



Food and Agriculture  
Organization of the  
United Nations

# TROPICAL RACE 4 AWARENESS RAISING AND CAPACITY DEVELOPMENT: KEY MESSAGES AND TRAINING COMPETENCY FRAMEWORK

## TR4 GLOBAL NETWORK - an initiative of the World Banana Forum -

### INTRODUCTION

The aim of this document developed by the **TR4 Task Force (TR4TF)** of the **World Banana Forum (WBF)**, is to provide a framework that can be used worldwide to develop awareness raising, information materials and training courses on the management of **Fusarium Tropical race 4 (TR4)**. It will ensure that awareness raising and training worldwide deliver the same clear and consistent messages to those involved in banana production and trade on how to contain, manage, and prevent the further spread of TR4.

As a first step, the **TR4TF** compiled a list of key messages and training competencies. These were presented to the WBF members for their comments, amendments and, finally, their endorsement. As result, the TR4TF came out with:

- Key messages that outline the main points that need to be understood and addressed to tackle TR4.
- Awareness raising refers to short messages; Capacity Development refers to deepen knowledge and skills. For both purposes, the key messages are leading.
- The Competencies provide the basis on which to design training courses; they specify what individuals need to know and be able to do by the time they complete the training. The competencies needed to tackle TR4 vary according to target group. The knowledge and skills needed by a transporter, for example, are different to those needed by a plantation manager.



The WBF's Training Competency Framework will act as a resource that can be used by any organisation worldwide to develop and deliver training on TR4. They provide a guide, ensuring that training is consistent and covers all the knowledge and skills needed. To be effective, these are best developed locally so that they are customised according to the local context and language. This will ensure that they are relevant, easily understood, and more likely to be adopted.

## Target Groups

The main target groups are:

- Government (Ministry and policy level).
- **National Plant Protection Organisations (NPPOs).**
- Individual small-scale farmers and farmer organisations.
- Large farms/plantations.
- Transporters and Traders (buyers and retailers).
- Technical support services (consultants, extension officers, training organisations, non governmental organizations [NGOs], certifying bodies).
- General public.

## Key Topics

The training competencies will vary according to whether countries already have TR4 present (where the focus should be on containment) or where TR4 is still inexistent, but at risk (where the focus should be on prevention). There a number of topics around which training can be organised:

### PREVENTION

- Understanding the pathogen (what it is, how it spreads).
- Identification and surveillance.
- Biosecurity measures at farm and country level.
- Agronomic practices.

### CONTAINMENT

- Managing existing infestations.
- Responsibilities of government.



## WHAT ARE THE KEY MESSAGES

- 1.** Fusarium TR4 is one of the greatest threats to worldwide banana production.
- 2.** It affects Cavendish and many other varieties including some plantain. It also survives in many other host plants in addition to *Musa* spp.
- 3.** It is a fungal disease; a soil borne pathogen.
- 4.** It can survive in the soil for decades. Once present, TR4 cannot be easily eradicated by any biological or chemical control methods currently available. It is therefore critically important to prevent TR4 from spreading and entering uninfected areas.
- 5.** It is easily spread through infected banana plant material, and contaminated soil and water. Humans are the main vector. Only small amounts of contaminated material are enough to infect a farm.
- 6.** At the moment, diagnosis of the TR4 pathogen requires specialized laboratory techniques. It is important to know the symptoms, but definitive identification cannot be done by means of field observation alone.
- 7.** Monitoring plans need to be in place from the national level to the individual farm/plantation to identify TR4 outbreaks early and timely to prevent spread. NPPOs should be contacted immediately in the event of a suspected TR4 outbreak at farm level.
- 8.** Biosecurity measures are the practices used to ensure that TR4 does not spread from an area that is infected into a farm, area or country that is free of the disease.
- 9.** In countries where TR4 is already present, very strict biosecurity measures are needed to ensure that the disease does not spread within farms, between farms, or between districts. In countries where TR4 is not present, biosecurity measures must focus on ensuring that the disease is not brought into the country.
- 10.** Biosecurity measures primarily target human activity, which is the main cause of TR4 dissemination. It is difficult to prevent the spread of contaminated soil and water by natural processes (wildlife, flooding, etc.) but biosecurity measures can still help to reduce the risk.
- 11.** Biosecurity measures must be adapted and applied to fit the context (e.g. for a small farm, large plantation, trader, or government agency) and according to the level of risk.
- 12.** Everyone involved in the banana industry has a responsibility to apply the recommended biosecurity measures to prevent the spread of TR4 and to protect areas and countries that are disease-free. This includes government agencies as well as everyone in the banana value chain from farmers to transporters, traders, service providers, and the public.



