



Food and Agriculture
Organization of the
United Nations



THE GLOBAL PROGRAMME ON BANANA FUSARIUM WILT DISEASE

(PROGRAMME SUMMARY)

PROTECTING BANANA PRODUCTION FROM
THE DISEASE WITH FOCUS ON TROPICAL RACE 4 (TR4)



PROGRAMME IN BRIEF:

Banana is an important crop for food security and rural livelihoods particularly in Asia, Africa and Latin America and Caribbean. This popular crop is now threatened by a new race [Tropical Race 4 – TR4] of a soil borne disease known as Fusarium wilt [FW]. Currently, this race is affecting 19 sites in 10 countries mostly in Southeast Asia, and 25 countries are considered at immediate risk in Asia, Near East and Africa. Preliminary assessment of scientists indicate that TR4 could potentially spread up to 1.6 million ha by 2040 if no significant interventions are instituted. This represents 17 percent of current area in production and corresponds to annual production potential of 36 million tonnes. Potential losses in these areas could have substantial socio economic impacts on livelihoods along the banana value chain.

This programme has been developed with the goal of enhancing sustainability and resilience of banana production under various crop production systems in different regions by preventing and managing the threats of the disease, in Asia, Africa, the Near East and Latin America and Caribbean.

The programme aims to strengthen preventive measures and disease management efforts by enhancing international synergy and collaboration among the existing initiatives in order to provide the necessary technical support to countries affected by, and at risk of, this devastating threat. National capacities will be strengthened through mobilising resources and catalysing efforts of organisations and institutions of the public and private sectors.

The programme will be implemented through a partnership among the Food and Agriculture Organization of the United Nations (FAO), Bioversity International, International Institute of Tropical Agriculture (IITA) and the World Banana Forum (WBF), in collaboration with relevant international and national institutions. Initially 67 countries are targeted from different risk groups and regions. Implementation of the 32 activity packages will require an estimated budget of \$ 98 million over five years.



BANANA IS A MAJOR SOURCE OF STAPLE FOOD AND REVENUE IN MANY COUNTRIES IN ASIA, AFRICA, LATIN AMERICA AND THE CARIBBEAN

THE CROP AND THE DISEASE:

Banana, together with plantains, is the most exported fruit in the world and the fifth most produced food crop in the least-developed countries. Of the 145 million tonnes of production 85 percent is consumed locally and the rest is marketed internationally. Thus it is not only a valuable market commodity but also an important staple food or source of income in developing countries for about 400 million people. This crop is now threatened by the most recent race of the fungus *Fusarium oxysporum* f. sp. *Cubense* [Foc], the Tropical race 4 [TR4]. This race is already affecting countries in Southeast Asia and posing a threat to production of this popular crop, with serious repercussions on the livelihoods of small holder producers and workers, and the banana value chain.

Fusarium wilt has been a major constraint to banana production for more than a century. It first gained prominence when it caused significant losses to

Gros Michel bananas grown for export during the first half of the 20th century. To prevent the export industry from collapse, Gros Michel was replaced with Cavendish bananas that are resistant to the Race 1 of the fungus which caused this epidemic. However, in the last two decades Cavendish varieties succumbed to the disease due to TR4. Until early 2000s, TR4 had been restricted to some Cavendish-producing countries in the Asia-Pacific region, but it was recently discovered outside this region, as far as South Asia, the Middle East and Mozambique, bringing the total number of infested countries to ten. This shows that the disease can spread further and threaten bananas worldwide, endangering both the food security and livelihoods of smallholders and banana trade. This global risk is exacerbated by the domination of world banana production by the highly susceptible Cavendish clones as well as many technical and socio economic factors contributing to disease spread.

