



# TR4 BIOSECURITY STANDARD

## Guidelines

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## TABLE OF CONTENTS

<b>1</b>	<b>BACKGROUND.....</b>	<b>3</b>
<b>2</b>	<b>INFORMATIVE OVERVIEW: THE PATHOGEN FUSARIUM OXYSPOURUM F. SP. CUBENSE TROPICAL RACE 4.....</b>	<b>4</b>
<b>3</b>	<b>FURTHER LINKS OF INTEREST .....</b>	<b>5</b>
<b>4</b>	<b>BASIC PRINCIPLES IN THE PREVENTION OF THE SPREAD OF FOC TR4.....</b>	<b>6</b>
4.1	PREVENTION IS THE BEST OPTION .....	6
4.2	DEFINE RISK AREAS .....	6
4.3	IMPLEMENT (FEASIBLE) MEASURES THAT ACHIEVE THE INTENDED OBJECTIVE .....	6
4.4	MONITOR YOUR DAILY AGRONOMIC PRACTICES.....	8
4.5	WASTE MANAGEMENT .....	10
4.6	HARVESTING.....	10
4.7	TRAINING .....	11
4.8	SAMPLING .....	11
<b>5</b>	<b>RISK ASSESSMENT GUIDELINE .....</b>	<b>12</b>
<b>6</b>	<b>BIOSECURITY DECLARATION TEMPLATE.....</b>	<b>16</b>
<b>7</b>	<b>COMMUNICATION WITH NATIONAL/REGIONAL PLANT PROTECTION ORGANIZATIONS .....</b>	<b>17</b>

## 1 BACKGROUND

*Fusarium oxysporum* f. sp. *cubense* is the causal agent of Fusarium wilt disease in bananas and plantains. As of now, one particular genetic lineage, known as Tropical Race 4, or Foc TR4, is the most imminent threat to the Cavendish-based industry and to the livelihoods that depend on banana and plantain production and consumption, as Foc TR4 is also pathogenic to many local banana and plantain varieties. The plants affected by Foc TR4 die. There is currently no known effective treatment to control Foc TR4 and therefore no effective means of managing Foc TR4 affecting banana and plantain cultivars. Preventive measures and containment are the only currently viable options. If nothing is done, the impact on livelihoods, local economies, and food security could be severe.

Our objective is to ensure the implementation of good agricultural practices worldwide. In this context, the TR4 Biosecurity Standard is intended as a tool to prevent the spread of Foc TR4 within/from banana and plantain farms and, most importantly, to help raise awareness of the seriousness of the disease on a global scale. Thus, the **TR4 Biosecurity Standard** is designed to address this biosecurity issue and provide further support to the entire banana and plantain sector. It is, however, only “one more tool in the toolbox,” and the GLOBALG.A.P. Secretariat is open for further partnerships and participation in collective efforts.

Foc TR4 infects the plant through the roots, moving into the vascular system to spread through the stem and pseudostem. Foc TR4 eventually blocks the plant’s vascular system, cutting off the supply of water and nutrients, which causes the plant to wilt and die. **Scientific research has shown that Foc TR4 does not enter the fruit.**

It is not feasible to eradicate the disease, as there are no proven control methods available to destroy Foc TR4. Foc TR4 can survive in the soil and alternative host plants for years, and there are currently no practical diagnostic protocols to detect the disease in soil or water. The disease affects most plantain and banana varieties, including Cavendish, and spores can survive for decades and lie latent in the soil for many years before a banana or plantain plant shows symptoms.

Foc TR4 is easily spread through the movement of infected plant material, but above all by contaminated soil particles and water transferred by people, animals, vehicles, machinery, and equipment or by natural processes such as overland water flow, drainage lines, floods, cyclones, and wind. The disease can also be spread through root-to-root contact with infected plants.

The phytosanitary authorities and ministries of agriculture in countries where banana and plantain production are important have taken measures or are taking measures to protect these sectors, for example through import restrictions on planting material, quarantine legislation, awareness raising and training, and public investments in biosecurity measures on access roads, in ports, and at airports. The level of attention and investment may differ from country to country. But in any case, the public sector can only play a limited role, or no role at all, on the other side of the farm gate, where the public domain ends. In other words: The private sector and banana and plantain farmers, ideally supported by their sector organizations, must also assume an important portion of responsibility for their own family businesses and those of their fellow farmers by implementing biosecurity measures on their own plantations. The intention of this GLOBALG.A.P. standard is to facilitate this.

