISPM 23 (*Guidelines for inspection*) and ISPM 31 (*Methodologies for sampling of consignments*), respectively. Wood packaging materials, including pallets, used for consignments must be in conformance with ISPM 15 (*Regulation of Wood packaging material in international trade*).

This document seeks to provide guidance on procedures to establish phytosanitary import requirements. It also identifies and describes specific phytosanitary measures that may be used to reduce pest risk and it provides guidance on sampling, inspection and phytosanitary certification of fresh legumes for export.

BACKGROUND

Description of legumes

Legumes are plants within the Fabaceae (Leguminosae) family or the fruit or seed of such a plant. The distinctive fruit is the most visual feature that may be used to identify crops that are classified in this family. The fruit of legumes produce a unique simple dry fruit which develops from a single carpel and usually dehisces on two sides. The pod of the legume is a one-celled seed container that is formed by two sealed parts referred to as valves. The pods always split along the seam that connects the two valves. Pods however vary between species in thickness, length, curve and fleshy nature. Additionally, some pods are described as winged or indehiscent (that is, they do not split open at maturity).

The Leguminosae family is classified into three sub-families: Papilionoideae, Caesalpinoideae, and Mimisoideae, which are identified and differentiated by their flowers. Edible legume crops are mainly found in the subfamily, Papilionoideae.

Used as a dry grain, legume seeds are called pulses. This family of plants is grown agriculturally, mainly for human consumption, livestock forage/silage, and as a soil-enhancing green manure.

Both peas and beans are legumes, and both have edible seeds and pods. The common names of beans and peas are not consistent. Generally, beans need warm temperatures to grow, and most are *Phaseolus* and *Vigna* species; peas fall under the species *Pisum sativum* and require cooler temperatures to grow. Some well-known legumes include beans, soybeans, chickpeas, peanuts, lentils, tamarind and peas.

Beans are found in a number of genera, the most prominently cultivated of which include *Phaseolus* and *Vigna* species. In the vine and bush types, the distinctive bean pods typically grow to five or six inches long. All peas are vine plants that creep onto low bushes, rocks or nearby poles using tendrils at the end of the stalk which allows the plant to climb.

The United Nations Food and Agriculture Organization (FAO) reserves the term "pulse" for those legume crops harvested solely for the dry seed; this therefore excludes green beans and green peas which are considered vegetable crops, as well as seeds mainly grown for oil extraction, such as soybeans and peanuts. In common usage, such distinctions are not always clearly made. Many of the dried pulses are also used for green vegetables, with their beans in pods while young.

This guideline will focus on trade of fresh legumes of the genera *Phaseolus*, *Vigna*, *Cajanus* and *Lens* in the Papilionoideae subfamily.

Phaseolus spp.

Legumes in the genus *Phaseolus* are herbaceous to woody annual and perennial vines comprising about 70 species, which are all native to the Americas. Beans in this genus are economically important legumes with the most prominent being *Phaseolus vulgaris* or common bean. This species is grown worldwide in tropical, semitropical and temperate climates. Species of this genus have been organized into eight groups based on phylogenetic clades or groups, namely: the Filiformis, Leptostachyus, Lanatus, Pauciflorus, Pedicellatus, Polystachios, Tuerckheimii and Vulgaris groups. The pods of *Phaseolus* species are vegetables consumed fresh or

processed. The pods are considered highly perishable since they are harvested at an immature stage and have a high moisture content.

Identity

Preferred Scientific Name
Phaseolus
Preferred Common Name
Beans

Taxonomic Tree

Domain: Eukaryota
Kingdom: Plantae
Phylum: Spermatophyta
Subphyllum: Angiospermae
Class: Dicotyledonae
Order: Fabales
Family: Fabaceae
Subfamily: Papilionoideae
Genus: *Phaseolus*

Intended Use

The guideline covers beans for the intended purpose of consumption as a green vegetable or for processing.

Vigna species

This genus of legumes includes some well-known cultivated species, inclusive of many types of beans including cowpea (e.g., black-eyed pea – *V. unguiculata*). Cowpea performs well on a wide variety of soils and soil conditions and performs best on well-drained sandy loams or sandy soils of pH ranging from 5.5 – 6.5. Legumes in this genus range in size from the very small wild types up to around 14 inches in length; seed shape is a major characteristic that correlates with seed development in the pod. Seeds become progressively more globular when seed growth is restricted by the pod. The seed coat can be either smooth or wrinkled and vary in color, to include white, cream, green, buff, red, brown and black. Seeds may also be speckled, mottled or blotchy. The pods are smooth, cylindrical and generally slightly curved and may be green, yellow or purple in color.

Cowpea can be used at all stages of growth as a vegetable crop. Immature snapped pods are used in the same way as snapbeans. Green cowpea seeds are boiled as a fresh vegetable.

Identity

Preferred Scientific Name
Vigna
Preferred Common Name
Cowpea

Taxonomic Tree

Domain: Eukaryota
Kingdom: Plantae
Phylum: Spermatophyta
Subphyllum: Angiospermae
Class: Dicotyledonae
Order: Fabales
Family: Fabaceae
Subfamily: Papilionoideae
Genus: *Vigna*

Intended Use

The guideline covers fresh cowpeas for the intended purpose of consumption as a green vegetable or for processing.

Pigeon Peas

The pigeon pea, *Cajanus cajan*, is a perennial legume often referred to in the Anglo parts of the Caribbean as "gungo peas". The species, an erect woody shrub, is widely cultivated in all tropical and semitropical regions of the world where it is primarily rainfed. Pigeon peas are quite drought-tolerant and can be grown in areas with less than 650 mm annual rainfall and in a wide range of altitude (0 – 3,000m). *C. cajan* is widely adapted to a range of soil types, temperatures and rainfall. Temperatures up to 35°C can be tolerated but the plant can be killed by heavy frost. Although the species cannot tolerate waterlogging, it tolerates low fertility and a pH range of 4.5-8.4. Additionally, some cultivars are tolerant of salinity and aluminum toxicity.

Reportedly, the name pigeon pea was first used in Barbados where pigeons were fed the seeds of the species.

Identity

Preferred Scientific Name
***Cajanus cajan* (L.) Millsp.**
Preferred Common Name
Pigeon pea
Other Scientific Names
Cajanus bicolor DC.
***Cajanus flavus DC.*, nom. illeg.**
***Cajanus indicus Spreng.*, nom. illeg.**
***Cytisus cajan* L.**

Taxonomic Tree

Domain: Eukaryota
Kingdom: Plantae

Phylum: Spermatophyta
Subphyllum: Angiospermae
Class: Dicotyledonae
Order: Fabales
Family: Fabaceae
Subfamily: Papilionoideae
Genus: Cajanus
Species: *Cajanus cajan*

Intended Use

The guideline covers pigeon peas for the intended purpose of consumption as a green vegetable or for processing.

