



Food and Agriculture  
Organization of the  
United Nations



International  
Plant Protection  
Convention

MAY  
2021

ENG

BEYOND COMPLIANCE GLOBAL ROLLING OUT SYSTEMS APPROACH GLOBALLY

# Building Production Chain Diagrams in Excel

06 Jan 2021 version





MAY  
2021

# Building Production Chain Diagrams in Excel

06 Jan 2021 version

**Required citation:**

FAO. 2021. *Building Production Chain Diagrams in Excel, 06 Jan 2021 version*. International Plant Protection Convention. Rome.

The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations (FAO) concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The mention of specific companies or products of manufacturers, whether or not these have been patented, does not imply that these have been endorsed or recommended by FAO in preference to others of a similar nature that are not mentioned.

The views expressed in this information product are those of the author(s) and do not necessarily reflect the views or policies of FAO.

© FAO, 2021



Some rights reserved. This work is made available under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 IGO licence (CC BY-NC-SA 3.0 IGO; <https://creativecommons.org/licenses/by-nc-sa/3.0/igo/legalcode>).

Under the terms of this licence, this work may be copied, redistributed and adapted for non-commercial purposes, provided that the work is appropriately cited. In any use of this work, there should be no suggestion that FAO endorses any specific organization, products or services. The use of the FAO logo is not permitted. If the work is adapted, then it must be licensed under the same or equivalent Creative Commons licence. If a translation of this work is created, it must include the following disclaimer along with the required citation: "This translation was not created by the Food and Agriculture Organization of the United Nations (FAO). FAO is not responsible for the content or accuracy of this translation. The original English edition shall be the authoritative edition."

Disputes arising under the licence that cannot be settled amicably will be resolved by mediation and arbitration as described in Article 8 of the licence except as otherwise provided herein. The applicable mediation rules will be the mediation rules of the World Intellectual Property Organization <http://www.wipo.int/amc/en/mediation/rules> and any arbitration will be conducted in accordance with the Arbitration Rules of the United Nations Commission on International Trade Law (UNCITRAL).

**Third-party materials.** Users wishing to reuse material from this work that is attributed to a third party, such as tables, figures or images, are responsible for determining whether permission is needed for that reuse and for obtaining permission from the copyright holder. The risk of claims resulting from infringement of any third-party-owned component in the work rests solely with the user.

**Sales, rights and licensing.** FAO information products are available on the FAO website ([www.fao.org/publications](http://www.fao.org/publications)) and can be purchased through [publications-sales@fao.org](mailto:publications-sales@fao.org). Requests for commercial use should be submitted via: [www.fao.org/contact-us/licence-request](http://www.fao.org/contact-us/licence-request). Queries regarding rights and licensing should be submitted to: [copyright@fao.org](mailto:copyright@fao.org).

## An Introduction to Production Chains

The concept of a Production Chain is closely associated with Systems Approach in plant health. Phytosanitary measures are applied at particular stages associated with specific time periods/locations and often by specific types of people in order to reduce the pest risk<sup>1</sup>. The method for reducing pest risk that is shown by the Beyond Compliance Global (BCG) tool is to reduce the probability of any consignment being shipped with a regulated pest. This, of course, directly reduces the probability of an introduction of that pest, although other factors such as the volume of trade and proper implementation of measures also affect the final risk to the importing country. (Measures to reduce the consequences of an introduction are not readily shown in this tool.) A different BCG tool is used to evaluate the efficacy, implementation and acceptability of the selected measures.

This tool can be used by the exporter or importer country NPPO to show the trade partner the chain of production and measures selected against the pest risk, by using an easily understandable diagram. Equally, it is an effective communication tool for an NPPO to use with domestic stakeholders who either need to carry out or document some of the activities or are interested in what will be required.

The simple tool is entirely flexible. While the template implies an annual crop that is planted each year, grows and then is harvested, the same tool applies to perennials or those with multiple harvests within one season with only minor editing to the wording. In fact, the concept can be applied to other pathways as well, although it is usually best to show the measures against a single pest<sup>2</sup> rather than all possible pests associated with a single pathway, unless the measures are the same regardless.

