2023 NCERA-101 Station Report – University of Delaware

Qingwu Meng, Assistant Professor
Department of Plant and Soil Sciences
University of Delaware, Newark, DE 19716
https://www.indooraglab.com/

1. New facilities and equipment

The University of Delaware purchased the following instruments: 1) dimmable LED bar fixtures of various colors (Demegrow); 2) an SQ-616 ePAR quantum sensor (Apogee Instruments); and 3) an LI-180 spectrometer (LI-COR).

2. Unique plant responses

- The inclusion of far-red light, but not green light, in the main photoperiod is necessary for day-extension blue light to inhibit flowering in chrysanthemum grown indoors.
- When applied at a sufficient concentration in the nutrient solution, a calcium-mobilizing chemical biostimulant mitigated tipburn of hydroponic lettuce 'Rex' without affecting biomass compared to the control, in a tipburn-inducing greenhouse environment.

3. Accomplishments

3.A. Short-term outcomes

- The University of Delaware collaborated with an industry partner, Croda, Inc. and validated that a chemical biostimulant is effective at reducing tipburn of greenhouse hydroponic lettuce by 88% compared to the control, thereby improving lettuce quality and sellable yield for controlled-environment growers.

3.B. Outputs

- The University of Delaware collaborated with Michigan State University on a peer-reviewed publication in the Journal of the American Society for Horticultural Science. This paper discussed a unique flowering response of chrysanthemum to light quality when grown indoors.
- The University of Delaware and Michigan State University collaborated on and published a peer-reviewed publication in Plants. This paper focused on factors that determined indoor hydroponic lettuce growth responses to broad-spectrum LED lighting.

3.C. Activities

- The University of Delaware collaborated with Michigan State University on an indoor chrysanthemum light quality experiment, which was conducted simultaneously at both locations. They worked together on the experimental protocol, execution, data analysis, and manuscript writing.
- The University of Delaware collaborated with an industry partner, Croda, Inc., to evaluate the efficacy of a calcium-mobilizing chemical biostimulant at mitigating lettuce

tipburn in greenhouse hydroponic production. They conducted two greenhouse experiments and worked on data analysis and interpretation.

3.D. Milestones

- The University of Delaware led the NE-1835 (Resource Optimization in Controlled Environment Agriculture) group to submit a project renewal proposal, engaging multistate researchers to brainstorm and compile new project objectives, activities, and milestones that will continue to benefit the controlled-environment agriculture industry.
- The University of Delaware is organizing the annual NE-1835 meeting that will take place on July 31, 2023, in Orlando, FL, concurrent with the American Society for Horticultural Science annual conference.

4. Impact statements

- Tipburn of lettuce is a major crop physiological disorder that severely affects crop quality and leads to economic losses in the controlled-environment agriculture industry. The collaboration between the University of Delaware and Croda, Inc. has leveraged a chemical biostimulant as an effective solution to mitigate lettuce tipburn by 88% in greenhouse conditions. This product thus has potential for wider industry adoption.
- Black cloth application is required to induce flowering of many summer-fall garden chrysanthemum production programs, but it is laborious and incurs material wear. The University of Delaware has investigated photoperiodic flowering responses of chrysanthemum cultivars to develop effective strategies that reduce black cloth use while ensuring flowering. Reduced black cloth can lower labor and material costs by 43% and thus increase chrysanthemum growers' profitability.

5. Published written works

5.A. Scientific peer-reviewed journal articles

- Kohler AE, Birtell EM, Runkle ES, Meng Q. 2023. Day-extension blue light inhibits flowering of chrysanthemum when the short main photoperiod includes far-red light. J. Amer. Soc. Hort. Sci. 148(2):89–98. [CrossRef]
- Meng Q, Runkle ES. 2023. Blue photons from broad-spectrum LEDs control growth, morphology, and coloration of indoor hydroponic red-leaf lettuce. Plants 12(5):1127. [CrossRef]

5.B. Scientific presentation abstracts

- Appel EY, Meng Q. 2022. Increasing nutrient solution electrical conductivity in Kratky-style hydroponics increases lettuce growth following the law of diminishing returns (abstr). HortScience. 57(9S):S52.
- Birtell EM, Meng Q. 2022. Blue light increases hot pepper seedling compactness and determines the influence of light intensity (abstr). HortScience. 57(9S):S63.
- Kennebeck EJ, Meng Q. 2022. Mustard 'Amara' seedlings benefit from superelevated co2, but not far-red light (abstr). HortScience. 57(9S):S25.