## 2 INFORMATIVE OVERVIEW: THE PATHOGEN *FUSARIUM OXYSPORUM* F. SP. CUBENSE TROPICAL RACE 4

*Fusarium oxysporum* f. sp. *cubense* Tropical Race 4 (Foc TR4) is one variety of the *Fusarium oxysporum* pathogenic strain. The main difference between this and other widely spread varieties is Foc TR4's strong pathogenic effect, not only on the hosts affected by races 1 and 2, but also on a wide variety of crops including the *Musaceae* group and the subgroup of Cavendish cultivars, which is the most common commercially cultivated banana variety in the world.

The wider spread of Foc TR4 throughout the world would therefore affect millions of farmers who rely on banana or plantain cultivation for their livelihoods. The pathogenicity of Foc TR4 also raises food security concerns in parts of the world that rely on bananas and plantains as a staple crop.

The *Fusarium spp.* family is also very complex, as it presents a wide range of hosts, pathogenic forms, and different *Fusarium* strains that can have very different effects. However, Foc TR4 is currently the most serious threat to bananas and plantains and has therefore been given priority in this TR4 Biosecurity Standard.

The dispersal of Foc TR4 occurs mainly through the soil or through contaminated plant propagation material (asymptomatic plants). The most commonly infected parts of the plants are the roots, rhizomes, pseudostems, and petioles. There are no known cases of Foc TR4 dispersal through (or presence in) the fruit. Foc TR4 can grow in temperatures between 9°C and 38°C, with optimal growth at approx. 25°C. Tropical (warm and humid) climates are therefore beneficial for its development.

Foc TR4 can also survive and sporulate on dead plant material and thus continue its dispersal once the host has died. Additionally, dispersal can occur through other hosts than banana cultivars. Another very important feature is that Foc TR4 produces long-lasting chlamydiospores, which are a special form of hibernation body. These chlamydiospores can survive in the soil for more than 30 years and, with the presence of banana or plantain root exudates, can germinate to contaminate the banana or plantain plant and continue their normal life cycle. This makes the eradication of Foc TR4 very challenging.

At the time this TR4 Biosecurity Standard was prepared, the worldwide confirmed dispersal of Foc TR4 extended to the following countries (by order of identification):

Taiwan, Malaysia (including Sarawak on the island of Borneo), Indonesia (Java, Sumatra, Sulawesi, Halmahera, Kalimantan, and Papua New Guinea), mainland China (Guangdong, Hainan, Guangxi, Fujian, and Yunnan), the Philippines (island of Mindanao), Australia (Northern Territory, Queensland), Oman, India (Katihar and Purnea districts of Bihar, Uttar Pradesh, Madhya Pradesh, and Gujarat), Jordan, Mozambique, Lebanon, Pakistan, Lebanon, Laos, Vietnam, Myanmar, Israel, Colombia, Turkey, Mayotte (France), Peru, and Venezuela. Its presence in the last 14 countries was confirmed within the last 7 years. Considering the geographic distances between these countries, it is evident that a sector-wide effort on a global scale is required to contain Foc TR4.

Foc TR4 has a long incubation time. This means that Foc TR4 takes a long time to cause “disease symptoms” in the host plants. This is due to the time it takes Foc TR4 to colonize the roots of the banana or plantain plant, enter the rhizome, continue to the pseudostem, spread its mycelium through the vascular system, and reach the xylem. Once the xylem has been reached, Foc TR4 produces microspores that are transported through the tap, and which continue to colonize the upper parts of the pseudostem. Finally, after a long time, the plant starts showing wilt symptoms, which in some cases may not be identified as Foc TR4. For example, they might be thought to be due to potassium deficiencies, water shortages (e.g., dry season), or other diseases such as Moko, which is a bacterial disease caused by *Ralstonia/Pseudomonas solanacearum*.

The main distinctions between Foc TR4 and Moko symptoms are as follows:

- 1) Foc TR4 first manifests in old leaves, then in new leaves, while Moko first manifests in new leaves, then in old leaves.
- 2) Moko-affected plantlets/chupons are immediately visibly affected, while Foc TR4-infected plants might show no immediate symptoms.
- 3) Moko-contaminated plant tissues show the “typical gum” exudate when cut, while Foc TR4 causes no gum exudate.
- 4) Moko visibly affects the fruits, while Foc TR4 does not show any symptoms in fruits.

