

# Proud 3® Controls Pineapple Black Rot

## Lab Report

Research by Phytopathology and Nematology Diagnostics Clinic, La Molina National Agrarian University, Lima, Peru

### Problem

*Thielaviopsis paradoxa* is a pathogen that causes severe damage in several financially significant crops, including pineapple (*Ananas comosus*), sugar cane (*Sacharum officinalis*), oil palm (*Elaeis guineensis*), and coconut (*Cocos nucifera*), among others.

In the case of pineapple, this pathogen causes considerable loss between harvest and post-harvest, both for fresh consumption and industry-use fruits. The fungus mainly develops when the stalk is cut after the harvest; this infection can also appear as a result of injuries or bruises caused by inappropriate handling and transportation. When the infection enters through the stalk, the fungus mycelium moves upward and quickly rots the fruit core (referred to as "black rot"). Once infected, the fruit can entirely rot within 5 to 7 days.

### Objective

The objective of this study was to conduct an *in vitro* assessment of the effectiveness of two doses of three fungicides to control the "pineapple black rot" caused by *Thielaviopsis paradoxa*.

### Materials and Methods

The study used a growing medium of Potato Dextrose Agar (PDA), which was inoculated with a slice of the studied fungus. Incubation temperature was 77°F (25°C) for seven days. Radial growth of the pathogen was measured during this period. The effectiveness of each fungicide was measured through Abbott's formula:  $E = (\text{Test} - \text{Treat}/\text{Test}) \times 100$ ; where E = Effectiveness (%), Test = mycelial growth on the sample (cm), Treat = mycelial growth in treatment (cm). The treatment design used in this trial was randomized, with four repetitions.

Six treatments plus a control were studied, including PROUD 3® and two sources of *Bacillus subtilis*. Treatments were designated as follows: T<sub>1</sub> and T<sub>2</sub>, PROBAC BS (*Bacillus subtilis*), at 0.1:100 and 0.3:100 dilution ratios; T<sub>3</sub> and T<sub>4</sub>, CUSTOM BIO B5 (*Bacillus spp.*), at 0.1:100 and 0.3:100; T<sub>5</sub> and T<sub>6</sub>, PROUD 3® at 0.75:100 and 1:100. All doses have been calculated as per the formulation, and were established according to recommendations on the manufacturers' labels. T<sub>7</sub> is the control without fungicide.

Disease incidence (number of leaf spots per plant) and severity (average visual estimate of the percentage of leaf area affected) were determined at 0, 3, 5, and 7 days after application. The analysis of variance (ANOVA) was determined using SAS v. 9.4.

### Results

Table 1 shows the results of the effect of three fungicides on the pathogen's mycelial growth (in mm) *in vitro*. Both doses of PROUD 3® showed good control of the fungus. At the 1:100 dilution dose, inhibition of mycelial growth was absolute.

**Table 1.** Effect of 2 Doses of 3 Fungicides On Mycelial Growth In *Thielaviopsis paradoxa* In Isolated, *In Vitro* Conditions On "Golden" Pineapple.

Treatment	Fungicide	Dilution Ratio	Mycelia Growth (mm)		
			3 Days	5 Days	7 Days
T <sub>1</sub>	PROBAC BS ( <i>Bacillus subtilis</i> )	0.1:100	34.0	34.3	34.5
T <sub>2</sub>		0.3:100	25.8	28.0	28.0
T <sub>3</sub>	CUSTOM BIO B5 ( <i>Bacillus spp.</i> )	0.1:100	85.0	85.0	85.0
T <sub>4</sub>		0.3:100	85.0	85.0	85.0
T <sub>5</sub>	PROUD 3®	0.75:100	0.0	4.5	8.8
T <sub>6</sub>		1:100	0.0	0.0	0.0
T <sub>7</sub>	No fungicide	0.0	85.0	85.0	85.0

Fungicide effectiveness was determined through Abbott's formula. The results are shown in Table 2. The highest effectiveness was shown by PROUD 3®, which presented a 100% control at the highest dose (1:100 dilution ratio). The second highest level of control came from the same product at 0.75:100 dilution.

**Table 2.** In Vitro Effectiveness of 2 Doses of 3 Fungicides Calculated as the Percentage of Inhibition of Mycelial Growth (mm) for *Thielaviopsis paradoxa* On "Golden" Pineapple.

Treatment	Fungicide	Dilution Ratio	Percentage of Mycelial Growth Inhibition		
			3 Days	5 Days	7 Days
T <sub>1</sub>	PROBAC BS ( <i>Bacillus subtilis</i> )	0.1:100	60	60	59
T <sub>2</sub>		0.3:100	70	67	67
T <sub>3</sub>	CUSTOM BIO B5 ( <i>Bacillus spp.</i> )	0.1:100	0	0	0
T <sub>4</sub>		0.3:100	0	0	0
T <sub>5</sub>	PROUD 3®	0.75:100	100	95	90
T <sub>6</sub>		1:100	100	100	100
T <sub>7</sub>	No fungicide	0:0	0	0	0

### Conclusion

Of the 3 products tested, only Huma Gro® PROUD 3® at the 1:100 dilution ratio was 100% effective at inhibiting mycelial growth for the pathogen *Thielaviopsis paradoxa*.