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GINGER & TURMERIC

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 GINGER & TURMERIC

Produced by the Caribbean Agricultural
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CONTENTS

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 the spices ginger (*Zingiber officinale* Roscoe) and turmeric (*Curcuma longa* L.) intended for human 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 trade in the rhizomes of all varieties of ginger and turmeric, without the roots, suckers or above-ground parts of the plant.

The major pests of ginger and tumeric 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. Broad consideration is given to general pests that affect cassava within the region. 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 rhizomes, 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 fresh ginger and turmeric rhizomes for export.

BACKGROUND

Description of ginger

Ginger (*Zingiber officinale*) is widely used as a spice, primarily the rhizome of the plant. *Z. officinale* is an herbaceous perennial plant of the family Zingiberaceae which also includes turmeric (*Curcuma longa*). Ginger is one of the first spices to have been exported from Asia, arriving in Europe where it was used by ancient Greeks and Romans. In 2018, world production of ginger was reportedly 2.8 million tonnes, with India producing 32% of the world total. The spice is grown in many areas across the globe.

Ginger has the ability to grow in a wide variety of environments but is best grown in a warm, humid environment, at a preferred elevation of 300-900 meters, and in well-drained soils of at least 30 cm deep. The preferred soils are medium loams with an adequate supply of organic matter and a pH of 6.0-7.0. Growth is best when there is a period of low rainfall prior to growing and well-distributed rainfall in the active growth phase (optimal rainfall of 2,500-3,000 mm).

In the Caribbean, ginger is a popular spice used in cooking and for making drinks such as ginger beer and sorrel. If consumed in reasonable quantities, ginger has few side effects.

Z. officinale is a major host of *Agrotis ipsilon* (black cutworm), *Chrysomphalus dictyospermi* (dictyospermum scale), *Globisporangium splendens* (blast of oil palm), *Macrophomina phaseolina* (charcoal rot of bean/tobacco), *Nipaecoccus nipae* (spiked mealybug), *Parasaissetia nigra* (pomegranate scale), and *Taphrina maculans* (leaf spot: turmeric). The species serves as a minor host of *Achatina fulica* (giant African land snail) and *Pseudococcus jackbeardsleyi* (Jack Beardsley mealybug). Ginger is also a wild host of *Raoiella indica* (red palm mite).

Identity

Preferred Scientific Name

***Zingiber officinale* Roscoe**

Preferred Common Name

Ginger

Other Scientific Names

***Amomum zingiber* L. (1753)**
***Curcumia longifolia* Wall.**
***Zingiber cholmondeleyi* (F.M.Bailey) K.Schum**
***Zingiber majus* Rumph.**
***Zingiber missionis* Wall.**
***Zingiber zingiber* (L.) H.Karst.**

Taxonomic Tree

Domain: Eukaryota
Kingdom: Plantae
Phylum: Spermatophyta
Subphyllum: Angiospermae
Class: Monocotyledonae
Order: Zingiberales
Family: Zingiberaceae
Genus: Zinziber
Species: *Zingiber officinale*

Intended Use

The guideline covers fresh ginger rhizomes for the intended purpose of consumption as food or for processing.

Description of turmeric

Turmeric (*Curcuma longa*) is a flowering plant of the family Zingiberaceae. The plant is native to Southeast Asia and the Indian subcontinent. Turmeric can be grown in diverse tropical conditions from sea level to 1,500 meters above sea level, at a temperature range of 20-35°C and an annual rainfall of at least 1,500 mm. Although the plant can grow on a variety of soil types, it thrives best in well-drained sandy or clay loam soils with a pH range of 4.5-7.5.

The rhizomes of *C. longa* are used fresh or boiled in water and dried, after which they are ground into a deep orange-yellow powder that is commonly used as a colouring and flavouring agent, as well as for dyeing.

