

# Effect of Fungicides on Development of Root and Crown Rot on Chile Pepper Plants Grown in Field Soil Naturally Infested with *Phytophthora capsici*

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## Abstract

*Phytophthora* blight of peppers (*Capsicum annuum*) is caused by the oomycete pathogen *Phytophthora capsici*. In Arizona, the root and crown rot phase of the disease initially can appear on plants early in the growing season in areas of the field where soil remains saturated with water after an irrigation. Disease severity can increase dramatically due to summer rains during July and August in the southeastern Arizona production area. The efficacy of the systemic fungicide mefenoxem (Ridomil Gold) for control of *Phytophthora* blight on pepper has been documented; however, in many pepper production regions, populations of the pathogen insensitive to this fungicide have developed. Other chemistries, including dimethomorph (Acrobat) as well as two new fungicides in development (Ranman and TM-459) have activity on some species of *Phytophthora* and associated diseases on crops other than pepper. The objective of the following trials was to evaluate and compare the effects of soil drench treatments with Ridomil, Acrobat, Ranman and TM-459 alone, as well as in combination treatments on subsequent development of root and crown rot on chile pepper plants grown in soil naturally infested with *P. capsici*. Three separate trials were conducted in the greenhouse. Usually, the top fresh weight of plants treated with an appropriate amount of Ranman, TM-459, or Acrobat did not differ from plants grown in sterilized soil. On the other hand, the top fresh weight of plants treated with Ridomil Gold often was not significantly different from plants grown in untreated infested soil, implying that this soil contained a population of *Phytophthora capsici* that is insensitive to this fungicide. These trials suggest that soil application of Ranman and TM-459 could effectively inhibit the development of *Phytophthora* root and crown rot on chile peppers grown in soil infested with *Phytophthora capsici*.

## Introduction

*Phytophthora* blight of peppers (*Capsicum annuum*) is caused by the oomycete pathogen *Phytophthora capsici*. Pepper production in Arizona and other states can be impacted significantly by the destructive effects of *P. capsici*. In southeastern Arizona, the root and crown rot phase of the disease initially can appear on plants early in the growing season in areas of the field where soil remains saturated with water after an irrigation. Subsequent irrigations encourage further disease development. As the crop leaf canopy develops and covers the rows within the field, the foliar blight phase of the disease may occur with the onset of the summer rainy season in July and August.

During this time, stems, leaves, and developing pepper fruits may be attacked by the pathogen.

The efficacy of the systemic fungicide mefenoxem (Ridomil Gold)) for control of Phytophthora blight on pepper has been documented; however, in many pepper production regions, populations of the pathogen insensitive to this fungicide have developed. Other chemistries, including dimethomorph (Acrobat) as well as two new fungicides in development (Ranman and TM-459) have activity on some species of *Phytophthora* and associated diseases on crops other than pepper. The objective of the following trials was to evaluate and compare the effects of a soil drench treatment with Ridomil, Acrobat, Ranman and TM-459 alone, as well as in combination treatments on subsequent development of root and crown rot on chile pepper plants grown in soil naturally infested with *P. capsici*.

## Materials and Methods

This experiment was conducted to assess the ability of some chemicals active against oomycete plant pathogens to control the development of Phytophthora root and crown rot on chile peppers caused by *Phytophthora capsici*. Naturally infested soil was collected from around diseased chile peppers within a field planting in southeastern Arizona and transported to our greenhouse at the University of Arizona Yuma Agricultural Center. Five parts of this naturally infested soil were thoroughly mixed with 2 parts Superstition sand, then this mixture was placed in a series of 1-pint capacity plastic pots (10 cm in diameter x 10 cm deep). A chile pepper seedling (cultivar TMR 23, approximately 15 cm tall) was transplanted into the soil within each pot, after which the various chemical treatments were applied by drenching the soil within each container with a 200 ml solution of each chemistry to be evaluated. Two sets of control treatments were established; pepper plants grown either in untreated field soil or sterilized field soil. A second application of chemical treatments was applied one month later. Each pot containing a pepper plant was placed in a container (11 cm in diameter x 4 cm deep), which was filled with water daily to maintain wet soil conditions that favor development of Phytophthora stem rot on pepper. Plants were maintained in the greenhouse for the duration of the trial. The experiment was terminated after about two months, when the final fresh weight of each plant top was measured. Other data collected included root fresh weight, time in days from initiation of the experiment until a plant permanently wilted, weight of pepper fruits, and the incidence of crown rot. The data collected from these other parameters generally supported the separation of treatments by plant top fresh weight; therefore, only the plant top fresh weight is presented in this report. This experiment was conducted three times in 2004. The initiation and termination date of each trial was as follows: trial # 1) September 29 to December 1; trial # 2) October 7 to December 7; and trial # 3) October 17 to December 14. The soil used in trial # 1 and 2 was collected from the field on September 23; whereas the soil used in trial # 3 was collected October 15. The recorded soil temperature in °C in the greenhouse (range) and [mean] was as follows: October, (12 to 36), [24]; November, (5 to 35), [20]; and December 1 to 14, (5 to 33), [19].

