Panama TR4 Program Response Strategy

Version 1.0, 10 August 2020

Please note: This document has been redacted to protect privacy and confidentiality
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Panama TR4 Program Response Strategy

1 Aims and objectives

1.1 Aim of the Response Strategy

This Response Strategy (Strategy) aims to assist the Panama TR4 Program Management Board (Board) to make strategic decisions relating to the control and containment of Panama disease tropical race 4 (Panama TR4, the disease).

The Strategy includes general background information and an overview of the phased approach for disease management used by the Panama TR4 Program (Program).

The Strategy will also consider what triggers may propel the management of Panama TR4 from the Managed Response phase into the Transition to Management and Management phases.

1.2 Aim of the Panama TR4 Program

The aim of the Program is to deliver activities in accordance with the strategic direction set by the Board to control and contain the spread of Panama TR4 in Queensland, in order to protect the banana industry and the community, maintain market access and minimise economic losses.

1.3 Objective of the Response Strategy

A Panama TR4 Program Response Strategy was initially developed within the Emergency Response phase and included activities for control and containment that supported the move toward the Managed Response phase on 1 September 2015.

This updated Strategy has been approved by the Panama TR4 Program Management Board. While the overarching purpose of the Program to control and contain the disease has not fundamentally changed since the Emergency Response phase, there have been adjustments to the aims and objectives of the Program and the response over time. This document acknowledges the activities carried out in alignment with previous Program objectives and uses current Program objectives to direct strategic decision making for the management of Panama TR4 into the future.

The current objectives of the Program are to:

1. Ensure surveillance and control and containment activities are delivered in accordance with the legislated biosecurity programs:
   a) Surveillance Program for Panama TR4 – Detection of disease in Queensland under the Biosecurity Act 2014; and
   b) Surveillance Program for Panama TR4 – Monitoring and Compliance, Queensland under the Biosecurity Act 2014.
2. Identify and establish efficiencies within the delivery of the control and containment response.
3. Encourage the uptake of biosecurity measures by growers through communication and stakeholder engagement strategies.
4. Assist the industry and stakeholders to build capacity to control and contain Panama TR4 over the long-term.
2 Phased Approach

The Program uses a four phased approach for the management of the disease (see Figure 1):

1. the Emergency Response phase;
2. the Managed Response phase;
3. the Transition to Management phase; and
4. the Management phase.

Figure 1: Four phased approach for disease management used by the Panama TR4 Program (Source: ACIL Allen Review)

2.1 Emergency Response phase

In March 2015 Panama TR4 was first detected in Queensland on a commercial banana growing property in the Tully Valley, North Queensland. This property, known as 1IP (infested property), and an additional property known as 2SP (suspect property) were both quarantined. At this time, the Chief Biosecurity Officer (CBO) declared an Emergency Response to the incursion.

Activities undertaken during the Emergency Response phase required significant investment by the Government to enable Biosecurity Queensland (BQ) to respond effectively to the outbreak. Activities were conducted in accordance with the requirements of the Emergency Plant Pest Response Deed (EPPRD). Activities included, but were not limited to:

- Development and implementation of surveillance, tracing, decontamination, sampling, diagnostics and other protocol documents.
- Establishment of quarantine and movement controls on infested and suspect properties.
- Regulated movement of risk materials from IPs.

2.2 Managed Response phase

The initial Emergency Response transitioned to the Panama TR4 Program on 1 September 2015. At this time, the Emergency Response phase moved into a Managed Response phase with the objective of controlling and containing the disease in order to buy time for industry adaptation and allow for further research into resistant varieties.

\[\text{\textsuperscript{1}}\text{ ACIL Allen Consulting, 2018 'Panama TR4 Program Review – Final Report', ACIL Allen Consulting, Victoria}\]
Control and containment activities during the Managed Response phase have included:

- Ongoing, regular surveillance of IP’s and high-risk properties.
- Continued tracing and risk assessments that help to refine risk pathways.
- Destruction of infected plants and the implementation of destruction zones to limit the spread of the pathogen.
- Building the capacity of IPs to self-manage the biosecurity risks posed by the disease and continue operating under their Notice of presence of Panama disease tropical race 4 (notice).
- Communication and engagement activities to raise awareness of the disease and ways to minimise its spread with a focus on encouraging the uptake of on-farm biosecurity measures.
- Undertaking risk assessments to ensure that control and containment activities minimise disease spread.
- Manage the corporate requirements of a government led response Program.

A successful Interstate Certification Assurance (ICA) arrangement was also established during this phase to allow IP growers to certify their own fruit as free of soil and plant material in order to maintain market access.