This version of template stops at the point of export but could easily be extended to include measures that are applied during transport or upon arrival to the importing country. Measures that ensure a consignment continues on to the intended use covered by the Pest Risk Analysis also could be shown, but the nature of the risk may be different so it could be more useful to make a shorter chain showing only that component. There are measures related to exposure to another population of the same pest post-harvest (often referred to as preventing re-infestation, although there was not necessarily infestation in the first place). The important thing is to consider if the risk represented in one Production Chain is really all the same risk.

A discussion of the development of this concept and tool appears in the Beyond Compliance eBook<sup>3</sup>. Read Chapter 4 to get background and context on the purpose and creation of a Production Chain. The eBook also reports on several trade cases shown in the tool. The tools have evolved somewhat in this current version, but the concepts remain fundamentally the same.

The Production Chain can be presented in a variety of ways, including drawing on a marker board or using more sophisticated software. This document focuses on how Microsoft® Excel® can be used to build Production Chains for describing the phytosanitary measures currently or potentially used in a crop/ orchard/ plantation in a particular country/ region.

For trade negotiations, it is helpful to lay out only the official measures under consideration, in order to focus the discussion. It could also be used to show all measures, however, to have the full picture

---

<sup>1</sup> This material follows the official IPPC glossary of terms, ISPM 5. See 'pest', 'pest risk', 'phytosanitary measures'. Terms that are not defined in the Glossary are defined here to clarify how we are using them.

<sup>2</sup> Each Production Chain may be against a single pest, or possibly a group of pests if they exhibit similar characteristics. For example, surface feeding insects might be managed by the same measures, even though there is more than one species.

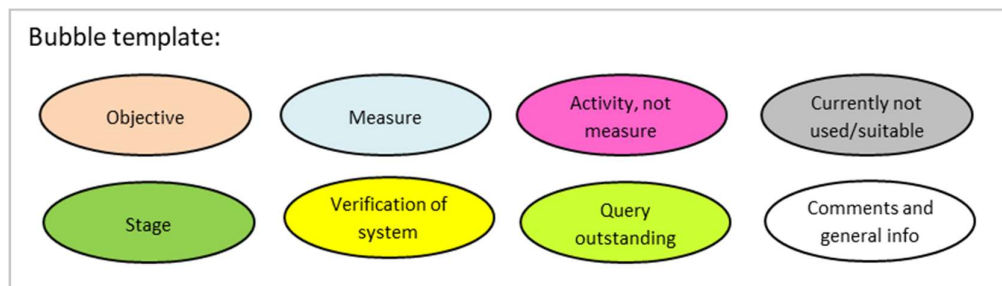
<sup>3</sup> This book is available through the usual suppliers, or may be downloaded for free from the STDF webpage:

<https://standardsfacility.org/PG-328#:~:text=Beyond%20Compliance%3A%20Integrated%20systems%20approach%20for%20pest%20risk%20management,of%20innovative%20decision%20support%20tools.>

of activities carried out. For example, when meeting with growers it may be useful to include commercial activities that are not officially required (showing the legal status). More discussion on how stakeholders (growers, shippers, etc.) responded to the tool appears in the eBook.

Therefore, the BCG Production Chain can be defined as: *A graphic representation of actions taken in relation to a featured plant product, shown at the stage where and when taken, and coded by objective (in terms of the means of risk reduction or as a source of information to make a decision) and the legal status of the action (phytosanitary measure, commercial activity, etc.).*

To show all of these aspects simultaneously, the BCG Production Chain uses colour-coding to distinguish 8 different categories:



Before building your Production Chain, it is recommended to have technical information about the crop and the life cycle of the target pest, to identify the risk points and possible mitigation measures that can be implemented. It is possible, however, to create the Production Chain without this resource if you are facilitating a group of experts. Experiences suggest that it is best to create the entire chain and then go back and edit it than to spend too much time analysing each step.

Finally, it could be useful to complete the tool alone. This may help for a manager of a case who has a large PRA, for example. The graphic illustration will clarify and simplify what may take many pages of text to explain. The tool generally is used as a communication tool for groups, however. That is why it is valuable to have a template which may be adapted quickly while discussion is underway.

### Objectives of Measures shown in a Production Chains

An important aspect of the BCG Production Chain that was not included in the diagram in the past is the Objective bubble. The objective refers to the mode of action or way in which a measure reduces risk. Some measures do not directly reduce risk but are vital to the success of the Systems Approach.

