

Durability Summary

FIELD TRIALS

A field trial was performed to test the effectiveness of ZeroTol[®] Broad Spectrum Algaecide/Fungicide to control *pythium* and *phytophthora* zoospores which are the main pathogens causing disease in re-circulating watering systems.

Previously, Dr. Robert Wick of the University of Massachusetts determined that ZeroTol is lethal to both *pythium* and *phytophthora* at 150-ppm hydrogen peroxide (H₂O₂) (1:2,000). A field trial was determined to test the durability of ZeroTol when used at these concentrations (150 ppm) to test for degradation of the concentration of the ZeroTol solution over time.

Comments:

In 2003, two field trials were conducted to test the durability of ZeroTol used in re-circulating watering systems for irrigating commercial greenhouse operations. Harts Farm and Geremia Greenhouses were participants in the study. The Harts Farm trial was short-term and utilized a flooded floor system; the Geremia study was longer term and involved a flooded bench system.

Procedure:

Hart Farm

Three and a half gallons of ZeroTol were added to the main reservoir of the flooded floor irrigation system as it was filled to its 7,000 gal capacity. The resulting irrigation solution contained 150 ppm of ZeroTol. For six days, ZeroTol sensitive strips were periodically used to measure the strength of the solution in the storage tank and on the flooded floors. The tank was not refilled during the six-day

trial.

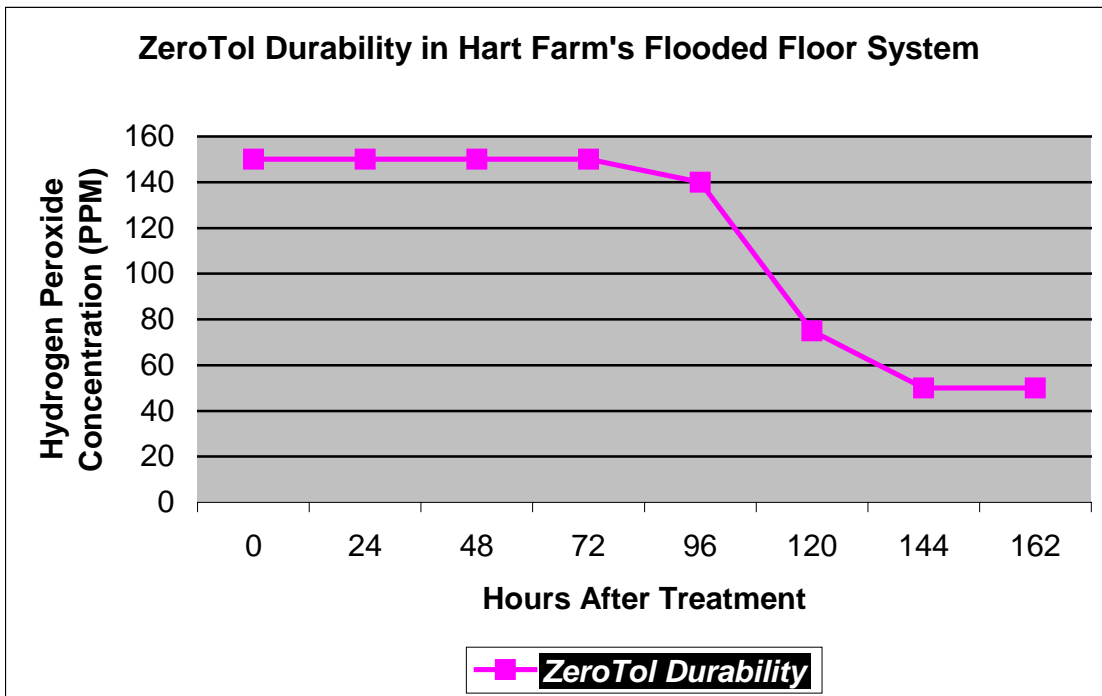
Geremia Farm

One gallon of ZeroTol was added to 1,000 gallons of water in the freshly cleaned storage tank of their re-circulating bench irrigation system. The solution was unused in the tank for one month. The irrigation system was unused during this time period. The strength of the solution was measured weekly using hydrogen ZeroTol sensitive strips (a 1:1,000 dilution of ZeroTol to water has an active ingredient of 270 ppm ZeroTol).

