

Methods:

A UV-cart capable of running in between tomato rows inside the greenhouse/high tunnel was built by procuring metal pieces, tires and batteries from online and local suppliers. Frame was assembled in Rahman lab with the help from WVU innovation lab that helped sizing the metal frames. Light bulbs (TUV PL-L 55W) that have a peak emission of 254 nm and irradiation intensity of 0.237 Wm were bought from Phillips North America Corp., Andover, MA, USA that were positioned in both sides of the frame from 2 feet above the ground to 6 feet by placing 1.2' apart (Fig. 1). Height of the light rack can be adjusted depending on the height of the tomato plants that will be treated to facilitate light penetration into the upper and lower canopies of the plants. Robot for self-propelling purpose could not be leased from TRIC robotics, and we developed a technique to pull the cart with a rope at designated speed. However, assembling a robotic arm to propel the unit is in progress.



Fig. 1. A custom-built UV-C cart that can be driven in between tomato rows at a designated speed to get powdery mildew infected tomato plants exposed to UV-C for a pre-optimized time.

Plant exposure to UV-C

Potted plants were kept inside the humid chamber together with previously powdery mildew infected plants to facilitate spread of the disease to new plants (Fig. 2). When symptoms were visible, plants were moved next to the UV-C cart (12" apart from the bulbs). Plants were

separately exposed to UV-C by turning on and off the lights with a remote-controlled switch to facilitate pre-determined exposure time during nighttime. To ensure consistent intensity levels, the UV-C lights were turned on 10 min prior to irradiation. Irradiance was measured with a calibrated spectrometer (StellarNet Inc. EPP2000, Tampa, FL) to ensure light intensity didn't exceed the level programmed. As previous studies indicated that tomato leaf is more sensitive to UV-C, multiple exposure levels (15 sec, 1 min, 10 min) were tested initially, each on 3 replicate plants with one non-treated check. Treated plants were evaluated within 72 hours of treatment for potential phytotoxicity. After a day of UV-C exposure, plants were again moved to a different humid chamber to observe if the disease comes back or fungal infection in the tissue were completely killed by UVC. Powdery mildew data were recorded 5 days after light exposure from both adaxial and abaxial sides of the middle leaves.

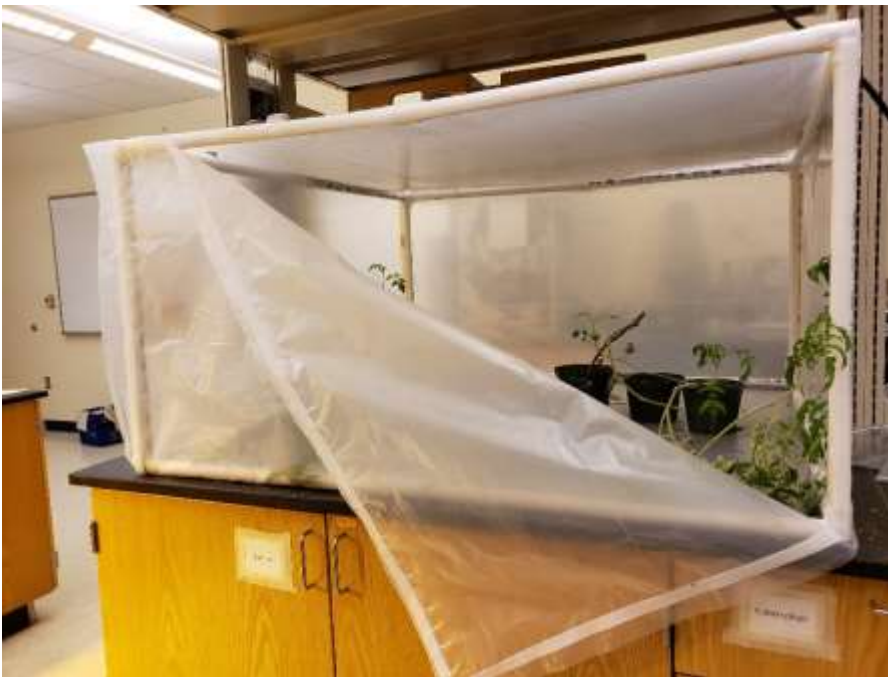


Fig. 2. A custom-built bench top humid chamber to keep tomato plants infected with powdery mildew and get new plants exposed to PM

Interaction with growers

Grower cooperator Joyce Shafer was on campus to observe the results and was briefed about how it works. However, other grower cooperator Paul Mock was contacted virtually, and we showed him the results as he is 3 hours away from the campus.