During this phase surveillance has been carried out on 100% of banana properties in the northern banana biosecurity zone (NBBZ), which occupies the area of Queensland from Rollingstone to north of Cooktown. This achievement, along with the experiences and knowledge gained over the past five years, has given the Program a good indication of where control and containment efforts could be focussed in future years.

Since the Program entered the Managed Response phase in September 2015, Panama TR4 has been detected on three additional properties, 169IP, 89IP and 652IP. All five properties (1IP, 2SP, 89IP, 169IP and 652IP) are under a notice issued under section 58 of the Biosecurity Regulation 2016 (Qld.) (Regulation). The Program works directly with these properties to ensure that effective control and containment is achieved, while maintaining market access.

At the time of writing, no further properties in Queensland have been confirmed with Panama TR4 and the Program remains in the Managed Response phase.

2.3 Transition to Management phase

In 2018 an independent review of the Program recommended the Program move from the Managed Response phase to the Transition to Management and Management phases of the response.

As of January 2020 the Program remains in the Managed Response phase. However, in April 2019, the Government received a written commitment from the ABGC to share the responsibility for funding, governance and delivery of the Program until 30 June 2023. The collaborative agreement is formalised through a Cost Sharing Deed and a Memorandum of Understanding.

The agreements support the establishment of the Board which will comprise of equal representation from the ABGC and the Government. The Board will be responsible for providing strategic direction to the Program.

It is expected that the Program’s operation under the agreement until 30 June 2023 will drive shared responsibility and capacity building objectives. As of 1 July 2021 it is anticipated that the ABGC will begin to take on additional responsibilities for the operational delivery of the Program and move the response into the early stages of the Transition to Management phase.
Among the factors that would predicate a transition are the triggers proposed in section 6 of this Strategy. Due to the somewhat unpredictable nature of the situation and the disease itself, this section is not exhaustive and may require review and updates as necessary.

2.4 Management phase

The Management phase will be triggered when industry management of the disease becomes the most appropriate long-term management method. At this point, Government will no longer have primary responsibility for managing the disease.

The exact time or context in which this will happen is largely unknown, and may depend on various factors (i.e. rate and extend of spread, progress of industry adaptation and resilience). However, it is expected that the ABGC will adopt additional responsibility for the delivery of the Program by 2023 in order to move the response into the Management phase.

Any decision made about progressing to the Management phase will require consideration by the Board and significant communication with Industry.

3 Current status of the incident

3.1 Extent of Incident

At the time of writing, five properties are under a notice. Four of these properties were given a notice based on actual knowledge that the disease was present, and one property was given a notice based on reasonable belief there is a significant risk that the disease is present due to close links with one of the known IPs.

1IP and 2SP are no longer used for growing bananas or any other agricultural purpose. All operations have ceased on these properties. The three remaining IPs continue to operate in accordance with the risk minimisation processes and procedures outlined in their notice.

Scientific and epidemiological information does not provide the Program with a concrete prediction of how the disease has or will spread. Therefore, tracing activities to identify the potential pathways by which Panama TR4 may have spread between properties, and to determine how the disease may have spread within a property’s boundary, are ongoing.

Tracing activities completed during the Emergency Response phase identified 105 commercial banana properties with links to the initial quarantined property through the movement of risk items such as machinery, equipment and plant material. These properties represent over 70% of the commercially planted banana area in Far North Queensland. This indicates an extremely high level of connectivity within the industry prior to the detection of Panama TR4 in Queensland.

Tracing activities completed during the Emergency Response phase identified an extremely high level of connectivity between the initial quarantined property and other banana growing properties in Queensland due to the movement of risk items such as machinery, equipment and plant material. Since the initial detection of Panama TR4 in Queensland, this connectivity has reduced due to a number of banana growing properties and service providers implementing biosecurity measures.

Given the number of properties, long latency period, area under surveillance, potential for wet weather events and requirements for diagnostic testing, it is impossible to predict how long it will take for the disease to spread.

3.2 Decision on feasibility of eradication

In April 2015 the Consultative Committee on Emergency Plant Pests (CCEPP) and the National Management Group (NMG) agreed that it is not feasible to eradicate Panama TR4
from Queensland due to the limited treatment measures available, the ability of the disease to survive in soil for long periods and an inability to effectively control all disease pathways.

Biosecurity measures to contain the disease to the current IP’s will not provide a permanent containment solution. However, even if the disease becomes widespread eventually, a control and containment approach should provide sufficient time for industry adaptation and capacity building, and advances in scientific research.

