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YAM

GUIDELINE TO FACILITATE INTRA-REGIONAL TRADE IN THE CARIBBEAN

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REGIONAL GUIDELINES FOR
PHYTOSANITARY MEASURES

GUIDELINE TO FACILITATE INTRA-REGIONAL TRADE IN YAM

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CONTENT

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 yam (*Dioscorea alata*) tubers 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 yam tubers without the leaves or stem of the plant.

The major pests of yam, 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 generally used in trade amongst Caribbean countries.

This guideline does not address issues related to living modified organisms, climate change, quality of yam tubers, or diversion from intended use; trade in the whole plant, cuttings, leaves or other plant parts is not covered in this document.

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 yam tubers for export.

BACKGROUND

Description of yam

Yam is described as a vigorous herbaceous vine which is an important edible tuber crop. The genus *Dioscorea* includes approximately 350-800 species which are distributed not only in the tropics but also in warm and temperate regions. Many *Dioscorea* yams are cultivated in the tropics. *D. alata* is native to southeastern Asia and is grown widely in the Caribbean area while *Dioscorea rotundata*, the white yam, and *D. cayenensis*, the yellow yam, are native to Africa. White yam tubers are roughly cylindrical in shape with a smooth, brown skin and a white firm flesh. Yellow yam has yellow flesh and is phenotypically similar to the white yam. The tuber shape of *D. alata* is generally cylindrical but can vary and the flesh is white and watery in texture.

There are at least 15 distinguishable cultivar groups of this species of yam. The plant can produce one singular tuber or several tubers, also known as yams, which extend from stolons

from a central corm. The shape of the tuber is generally cylindrical but can vary. The edible tuber has a rough skin that is difficult to peel but readily softened by heating. The skins of the various cultivars vary in colour from dark brown to light pink. The flesh of the tuber is much softer than the skin and ranges in color from white or yellow to purple or pink in mature tubers.

These species grow in temperatures of 25-35°C and high precipitation (at least 1,000 mm annual rainfall), and at low to middle elevations. *D. alata* is sensitive to aluminum toxicity in the soil. Yams grow optimally in deep, textured, loamy, well-draining fertile soils that are rich in organic matter and in full sun or part shade. Very wet soils promote tuber rot and *Dioscorea* species are susceptible to several pests to include anthracnose, viruses, nematodes and mealybugs. Yams are infested by a broad taxonomic diversity of insect pests, inclusive of at least 48 when the crop in in the field and 27 species after harvest (Korada *et.al.*).

Identity

Preferred Scientific Name
***Dioscorea* spp.**
Preferred Common Name
White yam, yellow yam

Taxonomic Tree

Domain: Eukaryota
Kingdom: Plantae
Phylum: Spermatophyta
Subphyllum: Angiospermae
Class: Monocotyledonae
Order: Dioscoreales
Family: Dioscoriaceae
Genus: Dioscorea

Intended Use

The guideline covers yam tubers for the intended purpose of consumption as food or for processing.

REQUIREMENTS

Pest risk analysis

The NPPO of the importing country should conduct PRA associated with yam tubers 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 Yam Tubers

None of the current regional priority plant pests are known and/or confirmed to affect yam grown in the Caribbean region. Appendices 1 and 2, respectively provide combined lists of general pests and regulated pests found on yam grown in the Caribbean region.

Table 1 is a list of pests associated with fresh yam tubers that may be identified as regulated pests requiring phytosanitary measures by the PRA process. Measures in Table 2 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.

Table 1. Pest groups associated with yam tubers

Pest Group	Family	Example species
Ants	Formicidae	*Acromyrmex octospinosus* (Reich)
Mealybugs	Pseudoccidae	*Planococcus dioscoreae* (Williams)
Moths	Blastobasidae	*Blastobasis* spp.
Slugs	Veronicellidae	*Veronicella cubensis* (Pfeiffer)
Thrips	Thripidae	*Elixothrips brevisetis* (Bangnall)
Viruses	Geminiviridae	Yam Mosaic Virus
Weevils	Curculionidae	*Paleopus costicollis*

General Procedures

Once technically justified, general procedures include the following:

Production:

- Registration of producers, farms and exporters and maintenance of a registry of these entities by the NPPO of the exporting country.

- 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
- Farm certification

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 to ensure suitability of tubers 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 packing house) in accordance with established procedures
- 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 yam tubers.

Most yam cultivars and varieties do not contain toxic compounds. However, bitter compounds tend to accumulate in immature tuber tissues of white and yellow yams which may be polyphenol or tannin-like compounds. Tubers should therefore be harvested only when mature.

Phytosanitary Measures

There are no regional pests of quarantine significance that have been confirmed/shown to be associated with yam tubers in the Caribbean region. Table 2 below provides information on pests associated with yam tubers along with measures considered to be effective in managing each pest group previously identified in Table 1.

