

Evaluation of Fosphite Rates against Fusarium wilt disease *Fusarium oxysporum* on Asparagus

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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 Fusarium wilt disease *Fusarium oxysporum* on Asparagus. Results showed that all Fosphite treatments and Aliette significantly ($p \leq 0.05$) reduced the disease symptoms over the control.

Introduction

Fusarium wilt disease *Fusarium oxysporum* has been observed to occur on Asparagus. In fact, Fusarium wilt disease the most serious disease affecting Asparagus production worldwide. Symptoms range from a slow decay of the crown to reduction in spear size and number, which lead to the reduction of the crop yield. This trial aimed to evaluate the efficacy of different Fosphite rates and Aliette (as the standard fungicide) for the control of Fusarium wilt disease *Fusarium oxysporum*.

Materials and Methods

Forty-eight Asparagus 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 15-ml./ plant (spray until wet). Control plants were untreated and sprayed with water.

Asparagus plants were infected with *Fusarium oxysporum*. 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.

Asparagus plants were transplanted on soil that was inoculated with *Fusarium oxysporum*. 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. Asparagus 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 *Fusarium oxysporum* disease rating at the pre-count for all Asparagus plants ranged from 2.00 to 2.50. 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 no significant ($p \leq 0.05$) difference on disease rating. 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 which happen very slowly. Treatments of Fosphite 0.25%, 0.5%, and 1.0% significantly ($p \leq 0.05$) 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 not statistically significant ($p \leq 0.05$). 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 week, Fosphite 0.50%, 1.0% and Aliette significantly ($p \leq 0.05$) reduced the disease ratings. 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 week. The disease rating for the control plants increased to 2.75 at the fourth week after treatment applications. 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 *Fusarium oxysporum*.

Table 1. Effect of Fosphite and Aliette on disease control by *Fusarium oxysporum* on Asparagus plants.

	Disease Rating				
	Pre-count*	Week 1*	Week 2*	Week 3*	Week 4*
Fosphite 0.125%	2.50a	2.38a	2.13 ab	2.00 ab	2.00 ab
Fosphite 0.25%	2.13a	2.00a	1.75 c	1.75 bc	1.50 bc
Fosphite 0.5%	2.50a	2.13a	1.63 c	1.50 c	1.63 abc
Fosphite 1.0%	2.00a	2.00a	1.63 c	1.38 c	1.38 c
Control	2.25a	2.25a	2.25 a	2.38 a	2.13 a
Alliette 4 lb./100 gallon of water	2.38a	2.25a	2.00 ab	2.00 ab	1.75 abc

*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	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	
Treatment	5	1.667	0.333	1.750	ns
Block	7	1.583	0.226	1.187	ns
Error	35	6.667	0.190		
Total	47	9.917			

Week 1

Source of Variation	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	
Treatment	5	0.917	0.183	1.262	ns
Block	7	0.667	0.095	0.656	ns
Error	35	5.083	0.145		
Total	47	6.667			

Week 2

Source of Variation	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	
Treatment	5	2.854	0.571	3.341	*
Block	7	1.646	0.235	1.376	ns
Error	35	5.979	0.171		
Total	47	10.479			

Week 3

Source of Variation	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	
Treatment	5	5.417	1.083	5.759	**
Block	7	0.667	0.095	0.506	ns
Error	35	6.583	0.188		
Total	47	12.667			

Week 4

Source of Variation	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	
Treatment	5	3.354167	0.670833	3.005333	*
Block	7	0.3125	0.044643	0.2	ns
Error	35	7.8125	0.223214		
Total	47	11.47917			

ns = Not significant at $p \leq 0.05$

* = Significant at $p \leq 0.05$

** = Significant at $p \leq 0.01$