Lentils

The lentil is an annual plant of the plant genus *Lens* and is known for its lens-shaped seeds. The plant is about 16 inches in height, and the seeds grow in pods, usually with two seeds in each pod. *L. culinaris* is an edible species of the small genus of legumes. Lentils may be classified according to their size, whether they are split or whole, and shelled or unshelled. The seed coats can range from light green to deep purple, as well as being tan, grey, brown, black or mottled. Shelled lentils show the color of the cotyledon which can be yellow, orange, red or green. Lentils can grow on a range of soil types, from sand to clay loam, but grow best in moderately fertile, deep sandy loam soils. A neutral soil pH is best. Lentils do not tolerate flooding or water-logged conditions.

Identity

Preferred Scientific Name
Lens culinaris* subsp. *culinaris
Preferred Common Name
Lentil
Other Scientific Names
Lens culinaris
Lens esculenta

Taxonomic Tree

Domain: Eukaryota
Kingdom: Plantae
Phylum: Spermatophyta
Subphyllum: Angiospermae
Class: Dicotyledonae
Order: Fabales
Family: Fabaceae
Genus: Lens
Species: *Lens culinaris* subsp. *Culinaris*

Intended Use

The guideline covers lentils for the intended purpose of consumption as a green vegetable or for processing.

REQUIREMENTS

Pest risk analysis

The NPPO of the importing country should conduct PRA associated with legumes in accordance with ISPM 2, *Framework for pest risk analysis* and ISPM 11, *Pest risk analysis for quarantine pests*, to determine the regulatory status of the pests for the area from which the commodity originates.

Pests of phytosanitary significance affecting trade in legumes

Of the current regional priority plant pests, *Tuta absoluta* (the tomato leafminer) is known to affect the leaves of bean plants in the genus *Phaseolus*. The Mediterranean fruitfly (*Ceratitis capitata*), another of the regional pests of priority, is listed as of unknown importance to *Phaseolus* species. Appendices 1 and 2, respectively provide combined lists of general pests and regulated pests found on legumes grown in the Caribbean region.

Table 1 is a list of pests associated with legumes that may be identified as regulated pests requiring phytosanitary measures by the PRA process. Measures in Table 3 are recommended for the management of these quarantine pests. These measures may be substituted where technically justified.

In the conduct of the pest risk assessment, significant uncertainty may be identified, making it difficult to evaluate phytosanitary measures. Cases of uncertainty do not mandate the application of measures unless it is determined that a pest is likely to be introduced and result in negative economic impacts in the PRA area.

In Table 2, included is a list of pests for which there is uncertainty in the Caribbean as to association with legumes in trade and a description of the uncertainty.

Table 1. Pest groups associated with legumes.

Pest Group	Family	Example species
Ants	Formicidae	*Atta cephalotes (Linnaeus)* *Atta sexdens (Linnaeus)*
Bacteria	Pseudomonadaceae	*Pseudomonas syringae* pv. *tabaci* (Wolf and Foster) Young *et.al.*
Beetles	Chrysomelidae	*Diabrotica balteata (Leconte)*
Bugs	Lygaeidae	*Oxycarerus hyalipennis (Costa)*
Fruitflies	Tephritidae	*Bactrocera cucurbitae (Coquillett)*
Leafminers	Gelechiidae	*Tuta absoluta* (Meyrick, 1917)[1]
Molluscs	Veronicellidae	*Vaginula plebeian* Fischer
Moths	Crambidae	*Spoladea recurvali (Fabricius)*
	Noctuidae	*Spodoptera litura (Fabricius)*
True bugs	Aphididae	*Aulacorthum solani (Kaltenbach)*
True flies	Agromyzidae	*Melanagromyza obtuse*
Weevils	Curculionidae	*Asynonychus godmanni (Boheman)*

Table 2. Pests with uncertain association with legumes.

Pest Group	Family	Pest	Description
Fruitfly	Tephritidae	*Ceratitis capitata*	The species is listed as of unknown importance to *Phaseolus* spp. (Thomas *et al.*, University of Florida, 2019); thus, in the absence of definitive information on whether these legumes would serve as hosts in the region, specific phytosanitary measures cannot be definitively determined.
Midge	Cecidomyiidae	*Prodiplosis longifila Gagné*	The larvae of this pest are known to feed on the flowers of host plants and the eggs are laid on parts of the flower. It is uncertain whether the larvae could be present in the young pods considering the close affiliation with the flowers.

[1] This has been designated as a priority plant pest for the Caribbean region

General Procedures

Once technically justified, general procedures include the following:

Production:

- Registration of producers, farms and exporters and maintenance of a registry of those entities by the NPPO of the exporting country
- Certification of farms
- Application of good agricultural practices (GAP) (e.g., site and land selection, use of agrochemicals in as recommended by the manufacturer, use of pest resistant or tolerant varieties where available, farm sanitation, weed management)
- Monitoring for pests and their vectors where applicable

Packaging and grading:

- Registration of packing houses
- Development of, and compliance with, packing house requirements
- Pest management in the packing house
- Packing in new and clean material (including protective material, where required)
- Labelling of packaging
- Storage prior to export and transportation in a secure manner to prevent contamination and infestation (e.g., use of insect-proof packaging)
- Grading (guided by CODEX standards[2]) to ensure suitability of legumes for export, including freedom from damage and/or rot, symptoms of pests and contamination with soil, plant debris and extraneous materials.

Treatment facilities:

- Registration and approval of export treatment facilities (where different to the packinghouse) in accordance with established procedures

[2] CODEX Alimentarius "Fresh Fruits and Vegetables"
https://www.fao.org/3/a1389e/a1389e00.htm

- Secure management to prevent contamination and infestation.

Sanitary (Food Safety) Measures

Food contamination can be caused in several ways, the main types of which are biological, chemical, physical and allergenic. Some such contamination could be due to naturally occurring contaminants in the environment or artificially introduced by certain agricultural practices.

Food contamination is a matter of serious food safety concern because high concentration of chemicals and contaminants present in food can pose serious health risks. The handling, packaging, transportation and storage of commodities intended for consumption are significant contributors to food contamination. It is therefore important that good agricultural practices and good hygiene practices are maintained from the point of production to the point of export to reduce or eliminate contamination of legumes. Use of chemical treatments must be approved for use on commodities for consumption and should be applied strictly in accordance with the manufacturer's recommendations on the label and in keeping with maximum residue levels (MRLs) as prescribed by the suitable authority.

