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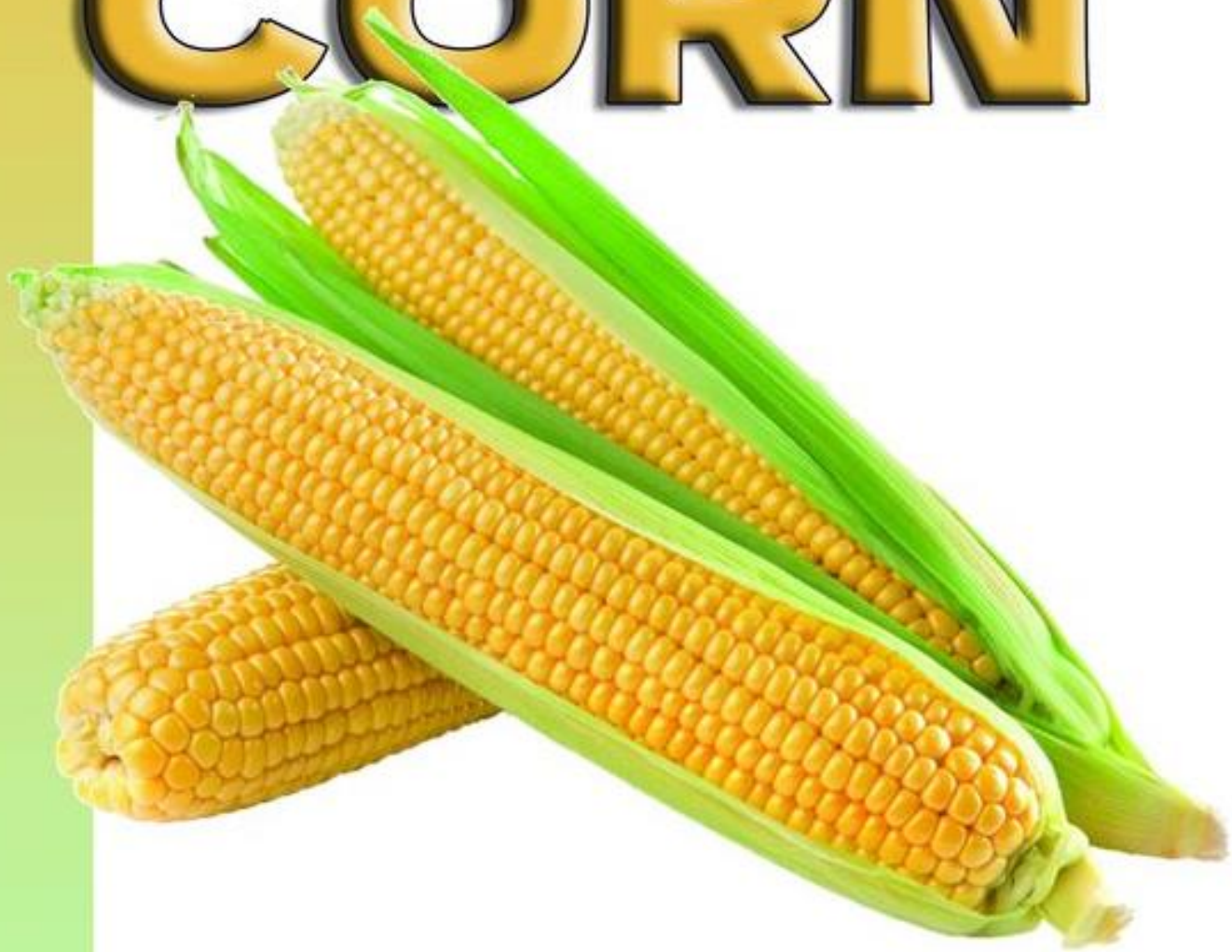
CORN



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 CORN

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 corn (*Zea mays* L.) 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 corn without the leaves or stem of the plant.

The major pests of corn 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. General consideration is given to exclusion of general pests that affect corn grown 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 corn, or diversion from intended use; trade in the whole plant, 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 corn for export.

BACKGROUND

Description of corn

Corn (*Zea mays*) is a cereal grain that was first domesticated by indigenous people in southern Mexico about 100 centuries ago. The leafy stalk of the plant produces pollen inflorescences and separate ovuliferous inflorescences called ears that yield kernels or seeds, which are the fruits. The commodity is a staple in many parts of the world, including the Caribbean region.