### **3 FURTHER LINKS OF INTEREST**

FAO/World Banana Forum

[http://www.fao.org/wbf/en/#.V-okjOT\\_qUk](http://www.fao.org/wbf/en/#.V-okjOT_qUk)

For the Foc TR4 task force page, visit:

<http://www.fao.org/economic/worldbananaforum>

Biosecurity Service of the Government of Queensland, Australia

<https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/biosecurity/plants/priority-pest-disease/panama-disease>

Government of Queensland, Australia: Growers Kit on TR4

<https://publications.qld.gov.au/dataset/panama-disease-tropical-race-4-grower-kit>

International Plant Protection Convention (IPPC)

<https://www.ippc.int/en/>

Page of the regional plant protection organization (RPPO) OIRSA

<https://www.oirsa.org/>

CIRAD (French research center)

<http://www.cirad.fr/nos-recherches/filieres-tropicales/banane-et-plantain/contexte-et-enjeux>

TR4 PROMUSA (scientific community for banana research)

<http://www.promusa.org/Tropical+race+4+-+TR4>

Wageningen University and Research Centre (Prof. Dr. Gert Kema)

<http://panamadisease.org/>

Instituto Colombiano de Agricultura – ICA

[www.ica.gov.co](http://www.ica.gov.co)

Health and Safety Executive: Five Steps to Risk Assessment

[www.hse.gov.uk/pubns/indg163.pdf](http://www.hse.gov.uk/pubns/indg163.pdf)

IICA/Global Alliance Against TR4

<https://iica.int/es/global-alliance>

## 4 BASIC PRINCIPLES IN THE PREVENTION OF THE SPREAD OF FOC TR4

This section presents a brief summary of the principles that shall be implemented to prevent the spread of Foc TR4 at farm level. The principles described here largely summarize the biosecurity standards and guidelines issued by the [Department of Agriculture and Fisheries of Queensland, Australia](#), and the applicable sections of the “Contingency plan for an outbreak of tropical race 4 of *Fusarium oxysporum* f. sp. cubense, in a country of the OIRSA region” issued by the Organismo Internacional de Sanidad Agropecuaria (OIRSA) (available in [Spanish](#)) in Latin America. The [Colombian Institute of Agriculture \(ICA\)](#) has also been conducting research and has developed publications and protocols of interest to Latin America. We strongly recommend reviewing these documents for more detailed information. For specific references, please consult these publications.

### 4.1 Prevention is the best option

There are currently no commercially viable (proven) eradication measures, which means that prevention is the best option. Preventing the introduction and spread of Foc TR4 therefore has top priority. For this purpose, the creation of physical barriers around and within the property or banana or plantain cultivation areas is recommended (where economically viable). These barriers should be designed to limit the unnecessary movement (access) of people, machinery, and equipment – and ideally animals – to and across the property to reduce the risk of introducing or spreading Foc TR4. Reducing movement – onto the farm or within defined risk areas – also reduces the time and costs associated with decontamination measures.

### 4.2 Define risk areas

There shall be clearly established risk areas within the production area (farm). Risk areas shall:

- Be differentiated by the activities that take place in each area (e.g., banana and plantain cultivation, packhouses, storage/warehouses, habitational, recreational)
- Define different risk levels based on the activities that take place within them and their position on the farm (e.g., near a road or river)

On the basis of the identified risk levels, preventive measures shall be put in place that achieve the objective of preventing the introduction/spread of Foc TR4.

In general, the following should be true about the established risk areas:

- The movement of workers, tools, and/or machinery and equipment shall be reduced to the minimum.
- Protective equipment (e.g., boots and overalls), working tools (e.g., knives, wheelbarrows, machetes), and machinery/equipment (tractors and trucks) shall be provided to the workers in each risk area.
- Materials and/or equipment shall not leave the risk area.

If movement between different risk areas is necessary, proper decontamination measures shall be performed before leaving the current area to facilitate a clean entry into the new area. This applies to people, equipment, machinery, etc., moving between risk areas.

### 4.3 Implement (feasible) measures that achieve the intended objective

The complete isolation of an entire farm from its neighborhood is of course impossible and achieving the objective of an intervention does not necessarily require a large investment.