Legumes, particularly *Lens culinaris*, have been shown to be capable of bioaccumulating heavy metals from contaminated soils (Fatnassi *et al.*). Soils of selected production areas should be tested for unacceptably high levels of heavy metals.

Persons handling legumes in production and after harvest processes should be (made) aware of proper personal hygiene and observe good hygiene practices at all times.

Phytosanitary Measures

Tuta absoluta is a regional pests of quarantine significance that is known to be associated with legumes, particularly *Phaseolus* species. Table 3 below provides information on pests associated with legumes along with measures considered to be effective in managing each pest group previously identified in Table 1.

NPPOs of importing countries in the region should recognize the effectiveness of treatments to manage the target pests or provide technical justification in support of alternative measures. Phytosanitary measures applied to manage the risk(s) from one pest could likely also manage the risks posed by other pests of the commodity.

In the case of phytosanitary import requirements, such should be required solely for pests that countries have identified as regulated pests that require the application of phytosanitary measures thus determined by PRA for the endangered area. In cases where the association of the pest or pest group to the pathway is uncertain, phytosanitary measures should be justified through PRA.

Table 3. Phytosanitary measures considered to be effective in managing the risk from specified pest groups

Pest Group	Phytosanitary Measure(s)[3]
Ants	ALPP
Bacteria	PFA, PFPP, exclusion of leaf material & debris from consignment
Beetles	ALPP, visual inspection to eliminate adults from consignment
Bugs	Export shelled peas & beans only, visual inspection of seeds
Fruitflies	PFA, PFPP, proper field sanitation, irradiation
Leafminers	PFA, PFPP
Molluscs	Visual inspection, exclusion of leaves from consignment, proper field sanitation
Moths	Visual inspection for all life stages, exclusion of leaves from consignment
True bugs	Use resistant varieties, chemical control in field
True flies	Visual inspection for symptoms & adults, chemical control in field, use of resistant varieties
Weevils	Fumigation, IPM & irradiation

Pest Free Areas (PFA)

Guidance on pest free areas may be sourced in ISPM 4 (*Requirements for the establishment of pest free areas*) and ISPM 8 (*Determination of pest status in an area*).

Due to its invasive nature and difficulty of management, export of fresh legumes should be limited to only those areas that are free of *Tuta absoluta*. Quarantine and regulatory procedures should be imposed if an infestation is known to exist in an area. Eradication may be feasible if action is taken immediately upon detection of an infestation and all host plants within 3.2 km of the infested area are removed and destroyed. The use of insecticide applications should be rationalized to prevent the development of resistance in the pest population. Packhouses should be carefully managed to eliminate *Tuta absoluta* from these areas.

[3] ALPP = Area of Low Pest Prevalence; PFA = Pest Free Area; PFPP = Pest Free Place of Production

Pest Free Places of Production (PFPP) and Areas of Low Pest Prevalence (ALPP)

Guidance on pest free places of production and areas of low pest prevalence is found in ISPM 10 (*Requirements for the establishment of pest free places of production and pest free production sites*) and ISPM 22 (*Requirements for the establishment of areas of low pest prevalence*). The utility of these phytosanitary measures may be limited by some characteristics of pests.

Pre-Harvest and Harvest Management

Pre-harvest management

Production of legume crops should be maximized through the use of good quality, disease-free planting material as well as the use of optimal production locations with the preferred soil types, pH and environmental conditions. The application of good agricultural practices, including an integrated system of pest management, is expected to support good crop yields. Water used for irrigation, fertigation, pesticide application, or other production activities should be free from contamination by microbial and/or biological agents and heavy metals. Pest management systems should include crop monitoring, inspection, chemical and/or biological control as appropriate. An official trapping and/or surveillance program for pests of concern is recommended where required.

Harvesting

Legumes for use as vegetables should be harvested at intervals after sowing and this would be dependent on the variety. Immediately after harvesting, the harvested produce should be moved to a shaded area. Harvested pods should be free of pests and disease as determined through inspection. Non-compliant product should be removed and not be left exposed to reinfestation. Use of harvesting containers with sharp edges must be avoided to reduce cuts, abrasions and bruising of pods. Pods should be harvested with about 1 cm of stem.

Vigna species such as cowpea can be harvested at three different stages of maturity: green snaps, green-mature, and dry. Depending on temperature, fresh-market (green-mature) pods are ready for harvest 16 to 17 days after bloom. Most cultivars of *Phaseolus* species are harvested 12-14 days after flowering.

Hand-harvested green legume pods suffer less damage than when mechanically harvested.

Post-harvest handling and treatments

Handling and sorting

Legumes, whether shelled or in pods, must not be over-mature or dry. All foliage and twigs should be removed to eliminate pest risks associated with these plant parts, and peas and beans must be examined closely for live arthropods, rots and disease symptoms, discoloration and deformities, signs of damage and extraneous materials (to include weed seeds). All non-compliant product should be removed. Produce should be cut and examined as necessary.

Post-harvest, it is recommended that shade and adequate ventilation be provided *en route* to the packhouse or storage area. Green legume pods should be immediately cooled to eliminate field heat, reduce respiration and reduce microbial growth. Gentle handling of pods is essential to prevent damage.

Cleaning

The pods or seeds of legumes should be washed and treated using approved methods and processes to remove soil, any remaining pests and other unwanted material. Water used in the cleaning process should be of a potable quality.

Storage

Legumes for use as vegetables should be cooled as rapidly as possible after harvesting and stored at optimal storage temperatures as the resulting heat produced by the pods after harvesting will result in spoilage. Care should be taken to maintain optimal temperatures to prevent chilling injury if temperatures fall too much, or to allow for the proliferation of pests and rot if temperatures get too high. Green bean pods should be stored at 5 – 7.5ºC and a relative humidity of 95-100%.

Treatments

Treatments include a range of processes that are targeted at the control or eradication of pests and contaminants from approved commodities, empty containers and export vessels. Treatments can include – but are not limited to – fumigation; irradiation; use of controlled atmosphere or temperature; application of a chemical substance; dismantling, repairing or cleaning; repacking; or blending. The choice of the treatment applied is the responsibility of the importing country, unless otherwise determined by legislation or international standards.

Specific treatments for legume pods and seeds may be selected and mutually agreed upon between the countries of import and export in accordance with approved international standards and treatments or where bilaterally agreed.

