

Evaluation of Fosphite Rates Against *Pythium ultimum*, Damping-off Disease on Lettuce

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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 damping-off disease on Lettuce *Pythium ultimum*. Results showed that all Fosphite treatments and Aliette significantly ($p \leq 0.05$) reduced the *Pythium* damping-off disease symptoms on Lettuce over the control.

Introduction

Damping-off disease has been observed to occur on Lettuce. The disease is a significant concern because of the economic loss that it can bring to the growers. Symptoms usually begin with root rot. As the fungi survives as oospores in the soil that germinate to attack root hairs and root tips, causing a progressive deterioration to the root system. The seedling may wilt before above ground lesions are evident. The damping-off disease can also infect the lower stem and cause mushy, watery rot. When seedlings are infected, the stem tissue collapses and plants fall over and die. This trial aimed to evaluate the efficacy of different Fosphite rates and Aliette (as the standard fungicide) for the control of damping-off disease on Lettuce.

Materials and Methods

Forty-eight Lettuce seedlings were 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, 7.35-ml./ plant (spray until wet). Control plants were untreated and sprayed with water.

Lettuce 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.

Lettuce 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. Lettuce 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 Lettuce plants was 2.00. There was no significant ($p \leq 0.05$) difference on the disease ratings among all the plants.

At the first week post treatment, all the treatment applications had significantly ($p \leq 0.01$) reduced the disease rating among the control. Smillie et 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. Treatments of Fosphite 0.125%, 0.25%, 0.5%, 1.0% and Aliette significantly ($p \leq 0.01$) reduced the disease over the control at the second week. Although the Fosphite treatments 0.125% and Aliette had lower disease rating than the control but the difference was statistically significant ($p \leq 0.01$). These results match with those of Fenn and Coffey (1985) as they stated that low concentrations of phosphorus lightly reduce the disease. At the third and fourth week, all the treatment applications had significantly ($p \leq 0.01$) reduced the disease rating among the control. There were no significant ($p \leq 0.01$) differences on the disease rating among the treatments of Fosphite 0.125%, 0.25%, and Aliette at the third week. The disease rating for the control plants increased to 2.5 at the fourth week after treatment applications. Fosphite treatments at 0.50% and 1.0% had significantly ($p \leq 0.01$) lower the disease rating than Aliette, Fosphite at 0.50% and 1.0% had the lowest disease rating followed by Fosphite applications 0.125% and 0.25%.

The results indicated that Fosphite treatments at 0.125%, 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 Lettuce plants.

	Pre-count	Week 1	Week 2	Week 3	Week 4
Fosphite 0.125 %	2.00a	2.00 b	1.500 b	1.500 bc	1.500. bc
Fosphite 0.25 %	2.00a	2.00 b	1.375 b	1.375 bc	1.500. bc
Fosphite 0.5%	2.00a	2.00 b	1.125 b	1.225 c	1.250 c
Fosphite 1.0%	2.00a	2.00 b	1.250 b	1.125 c	1.125 c
Control	2.00a	2.50a	2.250a	2.250a	2.500a
Alliette 4 lb./100 gallon of water	2.00a	2.00 b	1.625 b	1.750 b	1.750 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.

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	0.00	0.00	65535.00	ns
Block	7	0.00	0.00	65535.00	ns
Error	35	0.00	0.00		
Total	47	0.00			

Week 1

Source of Variation	df	SS	MS	F	
Treatment	5	1.667	0.333	7.00	**
Block	7	0.333	0.048	1.00	ns
Error	35	1.667	0.048		
Total	47	3.667			

Week 2

Source of Variation	df	SS	MS	F	
Treatment	5	9.688	1.938	5.583	**
Block	7	1.979	0.283	0.815	ns
Error	35	12.146	0.347		
Total	47	23.813			

Week 3

Source of Variation	df	SS	MS	F	
Treatment	5	6.667	1.333	7.000	**
Block	7	2.583	0.369	1.938	ns
Error	35	6.667	0.190		
Total	47	15.917			

Week 4

Source of Variation	df	SS	MS	F	
Treatment	5	6.438	1.288	7.046	**
Block	7	2.979	0.426	2.329	ns
Error	35	6.396	0.183		
Total	47	15.813			

ns = Not significant at $p \leq 0.05$

* = Significant at $p \leq 0.05$

** = Significant at $p \leq 0.01$