Turmeric is major host of *Aspidiella hartii* (yam scale), *Athelia rolfsii* (sclerotium rot), *Criconemella* (ring nematode), *Macrophomina phaseolina* (charcoal rot of bean/tobacco), *Pratylenchus coffeae* (banana root nematode), *Pythium aphanidermatum* (damping-off), *Radopholus similis* (burrowing nematode), *Stegobium paniceum* (drugstore beetle), *Stephanitis typica* (banana lace-wingbug), *Taphrina maculans* (leaf spot: turmeric), *Trichodorus* (stubby root nematodes), and *Xiphinema* (dagger nematode). It is also known to be a minor host of *Aspergillus niger* (black mould of onion), *Attacus atlas* (atlas moth), *Chaeridiona mayuri*, *Cochliobolus lunatus* (headmould of grasses, rice and sorghum), *Colletotrichum capsici* (leaf spot of peppers), *Conogethes punctiferalis* (castorcapsule borer), *Haematonectria haematococca* (dry rot of potato), *Melilotus indica* (Indian sweetclover), *Meloidogyne incognita* (root-knot nematode), *Paspalum distichum* (knotgrass), *Pythium graminicola* (seedling blight of grasses), *Pythium myriotylum* (brown rot of groundnut), *Ralstonia solanacearum* (bacterial wilt of potato), and *Rhyzopertha dominica* (lesser grain borer). *C. longa* is a wild host of *Raoiella indica* (red palm mite).

Identity

Preferred Scientific Name
***Curcuma longa* L.**
Preferred Common Name
Turmeric
Other Scientific Names
***Amomum curcuma* Jacq. (1776)**
***Curcuma domestica* Valeton (1918)**

Taxonomic Tree

Domain: Eukaryota
Kingdom: Plantae
Phylum: Spermatophyta
Subphyllum: Angiospermae
Class: Monocotyledonae

Order: Zingiberales
Family: Zingiberaceae
Genus: Curcuma
Species: *Curcuma longa*

Intended Use

The guideline covers fresh turmeric rhizomes 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 ginger and turmeric rhizomes 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 ginger and turmeric rhizomes

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

Table 1 is a list of pests associated with fresh ginger and turmeric rhizomes 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 ginger and turmeric rhizomes

Pest Group	Family	Example species
True bugs	Aphididae	*Pentalonia nigronervosa*
Weevils	Curculionidae	*Elytroteinus subtruncatus* (Fairmaire)

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, selection of quality planting materials, planting at the appropriate time, avoiding the excessive use of fertilizers)
- 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 to ensure suitability of rhizomes 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
- 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 ginger and turmeric rhizomes. 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.

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

Phytosanitary Measures

There are no regional pests of quarantine significance that have been confirmed/shown to be associated with ginger and turmeric rhizomes in the Caribbean region. Table 2 below provides information on pests associated with ginger and turmeric rhizomes 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 2. Phytosanitary measures considered to be effective in managing the risk from specified pest groups

Pest Group	Phytosanitary Measure(s)
True bugs	PFPP[1], Systems approach, GAP, visual inspection, sorting, cleaning, phytosanitary certification.
Weevils	PFPP, IPM (e.g., cultural, mechanical & chemical methods; field sanitation, removal of alternate hosts), cleaning (including removal of all soil)

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

Cultivation of ginger and turmeric is maximized through the use of good quality, disease-free planting material, choice of optimal locations with the preferred soil types, pH and environmental conditions. The application of good agricultural practices, including an

[1] Pest Free Places of Production

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. The time of planting is also very important.

Harvesting

Ginger rhizomes are harvested at various stages depending on the intended end use. It is advised that irrigation be stopped one month before harvest. Upon harvesting, care should be taken to (i) ensure that harvesting tools and equipment are clean and in good working order and (ii) remove soil, plant debris and other extraneous organic material from the rhizomes. Under wet conditions, harvested rhizomes should be immediately transferred to a drying shed.

Turmeric will be ready to harvest in 8-9 months when the leaves turn yellow and begin to dry up. Rhizomes are to be harvested by removal of the whole plant from the ground, taking care not to cut or bruise the rhizomes. Rhizomes should be completely cleaned of mud, roots, pseudostems, leaf scales and leaves.

