

## **Evaluation of Fosphite Rates Against *Pythium ultimum*, Root Rot Disease on Spinach**

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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 root rot disease *Pythium ultimum* on spinach (*Spinacia oleracea*). Results showed that all Fosphite treatments except 0.125% and Aliette significantly ( $p \leq 0.05$ ) reduced the root rot disease symptoms on Spinach over the control.

### **Introduction**

Root rot disease of spinach plants causes substantial economic losses to the grower. This widespread disease damping-off causes spinach plants to die. Fungi from the *Pythium spp* cause this soilborne disease. The disease symptoms include a brown, watery, soft rot, which will eventually lead to poor yield or plant death. The fungus can also attack seedlings before emerging from the soil. This trial aimed to evaluate the efficacy of different Fosphite rates and Aliette (as the standard fungicide) for the control of root rot disease on Spinach.

### **Materials and Methods**

Forty-eight Spinach seedlings were planted used in this trial. Eight plants were used for each treatment as replications. Two fungicides were tested for effectiveness. Fosphite was used at rates 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. All were applied as a foliar spray (spray until wet). Control plants were untreated and sprayed with water.

Spinach plants were infected with *Pythium ultimum*. The fungus was grown on 10% vegetable juice agar for five days at 25 °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.

Spinach plants were transplanted on soil that was inoculated with *Pythium ultimum*. 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. Spinach 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:

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 *Pythium ultimum* disease rating at the pre-count for all Spinach plants ranged from 0.125 to 0.625. There was no significant ( $p \leq 0.05$ ) difference on the disease ratings among all the plants.

At the first week post treatment, Fosphite treatment applications 0.25%, 0.50%, 1.0% significantly ( $p \leq 0.05$ ) reduced the disease rating. Although treatment of Aliette at the same week had lower disease rating than the control but the difference was not statistically significant ( $p \leq 0.05$ ). At the second week of treatments all of the Fosphite and Aliette treatments significantly ( $p \leq 0.05$ ) reduced the disease over the control. Fosphite treatments 0.25%, 0.50% and 1.0% significantly ( $p \leq 0.05$ ) reduced the disease over the Fosphite treatment 0.125% and Aliette at the second week of treatment. These results match with those of Fenn and Coffey (1985) as they stated that low concentrations of phosphorus lightly reduce the disease. There were no significant ( $p \leq 0.05$ ) differences on the disease rating among the treatments of Fosphite 0.25%, 0.50%, 1.00% and Aliette at the third and fourth week. The disease rating for the control plants increased to 2.625 at the fourth week after treatment applications. However, Fosphite at 0.25%, 0.50% and 1.0% and Aliette had significant ( $p \leq 0.05$ ) lower disease rating than Fosphite treatment 0.125% and the control at the fourth week. At the fourth week after the treatment application, all treatments except the Fosphite at 0.125% had significant ( $p \leq 0.05$ ) lower disease rating than control. Fosphite at 0.50% and 1.0% had the lowest disease rating followed by Aliette.

The results indicated that Fosphite treatments at 0.25%, 0.50% and 1.0% are effective on the control of disease caused by *Pythium ultimum*.

Table 1. Effect of Fosphite and Aliette on disease control by *Pythium ultimum* on Spinach plants.

	Disease Rating				
	Pre-count*	Week 1*	Week 2*	Week 3*	Week 4*
<b>Fosphite 0.125%</b>	0.500 a	1.375 a	1.375 b	2.500 a	2.750 a
<b>Fosphite 0.25%</b>	0.250 a	0.875 b	0.875 c	2.000 b	2.125 b
<b>Fosphite 0.5%</b>	0.125 a	0.750 b	0.750 c	1.750 b	1.750 b
<b>Fosphite 1%</b>	0.625 a	0.875 b	0.875 c	2.000 b	2.000 b
<b>Control</b>	0.375 a	1.152 ab	2.000 a	2.375 a	2.625 a
<b>Aliette 4 lb./100 gallon of water</b>	0.375 a	1.000 ab	1.375 b	1.750 b	1.875 b

\*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.

Appendix 2. Analysis of Variance

Pre-count

Source of Variation	df	SS	MS	F	
Treatment	5	1.250	0.250	1.296	ns
Block	7	3.250	0.464	2.407	ns
Error	35	6.750	0.193		
Total	47	11.250			

Week 1

Source of Variation	df	SS	MS	F	
Treatment	5	2.000	0.400	3.000	*
Block	7	1.333	0.190	1.429	ns
Error	35	4.667	0.133		
Total	47	8.000			

Week 2

Source of Variation	df	SS	MS	F	
Treatment	5	8.917	1.783	12.279	**
Block	7	1.917	0.274	1.885	ns
Error	35	5.083	0.145		
Total	47	15.917			

Week 3

Source of Variation	df	SS	MS	F	
Treatment	5	3.938	0.788	7.075	**
Block	7	2.979	0.426	3.824	**
Error	35	3.896	0.111		
Total	47	10.813			

Week 4

Source of Variation	df	SS	MS	F	
Treatment	5	6.688	1.338	9.097	**
Block	7	1.479	0.211	1.437	ns
Error	35	5.146	0.147		
Total	47	13.313			

ns = Not significant at  $p \leq 0.05$

\* = Significant at  $p \leq 0.05$

\*\* = Significant at  $p \leq 0.01$