The corn plant comprises the stem (commonly composed of 20 internodes), the leaves (arise from the nodes, alternately on opposite sides of the stalk, the ears (develop above a few of the leaves in the midsection of the plant, between the stem and leaf sheath) and the stem apex which ends in a tassel (inflorescence of male flowers). The ears of corn are harvested for

consumption generally when the kernels are fully grown but still soft. This guideline focuses on trade of corn for the purpose of consumption.

Identity

Preferred Scientific Name

***Zea mays* L.**

Preferred Common Name

Corn

Other Scientific Names

None

Taxonomic Tree

Domain: Eukaryota
Kingdom: Plantae
Phylum: Spermatophyta
Subphyllum: Angiospermae
Class: Monocotyledonae
Order: Cyperales
Family: Poaceae
Genus: Zea
Species: *Zea mays*

Intended Use

The guideline covers ears of corn traded 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 corn 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 Corn Trade

None of the current regional priority plant pests are known to affect corn grown in the Caribbean region. Appendices 1 and 2, respectively provide collated lists of general pests and regulated pests found on corn grown in the Caribbean region. Table 1 is a list of pests associated with fresh ears of corn that may be identified as regulated pests that require 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 corn in trade and a description of the uncertainty.

Table 1. Pest groups associated with fresh ears of corn

Pest Group	Family	Example species
Ants	Formicidae	*Atta sexdens* (Linnaeus)
Beetles	Chrysomelidae	*Chaetocnema confinis* Crotch
Moths	Noctuidae	*Spodoptera litura* (Fabricius)
	Crambidae	*Ostrinia nubilalis*
Thrips	Thripidae	*Franklieniella williamsi* Hood
True bugs	Coreidae	*Leptoglossus zonatus* (Dollas)
	Aphididae	*Melanaphis sacchari*
Wireworms	Elateridae	*Conoderrus falli* (Lane) *Conoderus rudis* (Brown)

Table 2. Pests with uncertain association with fresh ears of corn in trade

Pest Group	Family	Pest	Description
Bacteria	Enterobacteriaceae	*Pantoea stewartia* subsp. *stewartia* Smith	Although risk of transmission by seed is negligible, at high levels of field infestation, the bacterium could occur in the kernels. This may be managed by use of resistant corn varieties and control of the corn flea beetle (*Chaetocnema pulicaria*) which vectors the pathogen.

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 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 (guided by CODEX standards[1]) to ensure suitability of ears of corn for export, including freedom from damage, symptoms of pests and contamination with soil, plant debris and extraneous materials
- Removal of the leaves from the ears of the corn.

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

Treatment facilities

- Registration and approval of treatment facilities (where different to 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 concentrations of chemicals and contaminants present in food can pose serious health risks.

The handling, packaging, transporting 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 consignments of fresh corn. Chemical treatments must be approved for use 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 corn in production and after harvest should be (made) aware of proper personal hygiene and apply good hygienic practices at all times.

Aflatoxins are naturally occurring toxins produced by the fungus *Aspergillus flavus* which appears as gray-green or yellow-green mold growing on corn kernels in the field or in storage. Due to its extreme toxicity to warm-blooded animals, even at minimal levels, exclusion from corn for consumption must be paramount. Sanitation of harvesting equipment is the first step in preventing post-harvest aflatoxin contamination. In addition, all harvesting, handling and storage equipment must be thoroughly cleaned prior to harvest. Access of the corn and contamination by rats must also be prevented.

Record keeping is fundamental for a proper traceability system. Information to be recorded would include, but not be limited to, employee training, environmental assessments, water usage, pest control, production practices, and the source of all agricultural inputs used in the production of the crops.

Phytosanitary Measures

Table 3 below provides information on pests associated with dehusked ears of corn along with measures considered to be effective in managing each pest group previously identified in Table 1.

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

Pest Group	Phytosanitary Measure(s)
Ants	PFA[2], PFPP[3], systems approach
Beetles	Harvest management, removal of ear leaves, visual examination
Moths	PFA, brushing to exclude soil and remove puparia, fumigation
Thrips	PFA, PFPP, harvest management, visual examination
True bugs	PFA, PFPP, systems approach
Wireworms	Systems approach, removal of ear leaves, visual examination
Arthropods	IPM, visual examination, removal of ear leaves

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.

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*).

[2] Pest Free Area
[3] Pest Free Places 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

Pre-harvest pest management programmes, such as use of chemical, biological and cultural control methods, to reduce the incidence of pests of corn, and the removal of infested ears at harvest comprise good handling and cultural practices to be used in both the production and marketing of corn.

