

## Aqua-Hort rapport Poinsettia

Progress report on studies of disease spread in Poinsettia – Dec 2007-Jan 2008

Response to copper treatment of pathogen densities in recycled nutrient solution.

In response to the lack of organisms and a lack of disease, we inoculated second set of poinsettia plants. As in the previous inoculation, the inoculated plants were in a row over the inlet and outlet holes for the nutrient solution on each floor. The row of previously inoculated plants was removed and discarded. The remaining plants on each floor were re-spaced so that a row of non-diseased plants is over the inlet and outlet holes. These plants were inoculated in place with a liquid culture of the pathogens propagated in the lab. Inoculum were prepared from cultures of *Pythium* and *Phytophthora* that were recently isolated from the first set of inoculated plants. The pathogen were grown on V-8 agar for 5 days and blended together with sterile water. The slurry was poured through four layers of cheesecloth. Twenty mL were added to each plant; ten mL on each side. This procedure was done on 12 Dec 2007.

Before inoculation, all of the nutrient solution in both reservoirs was pumped out of the greenhouse. The solution was replaced to 60 cm in each reservoir, using 10 liters each of the two concentrates run through the 100:1 proportioner. Concentrate #1, 2400 grams Peters Ca(NO<sub>3</sub>)<sub>2</sub> in 20 Liters. Concentrate #2, 2400 grams 21-5-20 N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O in 20 Liters. Neither Zeritol nor Copper was added at this time. We used this fresh un-sterilized solution for two weeks, watering as required by the plants on the upgrade floor. Twenty liters of solution was removed after each watering to test for pathogens. These samples were filtered in 1-liter batches through paper filters. The filters were combined and agitated with 100 mL of water. One mL of this smaller volume was placed onto PARP selective media and cultured to determine the density of disease organisms in solution.

Plants were watered with the ebb & flow watering cycle on 18, 21 and 26 Dec with no treatment of the solution. After watering on 2 Jan 2008, we resumed operation of the copper ionization unit. Treatment with the Aqua-Hort unit consisted of pumping water from a reservoir at a flow of 0.9 m<sup>3</sup>/hour and treating with 3 ppm copper output. At the first treatment, each reservoir containing 2 m<sup>3</sup> of solution, was treated for about 60 minutes. A second treatment for 30 minutes was done after a watering cycle on 7 Jan, and a third after watering on 10 Jan 2008, for 60 min on the standard floor and 45 min on the upgrade floor. The free and total copper concentration in the reservoirs increased with each treatment, as summarized in the Table. Free copper increased from about 0.2 ppm before the first treatment to about 1.5 ppm after the third treatment.

Before treatment with copper, the observed pathogen densities were 15 - 35 colony forming units (cfu) per liter and 110 - 150 cfu/L, for solution sampled on 26 Dec 2007 and 2 Jan 2008, respectively. It appeared that pathogen densities were increasing with time with each watering. The density of viable pathogens in the nutrient solution declined after treatment with copper. The densities fell to 30 - 50 cfu/L after the 2<sup>nd</sup> and 3<sup>rd</sup> treatments. The results for each system are summarized in the Table. These results suggest that a free copper concentration of about 1 ppm was necessary to significantly lower the density of viable pathogens, to about 30% of the density observed before treatment. However, it is possible that the pathogen densities would have continued to increase without copper treatment, and copper treatment may have a greater effect on reducing pathogen viability than indicated here.

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Table. The relation between copper concentration and viable pathogen densities in nutrient solutions used in standard and upgrade ebb and flow watering of a flooded floor greenhouse with a crop of poinsettias.

Watering and sampling dates	Standard			Upgrade		
	Copper		Pathogen	Copper		Pathogen
	free ppm	total ppm	density cfu/L	free ppm	total ppm	density cfu/L
12/26/07	0.2	0.4	15	0.3	0.8	35
1/2/08	0.2	0.4	153	0.3	0.8	108
1/3/08	0.6	1.7	135	0.9	1.9	125
1/7/08	0.9	1.6	47	1.3	2.2	31
1/10/08	1.6	2.3	45	1.5	3.0	36

Spread of disease in Poinsettia in response to the method of ebb and flow watering

At each watering, plants were examined for symptoms of disease. The primary symptom observed was wilting and curling of lower leaves that retained their green color. In severe cases this was followed by a complete wilt and collapse of the plant. Plants were labeled on the first date that we observed unambiguous symptoms of disease. The first non-inoculated plants to develop symptoms of disease were noticed on 7 Dec 2007, approximately one month after infested plants were placed on the flooded floor. A few more plants with disease symptoms were identified at each watering.

By 20 Jan 2008, 20 plants had developed disease symptoms on the standard, long duration watering, flooded floor. No plants developed symptoms on the upgrade, short duration watering, flooded floor. Examination of the roots suggested all plants with disease symptoms were infected with *Pythium*. Wade Elmer is currently isolation the pathogen from roots and stems of each symptomatic plant. Clearly, pathogens were present equally in the separate nutrient solution reservoirs that supplied each floor.

However, the upgrade watering method either prevented *Pythium* from infecting plant tissue, or prevented its proliferation in tissue leading to symptoms of disease. Presumably this effect of the upgrade method of watering was due maintaining a lower water content of the root medium at all times, in comparison to the standard ebb and flow watering method.