Irradiation

Treatments for the use of ionizing radiation (irradiation) may be used for pest risk management. Phytosanitary irradiation is a treatment which uses ionizing radiation on commodities such as fruits and vegetables to inactivate pests. The method is used for international food trade as a means to prevent spread of non-native organisms. NPPOs should be assured that the efficacy of the treatment is scientifically demonstrated for the regulated pest(s) of concern and the required response. The application of irradiation as a phytosanitary treatment should be in accordance with ISPM 18 (*Guidelines for the use of irradiation as a phytosanitary measure*).

Fumigation treatment

Fumigation is the treatment with a chemical agent that reaches the commodity and target pest(s) in a gaseous state. The fumigant may be effective against all pest groups or used to target a particular pest group and may address all or most life stages. The application of fumigation as a phytosanitary treatment should be in accordance with ISPM 43 (*Requirements for the use of fumigation as a phytosanitary measure*).

Storage facilities, both on- and off-farm, should be approved and outfitted with the required cool stores and warehousing facilities linked to postharvest crop management. Fumigation should only be done when necessary and only by a licensed or trained operator. All fumigation instances, chemical agents used, and dates of application should be documented.

Chemical treatment

Chemical treatments are used on a wide range of agricultural products from pre-planting through to post-harvest stages. These treatments are intended to destroy, repel and control pests of agricultural commodities. The chemicals are commonly applied by **dipping** (i.e., fully immersing the commodity into a solution) or spraying at a specific concentration for a specified period, to reduce the risk of a broad range of pests in the target area or on the target commodity. Chemical treatments may also be used to destroy pests within empty holds of a vessel or container.

Temperature treatment

Temperature treatments may be used as a phytosanitary treatment option. The application of heat treatments and systems to support the treatments should be in accordance with ISPM 42 (*Requirements for the use of temperature treatments as phytosanitary measures*) and technically justified by PRA.

Vapour Heat Treatment (VHT) is the process in which water vapours are used to heat a commodity until it reaches a minimum temperature for a specified period of time to effectively control live infestations of certain pests. It is an option generally used for commodities that are resistant to high moisture and vulnerable to drying out.

Cold treatment involves the use of refrigerated air to lower the temperature of a product to, or below, a specific temperature for a specific period to mitigate the risks of infestations of target pests. This treatment is used primarily for fresh fruits and vegetables that are hosts of internally feeding pests. The treatment is generally commodity and pest specific.

Packing, packaging and labelling

Legume pods and seeds should be packaged using clean or new containers.

A label to be affixed to the packaging should clearly detail the name of the commodity, the place of production, the harvest date, and the names of the grower and the processor. Any other quantitative information should be also included on the label in keeping with the importing country's requirements.

Transportation

In the transportation of fresh legumes for consumption, all applicable handling, packaging and storage procedures must serve to prevent damage and proliferation of pests during the process. Vehicles used to transport legumes should be clean and provide a cool environment for the produce. Records should be kept of all vehicular cleaning activities.

Systems Approaches

Guidance for the use in development and evaluation of integrated measures in a systems approach can be found in ISPM 14 (*The use of integrated measures in a systems approach for pest risk management*). At least two measures which are independent of each other may be used to manage specific quarantine pests and any uncertainty.

Verification of compliance

Sampling and inspection should be carried out by the NPPO to verify compliance of legume consignments with phytosanitary import requirements.

The NPPO may authorize entities to conduct specific phytosanitary activities (e.g., sampling, inspection and testing in accordance with the ISPM 45 (*Requirements for national plant protection organizations if authorizing entities to perform phytosanitary actions*).

Sampling and phytosanitary inspection

ISPM 31 (*Methodologies for sampling of consignments*) and ISPM 23 (*Guidelines for Inspection*) may be used for official guidance on sampling and phytosanitary inspection.

In accordance with official procedures, the NPPO of the exporting country should sample and inspect each consignment of fresh legumes to verify conformance with importing requirements and freedom from quarantine pests. If infield controls require the registration of the production area or farm(s), sampling and inspection should be conducted in each homogenous grower lot. In instances where live pests are found, the exporting country NPPO should determine whether additional actions are required to meet the conditions of the importing country NPPO.

The number of packages presented for inspection should be consistent with documentation for the consignment. The documentation should certify that basic measures have been applied and that any required traceability labelling is complete. Initial inspection of the consignment should also verify that the phytosanitary security is maintained for the consignment.

Minimum sample size for inspection should be based on a 95% confidence level as set out in ISPM 31 (*Methodologies for sampling of consignments*), or as specified by the NPPO of the importing country with technical justification.

Phytosanitary certification

All commodities intended for export attain a phytosanitary status when they are produced in a PFA or PFPP; after harvest, for commodities from certified farms required to eliminate, manage or monitor specific pests; after a phytosanitary treatment, and after export inspection. A phytosanitary certificate should only be issued when the requirements of the importing country,

as set out in an Import Permit issued by its NPPO, have been verified as being met as confirmed in the certifying statement. Phytosanitary certification (for export and re-export) should be in keeping with ISPM 12 (Phytosanitary certificates). An additional declaration may be required by the country of import to verify compliance with the import requirements as specified by the importing country's NPPO.

For consignments of fresh legumes for consumption to receive phytosanitary certification, the consignments must:

- Meet the specific requirements as indicated in the Import Permit issued by the importing country
- Be considered free from viable regulated pests, soil and other contamination
- Be treated in a manner consistent with the application standard and treatment certificate presented
- Be accompanied by pest free area declaration, where required
- Be packaged in clean and new material (including packaging material used to prevent damage during transport)
- Be exported in a secure manner to prevent contamination.

Legumes must be intact and clean, and free from rot, visible foreign matter and damage caused by pests. If viable regulated pests are detected, a phytosanitary certificate should not be issued unless appropriate phytosanitary measures have been applied.

If a consignment of fresh legumes is opened, split up or packaging changed prior to arriving in the country of import, a phytosanitary certificate for re-export is required from the re-exporting country. Re-exported consignments must be accompanied by (a copy of) the original phytosanitary certificate.

Phytosanitary certificates, and Phytosanitary Certificates for Re-export should be in accordance with ISPM 12 (*Phytosanitary certificates*).

Phytosanitary security

Once commodities have received phytosanitary certification, and until such commodities are exported, the phytosanitary security of the commodities must be maintained at all times. As such, the commodities must be adequately protected to prevent infestation or contamination and labelled (in keeping with the legislation and importing country requirements) to prevent

substitution. Breaches of security during transport or storage disqualifies the phytosanitary status of the commodities.

Phytosanitary security is maintained:

1. when secure packaging (cartons, pallets) is used and/or
2. the consignment is isolated by physical barriers, distance or insect-proof space), AND
3. appropriate measures are taken while loading export containers.