Following the introduction of chlamydospores to a banana growing property, infestations have the potential to remain undetected for two to three years. Chlamydospores may remain viable in soil for decades. Therefore, surveillance, in some form, would need to continue in order to:

- a. delimit the extent of the current infestation;
- b. monitor spread of the infestations; and
- c. ensure early detection of infected plants on IPs; allowing for prompt destruction, and minimising the opportunity for inoculum production.

Surveillance during the Managed Response phase has relied upon routine inspection of banana growing properties by Program staff, as well as growers reporting suspect plants and follow up investigation of these reports by Program staff.

3.2.1 Availability of control methods

As effective chemical, cultural and biological control measures are currently not available there are somewhat limited options for the management of Panama TR4 at this time.

The fungus cannot be eradicated from the soil once it is present, and exclusion from unaffected banana growing properties is difficult once the pathogen is present in a growing area. Early detection of the disease, destruction of infected plants and the implementation of containment measures are essential to control the disease and slow its spread.

Current activities delivered by the Program such as surveillance, tracing and epidemiological analysis, inform disease pathways and assist in the monitoring of the extent of disease spread.

3.2.2 Economic feasibility

The importance of the banana industry to regional north Queensland, and the Queensland economy overall, is significant. The potential impact of Panama TR4 to the Queensland and regional economy is such that ongoing investment by stakeholders is warranted to address the needs of the commercial banana industry in the face of this disease.

Protocols have been established to limit disruption to trading on any new IPs. The Program works closely with the existing IPs to ensure that operations can continue as normal while ensuring compliance with the risk minimisation processes and procedures outlined in the notice.

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3 Pegg, K and Coates L, 2016, ’The Epidemiology of Fusarium Wilt’, Department of Agriculture and Fisheries, Queensland
4 Response Strategy

The following activities may be implemented during the Transition to Management phase or in preparation for the Management phase. Each activity aligns to the objectives of the Program and support the key activities outlined in the Programs Business Plan.

4.1 Transition to Management

The following section outlines the current four objectives of the Program and associated activities necessary for movement toward and/or during the Transition to Management phase.

4.1.1 Effectively deliver operational activities for surveillance and the control and containment of Panama TR4 in Queensland, under the legislated biosecurity programs.

- Continue to maintain an effective sampling and diagnostic capacity to confirm the presence or absence of Panama TR4.
- Continue tracing and surveillance for the detection of Panama TR4 and to monitor the spread of known infestations in line with the Programs Tracing and Surveillance Strategy.
- Perform compliance verification activities on IPs and monitor compliance with the legislative tools enforced under the Biosecurity Act 2014 (Qld) in line with the Programs Compliance Strategy.
- Regulate the movement of Panama TR4 matter, carriers and risk items from infested and suspect properties.
- Consult with Agri-Science Queensland (ASQ) and the ABGC to evaluate and refine protocols that effectively limit the spread of the disease.
- Continue destruction of infected plants and the establishment and maintenance of surrounding destruction zones.

4.1.2 Identify and establish efficiencies within the delivery of the control and containment response to Panama TR4 in Queensland.

- Continue research and development (R&D) to establish efficiencies for early detection of diseased plants, including the adoption of remote sensing technologies.
- Review and revise surveillance, sampling, decontamination and other protocols, and undertake relevant research, to reflect any changes to approach and responsibility.
- Continue the analysis of risk pathways and tracing linkages and determine how these can be used to more effectively manage pathways of disease spread and resource allocation.
- Monitor the effectiveness of existing control and containment methods to ensure that inoculum production is minimised and the biosecurity risk is effectively managed.
- Continue to investigate legal instruments (i.e: zones, code of practice) to determine the most effective and efficient way of managing Panama TR4 into the future.
- Support industry involvement in control and containment activities that build industry capacity and capability for managing Panama TR4 and support the principle of shared responsibility.
4.1.3   Encourage the uptake of biosecurity measures by growers through communication and stakeholder engagement strategies.

- Support ABGC and ASQ as they develop and deliver on-farm biosecurity programs and engagement activities to assist non-IPs to remain disease-free and encourage the uptake of biosecurity practices.
- Continue to develop and deliver communication and engagement strategies, in consultation with ABGC and ASQ, on the importance of on-farm biosecurity and encourage the uptake measures based on the learnings from the 2019 grower social research project.
- Communicate improved and scientifically validated biosecurity practices to industry.
- Use key banana industry suppliers and contractors to filter biosecurity and Panama TR4 messages through to growers.
- Establish mechanisms to receive and respond to suppliers and contractors’ feedback on growers’ barriers and motivators to on-farm biosecurity.

4.1.4   Assist the industry and stakeholders to gain the knowledge and motivation to control and contain Panama TR4 in the long term.