Planting time for corn crops can vary depending on the weather as well as the varieties being planted. Weeds should be controlled before and during the crops to reduce competition for nutrients. Crops should have adequate levels of moisture during the growth and ear formation period.

Harvesting

The harvest time will vary based on the variety of corn and its intended end use. Whenever possible, corn should be harvested early in the morning when its moisture content is high. During harvest, every effort should be made not to damage the butt portion of the ear. Rapid removal of field heat from the corn when temperatures exceed 86°F is critical to retard deterioration. If harvested ears are to be left in the transport vehicles for more than an hour, they should be kept out of direct sunlight and cooled appropriately. Ideally, corn should be pre-cooled to near 32°F within an hour after harvest.

Post-harvest handling and treatments

Sorting, Cleaning and storage

Ears of corn should be carefully selected and examined for evidence of infestation or aflatoxin contamination. Infested and contaminated ears should be separated from undamaged ears and destroyed using appropriate measures. Care should be taken in handling of the dehusked corn to prevent subsequent contamination and assure food safety. Mishandling fresh corn results in serious and irreversible deterioration. Corn should be held at an optimal relative humidity of 90-98% while in storage.

The sorting process and storage facilities should be supported by inspection of the commodity in the packinghouse to determine their effectiveness at pest removal. Ears of corn found to be infested during the process should be discarded or appropriate remedial actions applied.

Any water used in the sorting process should be clean.

Transportation

Vehicles used to transport corn should be clean and provide a cool environment for the produce. Records should be kept of all vehicular cleaning activities. Every effort should be made to prevent damage to the produce while being loaded, transported and off-loaded, regardless of the method of transport being used to move the goods.

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. The process of treatments should be guided by ISPM 28 (*Phytosanitary treatments for regulated pests*).

Specific treatments for fresh corn 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. Scientific data on fumigation treatment for fresh ear corn is not currently available; however, 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.

Corn may be subjected to an importing NPPO-approved chemical treatment where necessary but this would most likely be linked to infield pest management.

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

Packaging is a pivotal step in the journey of fresh produce from the farm to the table, and a number of options is available depending on the specifications of individual consignments (NC State Extension Publications, 1996). A label to be affixed to each carton/container should clearly details the name of the commodity and other relevant information (e.g., farmer's registration number, harvest and packing dates, gross or net weight) in keeping with the importing country's reqirements.

Transportation

In the transportation of fresh corn for consumption, all applicable handling, packaging and storage procedures must serve to prevent damage to the produce and proliferation of pests during the process. Closed trucks used to transport fresh produce should be either refrigerated or 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, fresh corn should not be placed in areas with extreme temperatures. The cartons 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.

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 to verify compliance of consignments of ear corn 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 ear corn 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 corn for consumption 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 packaged in clean and either new or refurbished material
- Be exported in a secure manner to prevent contamination.

Fresh corn 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 corn 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 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 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 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. Pack houses, 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 should be applied to safeguard fresh corn against infestation after the application of a phytosanitary measure. 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 ear corn 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.

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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 corn in the Caribbean region

[source: National Plant Protection Organizations of Member States]

Pest Type	Scientific name	Common name(s)
Bacterium	*Xanthomonas albilineans* (Ashby)	Leaf scald of sugarcane
Bacterium	*Xanthomonas axonopodis pv. vasculorum* (Cobb)	Sugarcane gumming disease
Bird	-	Birds
Fungus	*Athelia rolfsii*	sclerotium rot
Fungus	*Bipolaris sacchari*	eye spot