Sometimes the most experienced pest managers or regulators include measures based on past examples without really thinking about the purpose of the measure. By identifying the objective, it makes it clear how it relates to the other measures and how one might monitor, verify or adjust measures if the system does not appear to be achieving the level of efficacy desired. The ability to adjust the system while maintaining trade is a key advantage to using Systems Approach, since the failure or underperformance of a single measure should be noticed but may not result immediately in the failure of the entire system when employing a combination of measures.

Below are some suggested objectives that may be used to describe the purpose of a measure. These may need to be edited to increase detail associated with objective of an individual measure, if not clear to those using the tool. For example, growers may prefer to say that something kills the pest in the field, rather than reduces pest challenge. Regulators may prefer to label a measure as record

keeping for audits, rather than evidence of implementation; if it is not required it is just an activity. The way these are stated below, however, link back to the overall concepts of risk and how to reduce uncertainty. There is also an element of providing information for decision making and supporting implementation, which is where traceability comes in.

In some cases, it may be necessary to create a new Objective category that is not adequately described by those suggested below:

<b>Suggested categories of objectives <sup>4</sup></b>
Indicates level of pest challenge/infestation
Reduces pest challenge
Prevents pest infestation
Reduces pest infestation
Prevents re-infestation
Evidence of measure implementation
Verifying implementation performance
Traceability

### Building Production Chain Diagrams in Excel

Excel was chosen as the platform for the template because: a graphic placed upon the grid can expand (unlike PowerPoint), if the chain becomes more complicated for instance or more than one approach is shown on the same page. It is easy to copy and paste to create the chain similar to one you have already completed, for example to compare two options. A colour palette was available to use. Many people have Excel on their computers already.

To create a new Production Chain in the template provided:

1. Launch Excel on your computer and use File|Open to open the BCG Production Chain Template file “BCG Production Chain Template v1.0.xlsx”  
Alternatively, you can open the file from Windows File Explorer in which case you double click the file and this will launch Excel and load the file automatically.
2. Click File|Save As and save the file to your local drive (e.g. on computer) in a suitably named folder e.g. “C:\BCG Production Chain Tool”.
3. To keep that file as your master template, resave another copy of the file under a new name, e.g. “ProdChain–Mangoes\_20190603”, to start a version for a specific case.
4. At the top of the template page you will see a section coloured blue. Complete each part in order to easily identify the Production Chain under construction.

---

<sup>4</sup> For more information look the Table 4.1: Terms and concepts considered for development of Beyond Compliance (BC) tools. Of Beyond Compliance Book, pages: 65-67

5. In the box below the blue area just completed is a collection of bubble templates with colour coding (as shown above) and text to show what the colour coding refers to. These bubbles can be copied and pasted, moved, resized and their textual content edited.
  - a. To copy a bubble or an arrow: select the object with a left-click, then right-click the selected object and left-click on Copy from the menu. Then right-click and select the Paste icon from the menu. A new version of the object will appear which can then be moved and edited as you like.
  - b. To move an object, select the object with a left-click and hold the button down and drag the object to wherever you want it to be and release the mouse or touchpad button.
  - c. To edit text in a bubble, click on the text inside the bubble and edit as normal.
6. The green bubbles are already shown in what is a classic progression of stages. These can be edited, however, if not appropriate to the case at hand. Further to the right side, there is a longer chain of stages that also could be copied over, adapted or deleted if not relevant.
7. Most people will start by copying and pasting measures, other activities or question bubbles and filling in specific text while arranging these to the left of the green stage's bubbles. After that, groups consider the objective of the measures and finally come back to the question of whether there is a verification of the measure or not. You may start the chain at any point, however, based on the interest or discussion of the group.
8. The purpose of the arrows is to show relationships and dependencies. You may copy and paste the arrows, just like the bubbles (see additional instructions below). These also are easy to move around if you see the first version is not accurate.
  - a. To connect arrows to bubbles, select the arrow with a left click, two circles appear at each end. Grab the end you want to connect by clicking on the small circle and holding the button down and dragging it to the correct bubble.
  - b. Eight connecting points will appear around the edge of the bubble. Choose the connecting point that is best for your diagram and release the button. Connect the other end of the arrow in a similar way.
9. It is easy to alter the colour if you realize the bubble is something other than what you first entered.
10. If you are comparing two different Production Chains (for example, to show different measures or for different pests associated with the same plant product) you can copy that entire Production Chain and paste it to a new sheet where you will adapt it to your case. This will require deleting non-relevant sections.

