2025 NCERA-101 Station Report – University of Delaware

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1. New facilities and equipment

The University of Delaware purchased an anemometer (Anemomaster Lite, Kanomax), a handheld fluorometer (PAR-FluorPen FP 110-LM/S, Photon Systems Instruments), six carbon dioxide/temperature/relative humidity sensors (MX1102A HOBO MX CO2 Temp RH Logger, Onset Computer Corporation), and a dissolved oxygen meter (HI9147-04 dissolved oxygen meter for aquaculture, Hanna Instruments).

2. Unique plant responses

- The University of Delaware performed a greenhouse experiment to evaluate how the duration of nighttime photoperiodic lighting influenced flowering of long-day plants under warm-white (WW) or red + far-red (R+FR) light-emitting diodes (LEDs). Increasing the nighttime lighting duration increased the efficacy of WW LEDs at promoting flowering of petunia and increased the efficacy of R+FR LED lamps at promoting flowering of snapdragon. Delivering WW LEDs all night long can minimize flowering delay in petunia compared to R+FR LEDs. In contrast, sufficient FR light was needed to promote flowering of snapdragon, for which WW LEDs were ineffective.

3. Accomplishments

3.A. Short-term outcomes

- The University of Delaware disseminated research results that demonstrated high efficacy of a chemical biostimulant at controlling tipburn in greenhouse hydroponic lettuce. As a result of this effort, multiple grower inquiries were received across the U.S. to adopt this new product in their commercial hydroponic operations, which will aid in improving crop quality and yield and reducing crop loss and shrinkage due to tipburn.

3.B. Outputs

- The University of Delaware published two peer-reviewed articles in HortScience based on greenhouse floriculture lighting studies funded by the American Floral Endowment (AFE). The papers characterized how the timing, duration, and quality of nighttime photoperiodic lighting affected flowering of greenhouse long-day ornamental crops.
- The University of Delaware collaborated with Arizona State University to publish a peer-reviewed article in HortScience, which evaluated potassium sulfate supplementation with elevated electrical conductivity in indoor hydroponic strawberry production.
- The University of Delaware collaborated with an industry partner, Croda, Inc. on a grower-oriented article in the trade magazine, Inside Grower. This article summarized

experimental results showing that a chemical biostimulant was effective at reducing tipburn of greenhouse hydroponic lettuce without compromising biomass.

3.C. Activities

- The University of Delaware, Arizona State University, and Colorado State University continued to collaborate on a research-education grant from the USDA NIFA Urban, Indoor, and Emerging Agriculture Program (titled Tailoring Hydroponic Factors to Controlled-Environment Production of Emerging Food Crops). The group worked on set research goals (with foci including biostimulant, dissolved oxygen, and lighting) to further our understanding of hydroponic system/crop improvement.
- The University of Delaware's Qingwu Meng was invited to give a keynote talk at an international agrochemical industry symposium in Brazil to share challenges and opportunities in controlled-environment agriculture for the agrochemical industry. This event sparked interest and promoted potential cross-disciplinary collaborations.

3.D. Milestones

- The University of Delaware, Arizona State University, and Colorado State University are working collaboratively on development of open-access teaching modules for hydroponic lab activities. These include learning objectives, standard operating procedures, and demo videos for a broad range of topics relevant to introductory hydroponic crop production. The content is slated for completion in Fall 2025. Learning assessment will follow to validate the teaching materials and evaluate teaching efficacy.
- The University of Delaware is working on data acquisition, analysis, visualization, and interpretation in preparation for upcoming conference presentations on sole-source lighting, carbon dioxide enrichment, and biostimulant-enabled tipburn control, as well as associated scientific manuscripts to submit for publication.

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. Through continued, iterative experiments throughout the year, the collaboration between the University of Delaware and Croda, Inc. has identified a chemical biostimulant as an effective solution to decrease lettuce tipburn severity by 71% to 96% without affecting final yield in greenhouse conditions. This product has shown great potential for wider industry adoption to enhance crop quality and harvestable yield. The group is also actively disseminating research results with industry stakeholders including controlled-environment growers and agrochemical companies.

5. Published written works

5.A. Scientific peer-reviewed journal articles

- Ries, J., Q. Meng, and Y. Park*. 2025. Potassium sulfate supplementation with elevated electrical conductivity was unproductive for hydroponic strawberry at the original Yamazaki nutrient solution nitrogen level. HortScience 60(2):198–204. [CrossRef]

- Meng, Q.* and T.J. Kramer. 2024. Increasing the nighttime lighting duration can hasten flowering of long-day plants. HortScience 59(12):1833–1837. [CrossRef]
- Meng, Q.* and I. Kelly. 2024. Efficacy and optimal timing of warm-white or red + far-red LED lamps in regulation of flowering in long-day ornamentals. HortScience 59(6):767–776. [CrossRef].

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5.B. Scientific presentation abstracts

- Meng, Q.* and T. Kramer. 2024. Increasing the nighttime lighting duration can hasten flowering of long-day plants (abstr). HortScience 59(9S):S462. [oral]
- Meng, Q.* and S. Msabila. 2024. An intermediate calcium-mobilizing biostimulant concentration controls tipburn of two greenhouse hydroponic lettuce cultivars without affecting growth (abstr). HortScience 59(9S):S237. [oral]

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5.C. Trade magazine articles

- Meng, Q. 2025. Combatting lettuce tipburn with a biostimulant. Inside Grower 2:32–33.