Pest Type	Scientific name	Common name(s)
Fungus	*Cercospora zeae maydis*	sigatoka
Fungus	*Cochliobolus heterostrophus*	southern leaf spot
Fungus	*Cochliobolus lunatus*	head mould of grasses, rice and sorghum
Fungus	*Colletotrichum graminicola*	Anthracnose
Fungus	*Corticium rolfsii*	Collar rot
Fungus	*Fusarium oxysporum*	basal rot
Fungus	*Gibberella fujikuroi* (Sawada)	Fig endosepsis
Fungus	*Gibberella zeae*	Cobweb disease
Fungus	*Glomerella cingulata*	anthracnose
Fungus	*Helminthosporium turcicum*	Northern corn leaf blight
Fungus	*Lasiodiplodia theobromae*	diplodia pod rot of cocoa
Fungus	*Macrophomina phaseolina*	charcoal rot of bean/tobacco
Fungus	*Mycosphaerella cruenta*	leaf spot of cowpea
Fungus	*Phomopsis vexans*	Phomopsis blight
Fungus	*Puccinia polysora* Underw.	Rust
Fungus	*Puccinia purpurea* (Cooke)	Rust of grasses, sorghum
Fungus	*Puccinia sorghi*	Common rust
Fungus	*Sphacelotheca reiliana*	head smut of maize
Fungus	*Thanatephorus cucumeris* (Frank)	Damping off, root rot, sheath blight
Fungus	*Trichometasphaeria turcica* Lutrell	Leaf spot
Fungus	*Ustilago maydis* (P.C.) Corda	Corn smut
Insect	-	Stalk borer
Insect	-	Wireworms
Insect	*Agromyza parviconis* Loew	Corn blotch leafminer
Insect	*Agrotis* spp.	Cutworms
Insect	*Alphitobius diaperinus* (Panzer)	Litter beetle
Insect	*Alphitobius laevigatus* (Fabricius)	Black fungus beetle
Insect	*Amphicerus cornutus* (Pallas)	Powder post bostrichid
Insect	*Aphis gossypii*	cotton aphid
Insect	*Aphis spiraecola*	Spirea aphid, green citrus aphid
Insect	*Bemisia tabaci*	tobacco whitefly
Insect	*Blissus leucopterus*	chinch bug
Insect	*Ceroplastes floridensis*	soft scale
Insect	*Coccus hesperidum*	brown soft scale
Insect	*Corcyra cephalonica*	rice meal moth
Insect	*Diaprepes abbreviatus*	citrus weevil
Insect	*Diatraea lineolata*	neotropical corn stalk borer
Insect	*Diatraea saccharalis*	Sugarcane stem & cob borer, sugarcane stalk borer
Insect	*Dysmicoccus brevipes*	pineapple mealybug
Insect	*Edessa meditabunda*	green and brown stink bug
Insect	*Elasmopalpus lignosellus*	lesser corn stalk borer
Insect	*Erinnyis ello*	cassava hornworm (USA)
Insect	*Euphoria sepulcralis* (F)	Flower beetle
Insect	*Euschistus crenator*	Brown Stink bug
Insect	*Euxesta* sp.	Ortalid fly

Pest Type	Scientific name	Common name(s)
Insect	*Euxesta stigmatias*	Cornsilk Fly
Insect	*Ferrisia virgata* (Cockerell)	Striped mealybug
Insect	*Helicoverpa zea* (Boddie)	Corn earworm, American cotton bollworm
Insect	*Heliothis virescens* (Fabricius)	Tobacco budworm
Insect	*Heliothrips haemorrhoidalis*	black tea thrips
Insect	*Insignorthezia insignis*	greenhouse orthezia
Insect	*Lerema accius* (J.E. Smith)	Clouded skipper/corn leaf-tier
Insect	*Liorhyssus hyalinus* (Fabricius)	Hyaline grass bug
Insect	*Liriomyza sativae*	Vegetable leaf miner
Insect	*Liriomyza trifolii*	American serpentine leafminer
Insect	*Maconellicoccus hirsutus* (Green)	Pink hibiscus mealybug
Insect	*Manduca sexta*	tobacco hornworm (USA)
Insect	*Metamasius hemipterus* (Linneaus)	West Indian cane weevil
Insect	*Mocis latipes*	Grass looper
Insect	*Mythimna unipuncta*	rice armyworm
Insect	*Myzus persicae*	green peach aphid
Insect	*Nezara viridula* (Linneaus)	Green stink bug, green stink bug
Insect	*Opogona sacchari*	banana moth
Insect	*Oxycarenus hyalinipennis*	cotton, seed bug
Insect	*Peregrinus maidis* (Ashmead)	Corn delphacid (planthopper)
Insect	*Phenacoccus madeirensis*	Madeira mealybug
Insect	*Phyllophaga smithi*	white grub
Insect	*Planococcus citri*	citrus mealybug
Insect	*Protaetia fusca*	mango flower beetle
Insect	*Protoparce sextus jamaicensis*	Tobacco hornworm (pest?)
Insect	*Pseudaulacaspis pentagona*	mulberry scale
Insect	*Pseudococcus jackbeardsleyi*	Jack Beardsley mealybug
Insect	*Pseudococcus longispinus*	long-tailed mealybug
Insect	*Pulvinaria psidii*	green shield scale
Insect	*Rhopalosiphum maidis* (Fitch)	Green corn aphid, corn leaf aphid
Insect	*Scapteriscus vicinus* (Scudder)	West Indian mole cricket
Insect	*Schistocerca americana*	South American locust
Insect	*Scirtothrips dorsalis*	chilli thrips
Insect	*Sipha flava*	yellow sugarcane aphid
Insect	*Sitophilus zeamais*	Greater rice weevil
Insect	*Spodoptera eridania*	Southern armyworm
Insect	*Spodoptera frugiperda* (Smith)	Fall armyworm
Insect	*Spodoptera latifascia*	Lateral lined armyworm
Insect	*Spodoptera ornithogalli*	Leafworm
Insect	*Spoladea recurvalis* (Fabricius)	Hawaiian beet webworm
Insect	*Stegobium paniceum*	drugstore beetle
Insect	*Thrips tabaci*	onion thrips
Insect	*Trialeurodes vaporariorum*	whitefly, greenhouse
Insect	*Tribolium castaneum*	red flour beetle
Insect	*Trichoplusia ni*	cabbage looper
Insect	*Xyleborus ferrugineus*	black twig borer