### 4.3.1 Wash-down facilities

#### General

- Use only Foc TR4-free water sources (“clean water” sources may include rainwater from a clean roof, bore hole water, town/drinking water).
- Prevent indirect contamination by:
  - Avoiding the recycling of irrigation equipment (contaminated pumps)
  - Avoiding the use of second hand (or borrowed) irrigation machinery
  - Decontaminating any machinery and/or equipment before use (e.g., water pipelines, irrigation installation)
- For soil and plant material removal, use a biodegradable detergent followed by suitable disinfectants (proper concentrations and exposure times).
- When using a disinfectant, such as any quaternary ammonia compounds, keep in mind that:
  - The presence of soil and organic matter inactivates the efficiency of these disinfecting compounds.
  - The amount of accumulated soil and organic matter shall be constantly controlled and surpluses shall be disposed of.
  - Disinfectants shall likewise be monitored, and concentrations adjusted to the recommended optimum.
  - Caution must be taken with external dilutants (such as rainwater in the absence of a roof).

Efficient decontamination can only be achieved if the exposure time of the surface (e.g., boots) to the disinfectant solution is appropriate. The following should therefore be observed:

- Monitor the exposure times for all decontamination procedures on the farm (e.g., boot/foot/wheel baths).
- Make sure there is sufficient contact (depending on the concentration of the solution and the exposure time).
- Ensure that there is no danger of the targeted surface (e.g., boots) not being given sufficient contact with the disinfectant solution.
- First clean boots and vehicles (including chassis) with pressurized water and/or brushes, then apply disinfectants in doses recommended by phytosanitary authorities.

Wash-down facilities for machinery and vehicles:

- Ensure that parts of the machine/vehicle that might retain soil are dismantled and cleaned properly during the process (there is no point in only cleaning the outermost part(s) of the wheels if the internal parts are full of soil).

Effluent disposal:

- Effluents shall be properly disposed of.
- Decontamination pits shall have solid floors and catch dirty water (effluents).
- Effluents shall be properly treated prior to disposal.
- Disinfectant agents shall be degraded and pathogens eliminated before water is released into the environment.

Every wash-down facility shall implement a controlled drainage area (CDA) for efficient effluent disposal. CDAs should:

- Capture and hold water from wash-down facilities
- Be physically delimited, prevent the entry of sources of contamination, and prevent runoff into clean water bodies or areas
- Store water for as long as is necessary to treat the water (agent degradation)
- Allow water to evaporate or percolate within the property or exit without contaminating

Failure to achieve the objective of the intervention due to poor practices is a waste of time and resources.

#### **4.3.2 Major measures: roads and ditches**

Consider the costs and time necessary to implement measures with the current infrastructure versus the benefits of investing in new infrastructure where viable.

When constructing new roads and/or ditches, ensure the following:

- Materials shall be sourced from Foc TR4-free sources.
- Construction shall take place using clean, decontaminated equipment.
- Subcontractors shall be made aware of Foc TR4, the risks, and prevention measures.

Also consider upgrading available infrastructure (where feasible) by:

- Defining roads for delivery/pick up to packhouses
- Introducing “dirty” roads for packhouses supplied from the field
- Creating new ditches for heavy rain events that might spread Foc TR4

#### **4.4 Monitor your daily agronomic practices**

##### **4.4.1 Planting material**

- Never use material from contaminated or suspicious sources.
- Always demand a certificate that proves that the material you are using is Foc TR4 free.
- Make sure that no soil is transported with the planting material.
- Select resistant varieties, where available.

When establishing a new plantation and/or removing previous crops:

- Consider the creation of ditches and/or roads while establishing (or removing) a plantation.
- Use cover crops or other methods that help ensure that soil movement is minimized.

##### **4.4.2 Soil movement**

- Foc TR4 can be transported via soil. It is therefore important that you:
  - Reduce soil movement to an absolute minimum
  - Do not transport soil from one plot to another (e.g., through planting material, equipment, and/or machinery)
  - Limit erosion as a natural (or induced) soil movement



#### 4.4.3 Irrigation of crops

- Assess water quality before use. Dam water can be contaminated by overland flow or external agents (wild animals).
- To reduce the need for decontamination measures, you should ideally use machinery/vehicles that do not leave the farm.
- Purchase and use new (not second hand) irrigation equipment, irrigation pumps, sprinklers, drip tape, and equipment.