KEY FACT

FUSARIUM WILT DISEASE OF BANANA CAUSED BY TR4 IS AMONG THE MOST DESTRUCTIVE DISEASES OF BANANA

ROOT CAUSES OF THE CHALLENGE

Fusarium wilt of banana is particularly difficult to control. The responsible fungus is soil-borne and can survive in the soil for decades in the absence of bananas. The fungus infects the plants through the roots and causes a lethal wilt. It can spread into new areas, close or far, through movement of infected planting materials or through contaminated soil particles attached to items such as shoes, clothes, farm tools and vehicles as well as in drainage and irrigation water.

Control of the disease by fungicides is impossible and the only means to protect bananas is to prevent the fungus from spreading into disease-free fields through preventive measures, or by developing and planting resistant varieties. Because of the wide host-range

of TR4, many bananas grown as food crop and for local or international markets, are potential targets.

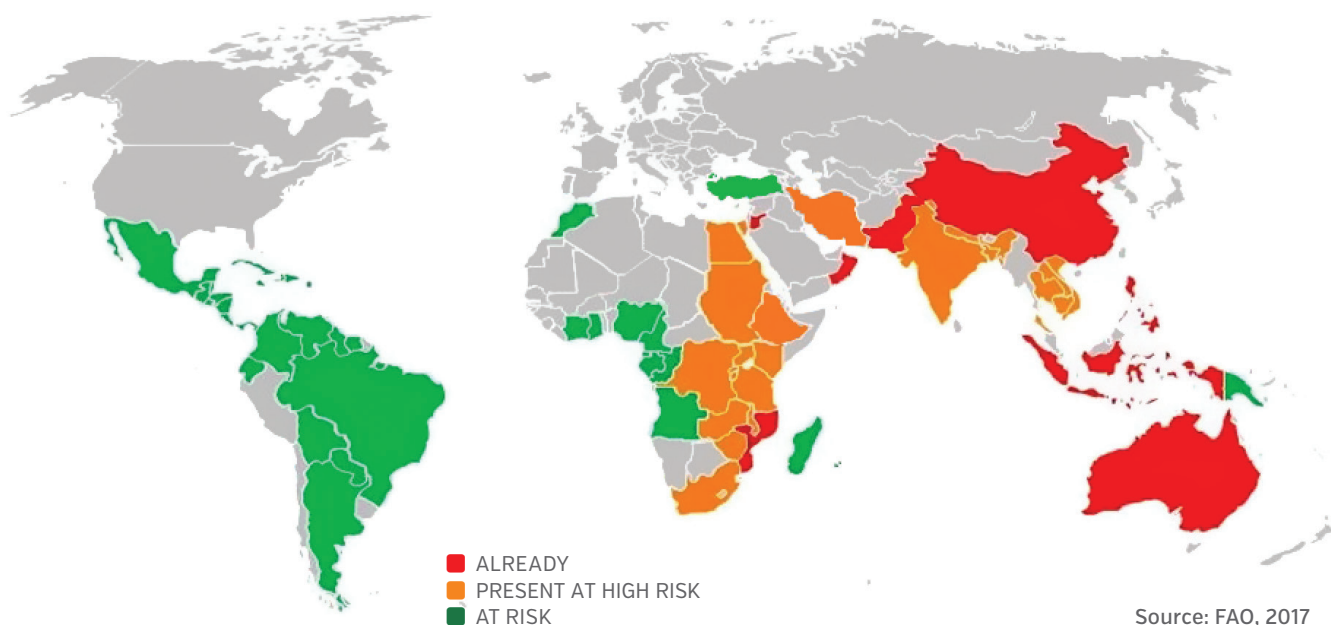
Besides the knowledge gaps, genetic vulnerability of the cultivars and technical constraints, the lack of awareness, surveillance systems, contingency plans and comprehensive and programmatic strategies contribute to the amplification of the risks of spread of the disease and its impact.

Weaknesses in national phytosanitary regulations, seed systems and research and extension capacities make countries concerned more vulnerable to the disease. A concerted effort is thus needed to enhance international collaboration and linkages among diverse stakeholders to assist countries to strengthen their ability to prevent and manage the disease effectively.

