NCERA-101: Committee on Controlled Environment Technology and Use

2017 Station Report – University of Guelph Phytotron

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New Facilities and Equipment

- Apogee Instruments SS-110 Field Spectroradiometer
- Hydrosystems SuperDos 45
- HE Anderson E-1S
- We recently completed retrofit of a 30+ year old Conviron E15 growth chamber from the original T12 light configuration and refrigeration system, to a compressor free, T5 light design. The project was supported by funding from Guelph Hydro, which awarded funds for energy savings retrofits. There are plans to retrofit remaining E15 and E8 chambers in a similar manner, but using LEDs rather than T5s. Testing is underway on different LED fixtures to determine which spectrum will work best for the wide range of plants grown in the Phytotron.

Unique Plant Responses

- None to report from Phytotron staff. Please see list of recent publications.

Accomplishments and Impacts

- The University of Guelph Phytotron has been providing service to the plant research community in Guelph for 12 years. During the 2015/2016 fiscal year, the Phytotron supported the work of 137 researchers from 24 research labs. As of January 2017, there were 42 active projects in the growth chambers and growth rooms and 14 active projects in the greenhouse. Additionally, there were 61 projects in the growth chambers and rooms and 19 projects in the greenhouse that were already in progress, but completed before the end of the 2015/2016 fiscal year.
- Addition of the Apogee SS-110 spectroradiometer has allowed us to: 1) compare light from different light sources in our growth chambers (ex T5 vs various LED fixtures under evaluation for future retrofits); 2) manipulate and consistently report R:FR ratio to researchers during growth chamber set up; 3) provide researchers with a way to make reflectance/transmittance measurements of their plant material; 4) more accurately

measure PAR under different fixtures (ex. LEDs) that our quantum sensors may underestimate

- The recently completed E15 growth chamber retrofit (from T12 to T5 light and removal of traditional refrigeration system) has been estimated to use 80% less energy in its new configuration. The retrofit also has the benefit of reducing future repair costs by removing the traditional refrigeration system (often costly repairs >$1000) and using campus chilled water to control temperature by way of a control valve and actuator (comparatively inexpensive, <$1000). Future retrofits of older growth chambers will incorporate LED lights and further reduce the energy consumption of our older growth chambers.

Recent Publications

Ahmed, Z., Tetlow, I.J., Falk, D., Liu, Q., and Emes, M.J. (2016) Resistant starch content is related to granule size in barley. Cereal Chemistry 93, 618-630.

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Chiuffo, M. C., MacDougall, A. S., & Hierro, J. L. (2015). Native and non-native ruderals experience similar plant–soil feedbacks and neighbor effects in a system where they coexist. *Oecologia*, *179*(3), 843-852.

Dedicated Industrial Oilseed Crops as Metabolic Engineering Platforms for Sustainable Industrial Feedstock Production. Zhu LH, Krens F, Smith MA, Li X, Qi W, van Loo EN, Iven T, Feussner I, Nazarenus TJ, Huai D, Taylor DC, Zhou XR, Green AG, Shockey J, Klasson KT, Mullen RT, Huang B, Dyer JM, Cahoon EB. Sci Rep. 2016 Feb 26;6:22181. doi: 10.1038/srep22181.

Eisen, K., A. L. Case, and C. M. Caruso. 2017. Variation in pollen dispensing schedules of Lobelia siphilitica. International Journal of Plant Sciences 178: 79-84.

Engineering the production of conjugated fatty acids in Arabidopsis thaliana leaves. Yurchenko O, Shockey JM, Gidda SK, Silver MI, Chapman KD, Mullen RT, Dyer JM. Plant Biotechnol J. 2017 Jan 13. doi: 10.1111/pbi.12695.

FYVE1/FREE1 Interacts with the PYL4 ABA Receptor and Mediates its Delivery to the Vacuolar Degradation Pathway. Belda-Palazon B, Rodriguez L, Fernandez MA, Castillo MC, Anderson EA, Gao C, González-Guzmán M, Peirats-Llobet M, Zhao Q, De Winne N, Gevaert K, De Jaeger G, Jiang L, Leon J, Mullen RT, Rodriguez PL. Plant Cell. 2016 Aug 5. pii: tpc.00178.2016.

Husband, B.C. 2016. Effect of inbreeding on pollen tube growth in diploid and tetraploid *Chamerion angustifolium*: do polyploids mask mutational load in pollen. American Journal of Botany 103:1-9. doi:10.3732/ajb.1500243 [Special Issue]

Husband, B.C., S.J. Baldwin and H.A. Sabara. 2016. Direct vs. indirect effects of whole-genome duplication on prezygotic isolation in *Chamerion angustifolium*: Implications for rapid speciation. American Journal of Botany 103:1259-1271 [Special Issue]

I. Mascheretti, K. Turner, R. S. Brivio, A. Hand, **J. Colasanti***, and V. Rossi, 2015. Florigen-Encoding Genes of Day-Neutral and Photoperiod-Sensitive Maize Are Regulated by Different Chromatin Modifications at the Floral Transition. *Plant Physiology* **168**: 1-13

K Mahmood, A El-Dereamy, S-H Kim, E Nambara and SJ Rothstein. ANAC032 Positively Regulates Age-Dependent and Stress-Induced Senescence in *Arabidopsis thaliana.* Plant and Cell Physiology 57 2029-2046, 2016.

K Mahmood, Z Xu, A El-Kereamy, JA Casaretto and SJ Rothstein. The Arabidopsis Transcription Factor ANAC032 Represses Anthocyanin biosynthesis in Response to High Sucrose and Oxidative and Abiotic Stresses. Frontiers in Plant Science doi: 10.3389/fpls.2016.01548, 2016.

K Ranathunge, L Schreiber, Y-M Bi and SJ Rothstein. Ammonium-induces architectural and anatomic changes with altered suberin and lignin levels significantly change water and solute permeabilities of rice (*Oryza sativa L*.) roots. Planta 243 231-249, 2016.

Lipid Droplet-Associated Proteins (LDAPs) Are Required for the Dynamic Regulation of Neutral Lipid Compartmentation in Plant Cells. Gidda SK, Park S, Pyc M, Yurchenko O, Cai Y, Wu P, Andrews DW, Chapman KD, Dyer JM, Mullen RT. Plant Physiol. 2016 Apr;170(4):2052-71. doi: 10.1104/pp.15.01977.

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Stanescu S., Maherali H. 2017. Mycorrhizal feedback is not associated with the outcome of competition in old-field perennial plants. Oikos, 126:248-258.

Sunflower HaGPAT9-1 is the predominant GPAT during seed development. Payá-Milans M, Aznar-Moreno JA, Balbuena TS, Haslam RP, Gidda SK, Pérez-Hormaeche J, Mullen RT, Thelen JJ, Napier JA, Salas JJ, Garcés R, Martínez-Force E, Venegas-Calerón M. Plant Sci. 2016 Nov;252:42-52. doi: 10.1016/j.plantsci.2016.07.002.

The calcium-dependent protein kinase RcCDPK2 phosphorylates sucrose synthase at Ser11 in developing castor oil seeds. Fedosejevs ET, Gerdis SA, Ying S, Pyc M, Anderson EM, Snedden WA, Mullen RT, She YM, Plaxton WC. Biochem J. 2016 Oct 15;473(20):3667-3682.

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