## TRAINING COMPETENCY FRAMEWORK

### Understanding the pathogen

What the person responsible for managing TR4 in the organisation needs to know and be able to do based on what the disease is and how it spreads.

#### Government (Ministerial and policy level) representative needs to:

- Be aware of TR4 and the threat it poses to the banana sector.
- Have concrete information and data on the potential impact of the spread of TR4 in the country and in particular regions: economic (direct, linkages with other sectors), social (including direct and indirect employment), food security, others.
- Know where TR4 is present – geographical distribution.
- Understand how it spreads.
- Be able to identify the main risks of introducing TR4 into the country (e.g. via trade and movement of goods and services from infected areas).
- Have a knowledge of the role of international organisations (to initiate dialogue on potential support in developing a national prevention strategy).

IT **INFECTS** MOST BANANA AND PLANTAIN VARIETIES, INCLUDING THE CAVENDISH, WHICH **PROVIDES** AROUND

 **50%**  
**OF GLOBAL  
SUPPLY**

**400** million



RELY ON THE FRUIT FOR **FOOD SECURITY** AND **LIVELIHOODS**

### **NPPO representative needs to:**

- Be aware of TR4 and the threat it poses to the banana sector.
- Understand the biology of the pathogen, including:
  - how it reproduces and develops.
  - how it affects the host plant; internal and external symptoms in leaves and stems.
  - susceptibility of commercial banana varieties and other hosts; susceptibility of varieties for domestic markets, local consumption and food security.
  - persistence in the soil and wild hosts.
- Understand how TR4 spreads, including:
  - by infected banana plants or plant material, contaminated soil, water.
  - by people, through the movement of dirty vehicles, footwear, machinery, tools, etc.
  - over short distances by root to root contact, and from parent plant to suckers.
  - by domestic animals, wildlife (e.g. rats, bandicoots, feral pigs, wading birds) and potentially by insects (e.g. banana weevil borer).
  - by natural processes such as heavy rainfall and floods.
- Have a knowledge of the management options, including:
  - that no effective control method is currently available.
  - that potentially resistant banana varieties are under development.
  - the different options of disinfectants and other supplies to be used as part of biosecurity systems, and be able to recommend users on the doses, periodicity and availability.
  - that the only management options available are biosecurity (to prevent spread), and agronomic practices (to reduce impact).
  - methods to put a part of the plantation infected by TR4 under quarantine.
- Have a knowledge of how TR4 is identified including:
  - identification of the TR4 pathogen cannot be done in the field; it requires a specialized laboratory that can conduct PCR analysis (Polymerase Chain Reaction) among other specialized for the topic.
  - that the laboratories conducting analysis need specialised skills, equipment and materials (including assessment, references and primers).

### **Individual Small-Scale Farmers need to:**

- Be aware of TR4 and the threat it poses to the banana sector, and their farms in particular.
- Understand how TR4 is spread (contaminated plant material, soil and water, domestic and wild animals).
- Understand the importance of maintaining the land free from TR4. Once present, it cannot be controlled, and will be present for many years, meaning that bananas can no longer be cultivated.
- To the extent of their possibilities and with further support of other stakeholders, implement all biosecurity measures, individually and collectively with neighbour farmers.
- For further indications visit **[www.fao.org/TR4GN](http://www.fao.org/TR4GN)**.

### Large-Scale Farmers/Plantation Managers need to:

- Be aware of TR4 and the threat it poses to the banana sector, and their plantations in particular.
- Understand how TR4 is spread (contaminated plant material, soil and water, domestic and wild animals).
- Understand the importance of maintaining the farm free of TR4 and apply all biosecurity measures possible.
- Continually to and according to the most up-to-date information, develop the capacities of its personnel regarding prevention and control.

