Purdue University

NCR-101 Report for 2002

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Activities. The Department of Horticulture and Landscape Architecture will host this year's annual meeting of the Association of Education and Research Greenhouse Curators (AERGC), July 24 -27 on the Purdue campus. *Managing Plants and Their People: The Research and Teaching Greenhouse* will feature talks on both technical issues and people-management issues, and will include a tour of campus facilities and Indianapolis conservatories. Between 75 and 100 managers from the U.S. and Canada are expected to attend. For a printable registration brochure, visit the following weblink: http://www.conf.purdue.edu/schedule/pdfs/AERGC02.pdf

Plant Responses to the Environment. Effort continues to develop a mechano-stress-application protocol in preparation for screening hundreds of thousands of *Arabidopsis thaliana* T-DNA insertional mutant lines in search of seedlings that express stress-resistance phenotypes. Initial trials were conducted with wild-type *Arabidopsis* C-24 Ecotype in the greenhouse environment, where screening initially was envisioned to occur on a massive scale. Several hundred plants per flat were subjected to periodic back-and-forth brushing treatments, rolling treatments, and/or overhead static-impedance treatments. The typical rosette growth habit of vegetative *Arabidopsis* hampered efforts to mechanically inhibit seedling growth, plus the variable temperature and light-level conditions of the greenhouse were suspected to be out of the range for optimal sensitivity of the plants to mechanical stress. When protocol development was moved into a standardized growth room at constant 22°C and a PPF of 123 to 150 $\mu mol \cdot m^{-2} \cdot s^{-1}$, seedling growth was more vigorous and uniform, but mechano-responsiveness still was marginal. However, use of shade cloth to further reduce PPF in the growth room stimulated upright rather than rosette growth by the seedlings. Flats of seedlings growing in commercial soilless mix were capillary watered to avoid confounding mechanical effects of overhead watering. However, this practice caused high pH and high soluble salt problems in the unrinsed root zone that further reduced responsiveness of the plants to mechanical stress. Experiments subsequently were moved into the laboratory, where culture was switched to rockwool slabs wetted with modified Hoagland's nutrient solution. Fluorescent lamp banks were set up in the laboratory where seedlings were grown and mechano-stimulated at low PPF without need for shade-cloth tents. *Arabidopsis* C-24 switched from a rosette to an upright growth habit within a PPF range of 50 to 80 $\mu mol \cdot m^{-2} \cdot s^{-1}$. Combinations of fluorescent lamps alone or fluorescent + incandescent lamps were tested for effects on mechano-responsivity. Both low irradiance *per se* and/or a high-input-wattage ratio of incandescent-to-fluorescent radiation encourages upright growth of young *Arabidopsis* seedlings, as well as significant visual dwarfing resulting from brief, periodic brushing treatments applied for several days during the period of rapid seedling growth. Present investigations are fine tuning the irradiance requirement as well as the influence of far-red/red ratio for maximum

mechano-responsivity. Static-impedance treatments will be compared with frictional brushing treatments using the new lighting protocols. Optimum temperature for the plant response also will be determined. It is anticipated that successful development of the mass mechano-stress screen for *Arabidopsis* that will reliably reveal mechanically resistant, mutant phenotypes on the basis of visual growth differences will require the use of multiple, highly controlled *Arabidopsis* growth chambers and controlled growth conditions. The mutant-screen development project is primarily the work of undergraduate Horticultural Science major Jill A. Montgomery.

Course Development. Two 1-credit, 5-week minicourses are being developed that could serve as senior capstone electives for Horticulture undergraduates.

The first minicourse, entitled "Environmental Plant Physiology" (HORT 491M), is a whole-plant, environmental extension of a required fundamental plant physiology course taken by all Hort students. The EPP course is organized around plant responses to the Cardinal factors of plant growth, i.e., light, temperature, water, nutrients, and atmosphere. The emphasis of the course is on concepts and principles of plant responses to environmental factors, including interactions of multiple environmental factors. Effort is made to relate environmental plant responses to agricultural application. The course is not limited to controlled environment issues, but does not exclude them.

The second minicourse, entitled "Controlled Environment Agriculture" (HORT 590C), is offered at the dual level. It accommodates seniors who will become practitioners in the Hort production industry, Public Hort and Landscape Hort majors, Hort Science majors heading for grad school, as well as beginning graduate students in the plant sciences who will use greenhouses or growth chambers for their thesis research. The CEA course also is organized around the Cardinal factors of plant growth, but the emphasis is upon the technology used to control and measure the environment rather than on plant responses *per se.* Unlike the Environmental Physiology course, the CEA course is limited to issues of semi- and fully controlled environments.

The two courses could be combined in the future into a single course covering both the science and the technology of environmental effects and/or control on plants, but for now they serve two somewhat different clientele, and there is only a small carryover of enrollment from one course to the other. This difference in clientele served allows for a small degree of overlap in material covered between the two courses. Both courses have been taught twice, and should be ready for Departmental and School Curriculum Committees to consider as permanent elective and/or required courses.

Publication.

Frantz, J.M., R.J. Joly, and C.A. Mitchell. 2001. Intracanopy lighting reduces electrical energy utilization by closed cowpea stands. J. Life Support & Biosphere Sci. 7: 283-290.