A BANANA PLANT AND FIELD AFFECTED BY *FUSARIUM OXYSPOURUM F. SP. CUBENSE TR4*



CURRENT RISK LEVELS OF TR4 FOR COUNTRIES WHERE BANANA IS AN IMPORTANT COMMODITY



POTENTIAL IMPACT OF THE DISEASE AND BENEFITS OF THE PROGRAMME

Estimating the current and potential impact of the disease proves challenging due to the lack of structured reporting systems and insufficient confirmed information. However, past experiences have shown how damaging it could be to the economies and local livelihoods. The damage caused by race 1 of the fungus in the last century is estimated over \$ 2.3 billion. Recent outbreaks in countries already affected by TR4 are a cause of concern. Some unofficial reports refer to affected areas of 15 500 ha in the Philippines, 40 000 ha in China and 80 percent of production area in the Jordan Valley. Globally, the affected area by TR4 so far is estimated by scientists to be close to 100 000 ha¹. In terms of economic losses caused by

TR4, certain reports refer to losses of \$ 121 million in Indonesia, \$253 million in Malaysia and 14.1 million in Taiwan province of China². Considering also the indirect consequences and social effects on the livelihoods of the producers, the workers and the locals, the real socio economic impact would be significantly higher than estimates. It is feared that the disease may already be present in some other locations and with additional incursions TR4 could spread to other non-affected countries and regions as well.

Regarding the potential global impact, scientists have estimated that TR4 could spread up to 1.6 million hectares of current banana lands by 2040 if no



**TR4 AFFECTS PARTICULARLY
CAVENDISH BANANAS, SUPPLYING
AROUND HALF OF GLOBAL BANANA
PRODUCTION**

¹ Ordóñez N, Seidl MF, Waalwijk C, Drenth A, Kilian A, Thomma B P H J, Ploetz R. C, Kema GHJ. . [2015]. Worse Comes to Worst: Bananas and Panama Disease—When Plant and Pathogen Clones Meet. *PLoS Pathog* 11(11): e1005197.

² Source: www.promusa.org

significant interventions are instituted³. This represents 17 percent of the current area under production. The annual production potential of this area is 36 million tonnes with an estimated value of around 10 billion dollars at current prices. Thus, it is feared that such extensive spread could cause significant socio economic impacts on banana productions and livelihoods along the banana value chain globally.

The programme, through wide international collaboration and engagement with the concerned countries and stakeholders, aims to minimize the risk of spread of the disease into new areas and to support the affected countries for its management and recovery through development and implementation of improved and novel technologies and practices. By targeting 67 countries in Asia, Africa, the Near East and Latin America and the Caribbean, the programme aims to reduce by 60 percent the potential area that can be affected by the disease at full impact rate, and by 30 percent at a moderate impact rate. The

programme will also support countries and regions which are already affected by the disease to introduce and support improved disease management practices.

It is estimated that through effective implementation of the programme, an annual investment of \$1 today would bring in 10 and 20 years' time a return of around \$48 and \$196 at full impact rate, and \$24 and \$98 at a moderate impact rate, respectively.

These estimations are made mostly based on expected outcomes of awareness raising campaigns and implementation of preventive phytosanitary measures and immediate management practices. The impact of longer term activities, such as research and breeding, would depend on the advancements, and the benefits would mostly be realized beyond the planned duration of the programme. However, these advancements and their implementation would be crucial for ensuring sustainability and resilience of banana production systems in the long term.



EFFECTIVE ERADICATION IS CURRENTLY NOT POSSIBLE. THE PATHOGEN REMAINS VIABLE FOR DECADES IN THE SOIL

THE PROGRAMME AND ITS OBJECTIVES

The programme is designed in view of the global magnitude of the risks posed to banana production by TR4, as well as other races. Considering the global mandate and strategic objectives of FAO and its partners Bioversity International, IITA, World Banana Forum, and others, the programme has been developed collaboratively with inputs of many institutions and experts. The programme aims to enhance international synergy and collaboration among the existing initiatives focusing on areas where further work is needed in order to provide the necessary technical support to countries affected by, and at risk of, this devastating threat. National capacities will be strengthened through mobilising resources and catalysing efforts of organisations and institutions of the public and private sectors.