To copy the entire Production requires a few steps:

- a. Click on the "Home" menu in the Excel ribbon at the top of the screen.
- b. Click on the down arrow of "Find & Select" button at the very right-hand end of the Home menu and then right click on the "Select Objects" option. From that menu click on the "Add to Quick Access Toolbar". Now, in the very top of your Excel, you



will see that a small arrow icon has appeared. This will allow you to quickly toggle between selecting objects with your mouse/touchpad or selecting cells. This only needs to be done one the first occasion of using this feature in Excel.

- c. Click on the arrow icon so that it is highlighted. You are now able to select multiple objects simply by dragging the cursor around the mouse outside of all the objects you wish to select.
- d. Move the cursor to the top left of your Production Chain and left click your mouse/touchpad keeping the button held down. Then drag the mouse to the bottom right of your Production Chain so that all the objects are inside the box. When you release the mouse/touchpad button all the objects inside that box will be selected.
- e. Right click on one of the selected objects and left-click on Copy
- f. Select a different worksheet from the Tabs at the bottom of the Excel screen, or open a new file (remember to name it differently). Right click on that worksheet and choose Paste.
- g. A copy of the Production Chain should now be visible.
- h. To remove the gridlines, go to View in the top menu and uncheck the Gridlines box.
- i. To return your cursor to its normal behaviour (to be able to select cells on the spreadsheet), simply click on the arrow icon at the top of the Excel screen so that it is unselected.
- j. Start editing the copied Production Chain to show the related example, having saved time by not starting over.

### **Analysing the Production Chain**

Once the graphic representation of the phytosanitary measures along a Production Chain is completed, it may become obvious that there are redundant measures, or measures missing simply by viewing the full chain. If there is doubt or disagreement, a Query Outstanding bubble may be added for follow up. Comments may be particularly useful to include points made in a PRA that do not seem to affect the pest risk at all. This might include the need to notify in advance of a shipment, add a particular declaration on the phytosanitary certificate or some other requirement that can lead to non-compliance and even stop trade, but is not really relevant to the specific pest risk.

The flexibility of the template to support a Production Chain also means that parts of the chain can be abandoned if there is only one section that is under discussion. Or a particular section can be copied over and then amplified if it appears to present a higher risk, to be a more problematic stage, has numerous or detailed measures and comments, or is the part which is under discussion between NPPOs.

The Production Chain has proven to be a very powerful tool for analysis, clear thinking and communication. It is not designed to capture information about efficacy, but it can feed directly into the Decision Support for Systems Approach (DSSA) tool for that purpose.

In order to demonstrate more nuanced dependencies or cumulative impact, it may be better to return to the earlier work of Beyond Compliance and create a bespoke Bayesian Network. That would also allow for underlying assumptions to be tested to understand the sensitivity of adding or removing each measure, or of expecting different levels of real performance compared to the original design.

## Annex I. Production Chain example, sweet orange fruits from China to United States for *Bactrocera* spp.

The purpose of this annex is to clarify the harmonised objectives; expand on the initial stage relating to area status or farm status; and demonstrate the verification of the system, sometimes referred to as control points for a Systems Approach in plant health. Typically, a Production Chain will represent one commodity and one associated regulated pest, but this examples shows several pest species of *Bactrocera*, with some variation in requirements. This illustrates the flexibility of the concept, showing that one can expand the details or collapse components, based entirely on what would be useful to those participating in discussions.

Figure A1 shows a Production Chain representing a Systems Approach described in the Commodity Import Report (CIR) for *Bactrocera* spp. for the export of Sweet Orange fruit from China into Continental U.S. Ports (APHIS, 2021).