Results:

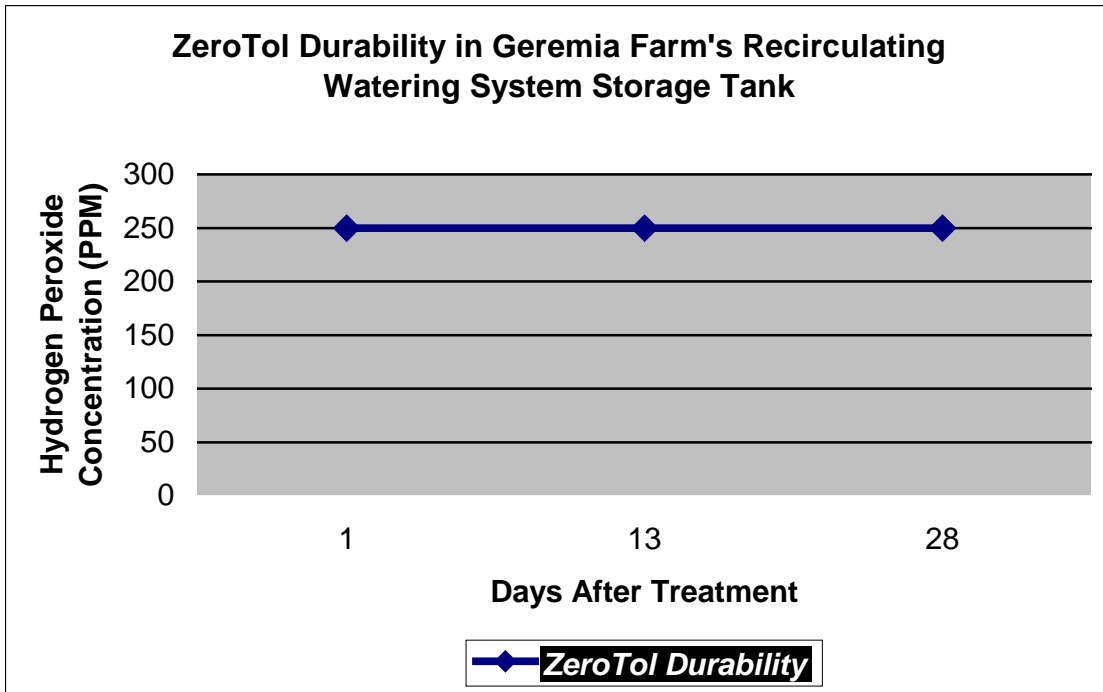
Hart Farm (System in Operation)

- No loss of efficacy for three days
- Down to ½ strength in five days
- 67% loss of efficacy after one week



Geremia Farm (System Not Operating)

- No loss of efficacy even after one month



Conclusion:

The test conclusively indicated that ZeroTol was sufficiently stable to be viable for up to three days of recycled water treatments before showing any signs of loss of potency in the active ingredient in the operating system at Hart Farms. The non-operating system at Geremia Farm indicated no loss of active ingredient for up to 28 days, indicating that ZeroTol will remain stable and viable when not exposed to organic material as a result of irrigation cycles.

IN-HOUSE LAB TRIALS

Comments:

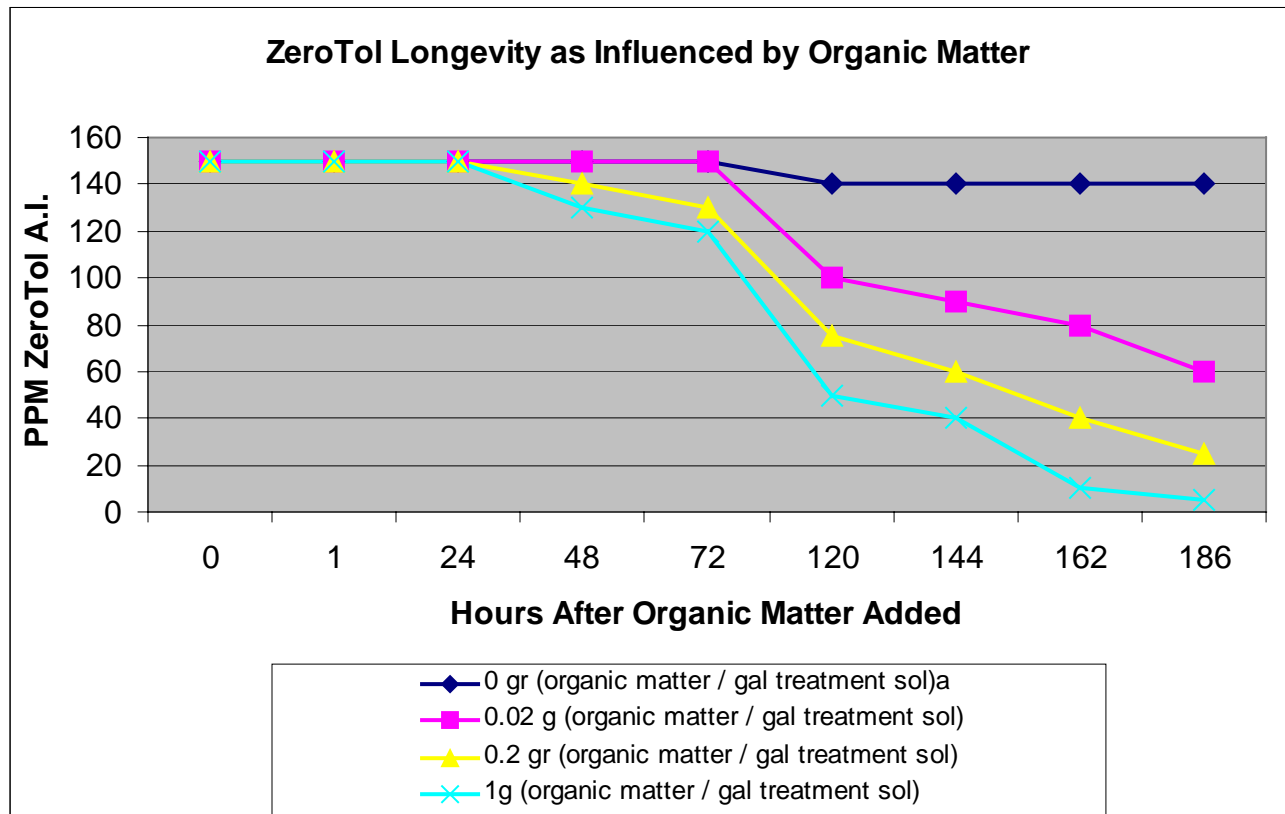
Lab tests were done in-house to measure the effects of materials in re-circulating watering systems on the durability of ZeroTol.

ZeroTol solutions were prepared and tested for the deterioration of ZeroTol over time following exposure to increasing levels of organic matter, soluble fertilizers, and solution alkalinity.

Results:

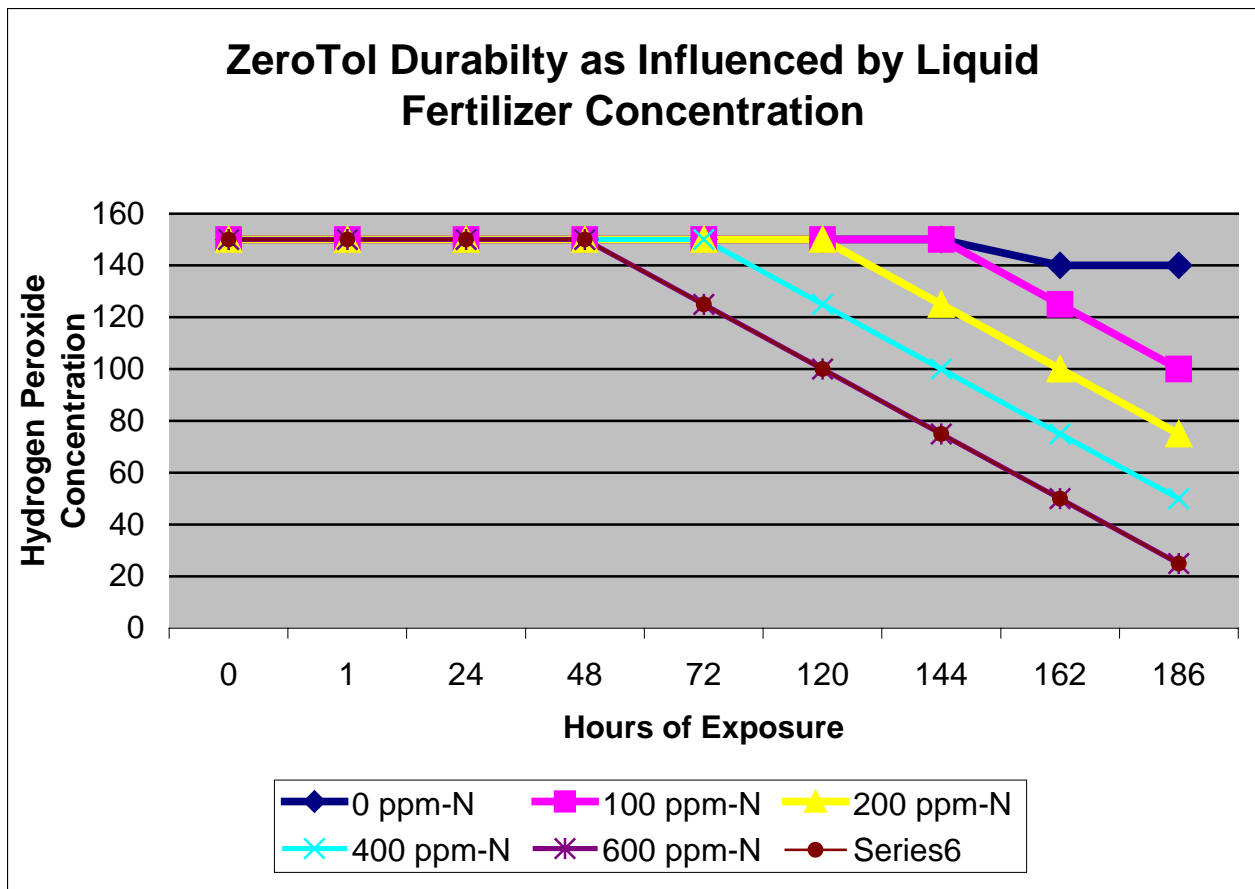
Organic Matter in System

- Organic matter was the most disruptive
- Minor effects on durability even at high rates for 3 days
- After 7 days: no, very low, moderate, high organic matter levels resulted in 7%, 60%, 83%, 97% reduction in efficacy, respectively.