Table 2. Phytosanitary measures considered to be effective in managing the risk from specified pest groups

Pest Group	Phytosanitary Measure(s)
Ants	PFA[1], PFPP[2], systems approach
Mealybugs	Harvest management, post-harvest brushing, visual examination
Moths	PFA, brushing to exclude soil and remove puparia, fumigation
Slugs	PFA, systems approach, GAPs, visual inspection
Thrips	PFA, PFPP, harvest management, visual examination
Viruses	GAP (incl. IPM to manage vectors, use of resistant varieties, etc.), PFPP
Weevils	Cleaning & removal of soil to the degree practicable.

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.

[1] Pest Free Area
[2] Pest Free Places of Production

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.

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*).

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

Crops should be managed using good agricultural practices. Plots should be kept weed free and appropriate fertilizers used where necessary. A crop rotation programme helps reduce pest incidence. Sporadic attacks of molluscs should be dealt with immediately with the use of snail and slug baits. Natural enemies of mealybugs should be conserved.

Harvesting

Yam tubers should be harvested when mature. Care should be taken when removing tubers from the soil since mechanical damage can provide a site for the entry of disease organisms, resulting in post-harvest losses due to rot. Every effort should be made to remove mealybugs from tubers before they are removed from the field as they cause damage while in storage (Badii *et al.*, 2016).

Post-harvest handling and treatments

Handling and sorting

All diseased, defective and moderately to severely damaged yam tubers should be removed from tubers to be exported. Plant debris should also be removed. Care should always be taken to reduce or prevent damage to the tubers.

Transportation

In the transportation of yam tubers for consumption, all applicable handling, packaging and storage procedures must serve to prevent damage to the produce and proliferation of pests during the process. Vehicles used should be cleaned and records kept of the cleaning activities. Closed trucks used to transport fresh produce should be suitably retrofitted to allow for ventilation of the produce. Ventilation of long-distance vehicles should be done by fitting the vehicle with air intakes and louvres to allow for a positive air flow through the load. During the shipping process, yam consignments should not be placed in areas with extreme temperatures. The containers should not be dropped, thrown, packed in inverted position, rolled or tipped. Regardless of the means of transport, the produce must be kept as cool as possible, dry, and moved to market as quickly as possible.

Cleaning

As soon as possible after harvest, tubers should be dry brushed or washed/cleaned in running water to remove all soil, roots and dead tissues. If the level of mealybug infestation is high, tubers should be sprayed with water at relatively high pressure to knock the mealybugs off. Alternatively, a soap solution (10-15 tablespoons of liquid soap: 16 litres water) may be applied using a knapsack sprayer (Badii *et al.*, 2016). Any water used to clean tubers in this process should be clean. The tubers should be partially dried to remove excess moisture. The degree of cleaning is dependent on the requirements of the importing country, but every effort should be made to ensure that tubers are practically free from soil.

Curing

One of the simplest and most effective ways to reduce water loss and decay during postharvest storage of yam tubers is curing after harvest. This involves the process of wound healing with

the development and suberization of new epidermal tissue. Yam tubers may be cured by holding at 32-40°C and 85-95% relative humidity for 4-7 days.

Storage

When stored, yams continue to respire, resulting in the oxidation of starch contained in the cells of the tuber, which then converts it to water, carbon dioxide and heat energy. Amongst the major roots and tubers, properly stored yam is considered to be the least perishable. However, successful storage of yams requires:

- Initial selection of sound and healthy yams
- Proper curing, if possible combined with fungicide treatment
- Adequate ventilation to remove the heat generated by respiration of the tubers
- Regular inspection during storage and removal of rotting tubers and any sprouts that develop
- Protection from direct sunlight and rain.

Storing yam at low temperatures reduces the respiration rates. It should be noted, however, that temperatures below 12°C (54°F) cause damage through chilling, resulting in the breakdown of internal tissues, increasing water loss and susceptibility to decay. The best temperature range for storing yams is 14-16°C (57-61°F), with high-technology-controlled humidity and climactic conditions, after a process of curing.

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 yam tubers 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.

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*).

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.

Within three days of harvest, yam tubers may be dipped for 10 minutes in a solution of an approved postharvest fungicide for decay control. The dipping solution should be changed after treatment of the maximum quantity of the tubers has been dipped to maintain treatment efficacy.

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

Yam packaging which should be properly labelled in compliance with the importing country's requirements. Generally, the label placed on each packing container of yam tubers should include the name and address of the packer or dispatcher, name of producer, origin of the produce, and the net weight. Handwritten labels are discouraged. The maximum recommended weight per carton is 20 to 25 kg.

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 consignments of yam tubers 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 yam tubers 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*).

For consignments of yam tubers to received phytosanitary certification, the consignments must:

- Meet the specific requirements as indicated in the Import Permit issued by the importing country
- Originate only from officially approved places of production
- Be clean (i.e., practically free from viable regulated pests, and associated tissue damage, soil, chemical contaminants, or any other extraneous material and substances)
- 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 protective material, where required)
- Be exported in a secure manner to prevent contamination.

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

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.