The programme also aims to fill in knowledge gaps by supporting the development and exchange of the science-based evidences, methodologies, experiences and tools in key priority areas, such as biology and epidemiology of the causal fungus, detection and surveillance, soil health and beneficial organisms, and development and adoption of resistant cultivars.

These tools will help to adopt integrated disease management practices that help to prevent disease spread and suppression of the fungus to ensure more resilient banana cropping systems in the long-term. Bio-economic and spatial analyses will be carried out to assess the potential and real impacts of the different interventions.

³ Scheerer L, Pemsil D, Dita M, Perez Vicente L and Staver C. [2016]. A quantified approach to project losses caused by Fusarium wilt Tropical race 4. Accepted for publication in: Proceedings of X International Symposium on Banana: ISHS-ProMusa Symposium on Agroecological approaches to promote innovative banana production systems, Montpellier, France, 10-14 October 2016. Acta Horticulturae. ISHS, Leuven, Belgium.

KEY FACT

ONCE ESTABLISHED IN A FIELD, IT CAN CAUSE 100 PERCENT YIELD LOSS

THE FRAMEWORK AND PLANNED ACTIVITIES

The programme activities have been designed to achieve eight thematic outputs targeting three major expected outcomes. The principle expected outcome is to create an enabling environment through improved international collaboration, development of multi-sectoral strategies and improved national capacities to support actions to prevent and manage the threats.

The outcome of improved prevention of disease spread will be achieved through supporting surveillance, phytosanitary measures and rapid containment focusing in countries where the disease is not present or just appeared. Improved disease management in countries where the disease already occurs will be achieved through developing and deploying resistant

varieties and promoting long-term integrated disease management practises. The programme will be continuously monitored and evaluated periodically to assess progress and ensure learning across the different areas of interventions and stakeholders.

The activities will be prioritised for different regions and countries based on the status of the disease, risk levels and assessments of national institutions. Similarly, these will be differentiated also for different banana production systems such as smallholder farming, mixed cropping systems and monocultures. In total, 67 countries are considered as beneficiary countries in Asia, Africa, the Near East and Latin America and the Caribbean.

KEY FACT

PREVENTION AND PHYTOSANITARY MEASURES ARE THE MOST EFFECTIVE WAYS OF CONTROLLING THE DISEASE

COORDINATION ARRANGEMENTS

The programme will be hosted at FAO headquarters and implemented in close collaboration with its partners Bioversity International, IITA, World Banana Forum and others from various sectors, regions and countries. Regional priorities and work plans will be established at regional levels around regional platforms in Asia, the Near East, Africa and Latin America and the Caribbean. These platforms will involve FAO regional, subregional and country offices, global and regional networks coordinated by Bioversity International, IITA and WBF, as well as Regional Plant Protection Organizations (RPPOs) linked with the IPPC and other relevant institutions.

