CONTROL OF PYTHIUM ROOT ROT

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The fungus Pythium is the most important root rotting organism that plagues greenhouse crops of all types. Most species of Pythium readily form swimming spores (zoospores) that can be carried in water from pot to pot among containers standing in puddles of water on benches or floors. Zoospores enter ebb and flow water and contaminate the reservoir, particularly when long irrigation times are used. Pythium can also infect plants when the non-swimming stage comes in contact with roots. If the activity of zoospores can be disrupted, one important means of Pythium spread can be greatly inhibited.

Workers in Stanghellini's program (1996, 1997) demonstrated that when surfactants such as AquaGro are added to water, zoospores quickly die and Pythium and Phytohthora spread in hydroponic systems is stopped. Calcium is an important element for plant growth but also plays a role in zoospore development and activity. High levels of calcium are known to disrupt the formation and activity of zoospores (von Broembsen and Deacon, 1996, 1997). Although these strategies can be readily applied to ebb and flow systems, their effects in overhead watering situations is not known.

In experiments reported here, high levels of calcium, three levels of AquaGro, Subdue, and the biological control agent RootShield (Trichoderma harzianum, fungus) were tested for their control of Pythium root rot in seedling geraniums. Showgirl geraniums were seeded in Fafard #2 potting mix in plug rays. Three commonly encountered species of Pythium were grown on rice grains. Pythium aphanidermatum and P. irregulare readily form zoospores. Pythium ultimum rarely, if ever, forms zoospores. A small amount of rice inoculum was incorporated into Fafard #2 potting mix used to fill 4" round, plastic pots just prior to transplanting. Some plants were potted in mix without rice inoculum. Treatments were begun on all plants immediately after transplanting. To the pots that had not been infested with inoculated rice, zoospores from either P. aphanidermatum or P. irregulare were added one week after transplanting and treatment initiation.

There were 10 pots in each treatment and the experiment was done twice. The calcium nitrate was added at 20 ppm and 30 ppm to 50 ppm N soluble fertilizer while AquaGro was added at 20, 30, and 100 ppm to 300 ppm N soluble fertilizer (15%N-15%P-15%K; Peters). These were applied at each watering. All other plants in the experiments received 300 ppm N soluble fertilizer at each watering. RootShield (7oz/100gal) and Subdue (1.5 fl. Oz/100 gal) were applied once at transplant.

Results and Conclusions

The results are summarized in the tables on page 12. Because results for Pythium ultimum (rice inoculum) were very similar to those of P. aphanidermatum and P. irregulare rice inoculated, that table was not included.

Subdue consistently protected against all three species of Pythium regardless of whether zoospores or infested rice was used as inoculum. The calcium-low nitrogen treatments tended to suppress disease when zoospores were used as inoculum but not when infested rice was used. Plants in the calcium-low nitrogen treatment had smaller, darker green leaves than plants in other treatments. These leaves had numerous, evenly distributed, tiny, tan spots possibly indicative of a nutrient imbalance. No phytotoxicity was observed in any other treatments.

Infesting the potting soil with Pythium -colonized rice produced very severe disease pressure. This simulates the situation where a grower is transplanting directly into soil heavily infested with Pythium. Only Subdue was effective in controlling disease under those conditions. However these experiments indicate that if zoospores were the main inoculum, from contaminated water for example, 20 or 30 ppm calcium nitrate supplementing an otherwise low nitrogen fertilization regime may provide some control.

Pythium irregulare zoospore inoculation resulted in rather slow disease development and less disease pressure. Calcium supplementation, AquaGro, and RootShield all tended to suppress Pythium irregulare zoospore inoculum.

There can be many interactions among the potting mix, plant species being grown, irrigation method used, and Pythium species found infecting the plants. More tests are needed in order to determine whether the treatments tested here would work effectively under other conditions including less severe disease pressure.

Acknowledgments

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Literature Cited

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	Average Percentage of Plants Surviving Days after potting				
	7	14	21	28	35
Pythium irregulare rice inoculum					
20 ppm calcium nitrate in 50 ppm N soluble fertilizer	75	40	35	35	10
30 ppm calcium nitrate in 50 ppm N soluble fertilizer	75	30	15	10	0
Subdue at transplant	100	100	100	100	100
RootShield at transplant	85	25	0	0	0
20 ppm AquaGro in 300 ppm N soluble fertilizer	60	0	0	0	0
30 ppm AquaGro in 300 ppm N soluble fertilizer	60	15	0	0	0
100 ppm AquaGro in 300 ppm N soluble fertilizer	65	20	0	0	0
300 ppm N soluble fertilizer	95	30	5	5	0
Pythium irregulare zoospore inoculum					
20 ppm calcium nitrate in 50 ppm N soluble fertilizer	100	100	100	100	100
30 ppm calcium nitrate in 50 ppm N soluble fertilizer	95	95	95	95	75
Subdue at transplant	100	100	100	100	100
RootShield at transplant	100	100	95	90	65
20 ppm AquaGro in 300 ppm N soluble fertilizer	100	100	100	85	50
30 ppm AquaGro in 300 ppm N soluble fertilizer	100	95	95	95	50
100 ppm AquaGro in 300 ppm N soluble fertilizer	95	90	80	75	55
300 ppm N soluble fertilizer	95	95	90	75	5

	Average Percentage of Plants Surviving Days after potting				
	7	14	21	28	35
Pythium aphanidermatum rice inoculum					
20 ppm calcium nitrate in 50 ppm N soluble fertilizer	100	45	40	40	20
30 ppm calcium nitrate in 50 ppm N soluble fertilizer	95	45	35	25	5
Subdue at transplant	100	100	90	90	90
RootShield at transplant	100	40	30	5	0
20 ppm AquaGro in 300 ppm N soluble fertilizer	100	35	15	10	0
30 ppm AquaGro in 300 ppm N soluble fertilizer	100	40	15	15	0
100 ppm AquaGro in 300 ppm N soluble fertilizer	100	45	5	0	0
300 ppm N soluble fertilizer	95	45	15	15	0
Pythium aphanidermatum zoospore inoculum					
20 ppm calcium nitrate in 50 ppm N soluble fertilizer	85	75	70	65	60
30 ppm calcium nitrate in 50 ppm N soluble fertilizer	100	85	75	75	65
Subdue at transplant	100	100	100	100	100
RootShield at transplant	85	60	60	55	45
20 ppm AquaGro in 300 ppm N soluble fertilizer	95	95	90	75	45
30 ppm AquaGro in 300 ppm N soluble fertilizer	75	75	65	65	25
100 ppm AquaGro in 300 ppm N soluble fertilizer	85	75	70	50	30
300 ppm N soluble fertilizer	75	65	60	60	30