## Results and Discussion

The results of each trial are presented in the following data table. Generally, the top fresh weight of plants treated with an appropriate amount of Ranman, TM-459, or Acrobat did not differ from plants grown in sterilized soil. On the other hand, the top fresh weight of plants treated with Ridomil Gold often was not significantly different from plants grown in untreated infested soil, implying that this soil contained a population of *Phytophthora capsici* that is insensitive to this fungicide. These trials suggest that soil application of Ranman and TM-459 could effectively inhibit the development of Phytophthora root and crown rot on chile peppers grown in soil naturally infested with *Phytophthora capsici*.

**2004 Chile Pepper Phytophthora root and stem rot fungicide trials.**

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Treatment <sup>1</sup>	Rate of product per plant	Application code <sup>2</sup>	Fresh weight (g) of plant top at end of trial		
			Trial #1 <sup>3</sup>	Trial #2 <sup>3</sup>	Trial #3 <sup>4</sup>
Sterilized soil	-----	-----	10.3	18.6	16.9
Untreated soil	-----	-----	0.7	10.6	1.2
Ranman (400SC)	0.01 ml	A, B	10.3	11.4	12.9
Ranman (400SC)	0.02 ml	A, B	10.3	7.7	16.0
Ranman (400SC)	0.05 ml	A, B	10.1	11.8	12.9
TM-459 (200SC)	0.02 ml	A, B	8.7	7.8	11.1
TM-459 (200SC)	0.04 ml	A, B	8.6	11.1	12.3
TM-459 (200SC)	0.1 ml	A, B	8.9	13.6	15.2
Acrobat 50WP	40 mg	A, B	10.2	14.1	8.6
Ridomil Gold 44WP	45 mg	A, B	0.7	7.5	3.2
Ridomil Gold 44WP	59 mg	A			
Ranman (400SC)	0.01 ml	B	8.0	5.3	3.0
Ridomil Gold 44WP	59 mg	A			
Ranman (400SC)	0.01 ml				
+ Acrobat 50WP	+ 20 mg	B	8.0	8.3	2.2
Ridomil Gold 44WP	59 mg	A			
TM-459 (200SC)	0.02 ml	B	9.2	9.3	3.2
Ridomil Gold 44WP	59 mg	A			
TM-459 (200SC)	0.02 ml				
+ Acrobat 50WP	+ 20 mg	B	8.3	6.9	2.6
<b>LSD (Least Significant Statistical Difference, <math>P=0.05</math>) <sup>4</sup></b>			<b>4.2</b>	<b>7.0</b>	<b>5.0</b>
<ol style="list-style-type: none"> <li>1. Sterilized soil was autoclaved for 60 minutes at 121°C and at a pressure of 102 kPa.</li> <li>2. Plants were treated when transplanted into field soil naturally infested with <i>Phytophthora capsici</i> in the greenhouse (the beginning of the experiment), then again one month later.</li> <li>3. Trial #1 was initiated September 29 and terminated December 1; trial #2 was initiated October 7 and terminated December 7; trial #3 was initiated October 17 and terminated December 14, 2004.</li> <li>4. Least Significant Difference at <math>P = 0.05</math>.</li> </ol>					