### Traders/Retailers and Transporters need to:

- Be aware of TR4 and the threat it poses to the banana sector, and how it could affect their banana business.
- Understand how TR4 is spread (contaminated plant material, soil and water).
- Assess how to support the farmers in banana producing countries to cope with the costs and impacts of the prevention and containment of the disease.

### Technical support services (consultants/extension officers/training organisations/NGO) need to:

- Be aware of TR4 and the threat it poses to the banana sector.
- Have constant communication with NPPO to assess current situation and opportune control strategies.
- Understand the biology of the pathogen, including:
  - how it reproduces and develops.
  - how it affects the host plant; symptoms in leaves and stems.
  - susceptibility of commercial banana varieties and other hosts.
  - persistence in the soil and wild hosts.
- Understand how TR4 spreads, including:
  - by infected banana plants or plant material, contaminated soil, water.
  - by people, through the movement of dirty vehicles, footwear, machinery, tools, others.
  - over short distances by root to root contact, and from parent plant to suckers.
  - by domestic animals, wildlife (e.g. rats, bandicoots, feral pigs, wading birds) and potentially by insects (e.g. banana weevil borer) .
  - by natural processes such as heavy rainfall and floods.
- Have a knowledge of the management options, including:
  - the main contact information of the NPPO and make it available for all staff as well as clarify and indicate the circumstances that will suggest that it is time to reach out to them.
  - that no effective control method is currently available.
  - that potentially resistant banana varieties are under development.
  - that the only management options available are biosecurity (to prevent spread), and agronomic practices (to reduce impact).
  - methods to put a part of the plantation infected by TR4 under quarantine.

- Have a knowledge of how TR4 is identified, including:
  - that identification can only be confirmed in a laboratory in coordination with the NPPO.
  - that the laboratories conducting analysis need specialised skills, equipment and materials.
- For further indications visit [www.fao.org/TR4GN](http://www.fao.org/TR4GN).

#### General Public need to:

- Be aware of TR4 and the threat it poses to the banana sector.
- Understand how TR4 is spread (contaminated plant material, soil and water).
- As responsible consumers, identify and implement the best way to support farmers through responsible value chain mechanisms.



## Identification and Surveillance

What the person responsible for managing TR4 in the organisation needs to know and be able to do.

### Government (Ministerial and policy level) representative needs to:

- Map the distribution of bananas and plantains in the country, including production for export and domestic markets, from small-scale farms to large-scale plantations.
- Become acquainted of the policy and legal framework that needs to be in place for a quarantine pest.
- Understand the policy and infrastructure needed for national surveillance programmes and diagnostic facilities.
- Be able to assess the human and financial resources needed to implement a national TR4 surveillance programme, sufficient staff with the necessary skills and operational resources.
- Be able to assess the human and financial resources needed to implement border controls.
- Have a knowledge of the TR4 diagnostic facilities required with appropriate equipment, skills and methods, and where these can be accessed at national, regional or international laboratories.
- Be able to bring together key stakeholders to implement a TR4 pest risk assessment and impact assessment, including but not limited to public-private alliances and support mechanisms for smallholder farmers.

## ARRIVAL OF TR4



**1970s**  
ASIA



**2013**  
AFRICA



**2019**  
LATIN AMERICA

TR4 HAS BEEN REPORTED  
across three continents

**21** countries



BANANAS AND PLANTAINS  
are produced in more than

**135** countries

### NPPO representative needs to:

- Based on mapping of plantations, be able to implement a national TR4 surveillance programme in line with risk assessment plans, taking soil samples on a regular basis in the banana producing zones.
- Identify what host species need to be included in the surveillance programme.
- Be able to establish and implement a procedure for further investigation and management of reports of suspected TR4 cases.
- Be able to train field officers (NPPO and extension services) on the symptoms of TR4.
- Be able to train field officers to take and handle soil and tissue samples for diagnostic purposes.
- Be able to oversee a TR4 diagnostic service in-country (or access to regional/international analytical facilities).
- Develop capacities within extensionists and farmers to address all aspects of TR4, this through workshops, distribution of TR4 Global Network materials of the World Banana Forum, as well as others pertinent for the situation.
- Maintain effective contact channels with extensionists and farmers, encouraging the support in case of emergency, avoid panic messages knowing that we are in this together.

