REPORT FOR THE NCERA-101 MEETING, April 14-17,

Faculty: A.J. Both, David Mears
Bioresource Engineering, Department of Plant Biology and Pathology
Phone; (732) 932-9534 http://aesop.rutgers.edu/~horteng
both@aesop.rutgers.edu; mears@aesop.rutgers.edu

1. New Facilities and Equipment
   A new 250 kW microturbine is being installed at the EcoComplex greenhouse facility (LFG).

2. Unique Plant Responses

Figures 1-4. Temperature treatments (from left to right): A) 30/25°C throughout; B) 16/11°C through six days after anthesis, 23/18°C thereafter; C) 23/18°C through six days after anthesis, 30/25°C thereafter; D) 23/18°C throughout. Plant age (for all treatments): 82 days after seeding (Feb. 26, 2007).

A reach-in growth chamber experiment was conducted with four identical growth chambers containing eight tomato plants each (Lycopersicon esculentum Mill., cv. 'Laura'). The aim was to investigate the occurrence of blossom end rot (BER) resulting from a temperature perturbation induced at the start of anthesis. All plants were drip irrigated from a common tank that was regularly adjusted for pH and EC. Environmental conditions were maintained as follows, PAR: 350-450 µmol/(m²s) at the top of the plant canopy during a 16-hour photoperiod (FCW plus INC), day/night temperatures as listed in the caption for Figures 1-4, RH: 80-90%, CO_2 concentration: 900-1900 µmol/mol (variable but the same for all treatments). Fruit set (following the single cluster system), growth, and development was significantly different among the four treatments (Figures 1-4). Significant leaf roll and hardening was observed for all treatments (partially) exposed to the highest temperature (30/25°C). Contrary to previous experiments, a significantly reduced number of BER fruits was observed on all treatments. Fruit set was affected in treatment A and those set fruits were significantly smaller than the fruits from other treatments. Although fruit size was larger compared to treatment A, catfacing and large blossom-end scarring was observed on many fruits in treatment B. At final harvest (determined by the color of the fruit), treatment B had the highest fruit weight per plant and the highest average fruit weight. Additional experiments are planned.

3. Accomplishment Summaries
   Original greenhouse floor heating research was conducted in an experimental open-roof greenhouse. Extensive measurements were collected and used for a computer simulation model that evaluates temperatures and heat distribution throughout the crop environment. The resulting recommendations for the design and operation of greenhouse floor heating systems can be directly applied by greenhouse growers.

   Greenhouse energy conservation strategies were presented and discussed at two out-of-state Extension meetings/workshops. An energy audit checklist was developed that growers can use to evaluate their operations and/or to make smart energy decisions regarding retrofits and/or new construction.

4. Impact Statements

Our floor heating research has resulted in a M.S. thesis, a peer-reviewed publication, a trade journal article, and has contributed to the soon-to-be released revision of a floor heating Extension bulletin.

An energy audit checklist was developed for commercial greenhouse operations. The checklist has been distributed throughout the northeast and beyond. Growers who implemented the information resulting from our research and various presentations and publications have been able to (conservatively) realize energy savings between 5 and 30%.

5. Published Written Works

Both, A.J. 2006. Airflow options affect crop growth. GMPRO, May issue. pp. 59-64.

Both, A.J. and D.R. Mears. 2006. Build and maintain greenhouses with energy conservation in mind. GMPRO, May issue. pp. 54-56.

Both, A.J. 2006. Keep your greenhouse cool this summer. GMPRO, April issue. pp. 45-48.

Both, A.J. 2007. Greenhouse ventilation. (Abstract) Proceedings of the Annual NJ Vegetable Growers' Association Meeting. January 16-18. Atlantic City, NJ. pp. 76-79.

Both, A.J. 2007. Maintain temperatures with evaporative cooling. Greenhouse Management and Production (GMPro). April issue. pp. 39-42.

Fleisher, D.H., L.S. Logendra, C. Moraru, A.J. Both, J. Cavazzoni, T. Gianfagna, T.C. Lee, and H. Janes. 2006. Effect of temperature perturbations on tomato (Lycopersicon esculentum Mill.) quality and production scheduling. Journal of Horticultural Science and Biotechnology 81(1):125-131.

Fleisher, D.H., L.F. Rodriguez, A.J. Both, J. Cavazzoni, and K.C. Ting. 2006. Advanced life support systems in space. CIGR Handbook of Agricultural Engineering. Volume 6: Information Technology. pp. 339-354.

Lefsrud, M., D. Kopsell, R. Augé, and A.J. Both. 2006. Biomass production and pigment accumulation in kale grown under increasing photoperiods. HortScience 41(3):603-606.

Mathieu, J., R. Linker, L. Levine, L. Albright, A.J. Both, R. Spanswick, R. Wheeler, E. Wheeler, D. deVilliers, R. Langhans. 2006. Evaluation of the NiCoLet model for simulation of short-term hydroponic lettuce growth and nitrate uptake. Biosystems Engineering 95(3):323-337.

Mears, D.R. 2006. Energy use in production of food, feed and fiber. Encyclopedia of Life Support Systems (EOLSS). UNESCO web publication: http://www.eolss.net.

Mears, D.R. 2006. Proposals for action to solve some key industry problems. NGMA Newsletter. Fall 2006.

Mears, D.R. 2007. Techniques on energy conservation and environment control in greenhouses. NIRE, Miyagi Prefecture, Japan. January 25, 2007 (3 papers each in English and Japanese).

Reiss, E., D.R. Mears, T.O. Manning, G.J. Wulster, and A.J. Both. 2007. Numerical modeling of greenhouse floor heating. Transactions of the ASABE 50(1):275-284.

Wyenandt, A., W. Kline, and A.J. Both. 2006. Important diseases of tomatoes grown in high tunnels and greenhouses in NJ (Rutgers Cooperative Extension Fact Sheet FS358).

Wyenandt, A., W.L. Kline, A.J. Both, and D. Ward. 2007. Effects of soilless bag production and soil fumigation on the development of white mold (Sclerotinia) in tomato high tunnel production. (Poster) Northeast Region of ASHS Annual Meeting, January 4-6, University of Maryland, College Park, MD.

6. Scientific and Outreach Oral Presentations

Both, A.J. 2006. Technologies for greenhouse energy conservation. OFA Workshop. Michigan State University, Lansing, MI. December 12, 2006.

Both, A.J. 2006. Advancing CEA through research and education. Department of Agricultural and Biosystems Engineering, University of Arizona, Tucson, AZ. June 22, 2006.

Mears, D.R. 2006. Challenges to opportunities to action. The National Greenhouse Manufacturer's Association, Phoenix, AZ. October 19, 2006.

Mears, D.R. 2007. Energy conservation: The future - What's next. Greenhouse Crop Production and Engineering Design Short Course. University of Arizona, Tucson, AZ. January 2007.

7. Other Relevant Accomplishments and Activities

International Committee for Controlled Environment Guidelines: A.J. Both, Chair

NE-1017 Developing and Integrating Components for Commercial Greenhouse Production: A.J. Both, Chair (2007)