

UV-C report 2023

Results and outreach activities conducted in 2022

Methods: The UV-C cart was transported to a greenhouse with tomato plants infected with powdery mildew. We did not successfully obtain a suitable robot from Tric robotics to run this cart in between tomato rows in a greenhouse. Despite this limitation, we moved the cart manually at a designated speed to expose diseased plants for 20 S/run (Fig. 1). Another row of tomato plants was exposed twice with a second run within an hour of the first run. In contrast, one row was left untreated/unexposed. This treatment was repeated 3 times at 5 days intervals. Disease severity(%) was determined from all three rows (5 replicate plant/row) 5 times starting from 10 days after UV exposure followed by every 10 days interval. The area under the disease progress curve (AUDPC) was calculated from 5 disease assessments for all 3 treatments from the formula described by Campbell and Madden (1990):

$$\text{AUDPC} = \sum[(x_i + x_{i-1})/2][t_i - t_{i-1}]$$

where $n=5$ is the total number of evaluation times, x_i is the proportion of the tomato leaves covered with fungal growth or disease severity (%) at i th observation; t_i , and $(t_i - t_{i-1})$ is the duration between each assessment (=10).



Fig. 1. Exposure of tomato plants affected with powdery mildew to UV-C in a greenhouse.

Results: UV-C exposure of tomato plants affected with powdery mildew could significantly reduce AUDPC value. However, the difference between single and double exposure indicates that multiple exposure could provide higher disease suppression compared to single exposure (Fig. 2). More work is needed to determine the time of exposure to obtain maximum disease suppression without any phytotoxicity.

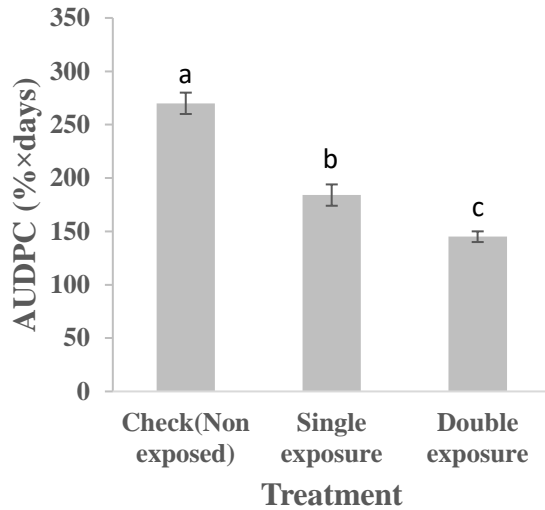


Fig. 2. Area under powdery mildew disease progress curve at two UV-C exposure regimes compared to non-exposure. Vertical bars with different letters are significantly different according to Fisher's protected LSD test (P=0.05).

Pitfall and future work plan: Our research technician moved UV-C cart in the greenhouse with appropriate personal protective equipment (shield). However, minor exposure with this PPE can't be ruled out completely, and there is a health risk from prolonged exposure to UV-C. We are in the process of assembling an autonomous robot with the light bulbs fixed in both arms capable of running in between rows. It will also have the capability to self-charge when it runs out of battery charges by docking to a charging station. Thus, it should gain the capability of treating a large commercial greenhouse. We also plan to treat tomato plants affected with leaf mold during the 2023 growing season.