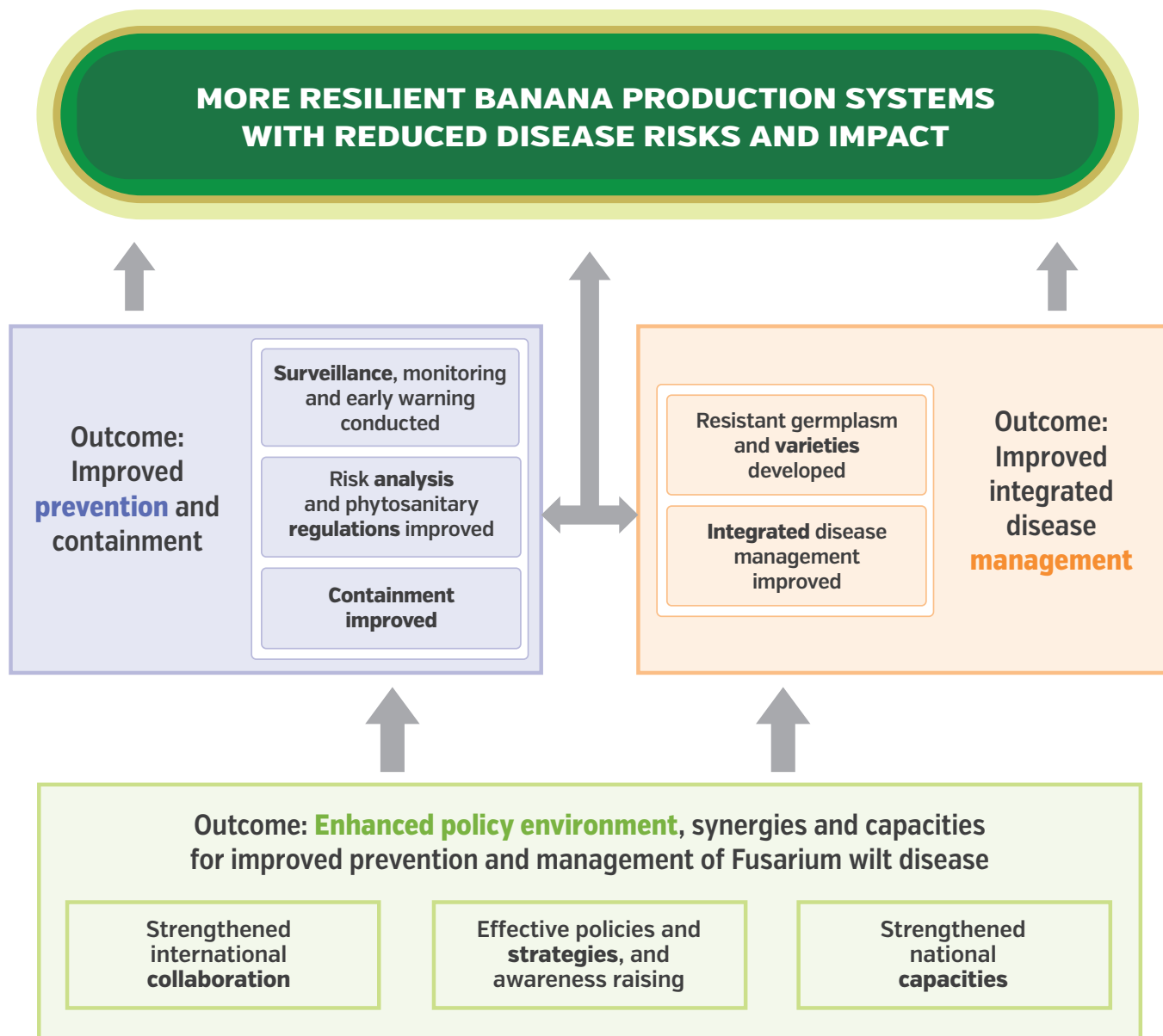
A programme steering committee consisting of members from FAO, Bioversity International, IITA, World Banana Forum and representatives from Asia, Africa, the Near East and Latin America and the Caribbean will guide and oversee the implementation and progress. This will be supported by a technical advisory panel which will consist of focal points of

the collaborating institutions and scientific experts. Progress of planned activities will be monitored through biannual assessments and annual workshops. Lessons learnt will be assessed, and updates and adjustments will be made as appropriate taking into account the recommendations of the participating institutions, member countries and resource partners.

Programme activities will contribute greatly to the protection of the banana productions under different cropping systems from the threats of the Fusarium wilt outbreaks by enhancing international collaboration and strengthening national capacities.