### Individual Small-Scale Farmers need to:

- Be acquainted with the NPPO plan and support its implementation, according to their guidelines.
- Relying on the farm's trained and conscientious staff, be able to monitor for the presence of TR4 (frequency, distribution).
- Know the symptoms of TR4, including external symptoms (leaf yellowing; wilting leaves; stem splitting) and internal symptoms (reddish coloration when stems are cut; xylem obstruction of the sap).
- Understand what to do if they find something suspicious, report to the NPPO is the most important thing.
- **Know what not to do:** infected plants should not be cut or removed without the support of the competent authorities; this results in the further spread of the fungus.
- For further indications visit [www.fao.org/TR4GN](http://www.fao.org/TR4GN).

### Large-Scale Farmers/Plantation Managers need to:

- Be acquainted with the NPPO plan and support its implementation, according to their guidelines.
- Relying on the company's trained and conscientious staff, be able to develop and implement a monitoring plan. Know that these activities need to be done on a regularly basis, including every plot (there are methods to take representative samples), and including all major host plants.
- Know the symptoms of TR4 including external symptoms (leaf yellowing; wilting leaves; stem splitting) and internal symptoms (reddish coloration when stems are cut; xylem obstruction of the sap).
- Be able to continuously train field staff to identify suspicious plants.
- Know what to do if they find something suspicious: report to the NPPO and complement their capacities and resources in order to properly implement protocols, including sampling and further diagnosis process.

- **Know what not to do:** infected plants should not be cut or removed as this causes the production of spores and further dissemination of the fungus.
- For further indications visit [www.fao.org/TR4GN](http://www.fao.org/TR4GN).

#### **Traders/Retailers and Transporters need to:**

- When possible, contribute to fund monitoring plans and systems in banana producing countries.

#### **Technical support services (consultants/extension officers/training organisations/NGO) need to:**

- Be acquainted with the NPPO contact information and guidelines.
- Be aware of national TR4 surveillance programmes and reporting mechanisms.
- Be able to train farmers/plantation managers on symptoms of TR4 and how to develop and implement surveillance plans (covering frequency, distribution, host species, others). The TR4 Global Network materials can support this endeavour.
- Be able to guide farm managers to avoid improper activities and pertinently contact the NPPO in case of a suspicious TR4 case.



## Biosecurity

What the person responsible for biosecurity in the organisation needs to know and be able to do.

### Government (Ministerial and policy level) representative needs to:

- Be able to ensure that the necessary regulatory framework is in place and is implemented to prevent the introduction or spread of TR4 as a notifiable pest (obligation to report, plant quarantine, sales of planting material, movement restrictions, others).
- Understand and put in place the infrastructure and resources (human and financial) needed to enforce regulations and implement official controls to prevent the introduction or spread of TR4 (including the NPPO, diagnostic services, extension services, disinfection points, others).
- Understand the importance of having a national TR4 focal point within the NPPO that responds to the International Plant Protection Convention (IPPC) and FAO.
- Understand the need to conduct a national inventory of the main producers, buyers, traders and retailers of banana.
- Be able to bring together key stakeholders to develop a national biosecurity action plan.
- Understand the infrastructure and resources needed (financial and human) to support implementation of a national TR4 action plan, including awareness raising and communication.



### NPPO representative needs to:

- Implement effective communication channels with the International Plant Protection Convention (IPPC) and FAO.
- Have a detailed knowledge of biosecurity measures needed at farm level and country level.
- Be able to oversee implementation of official controls, including inspection and border controls, according to national regulations.
- Be able to establish and oversee implementation of procedures for disinfection of vehicles and equipment at border entry points and between zones in countries where the disease is present.
- Be able to implement a simulation exercises as preventive measure and in case of a suspected TR4 cases.
- Be able to establish and oversee implementation of procedures for the containment and destruction of infected material.
- Be able to certificate and oversee the laboratories involved at national level and ensure their complying with international protocols and support.
- Be able to establish and oversee implementation of a TR4 advisory service for banana producers, transporters and traders on biosecurity measures, with biosecurity guidelines.
- Be able to establish and oversee an approval scheme for TR4-free planting material.
- Be able to facilitate the establishment and implementation of a national TR4 action plan, including awareness raising and communication.
- Know what disinfectants are effective and available on the market, and their recommended use (conventional and organic production systems); be able to communicate this information to producers.
- Be able to train and give technical assistance to stakeholders in above mentioned themes.