Pest Type	Scientific name	Common name(s)
Mammal	-	Rodents
Mammal	*Mus musculus*	House Mouse
Mammal	*Rattus rattus*	Black Rat
Mite	*Tetranychidae*	Mites
Nematode	*Helicotylenchus dihystera*	Common spiral nematode
Nematode	*Helicotylenchus multicinctus*	Banana spiral nematode
Nematode	*Helicotylenchus pseudorobustus*	Spiral nematode
Nematode	*Hemicriconemoides mangiferae* (Siddiqi)	Sheathoid nematode
Nematode	*Meloidogyne incognita* (Kofoid & White) Chitwood	root-knot nematode
Nematode	*Radopholus similis*	Burrowing nematode
Nematode	*Rotylenchulus reniformis* (Linford & Oliviera)	Reniform nematode
Nematode	*Xiphinema vulgare* (Tarjan)	Dagger nematode
Oomycete	*Peronosclerospora sorghii*	Mildew
Oomycete	*Phytophthora cinnamomi*	Phytophthora dieback
Oomycete	*Phytophthora infestans*	Phytophthora blight
Oomycete	*Pythium debaryanum*	damping-off
Oomycete	*Scleropthora macrospora*	Downy mildew
Virus	-	Stripe disease
Virus	Sugarcane mosaic virus	Mosaic of abaca
Weed	*Cleome rutidosperma*	Consumption weed
Weed	*Datura stramonium*	Jimsonweed
Weed	*Emilia sonchifolia*	Consumption weed
Weed	*Mimosa pudica* (L)	Sensitive plant
Weed	*Momordica charantia* (L)	Bitter gourd
Weed	*Panicum maximum* (Jacq.)	Guinea grass
Weed	*Parthenium hysterophorus*	Parthenium weed
Weed	*Passiflora foetida* (L)	Red fruit passionflower
Weed	*Senna obtusifolia* (L)	Sicklepod
Weed	*Stachytarpheta jamaicensis* (L)	Jamaica vervain
Weed	*Synedrella nodiflora*	Cinderella weed

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

[Source: National Plant Protection Organisations of Member States]

Pest Type	Scientific name	Common name(s)
Bacterium	*Pantoea stewartii subsp. stewartii* (Smith) Mergaert *et al.*	Bacterial wilt of maize
Insect	*Atta sexdens* (Linnaeus)	Acoushi ant
	Frankliniella williamsi Hood	Corn thrips
	Leptoglossus zonatus (Dollas)	Leaf footed bug
	Melanaphis sacchari	Sugar cane aphid

Pest Type	Scientific name	Common name(s)
	Ostrinia nubilalis	European corn borer
	Oxycarerus hyalipennis (Costa)	Cotton seed bug
	Papaipema nebris	Stalk borer
	Perkinsiella saccharicida	Sugar cane delphacid
	Thrips hawaiiensis (Morgan, 1913)	Hawaiian flower thrips
	Conoderus falli (Lane)	Potato wireworm
	Conoderus rudis (Brown)	Wireworm
	Caulophilus oryzae (Gyllenhal, 1838)	Broadnosed grain weevil
	Chaetocnema confinis Crotch, 1873	Sweet potato flea beetle
	Frankliniella williamsi Hood	Corn thrips
	Oryzaephilus surinamensis (Linnaeus)	Saw toothed grain beetle
	Sitophilus oryzae (Linnaeus)	Rice weevil
	Spodoptera litura (Fabricius)	Cluster caterpillar
	Tenebrio molitor Linnaeus	Yellow mealworm
	Thrips hawaiiensis (Morgan, 1913)	Hawaiian flower thrips
	Tribolium castaneum Herbst	Red flour beetle
	Trogoderma granarium Everts	Khapra beetle