- Continue communication and education activities to ensure that all banana growing properties, the wider banana growing industry and the community are aware of the disease and how they can meet their general biosecurity obligation (GBO) under the Biosecurity Act 2014 (Qld).
- Continue to develop and deliver communication and engagement strategies, in consultation with the ABGC and ASQ that encourage early detection of the disease.
- Develop education material to facilitate a transition to industry management of the disease in the long term.
- Ensure that concise, relevant and accurate Panama TR4 information and updates are always available for industry and stakeholders.
- Commit to a transitional approach to industry-led management of the disease, where capability and capacity is built over time.
- Identify opportunities to network with banana industry suppliers and contractors to help them build their understanding of the disease and the importance of effective biosecurity.

5   Timeframe for review

The Board will be required to review and approve the content of this Strategy.

This Strategy will be subject to a 12 month review period or earlier upon further detection of the disease on a new property, or if one or more of the triggers in section 6 are met.

Ongoing management and review of the Strategy will be the collective responsibility of the Board and the Program. This document should be reviewed to ensure that the content and activities continue to meet the ongoing needs of the Board and reflect the Programs objectives.
6 Response Strategy triggers

During the Managed Response phase, a number of factors may trigger a review of the Strategy. These triggers will determine whether the Managed Response phase should continue (either with or without modification), or if it is appropriate to move into the Transition to Management or Management phase.

The Program has triggers in place which have been informally accepted since the Panama TR4 response began in 2015. In June 2019, these triggers were presented to and accepted by the Collaborative Agreement Working Group (CAWG).

Currently, these same factors may trigger a review of the Strategy. The current triggers are:

- Five percent of commercial banana growing properties, scattered throughout the NBBZ, are infested (around 13 properties).
- Fifteen percent of banana production areas in the Tully district are under quarantine due to infestation. The Tully district includes Mission Beach, El Arish, Murray Upper and Kennedy (see Appendix 2 for a map of this district).
- A major aggregation of infested properties exists in more than one commercial banana production district in the NBBZ.
- Some infestation being present in all or most of the major commercial banana production districts in the NBBZ.
- There is a positive detection of the disease in Queensland outside of the NBBZ.
- No further detections of the disease in Queensland within five years of the last commercial banana growing property with a detection.

Commercial banana production districts in the NBBZ include the Tully district, Cairns district, Mareeba and Atherton district, Innisfail district and Cook Shire district (see Appendix 2 for a map of each district). The number of infested properties in these districts will impact whether a trigger has been reached or not.

Note: Appendix 3 outlines the current4 disease incidences by district.

If a trigger is reached, the decision to undertake a review should be made collectively by both parties and agreed by the Board. The implementation of any outcomes from a review will be subject to mutual agreement.

An appropriate risk based decision making tool should be used to ascertain the potential impacts or consequences associated with the above, or any other factors which may trigger consideration of a review.

Potential outcomes of a review may include:

- The Managed Response phase continues in its current form.
- There is modification to aspects of the Managed Response phase in response to the altered risk which has become evident.
- It is agreed that continuation of the Managed Response phase is no longer appropriate, and that a transition towards long-term management is appropriate. This may result in the initiation of the Transition to Management or Management phase.

Notwithstanding the above, even where the infestation remains limited to one or very few IPs over an extended period, industry resilience may progress to a point that industry management becomes more appropriate in the long term.

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4 This information is current at the time of writing this strategy.
Alternatively, it may be agreed at some point that it is no longer appropriate for the Government to have primary responsibility for delivering the Program. Therefore, the decision by stakeholders to transition to the Management phase may not rely upon any triggers alone. It is expected that once the decision to transition has been made, the Transition to Management phase will take several months. Any decision to commence this phase must be made by the Board, given that responsibility for delivering key activities will change both during and following transition.
References


Beckman, C.H. 1990, ‘Host responses to the pathogen In: Fusarium wilt of banana’, APS Press, St Paul, Minnesota, USA

Department of Agriculture and Fisheries, National Management Group: not feasible to eradicate Panama disease in Queensland, 2015


Horticulture Innovation Australia Limited, Fusarium wilt Tropical Race 4 – biosecurity and sustainable solutions, 2018

Meldrum, R A 2012, ‘Epidemiological and biological studies of Fusarium wilt of banana caused by Fusarium oxysporum f. sp cubense tropical race 4’, The University of Queensland, School of Agriculture and Food Sciences

Pegg, K and Coates L, 2016, ‘The Epidemiology of Fusarium Wilt’, Department of Agriculture and Fisheries, Queensland


Stover, RH 1962, ‘Fusarium Wilt (Panama disease) of Bananas and other Musa species’, The Commonwealth Mycological Institute, Kew, Surrey, pp. 67 - 72
8 Appendix 1 Details of the plant pest

8.1 Emergency Plant Pest (EPP) details

*Fusarium odoratissimum* (syn: *Fusarium oxysporum* f. sp. *cubense*) tropical race 4 (Foc TR4) is the causal agent of Panama disease tropical race 4.

