

Frequently asked questions about Panama TR4

Understanding Panama disease tropical race 4 (Panama TR4)

What is Panama disease tropical race 4?

Panama disease tropical race 4 (Panama TR4) is considered one of the most destructive diseases of banana plants worldwide. It is caused by the soil-borne fungus *Fusarium oxysporum* f. sp. *cubens*.

The fungus produces two main type of spores: Conidia is produced in large numbers and is dispersed rapidly, and Chlamydospores which are hardy and can survive in the soil undetected for decades.

More information: Biosecurity Queensland's factsheet - What is Panama TR4?



Does Panama TR4 affect any other fruit plants?

No, Panama TR4 does not affect other fruit crops; however, it infects most banana varieties including the main commercial variety Cavendish.

How does PanamaTR4 affect banana production?

Plants affected by Panama TR4 rarely produce marketable bunches. Once established, the fungus persists in the soil for many years, making the production of susceptible banana varieties such as Cavendish economically unviable.

Where is Panama TR4?

Panama TR4 has had a devastating effect on banana crops around the world, particularly in Asia and the Middle East. In Australia, it was first detected in Darwin in 1997, and in the Tully Valley Far North Queensland 2015.



How is it spread?

Panama TR4 is easily spread in infected banana plants or plant material and in contaminated soil and water. Anything that moves soil, such as machinery and equipment, vehicle, tools, clothing and footwear, can carry and spread the disease. The disease can also be spread:

- by natural processes such as heavy rainfall and floods
- by wildlife such as rats, bandicoots, feral pigs and wading birds
- over short distances by root to root contact
- from parent banana plant to suckers
- potentially by insects such as the banana weevil borer.

For more information visit biosecurity.qld.gov.au or call **13 25 23**

How does Panama TR4 infect banana plants?

Panama disease enters via the roots. Fungal spores germinate and use their filaments (hyphae) to enter the roots through natural openings or wounds, spreading through the corm and into the stem.

Until the fungus blocks the vascular tissues carrying the water and nutrients, there might not be any signs that the plant is infected. It might take weeks or a few months for signs to show depending on the environmental conditions (such as wet, dry, or extremely hot), and the plants age.

As blockage of the vascular tissue develops the plant yellows, wilts and eventually dies.

The disease does not affect the fruit so bananas are still good to eat.

Can Panama TR4 be eradicated?

Panama TR4 cannot be eradicated by any biological or chemical controls.

Early detection, rapid destruction of infected plants and on-farm restrictions are the only way to control and contain the disease.

Reporting symptomatic plants immediately to Biosecurity Queensland on 13 25 23 safeguards farm viability and protects the wider industry.

What are the signs of Panama TR4 in a banana plant?

- Yellowing leaf edges in the early stages
- Brown or black leaf edges
- Yellowing across the whole leaf
- Wilted, collapsed and dying older leaves forming a “skirt” around the stem
- Young leaves possibly still green and upright while older leaves and the stem are affected
- Split stem base (but not always) through two or three layers initially – later, deeper and higher up.

What should people do if they suspect they have seen Panama TR4?

If you see signs of Panama TR4, contact Biosecurity Queensland on 13 25 23 immediately.

Early detection, rapid destruction of infected plants and on-farm restrictions are the only way to control and contain the disease. If Panama TR4 is left unchecked on a farm, the disease can spread rapidly through people and vehicle movement.

It is a legal requirement to report suspicious plants, within 24 hours, under the *Biosecurity Act 2014* that classifies Panama TR4 as a Category 1 restricted matter.

Can growers cut or remove a suspect plant?

No. Cutting stimulates the fungus, promoting spore production and increases the risk of the disease spreading on and off the property. It can also make it harder to get samples for diagnostic testing. If you have cut down a symptomatic plant, contact Biosecurity Queensland immediately on 13 25 23.

What can banana growers do to protect their farm from Panama TR4?

Good on-farm biosecurity measures are critical to not only protect farms from Panama TR4 but to also contain the disease if it is detected on the farm.

Managing the movement of soil, water and plant material entering and exiting farms is the key to effective on-farm biosecurity. Some on-farm biosecurity measures can include:

- Zoning. It can provide simple and cost-effective biosecurity layers to manage disease risk pathways onto and off a farm.
- Footwear exchange stations and foot baths.
- Cleaning and disinfecting all vehicles and machinery.
- Setting up a clean access road.

More information: Biosecurity Queensland’s Grower kit.

Are there other races of Panama disease?

Yes, there are different races of the *Fusarium oxysporum* f. sp. *cabense* fungus which cause Panama disease, but not all are present in all the banana growing areas of Australia. The different races affect different banana varieties.

Race 1 infects a range of varieties Lady Finger, Sugar and Ducasse, but not Cavendish¹.

Race 2 infects cooking bananas like Bluggoe and Blue Java.

Race 3 infects only Heliconia species not bananas.

Race 4 infects most varieties including Cavendish, Lady Finger and Ducasse.

There are two important strains of Race 4.

Tropical race 4 occurs in tropical growing regions, like Far North Queensland.

Subtropical race 4 occurs in subtropical regions and usually only produces signs in Cavendish after a period of cold stress. Subtropical race 4 has been under quarantine control in south east Queensland, northern New South Wales and Western Australia for some time.

Can people still eat bananas?

Panama TR4 does not affect the fruit, so bananas are safe to eat.



