NCERA-101: Committee on Controlled Environment Technology and Use
2025 Station Report

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Mark Lefsrud March 29, 2025

New Facilities and Equipment. The Macdonald Campus is in the process of building a new greenhouse for teaching on campus. The greenhouse is expected to be open for summer of 2025. The structure has taken longer to get built due to numerous issues and is planned to replace our earlier teaching greenhouse with 6 bays, headhouse and meeting room.

Unique Plant Responses. We have been doing research work on using green light to manage post harvest storage of leafy greens, fruits and vegetables. Our research has shown that the addition of small amounts of green light (at the light compensation point) can extend shelf life of almost any produce by more than double and can change the quality of the produce to make it more nutritious and sweeter. We have found very few plants that respond to this treatment.

Accomplishment Summaries.

- 3.A. Short-term Outcomes: We have tested all of the wavelengths and have found that consistently, Amber light is preferential for plant growth. Adding small amount of blue light can be beneficial for nutritional quality and if remains less than 10 % (5% is ideal) then the plant both has high growth with high nutritional value.
- 3.B. Outputs: Mean fresh mass of Lettuce treated with amber light was at least 20% greater than plants treated with any other wavelength including HPS.
- 3.C. Activities: Plants were grown for the full growth cycle with amber and a small amount of blue light combined light-emitting diode (LED) wavelengths, at a photosynthetic photon flux density (PPFD) ranging from 200 to 350 μmol m−2 s−1 with a 16 h d−1 photoperiod.
- 3.D. Milestones: We have been finding that a high percentage of amber light (>90 %) with < 10 % blue light (450 nm) controlled environment crop production is highly beneficial for plant production. Further research is ongoing with amber light and will be outlined as this work progresses.

Impact Statements. Amber light (595 nm) continues to impress us and we are hoping others begin to use it. Light can be sourced if requested.

Published Written Works.

1. **Wu, B.S., P. Wiredu Addo, S. MacPherson**, V. Orsat, M. Lefsrud. 2024. Updates to McCree's Photosynthetically Active Radiation Curve - 55 years later. Photochemistry & Photobiology B: Biology. JPHOTOBIOL-D-24-00899R4
2. **Trumpler, K., B.-S. Wu, P. W. Addo, S. MacPherson**, M. Lefsrud. 2024. Plant growth optimization using amber light supplemented with different blue light spectra. Horticulturae 10(10):1097
3. **Kpai, P.Y., O. Adaramola, P.W. Addo, S. MacPherson** M. Lefsrud. 2024. Mineral nutrition for Cannabis sativa in the vegetative stage. Plant Science 15(2024):1-17.

4. **Salehinia, S., F. Didaran**, S. Aliniaeifard, **S. Zohrabi, S. MacPherson**, M. Lefsrud. 2024. Green light enhances the nutritional value and pigment preservation of lettuce during postharvest cold storage. PLoS ONE 19(11)1-18.
5. **Greiss P.M**., J.D. Rich, G.A. Mackay, D. Nguyen, M.G. Lefsrud, D.H. Eidelman, C.J. Baglole. 2024. The effect of cannabis-derived terpenes on alveolar macrophage function. Frontiers of Toxicology 6:1504508. doi: 10.3389/ftox.2024.1504508
1. **Desaulniers Brousseau, V**., B. P. Goldstein, **D. Leroux,** T. Giguère, **S. MacPherson**, M. Lefsrud. 2024. Estimating the global warming potential of animal waste-based organic liquid fertilizer for urban hydroponic farms. Journal of Cleaner Production 472(2024)143434.
2. Zhou, X., Y. Zhang, X. Jiang, K. Riaz, P. Rosenbaum, M. Lefsrud, S. Sun. 2024. Advancing tracking-by-detection with *MultiMap: Towards occlusion-resilient online multiclass strawberry counting.* Expert Systems With Applications 25b (1): 124587.
3. **Rufyikiri A.-S., P. A. Wiredu, B.-S. Wu, S. MacPherson**, V. Orsat, M. Lefsrud. 2024. The use of LEDs for the stomatal response, light compensation points, and storage of spinach and kale. Journal of Photochemistry & Photobiology 257(2024):112959
4. **Desaulniers Brousseau, V**., B. Goldstein, C. Sedlock, M. Lefsrud. 2024. The Environmental Impact of Outdoor Cannabis Production. ACS Agricultural Science & Technology. 4:690−699
5. **Desaulniers Brousseau, V**., B. Goldstein, M. Lachapelle, **I. Tazi**. M.G. Lefsrud. 2024. Greener green: The environmental impacts of the Canadian cannabis industry. Resource, Conservation and Recycling 208: 107737.
6. **Wu, B.S., M. Mansoori, M. Schwalb, S. Islam, M. T. Naznin, P. W. Addo, S. MacPherson,** V. Orsat, and M. Lefsrud. 2024. Light emitting diode effect of red, blue, and amber light on photosynthesis and plant growth parameters. Journal of Photochemistry & Photobiology 256: 112939
7. **Reddy, S., L. McCartney, B.-S. Wu, P. W. Addo, S. MacPherson**, M. Lefsrud. 2024. Amber LEDs outperform red, blue, and red-blue-amber LEDs for lettuce. The Journal of Horticultural Science & Biotechnology 99(6):721–737
8. **Desaulniers Brousseau, V**., E. Bahl, A. Robichaud, M. Lefsrud. 2024. Fungal Contamination Monitoring in Legal Cannabis Products Using UHPLC-MS/MS. Journal of Testing and Evaluation 52(6):1-21
9. **Rufyikiri, S., Martinez, R., P.A. Addo, B.-S. Wu**, M. Yousefi, D. Malo, V. Orsat, S. M. Vidal, J. H. Fritz, **S. MacPherson**, and M. Lefsrud. 2024. Germicidal efficacy of continuous and pulsed ultraviolet-C radiation on pathogen models and SARS-CoV-2. Photochemical & Photobiological Sciences 23: 339–354.
10. **Hitti, Y.,** I. Buzatu, M.D. Verme, M. Lefsrud, F. Golemo, A. Durand. 2024. GrowSpace: A reinforcement learning environment for plant architecture. Computers and Electronics in Agriculture 217(108613):1-10.

Other relevant accomplishments and activities. Our campus has shifted to a university wide cannabis license to preform research on cannabis from seed, plant production, post harvest processing, and extraction. We are working with researchers in the medical school to use these extracts for human cell line testing and have published our first paper on this.