8.2 Affected hosts

The affected host is banana (*Musa acuminata* ‘Cavendish’), although a number of other plant species can also host the pathogen. Weed hosts are thought to play a role in the persistence of the fungus in the absence of susceptible banana hosts. Foc TR4 has been isolated from the roots of grasses and other weeds on affected banana properties where tropical race 4 (Hennessy et al., 2005; Meldrum, 2012) has been present.

The pathogen can survive in the soil in several different ways such as, by colonising dead organic matter and producing long-lived chlamydospores. Although the level of survival in infested soils may be low after 30 to 40 years, the pathogen will still infect banana plants established in the soil.

8.3 Diagnostic details

On March 2015, molecular diagnostic (PCR- polymerase chain reaction) testing on cultures derived from a sample taken from a banana plant on the Tully property (1IP), confirmed the detection of Foc TR4. Diagnostic testing by a second independent laboratory confirmed this result. Biological confirmation based on vegetative compatibility group (VCG) testing was also conducted.

To date, the Program employs a ‘gold standard’ of diagnostics, which involves visual assessments, the isolation of fungi and culture, microscopic examination, DNA based molecular tests (including polymerase chain reaction or PCR and DNA sequencing) and a final confirmation through a vegetative compatibility group or VCG test. The VCG test provides conclusive diagnostic evidence if the disease is present.

8.4 Symptoms

In affected plants the xylem becomes reddish-brown and is eventually plugged as a result of the plants response to the pathogen. This impedes water and nutrient transport, resulting in the “wilted” appearance of plants. External symptoms begin with an irregular yellowing of leaf margins. The oldest leaves collapse at the petiole or towards the base of the midrib and hang down to form a ‘skirt’ around the pseudostem. Younger leaves remain green and upright giving the plant a spiky appearance.

Internal symptoms will present as discoloured vascular stands in the pseudostem. Currently, internal examination is only undertaken when external symptoms are consistent with Panama TR4.

On north Queensland banana growing properties, early detection of an infected plant may be difficult. This is due to plants usually being well hydrated and therefore less likely to show wilt symptoms. In addition, the older leaves, where symptoms first appear, are usually removed during the intense de-leafing program to reduce Yellow Sigatoka and other leaf disease inoculum.

As the disease progresses symptoms will become more obvious. After the plants die, they usually remain standing for one to two months before they decay and topple.
8.5 Description and affect

8.5.1 Disease cycle

Early and rigorous containment has been implemented at all IP’s in the Tully Valley. However, due to the long incubation period of the disease, it is likely that the pathogen was present several years before symptoms were detected.

The fungus produces microconidia which are carried upwards through the water stream. The upward stream can be temporarily blocked when the spores lodge on the perforated vessel end walls. The spores germinate and the hyphae grow through the perforations to produce more spores. The whole xylem system and surrounding tissue is eventually colonised once the plant is stressed or killed by an internal water deficit. The fungus grows out of the xylem and invades the associated parenchymal tissues where it produces many chlamydospores. All infected plants, even those in good health and growing under ideal conditions, will succumb to the effects of the disease. External symptoms may appear more readily during hot dry periods, when an evaporative stress is imposed on the plant. Symptoms develop much more slowly during the cooler months of the year when growth is also reduced.

8.5.2 Disease spread

Panama TR4 is disseminated in several ways. The most effective means of dissemination are by infected or contaminated planting material and through infested soil or water. Panama TR4 can be moved on contaminated tools, farm equipment, vehicles and footwear or by wildlife such as rats, feral pigs and birds who may transfer infected soil.

Beckman, C.H. 1990, 'Host responses to the pathogen In: Fusarium wilt of banana', APS Press, St Paul, Minnesota, USA
Appendix 2 Maps of commercial banana production districts in the NBBZ
10 Appendix 3 Infested commercial banana growing properties by district
### 11 Approval and revision history

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**Issue/approval date:** 10/08/2020

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<th>Issue Date</th>
<th>Amendment details</th>
<th>Editor/s</th>
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<tr>
<td>1.0</td>
<td>10/08/2020</td>
<td>First issue</td>
<td>Luciana Arcidiacono</td>
<td>Panama TR4 Program Management Board</td>
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