Evaluation of Fosphite rates against Phytophthora root rot Disease on Cucumber

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Abstract

Fosphite was applied as a foliar application at different rates compared to Aliette at the labeled rate, to evaluate the efficacy and to provide protection against Phytophthora root rot disease on cucumber. Results showed that all Fosphite treatments and Aliette significantly ($p \leq 0.05$) reduced root rot disease symptoms on Cucumber.

Introduction

Root rot disease caused by soilborne fungi, it has been observed to occur on cucumber. The disease is very common in the regions of high humidity and high soil moister. The soil born disease is a significant concern because of the economic loss that it can be possibly bring to the growers. Symptoms include damping-off, wilting, yellowing of the leaves and stem and leaf lesions that are light brown, water soaked, and irregular in shape. This trial aimed to evaluate the efficacy of different Fosphite rates and Aliette (as the standard fungicide) for the control of Phytophthora root rot disease on Cucumber.

Materials and Methods

Forty-eight of Cucumber plants were used in this trial. Eight plants were used for each treatment as replications. Two fungicides were tested for effectiveness. Fosphite was used at a rate of 0.125 %, 0.25 %, 0.5 % and 1 % v/v, and Chipco Aliette WDG (Rhone Poulenc) was used at a rate of 4 pounds per 100 gallons of water. Both were applied as a foliar spray (spray until wet). Control plants were untreated and sprayed with water.

Cucumber plants were infected with *Phytophthora parasitica.* The fungus was grown on 10% vegetable juice agar for five days at 25 $^{\circ}$C. Culture dishes were flooded with sterile deionized water and incubated at room temperature for one hour before zoospore suspensions from several dishes were collected. The zoospore concentration was determined using a hemacytometer and the suspension was adjusted to 10,000 zoospores per milliliter.

Cucumber plants were transplanted on soil that was inoculated with *Phytophthora parasitica*. Inoculation of the soil with fungus was carried out 7 days before transplanting. The fungus was allowed 7 days to grow in the soil before it was used for transplanting. The experimental design was randomized complete block with eight replications. Treatment was applied with a hand-sprayer to the plants once on the first week. Aliette was applied at the recommended rate of 4-lb./100 gallon of water also on the first week. Cucumber plants were completely wet after application. They were

rated prior to the initial application and also each week for the next four weeks. Ratings were based on University of California Pathogenically Rating Scale 0-5 (0 is no disease, 5 is terminally infected). The plants were visually evaluated. The following scale was used:
Pathogenically Rating Scale 0-5 (0 is no disease, 5 is terminally infected). The plants were visually evaluated. The following scale was used:

0	No spots
1	1-3 spots present on leaves but not obvious
2	1-3 spots obviously present on bracts
3	4-12 spots present on bracts and leaves
4	Spots present on bracts, leaves, flowers and stems
5	Plant totally blighted

Results and Discussion:

The *Phytophthora parasitica* disease rating at the pre-count, for all Cucumber plants were 2.00. There was no significant (p ≤ 0. 05) difference on the disease ratings among all the plants.

At the first week post treatment, all the treatment applications had no significant (p ≤ 0. 05) difference on disease rating. Smillie at al. (1989) indicated that phosphite when present in the plant might cause modification of the fungal cell surface in such a way the plant start recognizing it as foreign and respond with its normal defense mechanisms which happen very slowly. Treatments of Fosphite 0.5%, 1.0% and Aliette significantly (p ≤ 0. 05) reduced the disease over the control at the second week. There were no significant (p ≤ 0. 05) differences among the disease rating for the treatments of Fosphite 0.50%, 1.00% and Aliette. Fosphite at 0.125%, 0.25%, 0.50%, 1.0% and Aliette had significant (p ≤ 0. 05) lower disease rating than the control at the third week. The disease rating for the control plants increased to 3.00 at the forth week after treatment applications. At the forth week after the treatment applications, all Fosphite treatments and Aliette had significantly (p ≤ 0. 05) lower disease rating than control. Fosphite treatments at 0.25%, 0.50%, 1.0% and Aliette had significantly (p ≤ 0. 05) lower disease rating than those of Fosphite 0.125% at the same week. These results match with those of Fenn and Coffey (1985) as they stated that low concentrations of phosphorus lightly reduce the disease. The results indicated that all Fosphite treatments at 0.125%, 0.25%, 0.50% and 1.0% are effective on the control of disease caused by *Phytophthora parasitica.*

Table 1. Effect of Fosphite and Aliette on disease control by *Phytophthora parasitica* on cucumber plants

	Disease Rating				
	Pre-count*	Week 1*	Week 2*	Week 3*	Week 4*
Fosphite 0.125%	2.00a	2.00a	2.571 b	2.00 b	2.142 b
Fosphite 0.25%	2.00a	2.00a	2.714 ab	1.857 bc	1.857 bc
Fosphite 0.5%	2.00a	2.00a	2.000 c	1.428 c	1.428 cd
Fosphite 1.0%	2.00a	2.00a	2.000 c	1.428 c	1.285 d
Control	2.00a	2.00a	3.000 a	3.000a	3.000a
Alliette 4 lb./100 gallon of water	2.00a	2.00a	2.142 c	1.428 c	1.285 d

*Means in the same column not followed by the same letter differ significantly ($p \leq 0.05$) as determined by DMRT.

References:

Fenn, M. and M. Coffey, 1985: Further evidence for direct mode of action of Fosetyl-Al and phosphorous acid. Phytopathology 75 (9) 1064-1068.

Smillie R, Grant, B. and Guest, D., 1989: The mode of action of phosphite: evidence for both direct and indirect modes of action on three *Phytophthora spp*. In plants. Phytopathology 79 (9): 921-926

Appendix 2.   **Analysis of Variance**

Pre-count

Source of Variation	df	SS	MS	F	
Treatment	5	0.000	0.000	65535.0	ns
Block	6	0.000	0.000	65535.0	ns
Error	30	0.000	0.000		
Total	41	0.000			

Week 1

Source of Variation	df	SS	MS	F	
Treatment	5	0.000	0.000	65535.0	ns
Block	6	0.000	0.000	65535.0	ns
Error	30	0.000	0.000		
Total	41	0.000			

Week 2

Source of Variation	df	SS	MS	F	
Treatment	5	6.119	1.224	12.047	**
Block	6	0.952	0.159	1.563	ns
Error	30	3.048	0.102		
Total	41	10.119			

Week 3

Source of Variation	df	SS	MS	F	
Treatment	5	13.143	2.629	16.235	**
Block	6	1.143	0.190	1.176	ns
Error	30	4.857	0.162		
Total	41	19.143			

Week 4

Source of Variation	df	SS	MS	F	
Treatment	5	15.548	3.110	18.837	**
Block	6	1.333	0.222	1.346	ns
Error	30	4.952	0.165		
Total	41	21.833			

ns = Not significant at $p \leq 0.05$

** = Significant at $p \leq 0.01$