2010 Report from Georgia for NCERA-101

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Impact Nugget

A prototype irrigation and fertilization system was developed that can automatically irrigate and/or fertilize based on the needs of the crop. By measuring the water and fertilizer content, a controller decides when a crop should be irrigated or fertigated, assuring that water and fertilizer applications are in concert with the crop's needs. We expect that this approach can greatly reduce water and fertilizer applications, while improving crop growth and quality.

New Facilities and Equipment

Envirotron Update: In 2009 a total of seven plant growth chambers were added to the Georgia Envirotron facility. These additional chambers consisted of one new E15 Conviron chamber with a 6050 controller, and six used E15 chambers, fitted with 3000 series controllers. The older E15 chambers are capable of sustaining sub freezing conditions (-5^0C) without lights, and 5^0C with all lights in use. The new E15 chamber utilizes two sets of stacked lights thereby doubling the amount of available floor space. None of these additional chambers have CO_2 control.

Horticulture greenhouse, Athens: A new load cell system was designed and built that uses 24 load cells to monitor evapotranspiration of potted plants. All load cells are connected to a CR10 datalogger, and the datalogger is programmed to quickly and automatically calibrate each of the load cell with a simple procedure: first all load cells are measured without any weight on them, and subsequently 1 kg weights are placed on all load cells. Using these two measurements, to datalogger automatically calculates a calibration equation for each load cell and the datalogger program is instantly modified to incorporate these calibrations. The datalogger also measures the voltage from the power supply, and automatically corrects all measurements for changes in power supply voltage.

We also have developed an irrigation/fertigation system that can water or fertigate 16 separate plots based on the substrate water content and either bulk or pore water EC. When the substrate water content drops below the set point for that particular plot, a CR10X data logger will then compare substrate EC to the EC set point for that plot. If the substrate EC is below the EC set point, the plot will be irrigated with fertilizer solution, otherwise the plot will be watered with plain water. This is a first step towards integrating automation of irrigation and fertilization in greenhouses.

Unique Plant Responses

We have observed that high application rates of ABA can induce quick wilting in plants, even when adequate water is still present in the substrate. Apparently, ABA inhibits the ability of plants to take up water, and we are currently studying this phenomenon in more detail.

New Graduate Course

A new graduate course, titled 'Measurements and Control in Plant and Soil Science' was developed. This course focuses on how to measure a wide variety of environmental factors and physiological processes, using dataloggers. Also included in the course is the use of dataloggers to manipulate and

control environmental factors, such as light, CO_2, temperature and soil moisture. This course is offered for the first time in spring 2010.

Impact Statement

Water availability for irrigation and runoff of excess water and fertilizer are two issues important to the future of the greenhouse industry. To increase the sustainability of the greenhouse industry, we are working on new approaches to irrigation management. One method we are using is to develop simple models that can predict the water use of greenhouse crops, based on plant age and environmental conditions. We have conducted studies where we precisely quantified how much water petunias used each day during the production cycle, while monitoring environmental conditions in the greenhouse were monitored. These results were used to develop a simple mathematical model to predict how much water the plants need, based on their age and the environmental conditions in the greenhouse. We found that most of the daily fluctuations in water use can be explained based on two simple factors: plant age and the amount of light. The model we developed will be incorporated into a software program developed by Jonathan Frantz with the USDA. His software, Virtual Grower, is freely available to the public and growers will be able to use this software to estimate the water needs of their crops. We expect that growers will be able to reduce water usage by 50- 80% by using these models.

Published Written Works

Refereed Journal Articles

Ogden, A.B. and M.W van Iersel. 2009. Southern highbush blueberry production in high tunnels: environmental conditions, development, yield, and fruit quality. *HortScience* 44-1850-1856.

van Iersel, M.W., K. Seader, and S. Dove. 2009. Exogenous abscisic acid application effects on stomatal closure, water use, and shelf life of hydrangea (*Hydrangea macrophylla*). *Journal of Environmental Horticulture* 27:234-238.

Kang, J.-G. and M.W. van Iersel. 2009. Managing fertilization of bedding plants: a comparison of constant fertilizer concentrations versus constant leachate electrical conductivity. *HortScience* 44:151-156.

