

**North Carolina State University Phytotron  
2024 Station Report for NCERA-101  
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### **1. New Facilities and Equipment**

North Carolina State University's Phytotron has recently expanded its facilities by opening new growth spaces in the Plant Sciences Building. The new space includes 11 rooftop greenhouses with a total of 10,000 sq ft including a dedicated 1100 sq ft greenhouse and 1000 sq ft lab for biosafety level 3 compliance. In addition, there are walk-in and reach-in growth chambers including: 2 cold labs, 1 seed storage chamber, 5 walk-in Percival growth chambers, 12 Percival reach-in chambers, & 4 Angstrom Blue Box chambers designed by the University of Guelph CESRF team.

Over the course of the past two years, the PSB greenhouse compartments have been modified:

RO water for irrigation – 6 gallon/min production, 800-gallon reserve plumbed to all 11 greenhouse compartments and growth chambers.

Black out shading redesigned and installed for one compartment.

Additional electrical capacity in each compartment

Soil moisture and EC sensing equipment integrated into Argus control system.

LED dimming control added to 3 compartments.

Containment lab autoclave drains re-plumbed.

All greenhouse compartments had the floors re-graded for improved drainage.

The main campus Phytotron has seen improvements with the installation of an Argus system to control the rooftop greenhouses and testing of Percival controllers on existing chambers, with plans to install them on all chambers within the next two years.

### **2. Unique Plant Responses- None**

### **3. Accomplishment Summary**

- The Plant Science Building Phytotron growth facilities are open & operating successfully with about 70% occupancy in the greenhouses at this time.
- Automated irrigation systems have been designed and installed for the Percival walk-in chambers.
- BSL3 lab in the Plant Science Building Phytotron has been equipped and USDA-APHIS permitted.
- Various LED fixtures have been tested in the walk-in growth chambers in the main campus Phytotron and a 4-channel light fixture has been selected for further testing.

### **Impact Statements**

The Phytotron continues to play a vital role in supporting the NCSU campus community and large, as well as small companies in the NC Research Triangle Park area. The recent addition of growth facilities in the Plant Sciences Building has more than doubled the available controlled environment space on the NCSU campus, and has significantly enhanced the biocontainment facilities and growth space resources.

## Selected Publications

Adhikari P, Siddique MI, Louws FJ, Panthee DR (2023) Identification of quantitative trait loci associated with bacterial spot race T4 resistance in intra-specific populations of tomato (*Solanum lycopersicum* L.). *PLoS ONE* 18(12):e0295551.

<https://doi.org/10.1371/journal.pone.0295551>

Burris, K., O.D. Simmons III, H.M. Webb, L.M. Deese, R.G. Moore, L-A. Jaykus, J. Zheng, E. Reed, C.M. Ferreira, E.W. Broown & R.L. Bell. 2023. Colonization and Internalization of *Salmonella enterica* and Its Prevalence in Cucumber Plants. *Fronters in Microbiology*, doi: 10.3389/fmicb.2020.01135.

Charles, M., B. Edwards, E. Ravishankar, J. Calero, R. Henry, J. Rech, C. Saravitz, W. You, H. Ade, B. O'Connor and H. Sederoff. 2023. Emergent molecular traits of lettuce and tomato grown under wavelength-selective solar cells. *Front. Plant Sci.* 14:1087707. doi: 10.3389/fpls.2023.1087707.

Giwon L., O. Hossain, S. Jamalzadegan, Y. Liu, H. Wang, A.C. Saville, T. Shymanovich, R. Paul, D. Rotenberg, A.E. Whitfield, J.B. Ristaino, Y. Zhu, & Q. Wei. 2023. Abaxial leaf surface-mounted multimodal wearable sensor for continuous plant physiology monitoring. *Sci. Adv.* 9, eade2232.

Hansel, J., Saville, A.C., and Ristaino, J.B. 2023. Evaluation of a formulation of *Bacillus subtilis* for control of *Phytophthora* blight of bell pepper. *Plant Disease*. <https://doi.org/10.1094/PDIS-04-23-0807-RE>

Hornstein, E., M. Charles, M. Franklin, B. Edwards, S. Vintila, M.I Kleiner, and H. Sederoff. 2023. Re-engineering a lost trait: IPD3, a master regulator of arbuscular mycorrhizal symbiosis, affects genes for immunity and metabolism of non-host *Arabidopsis* when restored long after its evolutionary loss. *bioRxiv*. doi: 10.1101/2023.03.06.531368

Park, J., C. E. Collado, V. P. Lam and R. Hernández. 2023. Flowering Response of *Cannabis sativa* L. 'Suver Haze' under Varying Daylength-Extension Light Intensities and Durations. *Horticulturae* 2023, 9:526. <https://doi.org/10.3390/horticulturae9050526>

James R., M. Taggart, D. Martin, & E. Lobaton. 2023. Rapid Drought Stress Detection in Plants Using Bioimpedance Measurements and Analysis. *IEEE Transactions On Agrifood Electronics*, Vol. 1, No. 2, December 2023

Samira, R. L.F. Lopez, J. Holland & P.J. Balint-Kurti. 2023. Characterization of a Host Specific Toxic Activity Produced by *Bipolaris cookie*, Causal Agent of Target Leaf Spot of Sorghum. *Phytopathology*. 113:

Sinclair, T. & N. Jafarikouhini. 2022. Plant waterflow restrictions among sweet corn lines related to limited-transpiration trait. *Crop Science*. 2022;62:1242–1250. DOI: 10.1002/csc2.20717

Sinclair, T., N. Jafarikouhini & D. Pradhan. 2024. Unexpectedly, triple super phosphate fertilizer induces maize drought resilience. *Journal of Plant Nutrition*, DOI: 10.1080/01904167.2024.2325948