If a consignment of fresh yam tubers 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 (containers, 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 for the commodity 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 yam tubers 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 yam tuber 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

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APPENDICES

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

[source: National Plant Protection Organizations of Member States]

Pest Type	Scientific name	Common name(s)
Bacterium	-	Tuber wet rot
Bacterium	*Rhizobium radiobacter*	Crown gall
Fungus	-	Anthracnose
Fungus	*Athelia rolfsii*	Sclerotium rot
Fungus	*Ceratocystis paradoxa*	Fruit rot
Fungus	*Cercospora bataticola*	Sigatoka
Fungus	*Cercospora carbonacea*	Leaf spot
Fungus	*Cercospora dioscoreae*	Sigatoka
Fungus	*Cercospora* spp.	Leaf spot
Fungus	*Chalara elegans*	Black root rot
Fungus	*Colletotrichum capsici* (Syd.) Butler & Bisby	Leaf spot
Fungus	*Colletotrichum gloeosporioides* Penz.	Anthracnose
Fungus	*Corticium/Sclerotium rolfsii*	Sclerotium rot
Fungus	*Fusarium oxysporum*	Basal rot
Fungus	*Fusarium oxysporum* Schlect.	Root & collar rot
Fungus	*Fusarium solani*	Dry rot
Fungus	*Glomerella cingulata*	Anthracnose
Fungus	*Glomerella cingulata* (Stonem.) Spauld. & Schrenk.	Angular leaf spot
Fungus	*Lasiodiplodia theobromae*	Diplodia pod rot of cocoa
Fungus	*Nectria haematococca*	Dry rot of potato
Fungus	*Phyllosticta batatas*	Leaf blight
Fungus	*Rhizoctonia solani*	Collar & root rot, damping off, wire stem
Insect	-	Termites
Insect	-	Yam beetle or weevil
Insect	-	Defoliating caterpillars
Insect	*Aleurotrachelus trachoides*	White fly
Insect	*Aphis gossypii*	Cotton aphid
Insect	*Araecerus fasciculatus*	Cocoa weevil
Insect	*Aspidiella (Aspidiotus) hartii* (Ckll)	Yam scale
Insect	*Aspidiotus destructor* (Sign.)	Coconut scale
Insect	*Carpophilus dimidiatus*	Stored yam weevil
Insect	*Coccus hesperidum*	Brown soft scale
Insect	*Diaprepes abbreviatus*	Citrus weevil
Insect	*Ferrisia virgata*	Striped mealybug
Insect	*Hortensia similis*	Common green sugarcane leafhopper
Insect	*Lasioderma serricorne*	Cigarette beetle
Insect	*Ligyrus cuniculus*	Rough black hard-back (PR)
Insect	*Opogona sacchari*	Banana moth
Insect	*Palaeopus costicollis*	Yam weevil
Insect	*Phyllophaga smithi*	White grub
Insect	*Pinnaspis strachani*	Lesser snow scale
Insect	*Planococcus citri*	Citrus mealybug

Pest Type	Scientific name	Common name(s)
Insect	*Spodoptera eridania*	Southern armyworm
Insect	*Tribolium castaneum*	Red flour beetle
Insect	*Xyleborus ferrugineus*	Black twig borer
Nematode	-	Root-knot nematodes
Nematode	*Helicotylenchus dihystera*	Common spiral nematode
Nematode	*Helicotylenchus erythrinae*	Spiral nematode
Nematode	*Helicotylenchus multicinctus*	Banana spiral nematode
Nematode	*Helicotylenchus nannus/dihystera*	Spiral nematode
Nematode	*Hoplolaimus pararobustus*	Lance nematode
Nematode	*Longidorus*	Longidorids
Nematode	*Meloidogyne incognita*	Root-knot nematode
Nematode	*Meloidogyne javanica*	Sugarcane eelworm
Nematode	*Pratylenchus coffeae*	Banana root nematode
Nematode	*Pratylenchus sp*	Root lesion nematode
Nematode	*Radopholus similis*	Burrowing nematode
Nematode	*Rotylenchulus reniformis*	Reniform nematode
Nematode	*Scutellonema bradys*	Yam dry rot nematode
Nematode	*Scutellonema* sp.	Nematodes
Nematode	*Tylenchorhynchus acutus*	Stunt nematode
Oomycete	*Albugo ipomea pandurate*	White rust
Virus	Cucumber Mosaic Virus	Cucumber Mosaic
Virus	Yam mild mosaic virus	-
Virus	Yam Mosaic Virus	Yam Mosaic
Weed	*Synedrella nodiflora*	Cinderella weed

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

[Source: National Plant Protection Organisations of Member States]

Pest Type	Scientific name	Common name(s)
Insect	*Acromyrmex octospinosus* (Reich)	Leaf cutting ant
	Blastobasis sp.	Yam moth
	Elixothrips brevisetis (Bangnall)	Banana rind thrips
	Planococcus dioscoreae (Williams)	Yam Mealybug
Mollusc	*Veronicella cubensis* (Pfeiffer)	Two-striped slug
Virus	Yam Mosaic Mirus (Potyvirus)	Yam mosaic virus