#### 4.4.4 Water management

- Identify and secure the source of water for the packhouses and wash-down facilities. The water may come from a well, rainwater, or city water from a river, stream, canal, or dam.
- Prevent water runoff from your property by using soil erosion management practices (including grassed interrows, contouring or laser leveling, sediment traps, and/or wetlands) to minimize the movement of soil and water from your property onto adjacent properties, roads, and/or waterways.
- Prevent water runoff from neighboring properties to your crops by intercepting and managing the water through the use of drains and sediment traps to divert the flow of water away from the cultivation area.

#### 4.4.5 Fertilizing and application of plant protection products

- Avoid the introduction/spread of Foc TR4 while carrying out any application.
- Use clean water.
- Use Foc TR4-free machinery/vehicles/equipment.
- Subcontractors shall be made aware of the risks and contamination agents.

#### 4.4.6 Weeds

Certain weeds can host Foc TR4. They therefore require special attention. The following is a list of weeds currently known to be possible Foc TR4 hosts:

- *Chloris inflata* (syn. *C. barbata*)
- *Commelina diffusa*
- *Cyanthillium cinereum*
- *Ensete ventricosum*
- *Euphorbia heterophylla*
- *Heliconia* spp.
- *H. Caribaea*, *H. Psittacorum*; *H. Mariae*
- *Ixophorus unisetus*
  - *Musa* spp.
  - *M. textilis*; *M. acuminata*; *M. balbisiana*,
  - *Panicum purpurascens* (syn. *Urochloa mutica*)
  - *Tridax procumbens*

#### 4.4.7 Suppressing Foc TR4 in soil

Suppressing Foc TR4 in soil requires a wide range of tools. Information about the influence of different nutrients and soil pHs on the development of *Fusarium* wilt is available.

This information should be considered as part of suppression/containment measures and includes:

- Nitrogen (N): Huber and Watson (1974) reported that the increase of NO<sub>3</sub> in the soil decreases the development of the disease. Domínguez et al. (1995) reported that the increase of NH<sub>4</sub> favors the development of the disease. There is a consensus among growers that the use of urea significantly favors the disease.
- Calcium (Ca): Liming increases soil suppressiveness and reduces chlamyospore germination (Höper et al., 1995; Peng et al., 1999).
- Iron (Fe): A reduction in the availability of iron increases the suppressive quality of soils (Scher and Baker, 1982) and reduces chlamyospore germination (Peng et al., 1999).
- Adjusting soil pH to above 5.6 (ideally around 6) usually reduces *Fusarium* spp. (Dominguez et al., 2001). Suppressiveness generally has high pHs. When soil pH is reduced below 5.5, disease incidence increases (Peng et al., 1999).
- Periodic crop rotations help improve soil structure and minimize soil-borne pests and diseases. Crop rotation with nonhost plants has been used with the aim of reducing Foc TR4 population in the soil.

#### 4.5 Waste management

- Avoid moving waste, such as plant tissue/debris, from plots.
- Contaminated material shall be disposed of in accordance with national legislation.
- If national legislation does not specify procedures for removal, contaminated materials should be incinerated and any remains deep-buried.
- If a subcontracted agency is used, detailed records shall be available to track debris.
- If waste management services are provided by a subcontractor, proof of correct handling shall be available.
- Water contamination, especially underwater (flooding) contamination, shall be prevented at all costs.
- Waste receptacles and containers shall be closed and located at a distance from production areas entrances and packhouses and storage areas.
- Storage areas shall be free of objects/items that may provide harborage for pests/animals (e.g., there shall be adequate weed control around the perimeter of the site).

#### 4.6 Harvesting

- Do not harvest from contaminated plants or plots where contamination is suspected.
- Use only decontaminated tools and, if possible, use a separate set of tools for contaminated plots.
- Leave bunches that have come into contact with contaminated soil or material in the field.
- Harvested bananas and plantains shall, if possible, only be transported to the packhouse via “dirty” roads.
- Within the packhouses, there shall be clearly established clean and dirty areas.

