

NCERA-101: Committee on Controlled Environment Technology and Use 2023 Station Report

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Mark Lefsrud and Philip Addo, March 30, 2023

- **New Facilities and Equipment.**

The Macdonald Campus is in the process of building a new greenhouse for teaching on campus. We are hopeful that the building will be completed by summer of 2024, delays have occurred during construction.

- **Unique Plant Responses.**

We have completed a study growing plant on a lunar regolith simulant that we were able to convert into porous concrete. We are now forming this lunar regolith and hope to use the material for other applications beyond a root substrate.

- **Accomplishment Summaries.**

Salinity negatively impacts crop productivity, yet neutral and alkali salt stresses are not often differentiated. To investigate these abiotic stresses separately, saline and alkaline solutions with identical concentrations of sodium (12 mM, 24 mM and 49 mM) were used to compare the seed germination, viability and biomass of four crop species. Commercial buffers containing NaOH were diluted to generate alkaline solutions. The sodic solutions tested contained the neutral salt NaCl. Romaine lettuce, tomato, beet, and radish were seeded and grown hydroponically for 14 days. A rapid germination was observed for alkaline solutions when compared to saline-sodic solutions. The highest plant viability recorded (90.0%) was for the alkaline solution, containing 12 mM Na⁺, and for the control treatment. Plant viability, with a value of 49 mM Na⁺ in saline-sodic and alkaline solutions, was the lowest (50.0% and 40.8% respectively), and tomato plants did not germinate. EC values were higher for the saline-sodic solutions than the alkaline solutions, yielding greater fresh mass per plant for all species, with the exception of beets grown in alkaline solution, with a value of 24 mM Na⁺.

- **Impact Statements.**

The fresh mass of romaine lettuce grown in the 24 mM Na⁺ saline-sodic solution was significantly greater than romaine lettuce grown in the alkaline solution with the same sodium concentration.

- **Published Written Works.**

- **Hitti, Y., S. MacPherson, M. Lefsrud.** 2023. Separate Effects of Sodium on Germination in Saline-Sodic and Alkaline form at Different Concentrations. *Plants* 12(1234):1-13.
- **Warner, R., B.-S. Wu, S. MacPherson, M. Lefsrud.** 2023. How the distribution of photon delivery impacts crops in indoor plant environments: a review. *Sustainability*-2165879.

- **Other relevant accomplishments and activities.**

Our campus is under renovations and hope to have more to present next meeting.