Post-harvest handling and treatments

Handling, sorting and transportation

The rhizomes should be trimmed of roots, pseudostems and leaves using a sharp, clean knife. Foliage of ginger should be trimmed about 15mm above the spot where it meets the rhizome. Care should be taken not to damage the rhizome fingers while handling them. Harvested rhizomes should be washed with potable water where necessary to remove soil; a power nozzle attached to a hose may be used in this regard. Ginger and turmeric rhizomes should be transported in clean, dry conditions. The rhizomes should be placed in clean/sterile baskets, field crates, or other appropriate, well-aerated containers to reduce damage and then transported to the processing/packaging facility. The use of bags or sacks is not recommended due to the associated high level of breakage and rhizome damage. The containers should be capable of being stacked without damaging the rhizomes. Attention should be paid to eliminating excess moisture retention in containers that could support the growth of mold. The facility and vehicles used for transporting harvested rhizomes should be kept clean and free from previously harvested products and foreign materials. Records should be kept of all cleaning activities.

Rhizomes should be sorted to remove infested material and to select those that meet the quality and cleanliness specifications of the country of import.

Cleaning

All rhizomes should be cleaned and be practically free from soil prior to packaging to maintain the highest quality product. It is recommended that ginger rhizomes be cleaned by washing in potable water with 150 ppm hypochlorous acid either by scrubbing by hand or with a brush. Optimal sanitization using hypochlorous acid is most effective at a water pH of 6.5.

Reusable storage containers and sacks should be disinfected in chlorinated or boiling water prior to reuse.

Curing

When ginger is intended for storage, the product should be cured by air-drying at 22-26°C (71.5-79°F) and a relative humidity of 70-75% for periods of up to 14 days to allow for thickening of the epidermis and the cut surfaces to heal. Solar drying, as opposed to sun drying, is preferred as it aids in minimizing loss of quality and eliminates contamination by microbes.

Storage

Ginger and turmeric rhizomes should be stored in approved/registered, pest-free, clean facilities and at moisture levels of 10% or less. The storage facility should be free from insects, birds, rodents and other storage pests and should be inaccessible to livestock and domestic animals. Devices to regulate storage conditions (e.g., temperature, humidity) should be installed as required.

The optimal temperature for storage and transporting ginger rhizomes is 12°C. Storage below 12°C will result in chilling injury and should be avoided. Optimal relative humidity for storage is 70-75%. Levels of CO_2 produced by respiring rhizomes during storage should not be allowed to exceed 0.4% by volume; this can be controlled by controlling the supply of fresh air to the rhizomes.

Bulk turmeric rhizomes are to be stored in a cool, dry environment, away from direct sunlight.

Stored rhizomes should be regularly inspected; spoiled or infested produce should be removed and destroyed.

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 ginger and turmeric rhizomes 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*).

Irradiation treatments for ginger and turmeric rhizomes, if required, would have to be scientifically determined and justified.

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. Prior to storage of rhizomes, the room may be fumigated with a registered fumigant. 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.

If a fungicidal treatment is required, this may be done by adding the approved chemical at the time of cleaning/washing or it may be sprayed separately. A fungicide such as thiabendazole (1,000 ppm) is recommended for this treatment.

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

Ginger and turmeric rhizomes should be packaged using clean or new containers. Use of fibreboard cartons with a bursting strength of not less than 275 psi are preferred for use in trade of this commodity. A double-walled, self-locking waxed carton or a corrugated, two-piece, fully telescopic carton is recommended. Cartons must not be over-filled.

A label to be affixed to the packaging should clearly detail the name of the ginger or turmeric variety, 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 ginger and turmeric rhizomes, all applicable handling, packaging and storage procedures must serve to prevent damage and proliferation of pests during the process.

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 the ginger and turmeric rhizomes 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 ginger and turmeric rhizomes 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 ginger and turmeric rhizomes to receive 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 considered free from viable regulated pests, soil and other contamination
- 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

Fresh ginger and turmeric 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 ginger and turmeric 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 e accompanied by (a copy of) the original pytosanitary 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:

Carton level security

- The commodity is fully enclosed in a carton 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 cartons having plastic liners or bags must be fully sealed. The overlapping folded edges of the plastic liner with the carton lid on top would be considered fully sealed.

