The National Phytotron at Duke University
Station Report to the NCR-101 Committee for 2001
David Tremmel

There have been many changes at our facility over the last year-and-a-half. Following the recommendation of our recent NSF review (which we reported on last year), we convened the first meeting of our External Advisory Committee in January 2001. Members of this committee are:

Dr. Fakhri A. Bazzaz, *Harvard University*
Dr. F. Stuart Chapin III, *University of Alaska*
Dr. T. Hefin Jones, *Cardiff University*
Dr. Diana H. Wall, *Colorado State University*

Their major recommendations, in light of the report of the NSF review team were (1) to change the name of the facility from "The Duke University Phytotron" to "The National Phytotron," and (2) to formally make ecological global change research the primary focus of the facility. They also recommended that we increase our efforts to let members of the ecological community know what services we offer and that we are available to help them carry out controlled environment research.

In response to another recommendation of the NSF review team, we are convening a meeting in October 2001 to address the question of how the National Phytotron can best serve the controlled environment research needs of the ecological community. One of the goals of this meeting is to gather information that will help us develop a long-term strategic plan for the facility.

STAFF CHANGES

Generally staff turnover is not big news. However, the Phytotron recently lost over 40 years of experience with the departure of two long-time staff members, Larry Giles and Elizabeth Guy. As we reported last year, Larry – whom many NCR-101 members are familiar with from his association with this group – began working full time on research using stable isotope techniques in February 2000. Since he still worked in our building, he was still available for consultation and emergency work. However, in December 2000 he left Duke for a mass spectrometry job at the Carnegie Institute at Stanford University. Elizabeth Guy, a part-time employee of the Phytotron for over 20 years, left at the same time. After a lengthy and difficult search, we were fortunate enough to find someone with excellent technical skills to replace them on our staff.

NEW FACILITIES INSTALLED OR PLANNED

No new facilities have been installed in the Phytotron over the past year. We expect to submit a proposal in February 2002 to NSF's Major Research Instrumentation (MRI) program to replace our existing (32-year-old) reach-in growth chambers with more energy-efficient and sophisticated units.

NEW CONTROL SYSTEMS

We recently upgraded our glasshouse control systems from an old, manual system to a computer-based system from Argus Controls. Besides providing more reliable control and alarm capabilities than the old system, this system also allows us to log control data that we can then provide to our users. We have been extremely pleased with this system, which is flexible enough to allow us to tailor it to our glasshouses, which operate more like daylit growth chambers than glasshouses (they have no vents; all control is via an air handler with steam and chilled water coils). The Argus system has allowed us to control temperature in our glasshouses to within ± 0.5 °C of setpoint – similar to the level of control achieved in most growth chambers.

RESEARCH

While the Phytotron continues to support a large variety of research, the majority of experiments continue to be in the area of global change research, especially work on the effects of CO_2 concentration (both superambient and subambient) on plants, communities, and ecosystems. Work with stable isotopes has also become important in recent years, and we are gaining experience in labeling plants with both ^{15}N and ^{13}C. For example, we are currently growing 32 tulip poplar trees in one of our growth chambers for use in watershed carbon budget work by researchers at the Stroud Water Research Center. These plants are being grown for 52 days with a high concentration of atmospheric $^{13}CO_2$ by the continuous injection of pure $^{13}CO_2$ into the chamber during the light period. The resulting plant tissue will have a $\partial\ ^{13}C$ ratio much higher than that of tissue grown under ambient conditions. By placing this tissue in natural watersheds to simulate natural litterfall, researchers will be able to follow the fate of its carbon as it decomposes.

TECHNOLOGY TRANSFER

For the past few years we have reported on the progress of an ongoing corn breeding research program aimed at making this important crop resistant to corn rootworm using novel hybrids of corn ancestors. Excellent results have been obtained from a large series of bioassays, and the researcher involved is now working with a seed company to investigate the feasibility of bringing her rootworm-resistant hybrid to market as an alternative to genetically-engineered rootworm-resistant corn.

WEB SITE

The Phytotron's web site is **www.biology.duke.edu/phytotron**.

SELECTED PUBLICATIONS

Bernacchi C.J., J.S. Coleman, F.A. Bazzaz, and K.D.M. McConnaughay. 2000. Biomass allocation in old-field annual species grown in elevated CO_2 environments: no evidence for optimal partitioning. ***Global Change Biology*** 6:855-863.

Fernandez R.J., and J.F. Reynolds. 2000. Potential growth and drought tolerance of eight desert grasses: lack of a trade-off? ***Oecologia*** 123:90-98.

Lacey E.P., and D. Herr. 2000. Parental effects in *Plantago lanceolata* L. III. Measuring parental temperature effects in the field. ***Evolution*** 54:1207-1217. [NOTE: temperature effects on the parent plants conducted in Phytotron chambers; seed produced from crosses then sowed in the field to look at the effects of these treatments on performance of the offspring]

Ribas-Carbo M., S.A. Robinson, M.A. Gonzàlez-Meler, A.M. Lennon, L. Giles, J.N. Siedow, and J.A. Berry. 2000. Effects of light on respiration and oxygen isotope fractionation in soybean cotyledons. ***Plant, Cell and Environment*** 23:983-989.

Uselman S.M., R.G. Qualls R.G., and R.B. Thomas. 2000. Effects of increased atmospheric CO_2, temperature and soil N availability on root exudation of dissolved organic carbon by *Robinia pseudoacacia* L. ***Plant and Soil*** 222:191-202.

Ward J.K., J. Antonovics J., R.B. Thomas, and B.R. Strain. 2000. Is atmospheric CO_2 a selective agent on model C3 annuals? ***Oecologia*** 123:330-341.