### Individual Small-Scale Farmers need to:

- Implement effective communication channels with the NPPO.
- Be able to identify the main ways in which TR4 could enter the farm (dirty vehicles, equipment, machinery, tools, clothing, shoes; infected planting material; irrigation water; others).
- Be able to identify the high risk factors on the farm (visitors, workers and equipment, domestic and wild animals, irrigation water, flood water, others).
- Be able to identify which biosecurity measures can be used to reduce the risk of introducing TR4 onto the farm, and know how to apply them. For more details go to [www.fao.org/TR4GN](http://www.fao.org/TR4GN).
  - Record all visitors.
  - Provide visitors (neighbours, service providers, etc.) with information about TR4. Identify what information to include, and where to locate TR4 warning and information signs for visitors and neighbours.
  - Ensure all visitors follow the farm biosecurity measures.
  - Limit the entry and movement of visitors and vehicles, especially those that are high risk because they move between farms/areas that grow bananas (e.g. vehicles for delivery or collection, agronomists, others). Keep high-risk visitors and vehicles to a restricted area at the farm entrance.
  - Know how to manage effective disinfection of footwear using water and footbaths.
  - Know how to disinfect tools used for cultural practices on a regular basis.

- Know how to clean, wash down and disinfect vehicles, machinery, and equipment.
- Know what equipment and disinfectants are locally available and can be used.
- Be able to make sure that vehicles, equipment, machinery and footwear are washed and disinfected before they enter the farm.
- Be aware of the importance of using clean water for washing and disinfection, and how to maintain a restricted area for dirty washing water.
- As far as possible, restrict the movement of people and animals by having a boundary fence. Know how to construct and maintain a border fence.
- Know the importance of using clean planting material, and the meaning of certified planting material.
- Have a plan to limit the movement of farm animals.
- Have proper communication tools, such as posters and billboards, with TR4 information including preventive procedures and biosecurity measures.

- Be able to make sure that all family and farm workers know about TR4 and understand the importance of maintaining the farm TR4-free. Ensure they are aware of and follow the farm biosecurity measures.
- Understand the importance of having a designated person who is responsible for ensuring that farm biosecurity measures are followed at all times as far as is practically possible.

**USING A BRUSH, WATER AND DETERGENT,**  
 ALL SURFACES MUST BE **SCRUBBED WITH HIGH PRESSURE WATER** SO THEY ARE FREE OF SOIL AND PLANT MATERIAL.  
 (Queensland Government Publications. 2018)

*Most industrial and domestic brands of soaps, detergents and degreasers will work well.*



**REMEMBER, NEVER ENTER A BANANA FARM WITHOUT PERMISSION!**

### Large-Scale Farmers/Plantation Managers need to:

- Implement effective communication channels with the NPPO.
- Understand the importance of maintaining the farm free of TR4.
- Understand how TR4 is spread (contaminated plant material, soil and water, others).
- Be able to identify the main ways in which TR4 could enter the farm (dirty vehicles, equipment, machinery, tools, clothing, shoes, infected planting material, irrigation water, others).
- Be able to identify high risk factors, and select appropriate biosecurity measures to manage them.
- Know how to apply biosecurity measures, and implement them according to the risk. For more details go to **[www.fao.org/TR4GN](http://www.fao.org/TR4GN)**.
  - Maintain a record-keeping system for all visitors.
  - Ensure that visitors, family and farm workers know about TR4 and understand the importance of maintaining the farm TR4-free.
  - Provide visitors and neighbours with information about TR4. Identify what information to include, and where to locate TR4 warning and information signs for visitors and neighbours.