This will strengthen the resilience and sustainability of global banana production and livelihoods of around 400 million people for whom it is an important staple food crop or source of income. For implementation of this five year programme in full, a budget requirement of US\$ 98 million is estimated.

FRAMEWORK OF THE EXPECTED OUTCOMES AND OUTPUTS OF THE PROGRAMME



DIVERSIFICATION AND BETTER USE OF AVAILABLE GENETIC RESOURCES ARE KEY TO BUILDING RESILIENCE TO THE DISEASE IN THE LONG TERM

PROGRAMME SUMMARY

Outcome 1. Enhanced enabling environment, synergies and capacities to develop and implement strategies for improved prevention and management of banana Fusarium wilt disease worldwide			Outcome 2. Improved prevention of spread of Foc into non affected areas and countries			Outcome 3. Improved integrated management of the disease at field level	
OUTPUT 1:	OUTPUT 2:	OUTPUT 3:	OUTPUT 4:	OUTPUT 5:	OUTPUT 6:	OUTPUT 7:	OUTPUT 8:
International synergy, collaboration and knowledge sharing enhanced	Policies, strategies and awareness improved at all levels for effective prevention and management of the disease	Capacities strengthened for improved management, containment and prevention	Surveillance, early detection and monitoring approaches and systems improved	Risks assessed, and phytosanitary regulations and practices enhanced	Containment & preparedness measures developed and introduced	Germplasms, varieties and hybrids with resistance to Foc TR4 developed collaboratively	Integrated management practices and systems approach improved to suppress the disease at field level
1.1. Promote and support international and regional collaboration and networking to manage Foc globally	2.1. Develop and promote global, regional and national policies and strategies for improved prevention, preparedness and management	3.1. Strengthen technical capacities of regional and national institutions in disease prevention and management	4.1 Provide technical support and guidance for improved diagnosis, surveillance and monitoring	5.1. Conduct pest risk analysis and identify international, regional and national spread pathways	6.1. Assess and document efficiency of containment methods, tools and measures	7.1. Screen banana genepool to identify Foc TR4 resistance sources	8.1. Improve seed systems to make fungus free planting materials accessible
1.2. Organize international and regional technical consultations, workshops and meetings	2.2. Develop national and regional contingency plans through improving coordination among stakeholders	3.2. Improve human resources of national institutions in diagnosis, management and prevention	4.2. Develop and introduce early detection and warning tools, approaches and mechanisms	5.2. Assess the status of national phytosanitary regulations and make necessary improvements	6.2. Develop techniques, tools and approaches for disinfection, eradication confinement and suppression	7.2. Develop varieties and hybrids with resistance to Foc TR4	8.2. Assess and document best practices in disease management
1.3. Support technical field study exchanges and south-south collaboration	2.3. Advocate and raise awareness among stakeholders including public institutions, farmers, NGOs and industry	3.3. Conduct training for farmers and farm workers in diagnosis, management and prevention	4.3 Conduct national and regional surveys for updated disease mapping in affected and high-risk areas	5.3. Support national institutions in implementing phytosanitary measures and standards	6.3. Develop and introduce farm / community level contingency plans for improved preparedness	7.3. On-farm evaluation and deployment of promising germplasm and varieties	8.3. Develop and introduce plant and soil health promoting practices and systems approach to suppress the disease and its impact
1.4 Facilitate knowledge sharing and dissemination internationally and locally	2.4. Analyse and develop financial arrangement options that can help prevention and management	3.4. Strengthen infrastructure of national institutions in surveillance, management and prevention	4.4 Facilitate information sharing on disease occurrence and impact	5.4. Assess current and potential socio economic impacts of the disease on production and livelihoods	6.4. Introduce and disseminate and Implement measures and practices containment and suppression	7.4. Collect, characterize and conserve genetic resources in search for Foc TR4 resistance	8.4. Promote bio-diversification and integrated disease management practices to improve resilience in different production systems