- Only deliver bunches to the “dirty” side of the packhouse.
- Risk areas shall implement appropriate decontamination protocols.
- Ensure there is a one-way flow of products.
- Avoid moving fruit between areas.
- Do not reuse plastic bunch bags and dispose of them appropriately.
- Manage water categories/quality (clean vs. contaminated) according to areas within the packhouse.
- Dispose of waste appropriately (incl. contaminated water).
- Prevent cartons from touching contaminated soil.
- Cartons/Pallets shall be stored in a clean area. Cartons shall be easily identifiable, and a good traceability system shall be in place.
- The dispatch of uncontaminated products shall be carried out via clean roads.
- Ensure that drivers and trucks used for the dispatch of products respect the decontamination protocols in the packhouses (incl. registers).
- Manage vermin and birds according to the risk level (soil and contaminated waste movement).

#### 4.7 Training

Training of the relevant workers or people transiting the farm, as well as the refreshing of the necessary knowledge (risks), shall be repeated frequently. Training shall be customized to the type of work and/or the risk area that workers are operating in. Decontamination protocols shall be known and observed by all stakeholders. This is the only way to ensure that the objectives are internalized and applied on a daily basis.

**Record keeping** is an important part of the integrity of any system and shall be implemented rigorously. Proper records enable bad practices to be identified, corrective actions to be proposed, and improvements (operational and financial) to be made.

#### 4.8 Sampling

Sampling and soil testing for Foc TR4 identification: Since *Fusarium* spp. are omnipresent, it is important to follow specific sampling and identification protocols to ensure the positive identification of Foc TR4. To this end, please contact a competent organization for support. National plant protection organizations or extension service agencies can usually provide assistance.

## 5 RISK ASSESSMENT GUIDELINE

### Introduction to the risk assessment

Under the TR4 Biosecurity Standard, a number of risk assessments are required to facilitate Foc TR4 biosecurity measures and environmental protection at farm level. These guidelines provide assistance to producers by defining the requirements for a single document that complies with the risk assessment principles and criteria and the biosecurity requirements imposed in your country by the government and/or national plant protection organizations.

### What is a risk assessment?

A risk assessment is simply a careful examination of what, as part of your work, could cause harm to the products, the environment, and/or workers, so that you can evaluate whether you have taken sufficient precautions or should do more to prevent harm. In this standard, the risk assessment focuses on the biosecurity measures designed to prevent the introduction/spread of Foc TR4.

Do not overcomplicate the process. Within many farms, companies, regions, and countries, the risks are well known, and the necessary measures are easy to apply. Check that you have taken reasonable precautions to avoid/prevent the introduction/spread of Foc TR4.

When thinking about your risk assessment, remember:

- A hazard is anything that may cause harm, such as chemicals, electricity, working on ladders, etc.
- The risk is the chance, high or low, that these and other hazards may harm someone or something, together with an indication of how serious the harm might be.

### Five steps to the risk assessment

The risk assessment is an important tool designed to protect your farm against the introduction/spread of Foc TR4 and enable you to comply with the legal requirements in your country.

A risk assessment helps you focus on those risks that really matter in the workplace – the ones with the potential to cause real and serious harm. In many instances, straightforward, simple, effective, and inexpensive measures can readily control risks (e.g., ensuring that workers implement good boot cleaning practices when accessing the farm). You are not expected to eliminate all risks, but you are expected and required to protect your farm by implementing biosecurity measures as far as is reasonably practicable.

The method below is not the only way to perform a risk assessment. There are other methods that work well, particularly for more complex risks and/or circumstances. However, we believe this method provides a straightforward approach for most producers. Producers are legally required to assess the risks in their workplace so that a plan to control the risks can be put in place.

### How to assess the risks on your farm

#### Step 1: Identify the hazards

First, you need to identify how the farm, products, environment, and/or workers could be harmed. Here are some tips to help you identify the hazards that matter:

- Walk around the workplace and look at what could reasonably be expected to cause harm (situations, equipment, products, practices, natural vegetation that might serve as host for

Foc TR4, the presence of Foc TR4 in soil, the movement of contaminated soil to healthy areas, areas susceptible to flooding, etc.).

- Ask the workers or their representatives (where applicable) what they think. They may have noticed things that are not immediately obvious to you.
- Review previous incidences (flooding, presence of Foc TR4 in nearby areas, high frequency of soil movement between neighboring areas, etc.) as these often help to identify less obvious hazards.

