Can Fungicides Help Stop Panama Disease in Bananas?

Introduction

Bananas are one of the world's most important food crops. However, banana farms around the world are threatened by a disease called **Panama disease**, which is caused by a fungus known as **Fusarium Tropical Race 4 (TR4)**.

TR4 attacks the roots and stems of banana plants, causing leaves to yellow and wilt. Eventually, infected plants die. The fungus can survive in soil for many years, making it difficult to control.

Many scientists believe that fungicides do not work well against TR4. This study tested whether that belief is true.

Purpose of the Study

Researchers wanted to determine:

1. Whether TR4 is resistant to commonly used fungicides.
2. Which fungicides are most effective at stopping the fungus.
3. Why some fungicides fail while others work.

How the Study Was Done

Scientists tested:

- **21 fungicides**
- **7 different fungicide groups**
- Multiple forms of the fungus, including:
    - Hyphae (growing fungal threads)
    - Microconidia (small spores)
    - Macroconidia (large spores)
    - Chlamydospores (thick-walled survival spores)

The researchers first tested fungicides in laboratory cultures. They then tested promising fungicides on banana plants growing in soil.

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An Important Discovery

The researchers found that **all forms of TR4 can cause Panama disease**. Whether the fungus started as spores or as growing fungal threads, infected banana plants developed similar disease symptoms.

This means the fungus has several ways to spread and infect plants.

Why Many Fungicides Failed

The scientists tested several common fungicide groups, including:

- Azoles
- Strobilurins
- SDHIs (succinate dehydrogenase inhibitors)

These fungicides usually work well against many plant diseases. However, TR4 was surprisingly resistant to them.

The researchers discovered that a small group of fungal cells survived treatment. They called these cells **"persisters."**

These persister cells could:

- Produce extra copies of important enzymes.
- Pump fungicides out of their cells.
- Activate detoxification systems that helped them survive.

Because of these survival mechanisms, many common fungicides were unable to completely kill the fungus.

Which Fungicides Worked Best?

The study found that **multi-site fungicides** were generally more effective than single-site fungicides.

Most Effective Treatments

The best results came from:

- **Captan**
- Several compounds called **lipophilic cations** (special chemicals that attack fungal cells in multiple ways)

When these treatments were tested on banana plants, they significantly reduced Panama disease symptoms.

Why Multi-Site Fungicides Worked Better

Single-site fungicides attack one specific target inside a fungal cell.

Multi-site fungicides attack several targets at once.

Because TR4 can protect itself against one attack, it often survives single-site fungicides. However, it has a much harder time defending itself against several attacks happening at the same time.

What This Means for Banana Farmers

The results suggest that some fungicides may help manage Panama disease after all.

Although many commonly used fungicides were ineffective, captan and certain multi-site treatments reduced disease in greenhouse experiments. These products could become part of future strategies for protecting banana crops from TR4.

Important Note for Students

This study does **not** show that all fungicides work against Panama disease.

In fact, one of the main findings was that **many popular fungicides failed to control TR4** because the fungus has natural ways to survive them. Only a few treatments showed strong disease suppression.

Key Takeaway

The fungus that causes Panama disease can survive many common fungicides. However, the researchers found that certain multi-site fungicides, especially captan, were able to reduce disease and may help protect banana crops in the future.

Note: This article has been shortened and simplified using ChatGPT.

Link to original article: https://pmc.ncbi.nlm.nih.gov/articles/PMC9584521/

Cannon, S., Kay, W., Kilaru, S., Schuster, M., Gurr, S. J., & Steinberg, G. (2022). Multi-site fungicides suppress banana Panama disease, caused by Fusarium oxysporum f. sp. cubense Tropical Race 4. *PLoS Pathogens*, *18*(10), e1010860.

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