Pallet level security

For cartons 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 cartons 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 storage temperatures and 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 ginger and turmeric 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 ginger and turmeric 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 ginger & turmeric in the Caribbean region

[source: National Plant Protection Organizations of Member States]

Pest Type	Scientific name	Common name(s)	Host
Bacterium	*Pseudomonas sp*	Rhizome rot	ginger
Bacterium	*Ralstonia solanacearum*	Bacterial wilt of potato	Ginger, turmeric
Fungus	*Colletotrichum capsici*	Rot	ginger
Fungus	*Corticium rolfsii* (Curzi)	Sclerotium rot	turmeric
Fungus	*Fusarium moniliforme*	Rhizome/root rot	ginger
Fungus	*Fusarium oxysporum*	basal rot, root rot or wilt	Ginger, turmeric
Fungus	*Fusarium solani*	Wilt of rhizome	ginger
Fungus	*Macrophomina phaseolina* (Tassi) Goi	Charcoal rot of bean/tobacco	Ginger, turmeric
Fungus	*Nectria haematococca* (Wollenw.) Gerlach	Dry rot of potato	turmeric
Fungus	*Phyllosticta* sp. (?)	Pale leaf spot of ginger	ginger
Fungus	*Phyllosticta zinziberi* (T.S. Ramakr)	Leaf spot	ginger
Fungus	*Rhizoctonia solani* (*Thanatephorus cucumeris*)	Dry root, wilt of rhizome & root	ginger
Fungus	*Rosellinia bunodes*	Black root rot)	ginger
Fungus	*Rosellinia necatrix*	Black root rot	ginger
Fungus	*Verticillium sp*	Drying of rhizome	ginger
Insect	*Aspidiella hartii* (Targ.)	Yam scale	Ginger, turmeric
Insect	*Aulacaspis tubercularis*	Scale	ginger
Insect	*Carneocephala reticulate*	Hopper	ginger
Insect	*Corcyra cephalonica*	rice meal moth	Ginger, turmeric
Insect	*Dysmicoccus brevipes*	pineapple mealybug	Ginger, turmeric
Insect	*Lasioderma serricorne* (Fabricius)	Cigarette beetle	turmeric
Insect	*Nipaecoccus nipae*	spiked mealybug	Ginger, turmeric
Insect	*Paleopus costicollis*	Weevil	ginger
Insect	*Pseudaonidia trilobitiformis*	Scale insect	ginger
Insect	*Pseudococcus jackbeardsleyi*	Jack Beardsley mealybug	Ginger, turmeric
Insect	*Stegobium paniceum* (Linnaeus)	Drugstore beetle	Ginger, turmeric
Mite	*Tetranychus* spp.	Spider mite	ginger
Mollusc	*Veronicella laevis*	Slug	ginger
Nematode	*Helicotylenchus multicinctus*	Spiral nematode	ginger
Nematode	*Helicotylenchus nannus*	Spiral nematode	ginger
Nematode	*Helicotylenchus sp*	Spiral nematode	ginger
Nematode	*Meloidogyne* spp.	Root-knot nematode	Ginger, turmeric
Nematode	*Pratylenchus coffeae*	Banana root nematode	turmeric
Nematode	*Pratylenchus sp*	Lesion nematode	ginger
Nematode	*Radopholus similis*	Burrowing nematode	Ginger, turmeric
Nematode	*Retylenchus reniformis*	Reniform/Spiral nematodes	Ginger, turmeric
Nematode	*Rotylenchus sp*	Reniform nematode	ginger
Nematode	*Xiphinema* sp.	Dagger nematodes	ginger
Oomycete	*Pythium sp*	Root/rhizome rot	ginger

Appendix 2. List of pests of ginger & turmeric regulated by countries in the Caribbean region

[Source: National Plant Protection Organisations of Member States]

Pest Type	Scientific name	Common name(s)	Host
Insect	*Elytroteinus subtruncatus (Fairmaire)*	Ginger weevil	Ginger
	Pentalonia nigronervosa	Banana aphid	