### **Step 2: Decide who/what might be harmed and how**

For each hazard, you need to be clear about who or what might be harmed. This will help you identify the best way to manage the risk. Some hazards will require extra thought, especially in situations in which individuals (visitors, contractors, maintenance workers, etc.) may not be present in the workplace all the time.

### **Step 3: Evaluate the risks and decide on precautions**

Once you have identified the risks, you need to decide what to do about them.

The law requires you to do everything reasonably practicable to protect your farm from harm. You can work this out for yourself, but the easiest way is to compare what is being done to prevent the spread of Foc TR4 elsewhere and what has already been defined as good practice.

Examine what you are already doing and think about what controls you have in place and the biosecurity measures you are already implementing to prevent the spread of Foc TR4. Then compare that with established good practices and decide whether there is more you should be doing to bring yourself up to standard.

During your evaluation process, consider the following:

- Can I get rid of the risk altogether?
- If not, how can I manage risks so that harm is unlikely?

When managing risks:

- Issue clean personal protective equipment and other equipment that can only be used on the farm (e.g., clothing, boots).
- Design adequate drains to remove water and conduct it away from the farm.
- Provide boot baths (e.g., at the entry to the farm, construct washing facilities to remove contaminated material from workers and machinery).

### **Step 4: Record the plan of action/findings and implement them**

Putting the results of the risk assessment into practice will make a difference in protecting your business by preventing the introduction of Foc TR4 to your farm or reducing consequent harm.

Writing down the results of the risk assessment and sharing them with your workers will encourage you to complete the implementation.

When writing down the results, keep it simple (e.g., contamination at entry: boot baths at the field entrances).

The risk assessment is not expected to be perfect, but it shall be suitable and sufficient. You need to be able to show that:

- A proper check was made
- You asked who or what might be affected

- You dealt with the significant hazards
- The precautions are reasonable, and the remaining risk is low
- You involved your workers or their representatives (where applicable) in the process

A good plan of action often includes a combination of different responses such as:

- Temporary solutions until more reliable controls can be put in place
- Long-term solutions to those risks with the worst potential consequences
- Arrangements for training workers on the main risks that remain and how these risks are to be controlled
- Regular checks to make sure that the control measures are still in place
- Clearly defined responsibilities: Who will be in charge of what action and by when?

Remember to prioritize and tackle the most important things first. As you complete each action, tick it off your plan.

### Step 5: Review the risk assessment and update it when necessary

Sooner or later, you will bring in new equipment, substances, and/or procedures that may pose new risks. It therefore makes sense to review what you are doing on an ongoing basis.

Every year, conduct a formal review to determine where you are with respect to recognized good practices to make sure you are still improving, or at least not regressing. Make sure your risk assessment is kept up to date.

Source:

[“Integrated Farm Assurance – Guideline for fruit and vegetables” version 6.0](#)

An example of what a risk assessment might look like:

Process	Hazard	Risk level	Plan of action	Responsibility	Frequency
Soil preparation and soil movement, machinery	Presence of Foc TR4 in soil, movement of contaminated soil to healthy areas	High	<p>It is forbidden to move soil from outside farms, or to bring in machinery and external workers without first going through a disinfection process.</p> <p>Maintain records of workers and machinery accessing the farm as well as their disinfection.</p> <p>Keep workers and machinery operators informed and updated regarding these measures.</p>	Management, access and employees' officer	Daily



<p>Access to the farm</p>	<p>Possible introduction/spread of Foc TR4 caused by the free entry of workers, visitors, machinery, transport trucks, working on or visiting other farms in the region</p>	<p>High</p>	<p>Access/Entry points to the farm shall be identified and equipped with control stations in order to prevent the free movement of workers, visitors, machinery, transport trucks, service providers (waste collectors, energy, telephone, water/drainage, etc.).</p> <p>Boots, tools, and machinery tires shall be disinfected before access is granted. Limit the movement of domestic animals and livestock (including farm dogs).</p> <p>Maintain records of workers and machinery accessing the farm.</p> <p>Keep workers and machinery operators informed and updated regarding these measures.</p>	<p>Management, access and employees' officer</p>	<p>Daily</p>
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## 6 BIOSECURITY DECLARATION TEMPLATE

### BIOSECURITY DECLARATION FOR VISITORS AND AUDITORS

(1) LAST NAME \_\_\_\_\_ (2) FIRST NAME \_\_\_\_\_

(3) PASSPORT NO. \_\_\_\_\_ (4) COUNTRY \_\_\_\_\_

(5) COMPANY \_\_\_\_\_ (6) TELEPHONE NO. \_\_\_\_\_

(7) EMAIL ADDRESS \_\_\_\_\_

(8) POSITION \_\_\_\_\_

(9) HAVE YOU BEEN ON A BANANA PLANTATION BEFORE?