- Limit and manage the entry and movement of visitors and vehicles, especially those that are high risk because they move between farms/areas that grow bananas (e.g. vehicles for delivery or collection, agronomists, contractors, international visitors, etc.).
- Be able to establish and maintain farm zoning (exclusion, separation and farming zones).
- Implement appropriate biosecurity measures in each farm zone.
- Have procedures in place and implemented for wash-down and disinfection. Maintain a supply of clean water for washing and disinfection. Construct and maintain cleaning and disinfection facilities, with a restricted area for dirty washing water.
- Ensure thorough washing and disinfection of all machinery and equipment, especially items loaned or purchased second-hand.
- Maintain dedicated access roads with hard-surfaces and maintain a secure boundary fence where possible.
- Ensure that risks are managed where the farm is next to or crossed by public roads with signage to alert the public that entry is prohibited without permission.
- Construct drainage to divert water-run off from adjacent farms and public roads away from the farm.
- Know the importance of using clean planting material, and the meaning of certified planting material.
- Use animal proof fencing to exclude farm and wild animals from the farming zone.
- Have proper communication tools, such as posters and billboards, with TR4 information including preventive procedures and biosecurity measures.

○ Be able to give training on an ongoing basis to farm workers so that they are aware of and follow the farm biosecurity measures.

○ Understand the importance of having a designated person who is responsible for ensuring that farm biosecurity measures are followed at all times as far as is practically possible.



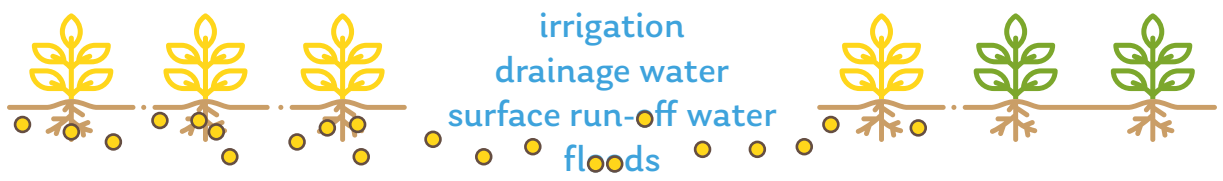
It penetrates and blocks the vascular system of the plant, **cutting off the supply of water and nutrients**



It causes wilting and death of plants and can cause **complete yield loss once established** in a field



The fungus lives in the soil and forms resistance structures that allow it to survive for **+30 years**



### Traders/Retailers and Transporters need to:

- Be able to identify the main ways in which TR4 can be transported between farms and between countries (dirty containers, pallets, vehicles, equipment, clothing, shoes, infected planting material).
- Understand that traders and transporters play a key role in preventing the spread of TR4: people, vehicles and equipment (e.g. containers) that move from farm to farm, between districts, and between countries where bananas are grown are very high risk.
- Know the biosecurity measures that traders should follow:
  - Know that they should ensure thorough washing and disinfection of all vehicles and equipment purchased second-hand.
  - Be able to put procedures in place and implement them for wash-down and disinfection of vehicles and equipment (e.g. containers, pallets).
  - Be able to follow all biosecurity measures required by public authorities and the farms visited.
- Be able to give training on an ongoing basis to ensure that all employees are aware of TR4, and the need to follow biosecurity measures at all times.
- Understand the importance of communicating with contractors to ensure that they have a training and information programme in place to ensure that their employees are aware of TR4, and the need to follow biosecurity measures at all times.

### Technical support services (consultants/extension officers/training organisations/NGO) need to:

- Implement effective communication channels with the NPPO.
- Have a detailed understanding of the pathogen.
- Have a thorough knowledge of the national regulations and official controls, as well as detailed knowledge of the full range of biosecurity measures available.
- Be able to help farmers develop a package of biosecurity measures appropriate to their circumstances.
- Understand that agronomists/service providers play a key role in preventing the spread of TR4 both as sources of advice, as well as potential vectors. People, vehicles and equipment (e.g. containers) that move from farm to farm, between districts, and between countries where bananas are grown, are very high risk.
- Understand the need to follow all biosecurity measures required by public authorities and the farms visited.
- Be able to provide ongoing training and information to ensure that all employees are aware of TR4, and the need to follow biosecurity measures at all times.
- Be able to communicate the importance of “arriving clean, leaving clean” to a variety of target audiences.

### General Public need to:

- Understand the main ways in which TR4 can be transported between farms and districts (dirty vehicles, clothing, shoes).
- Understand that transporting bananas and items made from banana leaves between countries is very high risk. Do not bring them with you.
- Know that if they visit banana producing areas or farms they must follow the required biosecurity measures such as disinfecting footwear and vehicles.

