Objective

Determine the efficacy of an Ozone/UV Advance Oxidation Process (AOP) in degrading Round-up (glyphosate) & Bonzi (paclobutrazol) in horticultural waste water

Overview

- Greenhouse growers are proactively adopting recirculating irrigation systems to:
  - Decrease costs
  - Reduce environmental impact of their operations
  - Comply with government regulations
- Issues with reusing horticultural wastewater include:
  - Nutrient imbalances from differential plant uptake
  - Perennial threat of pathogen proliferation
  - Chemical contaminant accumulation
- Pesticide and growth regulator contamination in the source water or from application within the greenhouse can impact plant productivity
- AOPs have been demonstrated as a method for degrading organic and inorganic contaminants in irrigation water (1)

Methodology

- The greenhouse set-up consisted of 4 subirrigation troughs on 4 benches each bearing a water treatment system (UV, O₃ (AOP) in a Complete Randomized Block
- A 2 L chamber containing a UV light and intensity monitor provided a dose of 75 ± 10 mJ • cm⁻² at 254 nm
- The O₃ generation device, supplemented by an oxygen concentrator, produced an aqueous ozone concentration of 2 ppm

Results

- Positive and negative control values for Round-up and Bonzi matched values from pretests done to verify EC50 concentrations reported in the literature
- Plant number did not return to control values except for O₃ treatment of round-up
- For Bonzi contamination, 5 minutes of treatment with O₃ or AOP, values for leaf number and leaf area returned to control values (Figure 3)
- After 15 minutes, a discrepancy was observed: O₃ and AOP treatment appeared marginally less effective at 15 minutes than at 5 minutes but still close to the control
- For Roundup, both 5 and 15 minutes of treatment with O₃ or AOP returned frond number and leaf area to control values (Figure 3)
- UV treatment was ineffective at treating either contaminant

Summary

- Both ozone and AOP treatments returned frond area and leaf number to control
- UV treatment was ineffective at degrading either Bonzi or Round-up
- Growth metrics at 15 min in the Bonzi trial did not agree with predicted performance and warrants further study:
  - Nutrient availability can be affected by UV, ozone and AOP treatment
  - Oxidative degradation of organic components are known to create degradation byproducts (1)

References