¹A unique population of the fungus, more closely related to Race 1 than Race 4, has infected Cavendish at Carnarvon, Western Australia

Detecting and diagnosing Panama TR4



How do you detect Panama TR4?

There is currently no way to test for Panama TR4 in soil or water. Early identification of plants showing signs of the disease and subsequent sampling and laboratory testing of these plants are the only way to know if the disease is present.

Surveillance for Panama TR4

Biosecurity Queensland's Panama TR4 Program has been undertaking regular surveillance since the disease was first detected in Far North Queensland in 2015. Under the Biosecurity Act 2014, the Program is authorised to determine the presence and extent of Panama TR4 in Queensland, monitor compliance with the Act and subordinate legislation, and to enter properties and undertake activities to detect and diagnose Panama.

More information: Biosecurity Queensland's factsheet: Surveillance for Panama TR4.

How important is surveillance by growers?

Regular checking of plants by growers is critical for early detection and containment. Surveillance can be integrated into regular farming practices through training staff how to identify and report suspect plants.

More information: Biosecurity Queensland's factsheet: Check your plants for Panama TR4.

How is Panama TR4 diagnosed?

Biosecurity Queensland undertake a surveillance program and growers check their plants to look for signs of the disease. When a plant showing signs of Panama TR4 is identified, Biosecurity Queensland surveillance staff and authorised officers visit the property to assess the plant for Panama TR4.

- **A visual inspection.** Plants are inspected for external signs of Panama TR4 including leaf yellowing, wilting and stem splitting. If found, the grower is advised that suspect plants have been found. The plant is then cut to look for internal signs – a yellow, reddish or brown-black discolouration of the stem or corm's vascular tissue. Photos are taken of intact and cut plants.
- **Collect and send samples.** Samples of plant material are taken from any discoloured tissue that is found in the stem or corm as the plant is systematically examined. The plant or the stump is then marked and a sign placed indicating that samples have been taken. Samples are securely packaged, labelled, and sent with a secure chain of custody to a specialised laboratory.
- **Laboratory testing.** A range of laboratory tests are undertaken which can take up to 6 weeks.
- **Give the results.** The results of the tests are given by phone and confirmed by a letter and a diagnostic report. If positive for Panama TR4 the grower will be advised how to control and contain the disease. Biosecurity Queensland also notify key stakeholders of the positive result, without giving away identifying information on the grower or the property.

More information: Biosecurity Queensland's factsheet - Diagnosing Panama Disease

What happens if test results are positive?

When test results are positive, a Biosecurity Queensland officer calls the grower directly and confirms via a formal letter and diagnostic report.

The grower is given a Notice of presence of Panama disease tropical race 4 (notice), which will contain conditions that the grower will need to meet to protect their farm and the broader industry.

A small team of Biosecurity Queensland staff will work closely with the grower to provide practical advice and assistance on how they can best meet the requirements of the notice. They will do their best to ensure the business can continue trading.

Can other fruit or crops be grown on infested properties in the future?

Alternative crops may be grown successfully on blocks infested with Panama TR4, however, the spores remain in the soil for decades. Any movement of infected soil by machinery, equipment, tools, animals or people would still present a risk for other banana farmers in Queensland. Strict biosecurity measures would still need to be implemented and maintained to prevent the risk of spread of Panama TR4 to other banana farms.



Are there Panama TR4 resistant bananas?

Are there any varieties of Cavendish resistant to Panama TR4?

Yes, but their level of resistance varies and most have other characteristics that result in them yielding significantly less than Williams Cavendish, the most popular Cavendish variety in Australia.

What disease-resistant varieties are currently available in Australia?

Currently there are about 10 Cavendish varieties in Australia with varying levels of resistance to Panama TR4. Some of these varieties have only recently passed through the quarantine system and are yet to be tested to determine their level of resistance and productivity. All of the varieties that have been tested so far have some deficiencies in yield compared to Williams or are not highly resistant and will eventually succumb to the disease.

There are also a number of non-Cavendish banana varieties with varying degrees of resistance however, these varieties have not been fully evaluated for commercial production, post-harvest defects and consumer appeal.

All these varieties have come from overseas breeding programs and their eventual use for commercial production will require a licencing agreement with the agency or institution that conducts the breeding programme.

There has been significant investment by the Queensland and Australian governments and the Australian banana industry to progress research and development projects that focus on developing banana varieties that balance resistance to pest and disease with high yield and good eating quality.

Research and breeding trials into genetically-modified varieties are also ongoing, however, it may take many years to identify suitable replacements for today's commercial Cavendish crops.

How long does it take to evaluate new varieties?

It generally takes two years for new varieties of bananas to pass through Australia's post-entry quarantine facility, which makes sure exotic pests and diseases are not introduced into Australia.

Once passed by the quarantine facility, new varieties of banana plants are screened for resistance to disease. This process is estimated to take two years, then further research is needed to investigate production requirements, post-harvest issues, supply chain suitability and marketing potential.



Panama TR4 and the law

What does the law say about Panama TR4?

In Queensland the *Biosecurity Act 2014* identifies Panama TR4 as a Category 1 restricted matter.

This means, diseased banana plants or plants suspected of Panama TR4 must be reported to Biosecurity Queensland within 24 hours. All people and business have a responsibility to protect the industry and limit the spread of the disease.

More information: Biosecurity Queensland's factsheet – Panama TR4 and the law.

Reporting symptomatic plants immediately to Biosecurity Queensland on 13 25 23 safeguards farm viability and protects the wider industry.