THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

NCERA-101 Station Reports

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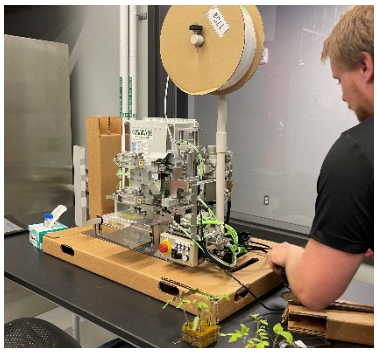
1. New Facilities and Equipment.

[Kubota/Kroggel] Our new greenhouse facilities (Controlled Environment Agriculture Research Complex, CEARC) installed a dry fog humidification system in a 5,000 sqft compartment.

- AKIMist system (Ikeuchi USA)

[Kubota/Hollick] We acquired a tomato grafting robot, which has a capacity to graft 400 plants per hour.

- Robo-GRF (Kusakabe, Japan)



2. Unique Plant Responses.

[Kubota/Tripathi] As part of multi-state collaboration led by North Carolina State University, we examined artificial chilling treatment as means to improve propagation efficiencies of difficult-to-propagate strawberry cultivars Albion and Fronteras. While 'Albion' responded positively to chilling by increasing runners and daughter plants, 'Fronteras' did not, likely due to their unique genotype and photoperiod characteristics.

[Kubota/Lin] We examined supplemental farred lighting as means to prevent semi-dormancy as means to grow short-day cultivars continuously under short day conditions. Supplemental FR treatment significantly extended petiole and peduncle length, regardless of daylength in two

selected cultivars Earliglow and Nyohou. Strawberry total yield, percent marketable yield, and total number of fruit were improved in plants with supplemental FR treatment. Supplemental FR light treatment also increased soluble solid concentration (SSC, brix %) and SSC-to-TA (titratable acidity) ratio regardless of cultivar.

[Kubota/Fulcher] Weekly flower mapping and structural analyses identified key developmental stages of floral buds in 'Albion' strawberry plants to predict near future yields (3 or 8 weeks ahead). Previously flower mapping was available to provide detailed information of plant reproductive growth. The specific knowledge we added will help US greenhouse strawberry growers to make more data-driven decision about labor and other resource allocation and market planning.

[Kubota/Kim] We confirmed that far-red light significantly contributes to photosynthesis of shaded leaves in the canopy and compensates for a lower PAR level. Therefore, conventional PPFD based quantification of leaf light compensation points are likely underestimated when higher far-red photons are present in the light source, as the contribution of far-red light is ignored.

3. Accomplishments:

3.A. Short-term Outcomes

N/A

3.B. Outputs:

[Kubota/Kim] Our second greenhouse trial confirmed that our newly developed leaf-pruning method based on the weekly light integral (PAR or ePAR) received at the bottom of canopy reduced the frequency of leaf pruning and thereby labor input significantly.

3.C. Activities

[OHCEAC] Organized an annual OHCEAC CEA Conference 'Advancement in CEA Automation and Crop Management'. This conference (July 19th, Columbus, OH) brought four keynote speakers from academia and industry R&D and eight research presenters. 103 in-person and 84 online participants.

[ADVANCEA] In collaboration with Rutgers University and University of Arizona, Kubota designed and offered online professional evening course "Introduction to greenhouse environmental control for crop production" with 26 one-hour lectures. OSU instructors included Chieri Kubota and Peter Ling.

3.D. Milestones

N/A

4. Impact Statements.

[Kubota] Working with other PIs in Michigan, Indiana, and Arizona, online forum, Indoor Ag Science Café series (https://scri-optimia.org/cafe.php) has made significant impacts to our CEA stakeholders by providing current information about indoor farming technologies and educational opportunities to learn the basics necessary for designing and operating indoor farms. There have been 11 webinars during the reporting period reaching a total of 1,654 online participants. The five most-viewed videos produced during 2024 on our YouTube channel received more than 3,000 views.

[Samarakoon] Nutrient optimization projects enabled identifying nutrient solution concentrations/ electrical conductivity management required for four leafy greens (lettuce arugula, kale, and collard) popular in the Controlled Environment Agriculture. Hydroponic system comparison under different growing seasons, advanced knowledge in plant performance, water uptake and nutrient solution changes of liquid culture systems. Selection of sustainable substrates for Dutch-bucket systems has enabled growers to choose their growing media based on sustainability, economy, and local availability. The follow up project on propagation helped developing protocols for seedling development to fully compliance with the new alternate substrates identified in the previous projects.

5. Published Written Works.

Journal papers (peer-reviewed)

Amrhein, J., F. Rotondo, **C. Kubota**, S.A. Miller, and A.L. Testen 2024. Diagnostic guide for Pythium root rot in hydroponic leaf green and herb production. Plant Health Progress. https://apsjournals.apsnet.org/doi/10.1094/PHP-07-24-0070-DG

Chowdhury M., **U.C. Samarakoon**, and J.E. Altland. 2024. Evaluation of hydroponic systems for organic lettuce production in controlled environment. Front. Plant Sci. 15:1401089. doi: 10.3389/fpls.2024.1401089

Chowdhury M., A. Espinoza, **U.C. Samarakoon**, J. Altland, and T. Yang. 2024. Substrate comparison for tomato propagation under different fertigation protocols, Agriculture Special issue Special Issue Innovative Technologies for Sustainable Crop Production in Controlled Environment. Agriculture 2024, 14(3), 382; https://doi.org/10.3390/agriculture14030382

Valle de Souza, S., K.C. Shasteen, J. Seong, **C. Kubota**, M. Kacira, and H.C. Peterson. 2024. Production planning in an indoor farm: Using time and space requirements to define an efficient production schedule and farm size. International Food and Agribusiness Management Review. 27. DOI: 10.22434/IFAMR2023.0038

Yang, T., **U.C. Samarakoon**, and J. Altland. 2024. Growth, phytochemical concentration, nutrient uptake, and water consumption of butterhead lettuce in response to hydroponic system design and growing season. Scientia Horticulturae, 332, p.113201. https://doi.org/10.1016/j.scienta.2024.113201

Yang, T., **U.C. Samarakoon**, J. Altland, and **P. Ling**. 2024. Influence of Electrical Conductivity on Plant Growth, Nutritional Quality, and Phytochemical Properties of Kale (Brassica napus) and Collard (Brassica oleracea) Grown Using Hydroponics. Agronomy 14, 2704. https://doi.org/10.3390/agronomy14112704

Other technical articles

Hollick, J. and **C. Kubota.** 2024. How to grow grafted watermelon transplants. eGro Edible Alerts. Vol 9.1 https://www.e-gro.org/pdf/e901.pdf

Kubota, C. 2024. UV radiation transmission of common greenhouse glazing materials. eGro Edible Alerts. Vol 9.9 https://www.e-gro.org/pdf/e909.pdf

Tran, K., A.J. Both, and **C. Kubota**. 2024. A primer of artificial intelligence for greenhouse control. eGro Edible Alerts. Vol 9.8 https://www.e-gro.org/pdf/e908.pdf