Secure packaging

Secure packaging requirements could comprise of the following:

Container level security

- The commodity is fully enclosed in a container with the lids tightly fixed to the base
- Ventilation holes or other openings are covered with insect-proof mesh that has no more than a 1.6mm diameter pore size diagonally; alternatively, ventilation holes are fully sealed.
- Vented containers having plastic liners or bags must be fully sealed. The overlapping folded edges of the plastic liner with the container lid on top would be considered fully sealed.

Pallet level security

For containers that are palletized, security would be achieved using one of the following options:

- Each pallet is fully shrink-wrapped, with the base and the top of the pallet sealed (e.g., using a sheet of cardboard), as well as all sides, to completely enclose the commodity consignment.
- Each pallet is secured with insect-proof mesh using a pallet net with no more than a 1.6 mm pore size diagonally, to include the surface area between the bottom row of the containers and the pallet.

Isolation requirements

Commodities that are not secure-packaged may be kept secure if they are isolated from all potential sources of infestation or contamination and from other goods of different or unknown phytosanitary status.

Isolation by physical barriers

Physical barriers (e.g., walls or solid structures) can be used to form a barrier to exclude pest access. This option can be applied when the commodities are stored and handled in insect-proof spaces, shipping containers, enclosed vans or cool rooms.

Isolation by distance

The phytosanitary status of consignments may be maintained by creating a minimal acceptable distance between goods of different or unknown phytosanitary status within insect-proof spaces. This can be achieved if goods are kept at optimal temperature with at least 1m separation from any other goods.

Isolation by insect-proof spaces

The phytosanitary security of a consignment can be maintained if, at all times, the goods are kept in insect-proof spaces and are kept isolated from all potential sources of infestation or contaminants, to include products of different or unknown phytosanitary status. Packhouses, treatment facilities and cool room storage doors must be suitably insect-proof through the use of double doors, automatic doors, rubber curtains, air curtains or other approved mechanism.

Loading procedures

During the loading process, it is important to maintain phytosanitary security of the consignment by ensuring the following occurs:

- Containers with vent holes and openings must be sealed, with openings no more than 1.6 mm pore size diagonally (e.g., drain holes or air intakes)
- Consignments must be loaded directly into the export container
- Commodities not securely packaged and not immediately loaded must be stored securely to prevent contamination or infestation
- Personnel loading export containers must ensure that the consignments are moved from the secured area into the export containers as quickly as possible
- Consignments must not be left unsecured and loading procedures must mitigate potential infestation.

One or more methods to safeguard fresh legumes against infestation after the application of a phytosanitary measure should be applied. Such methods should take into account the biological characteristics of pests and the strength of the phytosanitary measures that have been applied.

Consignments in transit

In the movement of regulated commodities within the Caribbean, such commodities may transit various countries *en route* to the country of import. Procedures to identify, assess and manage pest risks associated with consignments of these commodities which pass through a country without being imported, should be conducted in such a manner that any phytosanitary measures applied in the country of transit are technically justified and necessary to prevent the introduction into and/or spread of pests within that country. ISPM 25 (*Consignments in transit*) provides guidance for handling of consignments in transit.

Audit and compliance of the export pathway

In keeping with ISPM 20 (*Guidelines for a phytosanitary import regulatory system*), the importing country's NPPO may request an audit of specific elements of the fresh legumes export system. This could relate to entities registered/approved to export as well as the records relating to exported consignments. Verification of compliance of the consignment may be sought by the importing country in the country of export.

REFERENCES

This guideline refers to International Standards for Phytosanitary Measures (ISPMs). ISPMs are available on the International Phytosanitary Portal (IPP) at https://www.ippc.int/core-activities/standards-setting/ispms

Achaglinkame, M.A, N. Opoku and F.K. Amagloh (2017). **Aflatoxin contamination in cereals and legumes to reconsider usage as complementary food ingredients for Ghanaian infants: A review**. *Journal of Nutrition & Intermediary Metabolism, Vol.10, pp. 1-7.* https://www.sciencedirect.com/science/article/pii/S2352385917302475

Allaire, H. and T. Brady (2008). **Classification and Botanical Description of Legumes**. https://academics.hamilton.edu/foodforthought/our_research_files/beans_peas.pdf

Allamin, I.A., N.A. Yasid, S.R.S. Abdullah, M.I.E. Halmi and M.Y. Shukor. (2021). **Phyto-Tolerance Degradation of Hydrocarbons and Accumulation of Heavy Metals by of Cajanus cajan (Pigeon Pea) in Petroleum-Oily-Sludge-Contaminated Soil**. *Agronomy* **2021**, 11, 1138. https://doi.org/10.3390/agronomy11061138

Australia Department of Agriculture. Risk assessment – fresh beans and snowpeas for human consumption into Norfolk Island from mainland Australia: Australia and Norfolk Island biosecurity policy framework. https://www.agriculture.gov.au/import/goods/external-territories/norfolk-island-produce/beans-snowpeas

Australian Government – Department of Agriculture, Water and the Environment (2021). **Guideline: Maintenance of phytosanitary security for horticulture exports - version no. 4**.

Australian Government – Department of Agriculture, Water and the Environment (2021). **Reference: Use of Phytosanitary treatments for plant exports - version no. 1**.

CABI Invasive Species Compendium: **Datasheet - Cajanus.** https://www.cabi.org/isc/datasheet/10792

CABI Invasive Species Compendium: **Datasheet - Cajanus cajan (pigeon pea).** https://www.cabi.org/isc/datasheet/10794

CABI Invasive Species Compendium: **Datasheet - Lens culinaris subsp. culinaris (lentil).** https://www.cabi.org/isc/datasheet/30274

CABI Invasive Species Compendium: **Datasheet - Phaseolus (beans).** https://www.cabi.org/isc/datasheet/40612

CABI Invasive Species Compendium: **Datasheet - Vigna (cowpea).** https://www.cabi.org/isc/datasheet/56374

CABI Invasive Species Compendium: **Datasheet - Vigna luteola.** https://www.cabi.org/isc/datasheet/109452

CABI Invasive Species Compendium: **Datasheet - Vigna radiata (mung bean).** https://www.cabi.org/isc/datasheet/40616

CABI Invasive Species Compendium: **Datasheet - Vigna unguiculata (cowpea).** https://www.cabi.org/isc/datasheet/56377

Canadian Food Inspection Agency (2019). ***Tuta absoluta* (Tomato Leafminer) - Fact Sheet.** https://inspection.canada.ca/plant-health/invasive-species/insects/tomato-leafminer/fact-sheet/eng/1328634442933/1328887251933