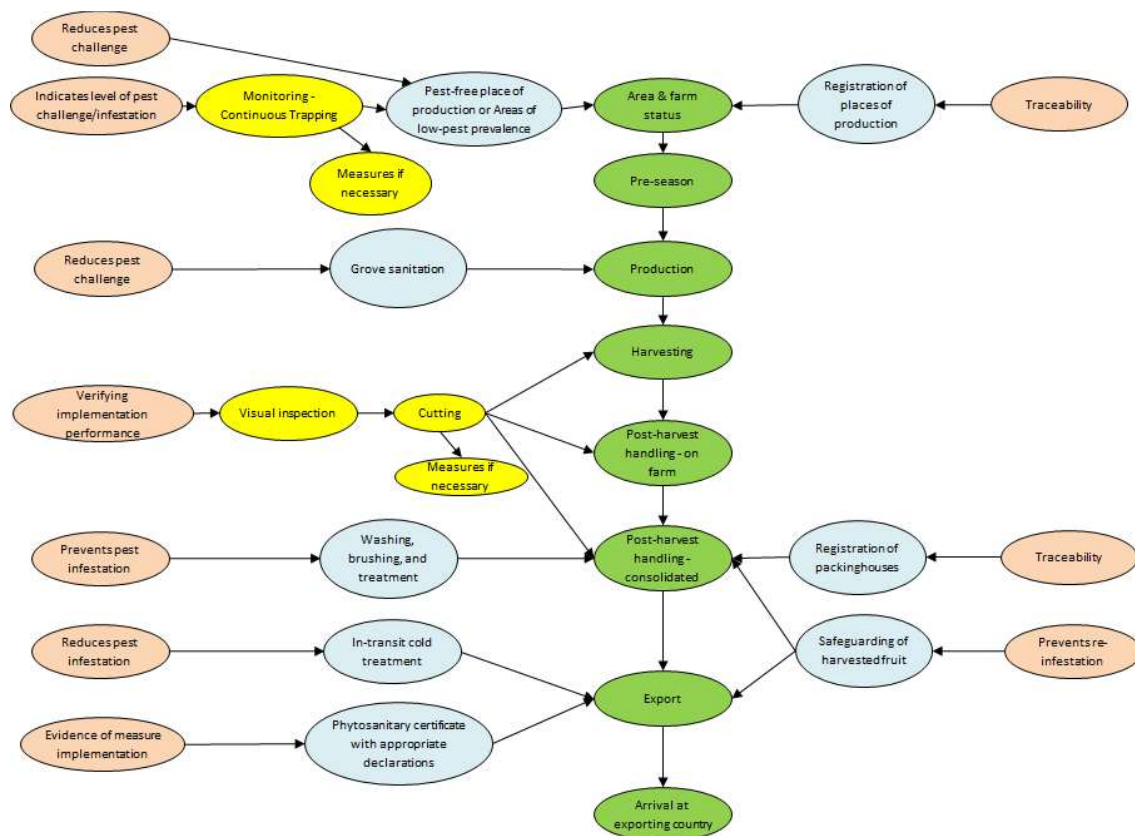


Figure A1. Overview of entire systems approach to manage fruit fly species of concern associated with fruits of sweet orange from China to the USA [cold treatment is required under certain conditions].

This Systems Approach outlines eight measures (phytosanitary measures, procedures or actions) for pest risk management (shown as blue bubbles):

1. Exported sweet oranges must come from within a pest free place of production (PFPP) or area of low pest prevalence (ALPP), as defined in ISPMs, depending on the *Bactrocera*

species present in the production area (with further conditions described below). The initial stage (green bubble, 'Area & farm status') relates to activities and/or measures that may be maintained throughout the season or even over years. So, for example, establishing an ALPP or assigning a code for traceability at this stage implies it is maintained throughout and that measure does not need to be repeated at each stage in the Production Chain, although checks on the measure may occur.

**Objective (of the PFPP or ALPP):** Reduces pest challenge (meaning that the primary objective is to reduce the pest population directly rather than manage the commodity).

This stage provides the first opportunity to monitor and correct against a predetermined standard (although such detail is not required if discussed elsewhere). **Objective (of monitoring):** Indicates level of pest challenge/infestation. An indication of the level of the population does not alter the pest risk directly but could alter the status of PFPP or ALPP (see FAO Guide for Establishing and Maintaining Pest Free Areas, 2019).