YES \_\_\_ WHERE \_\_\_\_\_ NO \_\_\_

(10) HAVE YOU VISITED ANY COUNTRY IN SOUTH ASIA OR LATIN AMERICA IN THE LAST 6 MONTHS?

YES \_\_\_ WHERE \_\_\_\_\_ NO \_\_\_

(11) MARK ALL THE COUNTRIES ON THIS LIST THAT YOU HAVE VISITED IN THE LAST 6 MONTHS

- Taiwan
- Malaysia (including Sarawak on the island of Borneo)
- Indonesia (Java, Sumatra, Sulawesi, Halmahera, Kalimantan, and Papua New Guinea)
- Mainland China (Guangdong, Hainan, Guangxi, Fujian, and Yunnan)
- Philippines – the island of Mindanao
- Australia (Northern Territory or Queensland)
- Oman
- India (Katihar and Purnia districts of Bihar, the states of Uttar Pradesh, Madhya Pradesh, and Gujarat)
- Jordan
- Mozambique
- Lebanon
- Pakistan
- Laos
- Vietnam
- Myanmar
- Israel
- Colombia
- Turkey
- Mayotte (France)
- Peru
- Venezuela
- Others, please specify: \_\_\_\_\_

With my signature, I hereby declare that the above information is true.

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Passport No.: \_\_\_\_\_

## 7 COMMUNICATION WITH NATIONAL/REGIONAL PLANT PROTECTION ORGANIZATIONS

This section aims to provide producers with a basic level of guidance on communicating with national plant protection organizations (NPPOs). This is important, as Foc TR4 may be classified by banana- and plantain-producing countries as a quarantine pathogen and special legal requirements may therefore apply. For example, a national strategy to suppress and/or avoid Foc TR4 may be coordinated by the government. Not complying with such national efforts may be regarded as a breach of the law. Furthermore, Foc TR4 is a sector-wide concern, meaning that a joint effort is required. This can only be achieved if all parties communicate openly.

Please note that in the case of a quarantine pest or pathogen, NPPOs are usually legally empowered (obliged) to enter private property to sample, isolate, and eliminate infested plants and, if necessary, to implement measures to ensure that the pest or pathogen is contained. Any obstruction of these efforts may result in prosecution, which is why it is imperative that producers cooperate with NPPOs. However, the details of national legislation vary considerably from country to country, which also applies to the respective law enforcement. Any suspected incidence of Foc TR4 in a country may activate quarantine measures in that particular country, which is why it should be taken seriously.

### First steps

- Identify the contact person within your NPPO who is responsible for bananas and/or plantains.
- Actively request all available information about Foc TR4 from this agency, as well as information regarding national contingency plans or support programs.
- If no national program or support material is available in your country or region, request proof of this absence.
- Request advice from a GLOBALG.A.P. approved Registered Trainer or certification body/verification body regarding this issue.
- If no one can assist you in your region, contact an international organization like the FAO World Banana Forum or IICA Global Alliance Against TR4.

### It is important to take any suspected/possible incidence of Fusarium wilt seriously

- Any sample taken in the context of a suspected case shall be treated with all applicable biosecurity measures (sampling, transport of sample, analysis, etc.) in order to avoid the spread of Foc TR4 in case the presence of Foc TR4 is confirmed after analysis.
- Positive results shall be reported to your NPPO.
- Suspected cases may be investigated, not just in the banana or plantain cultivars, but in any other Musaceae spp. or any possible host organisms (e.g., weeds).
- The report shall include the information necessary to identify the host (plants), infested area (incl. GIS coordinates), and the contact person (e.g., producer, extension officers, consultants).
- Taking and analyzing samples for the official identification of Foc TR4 is a highly complex process. Producers should therefore request assistance from NPPOs or another appointed organization when taking samples. Please always contact your NPPO for assistance.

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