Davis, D.W., E.A. Oelke, E.S. Oplinger, J.D. Doll, C.V. Hanson and D.H. Putnam (1991). **Cowpea.** In *Alternative Field Crops Manual*, Univ. of Wisconsin-Exension, Cooperative Etension & Univ. of Minnesota; Centre for Alternative Plant & Animal Products and the Minnesota Extension Service. https://hort.purdue.edu/newcrop/afcm/cowpea.html

El-Mogy, M.M. and L. Kitinoja (2019). **Review of best postharvest practices for fresh market green beans**. PEF White Paper No. 19-01. La Pine, Oregon, USA: The Postharvest Education Foundation. http://postharvest.org/PEF_White_Paper_19-01_El-Mogy_Kitinoja_GreenBeans.pdf

Fatnassi, I.C., M. Chiboub, M. Jebara and S.H. Jebara (2014). **Bacteria associated with different legume species grown in heavy-metal soils**. In *International Journal of Agricultural Policy and Research Vol. 2(12), pp. 460-467, December 2014.* http://www.journalissues.org/IJAPR/ http://dx.doi.org/10.15739/IJAPR.018

Fulano, A.M., G.M.W. Lengai and J.W. Muthomi. 2021. **Phytosanitary and Technical Quality Challenges in Export Fresh Vegetables and Strategies to compliance with Market Requirements: Case of Smallholders Snap Beans in Kenya**. *Sustainability* 13, 1546. https://doi.org/10.3390/su13031546. https://www.mdpi.com/journal/sustainability

IICA/CPHD/USDA. **National Emergency Response Plan for Caribbean Countries: Tomato Leafminer, *Tuta absoluta* (Meyrick).** https://www.iica.int/en/programs/agricultural-health

IPPC. 1997. International Plant Protection Convention. Rome, IPPC, FAO.

Qureshi, J.A, D. Seal and S.E. Webb. **Insect Management for Legumes (Beans, Peas)**. UF/IFAS. https://edis.ifas.ufl.edu/publication/IG151

Sameer Kumar, C.V., S.J. Satheesh Naik, N. Mohan, R.K. Saxena and R.K. Varshney (2017). **Botanical Description of Pigeonpea [*Cajanus cajan* (L.) Millsp.]** Chapter 3 in *The Pigeonpea Genome, Compendium of Plant Genomes*, DOI 10.1007/978-3-319-63797-6_3. Springer International Publishing. http://oar.icrisat.org/10485/1/Botanical%20Description%20of%20Pigeonpea.pdf

Thakur, D.R. (2010). **Invasion and threats of *Acanthosceides obtectus* (Say) (Coleoptera: Bruchidae) to kidney beans in India – a first record**. *10th International Working Conference on Stored Product Protection*. Julius-Kuhn-Archiv, 425, 2010. DOI: 10.5073/jka.2010.425.007

Thomas, M.C., J.B. Heppner, R.E. Woodruff, H.V. Weems, G.J. Steck and T.R. Fasulo (2019 – latest review). **Mediterranean fruit fly – *Ceratitis capitata* (Wiedermann)**. Florida Department of Agriculture and Consumer Services, Division of Plant Industry and University of Florida.

Vikaspedia. **Field Pea**. https://Vikaspedia.in/agriculture/crop-production/package-of-practices/vegetables-1/fieldpea

Vikaspedia. **French Beans**. https://Vikaspedia.in/agriculture/crop-production/package-of-practices/vegetables-1/french-beans

Wikipedia. **Legume**. https://en.wikipedia.org/w/index.php?title=Legume&oldid=1044443120

Wikipedia. **Pigeon Pea**. https://en.wikipedia.org/w/index.php?title=Pigeon_pea&oldid=1041504275

Wikipedia. **Lentil**. https://en.wikipedia.org/wiki/Lentil

Wikipedia. **Vigna**. https://en.wikipedia.org/w/index.php?title=Vigna&oldid=1009437447

Wikipedia. **Phaseolus**. https://en.wikipedia.org/w/index.php?title=Phaseolus&oldid=1025817492

WTO. 1994. Agreement on the Application of Sanitary and Phytosanitary Measures. Geneva, World Trade Organization.

APPENDICES

Appendix 1. List of pests found on legumes in the Caribbean region

[source: National Plant Protection Organizations of Member States]

Pest Type	Scientific name	Common name(s)	Host[4]
Bacterium	*Pseudomonas phaseolicola*	halo blight	Peas, beans
Bacterium	*Pseudomonas savastanoi* pv. *phaseolicola*	halo blight (of beans)	Peas, beans
Bacterium	*Pseudomonas syringae*	bacterial blast	Peas, beans
Bacterium	*Pseudomonas syringae* pv. *syringae*	brown spot blight	Peas, beans
Bacterium	*Xanthomonas axonopodis pv. phaseoli*	Bacterial blight of bean	Peas, Beans
Bacterium	*Xanthomonas phaseoli*	common blight	Peas, beans
Bacterium	*Xanthomonas vesicatoria*	Bacterial leaf blight of tomato and pepper	Peas
Fungus	*Alternaria brassicae*	dark spot of crucifers	Peas, beans
Fungus	*Athelia rolfsii*	collar rot	Peas, beans
Fungus	*Cercospora cajani* P. Henn.	Pigeon pea leaf spot	
Fungus	*Cercospora canescens*	leaf spot	Peas, beans
Fungus	*Colletotrichum capsici*	leaf spot of peppers	Peas, beans
Fungus	*Colletotrichum lindemuthianum*	Bean anthracnose, black spot disease	Peas, beans
Fungus	*Colletotrichum truncatum*	soyabean anthracnose	Peas, beans
Fungus	*Corticium solani* (Prild. & Delacr.) Bourd & Galz.	Root rot	beans
Fungus	*Erysiphe polygoni*	White bean	Peas, beans