2. Registration of places of production with the National Plant Protection Organization (NPPO) of China. The identity and origin of the lot of fruit must be maintained throughout the export process to the United States. **Objective:** Traceability. This objective does not directly reduce the pest risk but does provide important information for managing the risk and implementing the Systems Approach.
3. Grove sanitation, we consider this to be a method to reduce the pest population therefore we have selected - **Objective:** Reduces pest challenge.
4. Washing, brushing and treatments (with surface disinfectant and fungicide). This appears to be aimed at secondary quarantine pests, although the reference does not state which ones. **Objective:** Without more information this could be to 'Reduce pest challenge' (secondary quarantine pest) by reducing the population of the pest or 'Prevents pest infestation' because it physically prevents something present from moving to the point of infestation or infection (this might be for a secondary quarantine pest such as *Phytophthora* or scale insects). The difference between these two objectives is less clear with plant diseases, e.g. surface pathogens.
5. Registration of packinghouses (as shown, or can be included in the initial stage which covers the entire chain). **Objective:** Traceability, as the primary objective although registration may itself require some other measures such as screening to prevent the presence of pests.
6. Safeguarding of harvested fruit (no further detail in that reference). **Objective:** Prevents re-infestation, or more accurately prevents post-harvest infestation.
7. In-transit cold treatment with the following conditions:
  - a. the consignment requires cold treatment in transit to the United States if the consignment is produced in a PFPP for *Bactrocera minax* and *B. tsuneonis* or/and an area of low-pest prevalence for the remaining species of concern (areas with *B. correcta*, *B. cucurbitae*, *B. dorsalis*, *B. occipitalis*, *B. pedestris*, and *B. tau*), in accordance with the described Systems Approach;

- b. In-transit cold treatment is not required if the consignment was produced in a PFPP for areas with *B. correcta*, *B. cucurbitae*, *B. dorsalis*, *B. occipitalis*, *B. pedestris*, and *B. tau* [without the other two species] and in accordance with the Systems Approach.

**Objective:** Reduces pest infestation (for the purpose of objectives, all commodity treatments assume that infestation has occurred and the treatment is devitalizing those individual pests that survived to that point).

- 8. Phytosanitary certificate with appropriate with appropriate declarations. **Objective:** Evidence of measure implementation (this objective implies checking records and paperwork rather than sampling, testing or intensive inspection).

Note that some measures have multiple objectives. For example, continuous trapping may reduce the pest challenge (pest population) but is primarily included to 'indicate the level of pest challenge'. Only the primary objective of a measure should be included, to support analysis of the system.

In addition to the eight measures, the yellow bubbles indicate control points made up of measures that provide real-time verification of the system and allow corrective measures be taken, if required.

**N.B. At least two yellow bubbles should be used for a verification of system: one to describe the method for monitoring or measuring the realized performance of the system and one to describe the measure(s) required to maintain safe trade if action is needed.** Monitoring methods may include visual inspection, cutting of fruits, field trapping, etc. Examples of actions prescribed if the pest risk is too high (e.g., passes a set threshold or infestation is detected) include the application of additional phytosanitary measures, destruction of the consignment or the diversion of the affected consignment to an alternative market with fewer restrictions. The responsive action may correct the system for the current consignment, the next consignment or even the following season.

Please note, this example was developed from publicly available information, but may not reflect the actual situation of this trade due to lack of details in the publication or a misunderstanding by the authors. It is meant to be illustrative rather than to provide regulatory information.

#### Reference

APHIS (2021). Commodity Import Report (CIR) for Orange, Sweet (Fruit) from China into Continental U.S. Ports [https://epermits.aphis.usda.gov/manual/?action=cirReportP&PERMITTED\\_ID=10610603](https://epermits.aphis.usda.gov/manual/?action=cirReportP&PERMITTED_ID=10610603)



## IPPC

The International Plant Protection Convention (IPPC) is an international plant health agreement that aims to protect global plant resources and facilitate safe trade. The IPPC vision is that all countries have the capacity to implement harmonized measures to prevent pest introductions and spread, and minimize the impacts of pests on food security, trade, economic growth, and the environment.

## Organization

- » There are over 180 IPPC contracting parties.
- » Each contracting party has a national plant protection organization (NPPO) and an Official IPPC contact point.
- » 10 regional plant protection organizations (RPPOs) have been established to coordinate NPPOs in various regions of the world.
- » IPPC liaises with relevant international organizations to help build regional and national capacities.
- » The Secretariat is provided by the Food and Agriculture Organization of the United Nations (FAO)

## International Plant Production Convention Secretariat

[ippc@fao.org](mailto:ippc@fao.org) | [www.ippc.int](http://www.ippc.int)

## Food and Agriculture Organization of the United Nations

Rome, Italy



Funded by the Standards and Development Trade Facility