Non-Refereed Journal Articles

Krewer, G., C. Horner, R. Horner, E. Andrews, M. van Iersel, A. Ogden, M. Rieger, M. Tertuliano, and B. Mullinix. 2009. Evaluation of high tunnels for organic southern highbush production in South Georgia. Proceedings for the Southeast Blueberry Conference (G. Krewer, editor), p. 26-31.

Fernandez, R.T., J. Lea-Cox, G. Zinati, C. Hong, R. Cabrera, D. Merhaut, J. Albano, M. van Iersel, T. Yeager and D. Buhler. 2009. NCDC216: A New Multistate Group for Water Management and Quality for Ornamental Crop Production and Health. *Proceedings of the SNA research conference* 54:35-38.

van Iersel, M., R.M. Seymour, M. Chappell, F. Watson, and S. Dove. 2009. Soil moisture sensor-based irrigation reduces water use and nutrient leaching in a commercial nursery. *Proceedings of the SNA research conference* 54:17-21.

Kim, J. and M.W. van Iersel. 2009. Daily water use of abutilon and lantana at various substrate water contents. *Proceedings of the SNA research conference* 54:12-16.

Popular Articles

van Iersel, M. and M. Chappell. 2009. Using soil moisture sensors to control irrigation in a production setting. *Georgia Green Industry Association Journal* 20(4): 23.

Scientific and Outreach Oral Presentations

Lea-Cox, J., R.T. Fernandez, G. Zinati, C. Hong , R. Cabrera, D. Merhaut , J. Albano, M. van Iersel, T. Yeager, and D. Buhler. 2009. NCDC216: A new multistate group for water management and quality for ornamental crop production and health. 2009 National Water Conference, St. Louis, MO.

Kim, J. and M.W. van Iersel. 2009. Modeling daily water use of abutilon and lantana based on environmental conditions. 2009 Annual Conference of the American Society for Horticultural Science, St. Louis, MO.

Kim, J. and M.W. van Iersel. 2009. Daily water requirements of petunias as a function of plant age and environmental conditions. 2009 Annual Conference of the American Society for Horticultural Science, St. Louis, MO.

van Iersel, M.W. 2009. Using soil moisture sensors for controlled drought stress experiments. 2009 Annual Conference of the American Society for Horticultural Science, St. Louis MO.

van Iersel, M.W and S. Dove. 2009. Water content in soilless substrates: spatial and temporal dynamics. 2009 Annual Conference of the American Society for Horticultural Science, St. Louis, MO.

van Iersel, M.W. and J. Lea-Cox. 2009. Using soil moisture sensors for irrigation control. Annual meeting of USDA regional project NCERA-101, Controlled environment technology and use. Park City, UT.

Kim, J. and M.W. van Iersel. 2009. Modeling daily water use of abutilon and lantana based on environmental conditions. Annual meeting of USDA regional project NCERA-101, Controlled environment technology and use. Park City, UT.

van Iersel, M.W., A. Ogden, J. Kim, C. Radcliffe, L. Donovan, and A. Sugiyama. 2009. High tunnel microenvironment affects leaf and bud temperatures of southern highbush blueberries (*Vaccinium corymbosum* L.). GreenSys 2009, Quebec City Canada.

van Iersel, M.W., S. Dove, and S.E. Burnett. 2009. The use of soil moisture sensors for improves uniformity and irrigation control in greenhouses. GreenSys 2009, Quebec City, Canada.

Kim, J. and M.W. van Iersel. 2009. Daily water use of abutilon and lantana at various substrate water contents. SNA research conference, Atlanta, GA.

van Iersel, M, R.M. Seymour, M. Chappell, F. Watson, and S. Dove. 2009. Soil moisture sensor-based irrigation reduces water use and nutrient leaching in a commercial nursery. SNA research conference, Atlanta, GA.

van Iersel, M.W. 2009. New technologies for water conservation in the landscape. GGIA Wintergreen, Athens, GA. 1/21/2009.

van Iersel, M.W. 2009. Efficient irrigation: Better crops with less water. GGIA Wintergreen, Athens, GA. 1/21/2009.