[4] As declared by BMCs

Pest Type	Scientific name	Common name(s)	Host[4]
Fungus	*Fusarium oxysporum* f.sp. *vasinfectum* (Atk.) Synd. & Hans	Fusarium wilt	Peas
Fungus	*Fusarium oxysporum* Schlect	Fusarium wilt	beans
Fungus	*Fusarium solani* (Mart.)(Sacc.)	Root rot, wilt	Peas, beans
Fungus	*Fusarium solani* f. sp. *phaseoli*	Dry rot	Peas, beans
Fungus	*Fusarium udum*	pigeon pea wilt	Peas, beans
Fungus	*Gibberella zeae*	Cobweb disease	Beans
Fungus	*Glomerella cingulata* (Stonem.) Spauld & Schrenk	Anthracnose, Dieback	Peas, beans
Fungus	*Lasiodiplodia theobromae*	diplodia pod rot of cocoa	Peas, beans
Fungus	*Macrophomina phaseolina* (Tassi) Goid.	Root rot of bean, ashy stem blight	Peas, beans
Fungus	*Mycosphaerella cruenta*	leaf spot of cowpea	Peas, beans
Fungus	*Mycovellosiella cajani*	Leafspot of pigeon pea	Peas
Fungus	*Oidium* sp.	powdery mildew	Peas, beans
Fungus	*Phaseoisariopsis griseola*	Angular spot	Peas, beans
Fungus	*Phoma herbarum* Westend	Leaf spot	beans
Fungus	*Phoma insidiosa* Tassi	Dieback	peas
Fungus	*Phyllosticta phaseolina*	Leaf spot	Peas, beans
Fungus	*Physalospora cajanae*	Collar rot	
Fungus	*Pseudocercosporella albida*	White spot	Peas, beans
Fungus	*Rhizoctonia solani (Thanatephorus cucumeris)*	collar rot, stem blight	Peas, beans
Fungus	*Uredo cajani*	Rust of pigeon pea	Peas, beans
Fungus	*Uromyces appendiculatus*	bean rust	Peas, beans
Fungus	*Uromyces dolicholi*	Rust of pigeon pea	Peas
Insect	-	aphids	Peas, beans
Insect	-	Pigeon pea pod borers (unidentified)	Peas
Insect	-	Pigeon pea weevil (unidentified)	Peas
Insect	*Acrosternum* sp.	Green stink bugs	Peas, beans
Insect	*Agromyza inaequalis* Malloch	Bean leafminer	Peas, beans
Insect	*Agromyza nitida*	Leafminer	beans
Insect	*Aleurodicus dispersus*	whitefly	Peas, beans
Insect	*Anasa scarbutica* (F.)	Squash bug	Peas
Insect	*Ancylostomia stercorea*	pod borer	Peas, beans
Insect	*Anticarsia gemmatalis* (Hubn.)	Velvetbean caterpillar	Peas, beans
Insect	*Aphis craccivora* (Koch)	Cowpea aphid	Peas, beans
Insect	*Aphis gossypii*	cotton aphid	Peas, beans
Insect	*Aphis spiraecola*	Green citrus aphid	Peas, Beans
Insect	*Aspidiella sacchari*	Brown sugarcane scale	Beans
Insect	*Aspidiotus destructor*	coconut scale	Peas, beans
Insect	*Asterolecanium pustulans*	Scale	peas
Insect	*Bemisia tabaci*	tobacco whitefly	Peas, beans
Insect	*Callosobruchus chinensis*	Chinese bruchid	Peas
Insect	*Chrysomelidae spp. (?)*	Leaf beetles	Beans
Insect	*Coccus hesperidum* L.	Brown soft scale	Peas
Insect	*Corcyra cephalonica*	rice meal moth	Peas, beans
Insect	*Corythuca gossypii* (F.)	Cotton lace bug, bean lace bug	Peas, beans
Insect	*Crypticerya genistae* Hempel	White scale	Peas
Insect	*Diaprepes abbreviatus*	citrus weevil	Peas, beans
Insect	*Diaprepes famelicus*	root borer, sugarcane	Peas, beans

Pest Type	Scientific name	Common name(s)	Host[4]
Insect	*Duplaspidiotus subtessaratus*	Scale	peas
Insect	*Dysmicoccus brevipes*	Pineapple mealybug	Peas
Insect	*Dysmicoccus neobrevipes*	grey pineapple mealybug	Peas, beans
Insect	*Edessa bifida* Say	Stink bug	Peas
Insect	*Edessa meditabunda* (F.)	Green and brown stink bug	Peas, beans
Insect	*Elasmopalpus lignosellus*	lesser corn stalk borer	Peas, beans
Insect	*Elastopalpus* spp.	Por borers	Peas
Insect	*Empoasca fabae* (Harris)	Potato leafhopper	Peas, beans
Insect	*Empoasca krameri*	Leaf hopper	Peas, beans
Insect	*Empoasca spp*	Leafhoppers	Peas
Insect	*Enchenopa ignidorsum* Wlk.	Orange and black treehopper	Peas
Insect	*Epargyreus zestos (Astraptes anaphus)*	Skipper Caterpillar	Peas
Insect	*Etiella zinckenella*	pea pod borer	Peas, beans
Insect	*Euschistus crenator*	Bug	
Insect	*Ferrisia virgata*	striped mealybug	Peas, beans
Insect	*Frankliniella insularis* (Frank)	Blossom (flower) thrips	Peas, beans
Insect	*Frankliniella schultzei*	cotton thrips	Peas, beans
Insect	*Fundella (pellucens) cistipennis* (Dyar)	Caribbean (white) pod borer	Peas
Insect	*Hedylepta (Lamprosema) indicata* (F.)	Bean leaf webworm moth, soybean leaf folder	Peas, beans
Insect	*Helicoverpa armigera* Hubner	Pigeon pea pod borer	Peas
Insect	*Helicoverpa* spp.	Pigeon pea pod borers	Peas
Insect	*Helicoverpa virescens*	Noctuid moth	Peas
Insect	*Helicoverpa zea*	American cotton bollworm, Corn earworm	Peas, beans
Insect	*Heliothis virescens*	tobacco budworm, pod borer	Peas, beans
Insect	*Heliothis zea*	Corn earworm	peas
Insect	*Hesperiidae (?)*	Black head Skipper	Beans
Insect	*Hesperiidae (?)*	Yellow head Skipper	Beans
Insect	*Howardia biclavis*	Mining scale	peas
Insect	*Humenia (Zinckenia) fascialis* (Cram.)	Beet webworm	Peas, beans
Insect	*Hypercompe (Ecpantheria) icasia* Cramer	Moth	Peas, beans
Insect	*Icerya monsterattensis*	Scale insect	Peas
Insect	*Icerya purchasi*	cottony cushion scale	Peas, beans
Insect	*Liriomyza sativae*	vegetable leaf miner	Peas, beans
Insect	*Liriomyza* sp.	Leafminers	Peas, beans
Insect	*Liriomyza trifolii*	American serpentine leafminer	Peas, beans
Insect	*Litostylus diadema* Schoenh	Broad nose weevil	Peas
Insect	*Maconellicoccus hirsutus*	pink hibiscus mealybug	Peas, beans
Insect	*Maruca sp. (?)*	Pod borers	Peas
Insect	*Maruca vitrata*	Legume pod borer	Peas, beans
Insect	*Megalurothrips sjostedti*	Bean flower thrips	Peas, beans
Insect	*Melanacanthus scutellaris (?)*	bean bug	Beans
Insect	*Mythimna unipuncta*	rice armyworm	Peas, beans
Insect	*Myzus persicae*	green peach aphid	Peas, beans
Insect	*Nezara viridula* (L.)	Green stink bug	Peas, beans
Insect	*Nipaecoccus nipae*	spiked mealybug	Peas, beans
Insect	*Ormenoides* spp.	Treehopper	Peas