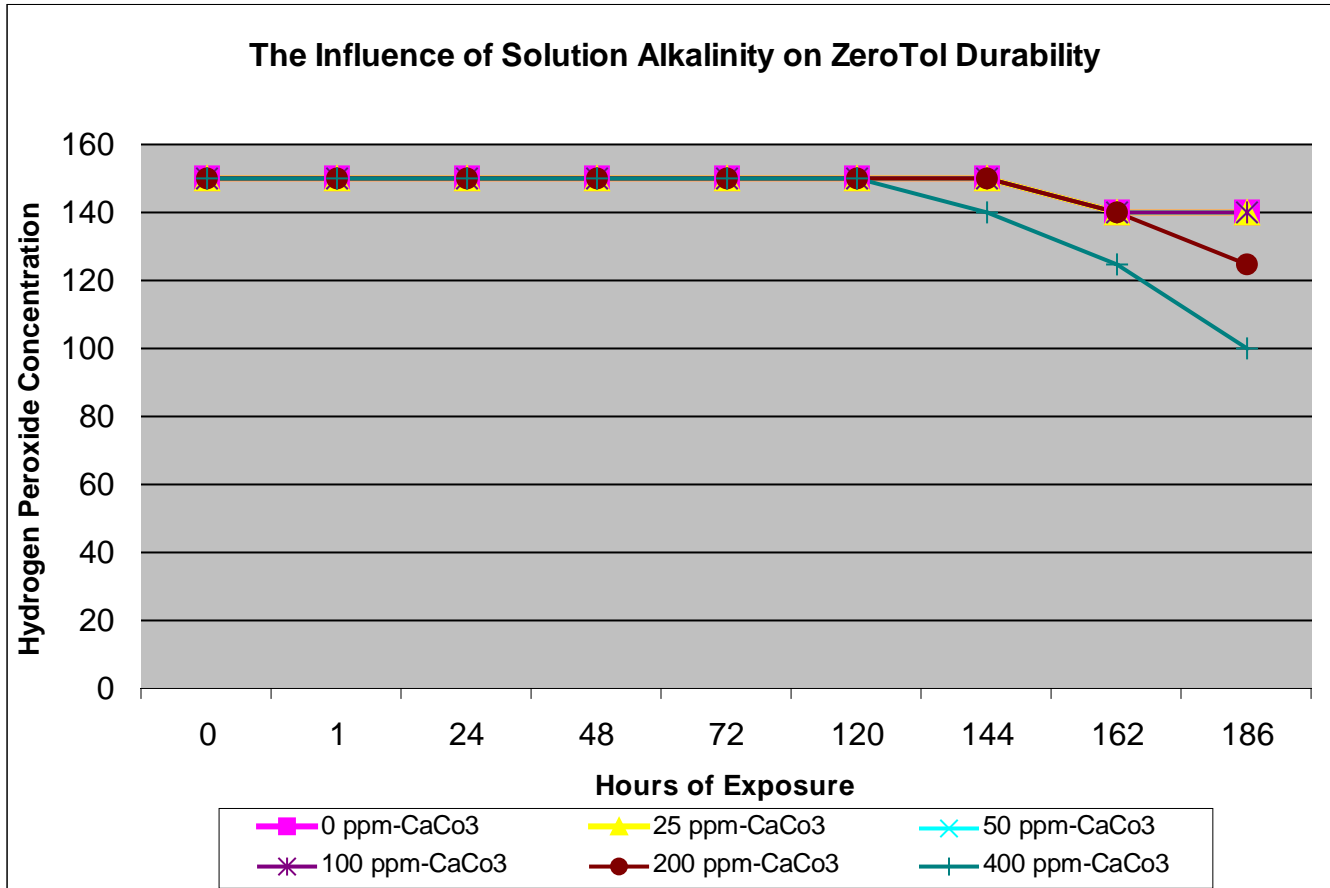
Liquid Fertilizer

- Second most influential water quality factor in loss of efficacy
- For 6 days no loss in efficacy at sub-irrigation nutrient strength (100ppm-N)
- After 7 days: 0, 100, 200, 400, and 600 PPM-N lost 7, 34, 50, 67, and 83% efficacy, respectively.



Solution Alkalinity

- The least effect on water quality
- After 7 days: 0, 25, 50, 100, 200, and 400-ppm alkalinity lost 7, 7, 7, 7, 17, and 33 percent efficacy, respectively.



Results:

Comparing the durability of hydrogen peroxide to ZeroTol in solution

- ZeroTol was degraded to a greater degree by organic matter than by solution alkalinity.
- ZeroTol unaffected by 2% organic matter for two days and by alkalinity for 4 days.
- One week of exposure to 400ppm of alkalinity diminished ZeroTol

7%.

- One week of exposure to 2% organic matter diminished ZeroTol 83%

Conclusion:

The alkalinity of the water had minimal impact on the ZeroTol solution and a 2% organic content of treated water would over a week's time degrade ZeroTol beyond the point of being efficacious. Recommendations would be for those recycled water systems to be treated with ZeroTol that any filtration that could be added to help reduce free organic matter in the water would help prolong the efficacy of ZeroTol. ZeroTol basically unaffected for 5 days by nutrient levels in the range of 200 ppm N.

In Summary, ZeroTol is an effective treatment for recycled water using a 3-4 day treatment cycle as a time frame for chemical longevity.