NCERA-101: Committee on Controlled Environment Technology and Use
2022 Station Report

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Mark Lefsrud and Bo-Sen Wu, October 22, 2022

1. **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 2023.

2. **Unique Plant Responses.**
   -Completed a study on the impact of cannabis under different narrow spectrum of LED lights. We were able to maximize growth of the plants using red and amber lights, with the highest cannabinoids occurring under HPS, blue and a mixture of blue with other wavelengths of light. However, HPS light sources were still the best at producing the highest biomass.
   -We have completed a study growing plant on a lunar regolith simulant that we were able to convert into porous concrete.

3. **Accomplishment Summaries.**
   The Biomass Production Laboratory at Macdonald Campus of McGill University is investigating the relationship between pigment absorbance and supplemental lighting for crop production. We have been doing studies on the impact with low pressure sodium lamps (LPS) and have been collecting data that LPS lamps are equivalent to other amber light systems for plant growth.

4. **Impact Statements.**
   Low pressure sodium lamps have the capacity to grow plants at an equal level as other lighting fixtures. Supplementing with blue light improves the growth but only small amounts of blue light is required to maximize growth.

5. **Published Written Works.**
   - Rahman, M. S., S. MacPherson, A. Akbarzadeh Shafaroudi; A. Guerini; J. Chapelat; M. Lefsrud. 2022. Experimental investigation of heat and moisture transfer with ventilation through porous concrete with embedded coils for air conditioning. Building and Environmental Journal. 222(2022)109370
   - Rahman, M. S., S. MacPherson, A. Akbarzadeh Shafaroudi; A. Guerini; J. Chapelat; M. Lefsrud. 2022. A study on heat and mass transfer through vegetated porous concrete for environmental control. Journal of Cleaner Production. 366(2022)132984
   - Yavari, N., R. Tripathi, B.S. Wu, S. MacPherson, J. Singh, M. Lefsrud. 2022. Comparative proteomics analysis of Arabidopsis thaliana response to light-emitting diode of narrow wavelength 450 nm, 595 nm, and 650 nm. Journal of Proteomics 265:104635
   - Rahman, M. S., S. MacPherson, Lefsrud. 2022. Prospects of porous concrete as a plant-growing medium and structural component for green roofs: A review. Renewable Agriculture and Food Systems:1-14 RAFS-D-21-00098R1 Published May 25, 2022
   - Addo, P.W., P. Ossowski, S. McPherson, A. Gravel, R. Kaur, J. Singh, V. Hoyos-Villegas,V. Orsat, M.J. Dumont, M. Lefsrud. 2022. Development of a nuclear magnetic resonance method and a near infrared calibration model for the rapid determination of lipid content in field peas. Molecules 2;27(5):1642.

- Seguin, R. M.G. Lefsrud, T. Delormier, J. Adamowski, H. Fyles. 2022. Interregional differences in agricultural development across circumpolar Canada. Arctic 75(1):38-55
- Maisonneuve, J., P. Pourmovahed, M.Lefsrud. 2022. Thermodynamic limits of using fertilizer to produce clean fertigation solution from wastewater via forward osmosis. Journal of Membrane Science. 647(April);120168
- Seguin, R. M.G. Lefsrud, T. Delormier, J. Adamowski. 2021. Assessing constraints to agricultural development in circumpolar Canada through an innovation systems lens. Agricultural Systems 194:103268
- Parrine, D., T. Greco, B. Muhammad, B.-S. Wu, X. Zhao, M. Lefsrud. 2021. Color-specific response to extreme high-light stress in plants. Life 11:81

6. Other relevant accomplishments and activities.

Ebenezer Miezah Kwofie and Idaresit Ekaette have been hired as assistant professors in the Department of Bioresource Engineering at McGill University. Dr Kwofie is interested in understanding food security in developed and developing countries. Dr. Ekaette main research interests are developing novel food system.