

**REPORT FOR THE NCERA-101 MEETING, July 8-11, 2015**

Faculty: A.J. Both\*, Harry Janes\*\*, David Mears (emeritus)

Staff: Jeff Akers, Tom Manning, David Specca, Claude Wallace

\*BioEnvironmental Engineering, Department of Environmental Sciences

<http://aesop.rutgers.edu/~horteng>

\*\*Department of Plant Biology and Pathology

1. New Facilities and Equipment

None

2. Unique Plant Responses

None

3. Accomplishment Summary

We continue evaluating a variety of lamps for light output, light distribution and power consumption using our 2-meter integrating sphere and a small dark room. A variety of outreach presentations on greenhouse operation and energy consumption have been delivered at several local and out-of-state venues. A variety of publications were completed, including the long-awaited “Guidelines for measuring and reporting environmental parameters for experiments in greenhouses”.

4. Impact Statement

Nationwide, Extension personnel and commercial greenhouse growers have been exposed to research and outreach efforts through presentations, publications and evaluation tools. It is estimated that this information has led to proper greenhouse designs and updated operational strategies that saved an average sized (1-acre) greenhouse business a total of \$20,000 in operating and maintenance costs annually. Greenhouse energy conservation presentations and written materials have been prepared and delivered to local, regional, and national audiences. Growers who implemented the information resulting from our research and outreach materials have been able to realize energy savings between 5 and 30%.

5. Published Written Works

Both, A.J., L. Benjamin, J. Franklin, G. Holroyd, L.D. Incoll, M.G. Lefsrud, and G. Pitkin. 2015. Guidelines for measuring and reporting environmental parameters for experiments in greenhouses. Accepted for publication in *Plant Methods*.

Both, A.J. 2015. LED lighting (abstract). Proceedings of the 60<sup>th</sup> New Jersey Agricultural Convention and Trade Show. February 3-5. Atlantic City, NJ. pp. 89.

Both, A.J. 2015. High tunnel construction and operation update (abstract). Proceedings of the 60<sup>th</sup> New Jersey Agricultural Convention and Trade Show. February 3-5. Atlantic City, NJ. pp. 52.

Johnson, M., T.S. Villani, A. Azmat, J.E. Simon, and A.J. Both. 2015. Evaluation of algal biomass production on vertical aeroponic substrates. *Algal Research* 10:240-248.

Manning, T., A.J. Both, and J. Rabin. 2014. Assessing on-farm equipment efficiency and energy use. (Rutgers Cooperative Extension Web Publication). Available at:  
<http://sustainable-farming.rutgers.edu/assessing-farm-equipment-efficiency/>

Mears, D.R., L. Okushima, S. Sase, T. Takakura, H. Moriyama, S. Furuno and M. Ishii. 2014. The cooling capacities of the greenhouses with the heat pump systems in Japan. *Journal of the Society of Agricultural Structures, Japan*, Vol.45, No.2, June, 2014. (In Japanese, English version online).  
[http://www.naro.affrc.go.jp/org/nkk/soshiki/soshiki04-nouchi/04nougyoushisetsu/ceac\\_news/2014\\_HP\\_cool\\_paper\\_final.pdf](http://www.naro.affrc.go.jp/org/nkk/soshiki/soshiki04-nouchi/04nougyoushisetsu/ceac_news/2014_HP_cool_paper_final.pdf)

Mitchell, C.A., J.F. Burr, M.J. Dzakovich, C. Gómez, R. Lopez, R. Hernández, C. Kubota, C.J. Currey, Q. Meng, E.S. Runkle, C.M. Bourget, R.C. Morrow, and A.J. Both. 2015. Light-emitting diodes in horticulture. Accepted for publication in *Horticultural Reviews*.

## 6. Scientific and Outreach Oral Presentations

- Both, A.J. 2015. Greenhouse energy efficiency. NE-SARE project titled 'Farm Energy IQ'. NJ EcoComplex, Columbus, NJ. April 8-10.
- Both, A.J. 2015. Five presentations (Greenhouse structures, Greenhouse heating, Supplemental lighting and shading, Ventilation and cooling, Control systems). Greenhouse Production Short Course. NJ EcoComplex, Columbus, NJ. March 2-3.
- Both, A.J. 2015. Measuring LED lamps used for applications in horticulture. Presented at the LED Symposium organized by the USDA-SCRI project titled 'Developing LED Lighting Technologies and Practices for Sustainable Specialty-Crop Production'. Tucson, AZ. February 20.
- Both, A.J. 2015. Greenhouse heating, ventilation & cooling, supplemental lighting & shading. Three presentations presented at *Identifying and Modeling Energy Efficiency in the Greenhouse -- In-service Training Program*, Virginia Tech. Buffalo Junction, VA. January 13-14.
- Both, A.J. 2015. Indoor agriculture. Guest lecture for students at the Bridgewater-Raritan High School, Bridgewater, NJ. January 6.
- Both, A.J. 2014. Urban agriculture. Guest lecture for students at the Stuart County Day School of the Sacred Heart, Princeton, NJ. November 5.
- Both, A.J. 2014. Engineering and energy conservation for controlled environment agriculture. Presented at the annual Biofuels-IGERT meeting, New Brunswick, NJ. July 22.
- Both, A.J. 2014. Controlled environment agriculture and energy conservation. Presented at the Bioenergy and Bioproducts Education Program meeting organized at the EcoComplex, Columbus, NJ. July 9.
- Both, A.J. 2014. LED lighting for greenhouse crops. Presented at the NJNLA Greenhouse Growers Conference. EcoComplex, Columbus, NJ. June 28.

## 7. Other Relevant Accomplishments and Activities

- Both, A.J. 2015. Contributed to several chapters in the forthcoming second edition of 'Lighting Up Profits, Understanding Greenhouse Lighting'. E. Runkle and R. Lopez, editors.
- Both, A.J. 2014. A total of eight video presentations were delivered as part of the multi-institutional USDA-HEC project. The titles include: Alternative Energy and Resource Use; Carbon Dioxide Enrichment; Evaporative Cooling and Shading; Greenhouse Heating Basics; Greenhouse Heating Systems; Greenhouse Location and Structures; Supplemental Lighting and Shading; Greenhouse (Mechanical) Ventilation.
- Both, A.J. 2014. Two webinars were delivered as part of the USDA-NRCS funded project titled 'On-Farm Energy Quality Assurance Training Program' that was organized through the University of Wisconsin. The webinar titles were 'Greenhouse heating and ventilation considerations' and 'Evaporative cooling, supplemental lighting and shading'.
- Both, A.J. (Chair since 2004) International Committee for Controlled Environment Guidelines.
- Both, A.J. (since 2003) Associate Editor, Transactions of the ASABE/Applied Engineering in Agriculture.