NCR-101: Committee on Controlled Environment Technology and Use
2002-2003 Station Report

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New Facilities Planned

Eighteen general purpose plant growth chambers have been ordered, with six of these already installed. Twelve of these are Enconair's model GC-20's (20 ft^2 reach-in design), four are AC-60's, and two are AC-40's (with 60 or 40 ft^2 of growing space, respectively). All 18 have humidity controls and remote programming and environmental monitoring capabilities.

We expect to order another 7 to 10 chambers in May 2003. These remaining chambers are aimed at satisfying the special needs of several groups on campus, e.g., with various needs for low temperatures, high light intensities, supplemental CO_2 capabilities, or some combinations of these. In late 2001, MSU received an NSF Major Research Instrumentation Grant that will pay for the majority of the new chambers.

A management plan has been developed by a group of faculty users representing eight departments, requesting that growth chamber management and operations be centralized as a campus-wide service facility, with user fees, and numerous other details that pertain to how the facilities will be used, assigned, and fiscally maintained.

New Sensors

In early 2002, we purchased 20 line quantum bars (10 quantum sensors on a 30" long bar) from Apogee instruments to record daily light integrals in our research greenhouses.

Research Highlights

We (with Hiroshi Shimizu at Ibaraki University, Japan) have developed a model to simulate plant shoot-tip temperature of poinsettia using an energy-balance equation by using five greenhouse environmental factors: dry-bulb, wet-bulb, and sky temperature; transmitted shortwave radiation; and air velocity. A sensitivity analysis was performed with the model to determine the relative impact of these five variables on shoot-tip temperature. The model is more effective at predicting plant shoot-tip temperature when solar radiation is moderate to high compared with the measured dry-bulb temperature. This model may be a useful tool to predict shoot-tip temperature and evaluate the effect of greenhouse environmental factors on shoot-tip temperature. It could also be used in an environmental control computer to determine when shade curtains should be deployed based on some maximum plant temperature, rather than some arbitrary light level.

A separate research project is investigating the effects of temperature and light quantity on growth and development of several bedding plant species. Lee Ann Pramuk, working on her Masters thesis, is quantifying how light quantity and temperature interact to control flower timing, flower

number and size, dry weight, and other growth factors at the plug stage (from seed sow to a mature transplant) and at the finish stage (from a mature transplant until first flowering). Plants have been grown at constant temperatures ranging from 14 to 26 ^{o}C under average daily light integrals ranging from 5 to 26 molAm^{-2}Ad^{-1}.

A third noteworthy research project (with Ph.D candidate Beth Fausey) is focusing on vernalization responses of a number of herbaceous perennial species, including *Achillea*, *Ajuga*, *Campanula*, *Coreopsis*, *Erigeron*, *Laurentia*, *Oenothera* and *Veronica*, to chilling temperature and duration. Plants are being cooled in ten growth chambers with temperature setpoints of -2.5 to 20 ^{o}C for various durations. This study will enable us to develop models based on cooling units for each species to help growers more efficiently vernalize herbaceous perennials.

2002 Publications

Enfield, A., E. Runkle, R. Heins, A. Cameron, and W. Carlson. 2002. Herbaceous Perennials: Quick-cropping Part I. Greenhouse Grower 20(1):80-86.

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Liu, B. and R.D. Heins. 2002. Photothermal ratio affects plant quality in 'Freedom' poinsettia. J. Amer. Soc. Hort. Sci. 127(1):20-26.

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Shimizu, H. and R.D. Heins. 2002. Prediction of plant shoot-tip temperature on a Penman-Monteith model. Acta Hortic. 580:169-176.

Whitman, C. and E. Runkle. 2002. Driven to Succeed. GrowerTalks 66(1):54-60.