## Agronomic methods of prevention

What the person responsible for managing TR4 in the organisation needs to know and be able to do.

### Government (Ministerial and policy level) representative needs to:

- Be able to understand the importance of clean planting material; promote or facilitate access to clean planting material (especially for small producers).

### NPPO representative needs to:

- Be able to understand the importance of clean planting material.
- Supervise certification of planting material.



**Individual Small-Scale Farmers need to:**

- Know where to obtain clean planting material from approved tissue culture nurseries or how to use suckers from the farm.
- Be able to minimize risks of spreading by irrigation; preferably using water for irrigation sourced from boreholes (not a river, channel, water reservoir).
- Know how to manage water run-off from exclusion and separation zones on their farm.
- Implement measures to minimize soil erosion, to minimize soil and water movements.
- Manage soil movement through in-coming and out-going drainage channels, building sediment traps.
- Make sure that waste plant materials are dumped in areas that do not drain to other parts of the farming zone.
- Avoid soil movement from one part of the farm to another.
- Make sure that solid waste (bunch bags, strings) is separated and safely disposed of.
- Construct fences to avoid the movement of livestock or hinder the movement of wildlife.
- Check the origin of organic based soil amendments (compost, compost teas based on microorganisms); this must be sourced from areas or prime materials not associated with banana production.
- Be prepared for natural phenomena that could have effect on the risk of spreading of TR4 (flooding, storms).
- Not use banana leaves for protection of bunches on trailers.

**Large-Scale Farmers/Plantation Managers need to:**

- Know where or how to get clean planting material from approved tissue culture nurseries, or sourced from own farms.
- Be able to minimize risks of spreading by irrigation; preferably using water for irrigation sourced from boreholes (not a river, channel, water reservoir).
- Know how to manage effective disinfection of footwear using water and footbaths.
- Know how to disinfect tools used for cultural practices on a regular basis.
- Know how to manage water run-off from exclusion and separation zones on their farm.
- Implement measures to minimize soil erosion, to minimize soil and water movements.
- Manage soil movement through in-coming and out-going drainage channels, building sediment traps.
- Make sure that waste plant materials are dumped in areas that do not drain to other parts of the farming zone.
- Avoid soil movement from one part of the farm to another.
- Make sure that solid waste (bunch bags, strings) is separated and safely disposed of.
- Construct fences to avoid the movement of livestock or hinder the movement of wildlife.
- Check the origin of organic based soil amendments (compost, compost teas based on microorganisms); this must be sourced from areas or prime materials not associated with banana production.

- Be prepared for natural phenomena that could have effect on the risk of spreading of TR4 (flooding, storms).
- Not use banana leaves for protection of bunches on trailers.

#### Traders / Retailers and Transporters need to:

- Be able to make use of disinfection facilities (footbaths, disinfection facilities) in an effective manner.
- Know that the use of banana leaves to protect bunches on trailers should be refused.

#### Technical support services (consultants/extension officers/training organisations/NGO) need to:

- Be able to make use of disinfection facilities (footbaths, disinfection facilities) in an effective manner.
- Know how to give technical assistance and training covering all knowledge and practices mentioned above for small- and large-scale farmers and traders.

#### General public need to:

- Be able to know the importance of cleaning and disinfecting footwear, entering and leaving the farm, even if this is not their own footwear but footwear provided by the farm.

## THE MOST EFFECTIVE APPROACH TO **COMBAT** TROPICAL RACE 4



## REFERENCES

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### Become part of the TR4 Global Network!

To learn more or to access resources, subscribe to our **newsletter** or visit our **website**:

**TR4GN@fao.org** | **www.fao.org/TR4GN**

The **TR4GN** is jointly facilitated by the World Banana Forum Secretariat - hosted by FAO's Trade and Markets Division - and by FAO's Plant Production and Protection Division.

To discover the benefits of becoming a member of the World Banana Forum and to take an active role towards a sustainable banana sector, please visit:

**www.fao.org/world-banana-forum**

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*If you think you may have seen soil, water or plant material entering or exiting the farm, or if you have any questions, contact the phytosanitary authorities!*



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