Pest Type	Scientific name	Common name(s)	Host[4]
Insect	*Paracoccus marginatus*	papaya mealybug	Peas, beans
Insect	*Parasaissetia nigra*	pomegranate scale	Peas, beans
Insect	*Pantomorus cervinus (Naupactus simplex)* Boheman	Fuller rose beetle	Peas
Insect	*Phenacoccus madeirensis*	Madeira mealybug	Peas, beans
Insect	*Phyllophaga smithi*	white grub	Peas, beans
Insect	*Phyobius pomacea* Gyllenhal	Green weevil	Peas
Insect	*Piezodorus guildinii* (Westwood)	Red banded stinkbug	Peas
Insect	*Pinnaspis strachani*	lesser snow scale	Peas, beans
Insect	*Planchonia stentae (?)*	South African pit scale	Peas
Insect	*Planococcus citri*	citrus mealybug	Peas, beans
Insect	*Pseudaulacaspis pentagona*	mulberry scale	Peas, beans
Insect	*Pseudauleaspis cockerelli* (Cooley)	False oleander scale	Peas
Insect	*Pseudococcus elisae*	banana mealybug	Peas, beans
Insect	*Pseudococcus jackbeardsleyi*	Jack Beardsley mealybug	Peas, beans
Insect	*Pulvinaria psidii*	green shield scale	Peas, beans
Insect	*Riptortus serripes (?)*	bean bug	Beans
Insect	*Rotylenchulus reniformis*	Reniform nematode	Beans
Insect	*Saissetia coffeae*	hemispherical scale, helmet scale	Peas, beans
Insect	*Saissetia oleae*	olive scale, black scale	Peas, beans
Insect	*Spodoptera eridania*	southern armyworm	Peas, beans
Insect	*Spodoptera frugiperda*	Corn leafworm/fall armyworm	beans
Insect	*Spodoptera latifascia*	Lateral lined armyworm	Peas, beans
Insect	*Spodoptera ornithogalli*	Yellow striped armyworm	Beans
Insect	*Spoladea recurvalis*	Hawaiian beet webworm	Peas, beans
Insect	*Systena blanda (?)*	Striped flea beetle	Beans
Insect	*Tenuirostritermes tenuirostris* (Desneux)	Termites/woodlice	Peas
Insect	*Thrips palmi*	melon thrips	Peas, beans
Insect	*Thrips tabaci*	onion thrips	Peas, beans
Insect	*Thyanta* spp.	Stink bugs	Peas
Insect	*Trialeurodes vaporarium* (Westwood)	Whitefly	Peas
Insect	*Tribolium castaneum*	red flour beetle	Peas, beans
Insect	*Trichoplusia ni*	cabbage looper	Peas, beans
Insect	*Trichoplusia* sp.	Semi-looper	peas
Insect	*Unaspis citri*	Citrus snow scale	Peas
Insect	*Urbanus (Goniurus) proteus* (L.)	Long-tailed skipper	Peas, beans
Mite	*Tetranychus* spp	spider mites	Peas, beans
Nematode	*Helicotylanchus multicinatus*	Banana spiral nematode	Peas, beans
Nematode	*Helicotylenchus dihystera*	Common spiral nematode	Peas
Nematode	*Helicotylenchus multicinctus*	Banana spiral nematode	Beans
Nematode	*Helicotylenchus pseudorobustus*	Spiral nematode	Beans
Nematode	*Meloidogyne incognita*	root-knot nematode	Peas, beans
Nematode	*Radopholus similis*	Burrowing nematode	Peas, beans
Nematode	*Rotylenchulus reniformis*	Reniform nematode	Peas
Nematode	*Xiphinema vulgare*	Dagger nematode	Peas, beans
Oomycete	*Pythium spp.*	Damping off	Peas, beans
Phytoplasma	*Candidatus Phytoplasma 16SrIX*	Witch broom	Pigeon peas
Virus	Common Bean Mosaic Virus	CBMV	Peas, beans
Virus	Cowpea Mosaic Virus	Vineyard Mosaic Virus	Peas
Virus	Cucumber mosaic virus	cucumber mosaic	Peas, beans

Pest Type	Scientific name	Common name(s)	Host[4]
Virus	Golden Mosaic Virus	GMV	Peas, beans
Virus	Tomato yellow leaf curl virus	Leaf curl	Beans
Virus	Yellow Mosaic Virus	YMV	Peas, beans
Weed	*Cassia obtusifolia*	Sicklepod	Beans
Weed	*Datura stramonium*	Jimsonweed	Beans
Weed	*Emilia sonchifolia*	Consumption weed	Beans

Appendix 2. List of pests of legumes regulated by countries in the Caribbean region

[Source: National Plant Protection Organisations of Member States]

Pest Type	Scientific name	Common name(s)	Host
Bacterium	*Pseudomonas syringae pv. tabaci* (Wolf and Foster) Young *et. al.*	Wild fire	Peas
Insect	*Asynonychus godmanni* (Boheman)	Fuller's rose weevil	
	Atta cephalotes (Linnaeus)	Bachac/Umbrella ant	
	Atta sexdens (Linnaeus)	Acoushi ant	
	Aulacorthum solani (Kaltenbach)	Foxglove aphid	
	Bactrocera cucurbitae (Coquillett)	Melon fly	
	Colapsis hypochlora (Lefevre)	Fruit scarring beetle	
	Diabrotica balteata (leconte)	Banded cucumber beetle	
	Melanagromyza obtuse (?)	Pigeon pea pod fly	
	Oxycarerus hyalipennis (Costa)	Cotton seed bug	
	Paratachardina lobata (Kondo & Gulllan)	Lobate lac scale	
	Prodiplosis longifila Gagné	Citrus gall midge	Beans
	Spodoptera litura (Fabricius)	Cluster caterpillar	Peas, beans
	Spoladea recurvali (Fabricius)	Hawaiian beet webworm	Beans
	Trialeurodes abutilonea Haldeman	Banded-winged whitefly	Beans
	Tribolium castaneum Herbst	Red flour beetle	Peas, beans
Mite	*Tetranychus cinnabarinus* (Boisduval)	Carmine spider mite	Beans
Mollusc	*Vaginula plebeia* Fischer	Brown slug	Beans