NCERA-101 Station Report 2022 – The Ohio State University

Reporting period: November 2021 – October 2022

OSU members:

- Chieri Kubota, Horticulture and Crop Science (kubota.10@osu.edu)
- Peter Ling, Food, Agricultural, Biological Engineering
- Darren Drewry, Food, Agricultural, Biological Engineering (since 2022)
- Mark Kroggel, Horticulture and Crop Science

1. New Facilities and Equipment (including sensors, instruments, and control systems purchased/installed)

- Construction of Controlled Environment Agriculture Research Complex (CEARC) will be completed in October 2022. This state-of-the-art research greenhouse facility will provide a platform for interdisciplinary research at the nexus of horticulture/crop science, engineering, entomology, plant pathology, food science, computer science, and human nutrition/health. The $36 million project is located at Waterman Agricultural and Natural Resources Laboratory farm in the main campus of the Ohio State University (Columbus, OH).
- New electrolytic humidity sensors (Novasina AG, Switzerland) were acquired for applications in high humidity environment. These sensors will be specifically used to achieve 95% RH (<0.1 kPa at 10C) for a few hours during the night in order to prevent tipburn in strawberry. The specific technology used for this type of sensor does not cause drift problematic in conventional sensors and allows more accurate humidity measurements. More information will follow next year.

2. Unique Plant Responses

- We continued our investigation towards possible use of low pH nutrient solutions to mitigate the risk of introducing oomycete pathogens in hydroponic water culture for leafy greens. Over the past year, additional four species (eight cultivars) of leafy greens were grown under varied pH (4.0 – 5.5) and sensitivity to lowering pH as well as potential causal elements limiting the growth under low pH were identified. Based on our study, basil, bok choy, and lettuce were classified as 'low pH tolerant', kale and arugula were classified as 'moderately pH sensitive' and spinach was classified as 'low pH sensitive'. (Bates and Kubota, unpublished)
- Nighttime dim lighting was investigated as a potential measure to mitigate problematic tipburn in lettuce. Leaf conductance (stomatal and non-stomatal conductance) was increased when the nighttime dim lighting was applied in 100% blue light; however, this increase did not reduce tipburn incidence likely due to the significant impact of low boundary layer conductance seen in our tipburn-inducing environmental conditions. (Ertle and Kubota, unpublished)

3. Accomplishment Summaries

- The Ohio Controlled Environment Agriculture Center (OHCEAC) with 21 academic members launched research consortium with seven inaugural members supporting to advance CEA through various researches covering Horticulture, Engineering, Plant Pathology, Microbiology, Entomology, Workforce training, and Food Safety.
- The first annual conference of OHCEAC was held on July 20th with with a total of 169 participants. This year's focus was 'Advancement of Microbial Technologies in Controlled Environment Agriculture'.

4. Impact Statements

We continue offering an online monthly forum 'Indoor Ag Science Café' to serve as a non-competitive communications platform for indoor farmers and relevant stakeholders. The listserv currently has a wide range of stakeholder members, serving as a very effective engagement method with industry stakeholders. During the reporting period, the forums reached a total of 1,373 stakeholders. Cumulative number of views (YouTube) of recorded presentations was 2,278 for the reporting period and 27,969 for the period since August 2018.

5. Published Written Works

Books/Book Chapters

- None

Refereed Journal Articles

- Hollick, J.R. and **C. Kubota**. 2022. Effect of self- and inter-cultivar grafting on growth and nutrient content in sweet basil (*Ocimum basilicum* L.). Front. Plant Sci. 13:921440. Doi:10.3389/fpls.2022.921440
- Ertle, J.M. and **C. Kubota.** 2022. Watermelon seedling quality, growth, and development as affected by grafting and chilling exposure during simulated transportation. HortScience. 57:889-896. Doi:10.21273/HORTSCI16557-22
- Chowdhury, B.D.B., Y.J. Son, **C. Kubota,** and R. Tronstad. 2022. Automated workflow analysis in vegetable grafting using an Ultra-Wide Band based real-time indoor location tracking system. Computer and Electronics in Agriculture. 194:106773. Doi:10.1016/j.compag.2022.106773
- Chowdhury, B.D.B., S. Masoud, Y.J. Son, **C. Kubota,** and R. Tronstad. 2021. A dynamic HMM-based real-time location tracking system utilizing UHF passive RFID. J. Radio Frequency Identification. Doi: 10.1109/JRFID.2021.3102507

Refereed Conference Proceedings Articles

- **Kubota, C.**, G. Papio, and J. Ertle. 2022. Technological overview of tip-burn management for lettuce (*Lactuca sativa*) in vertical farming conditions. Acta Horticulturae (in review)

Trade Articles

- **Kubota, C.** 2022. Why does condensation happen on your plants? eGro Edible Alerts Vol 7.15. https://www.e-gro.org/pdf/E715.pdf

- **Kubota, C.** 2022. Are your air temperatures accurate? eGro Edible Alerts Vol 7.12 https://www.e-gro.org/pdf/E712.pdf
- Lopez. R., **C. Kubota**, E. Runkle and C. Mitchell. 2022. Indoor Farming FAQs. Inside Grower 10(2):48–49.

Other Creative Works

Website and social media

- Indoor Ag Science Café YouTube Channel: https://www.youtube.com/playlist?list=PLjwIeYlKrzH_uppaf2SwMIg4JyGb7LRXC
- Kubota Lab (Controlled Environment Plant Physiology and Technology): http://u.osu.edu/cepptlab
- Facebook for Controlled Environment Plant Physiology and Technology Lab: https://www.facebook.com/CEPPTLAB/
- CEA Strawberry Information: http://u.osu.edu/indoorberry
- CEA Hydroponics Information: http://u.osu.edu/hydroponics
- Kubota Lab CEA Science Communication blog: http://u.osu.edu/ceatalk