2025 NCERA-101Annual Station Reports---Hawaii

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1. **New Facilities and Equipment**
   T5 fluorescent grow lights
   LED grow lights

2. **Unique Plant Reponses**
   Food safety, environmental impact, and efficient energy usage are growing concerns in horticultural production systems. In Hawaii, ‘Koba’ and local strains of green onion can be planted year-round. The use of artificial lighting in green onion production could be a solution to help address the above concerns. The objective of this study was to compare the effects of red and blue LED lighting on the growth of ‘Koba’ green onion plants in a noncirculating hydroponic system. ‘Koba’ green onion (*Allium fistulosum*) seeds were germinated in Oasis® cubes under T5 high output fluorescent lighting in the lab. Seedlings were then transferred to 5.1-cm net pots, which were placed in 1.9-liter containers containing a hydroponic nutrient solution of Hydro-Gardens' Chem-Gro lettuce formula 8-15-36 hydroponic fertilizer with added calcium nitrate (19% Ca and 15.5% N) and magnesium sulfate (9.8% Mg and 12.9% SO_4). Half of the seedlings were grown under red LED lighting (82 µmol/m^2/s, 12-h photoperiod) and half under blue LED lighting (82 µmol/m^2/s, 12-h photoperiod). Data was collected at the end of the experiment. At the end of the study, there were significant differences in plant height, number of leaves per plant, stem diameter, total leaf length per plant, leaf dry weight per plant, and root dry weight per plant. For all these variables, red LED lighting resulted in greater values than those for blue LED lighting. In conclusion, different LED lighting could be used to supply artificial lighting for ‘Koba’ green onion plants. Red LED lighting enhanced the growth of ‘Koba’ green onions.

3. **Accomplishments**
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   How can we help students, the public, and stakeholders become familiar and engaged with controlled environment agriculture (CEA) and its benefits? Besides offering undergraduate courses such as TPSS 300 Tropical Production Systems and TPSS 491 Experimental Topics “Controlled Environment Agriculture”, we sought other ways to accomplish this. The objective is to describe how we use displays about our CEA lab at campus-wide events to

help inform audiences about CEA and its technology. Various events at the University of Hawaii at Manoa (UHM) enable colleges, departments, units, and individual laboratories the opportunity to showcase their programs, curricula, and research. At these campus-wide events, we set up table displays that explain CEA and highlight our CEA research. Our displays exhibit various aspects of the technology used in CEA such as LED (light-emitting diodes) lights, hydroponics, and greenhouse materials. We display high tech acrylic greenhouse coverings and walls, smart glass, photoselective shadecloths, and light spectrum control plastic films to show recent developments in greenhouse coverings. Hydroponic principles are explained through the use of micro-hydroponics, dwarf vegetables grown under LED lights, and hydroponic kits. A display using simulated Martian soils and LEGO® figures shows a Martian landscape with a plastic dome greenhouse with plastic vegetables growing inside. The audience gets to experience a hands-on working miniature grow tent, a replica of actual grow tents, to demonstrate how CEA experiments are conducted using grow tents with manually controlled red, blue, and white LED lights and fans. We have a shadecloth covered PVC pipe box with red and blue photoselective shadecloths and LED light placements on top, sides, and intracanopy to explain light spectrum and light placement. The Lunar/Martian greenhouse model displays an example of how plants could be grown on extraterrestrial bodies such as the moon and Mars. The display shows a cutaway view of a greenhouse installed below the soil surface for protection from radiation. Natural light is supplied with light pipes and artificial light is supplied with LEDs. Our lab's table displays have been well received by people stopping by our tables. The campus events provide the opportunity for students to assist in staffing the tables and talking about CEA and their research. We also discuss CEA research opportunities provided by the UHM Undergraduate Research Opportunities Program (UROP) and the UHM Hawaii Space Grant Consortium Program.

4. Impact Statements

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5. Published Written Works

Poster Presentations

Kurasaki, R. and K. Kobayashi. 2025. Controlled Environment Agriculture for Hawai'i's Climate. Presented at the CTAHR Conference, University of Hawaii at Manoa, Honolulu, HI. April 11, 2025.

Kobayashi, K. 2025. TPSS 300 Tropical Production Systems: The Course on the Edge of Forever. Presented at the CTAHR Conference, University of Hawaii at Manoa, Honolulu, HI. April 11, 2025.

Oral Presentations

Kobayashi, K. 2025. Controlled Environment Agriculture and Protected Cultivation. Presented at the CTAHR Conference, University of Hawaii at Manoa, Honolulu, HI. April 10, 2025.