

Curriculum Vitae

Arend-Jan Both

Associate Extension Specialist
BioEnvironmental Engineering
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EDUCATION

- Ph.D. January 1995
Cornell University, Department of Agricultural and Biological Engineering. Major: Structures and their Environment; Minors: Floriculture and Ornamental Horticulture, and Meteorology.
- M.S. November 1988
Agricultural University in Wageningen, the Netherlands. Department of Agricultural Engineering. Major: Structures and their Environment; Minors: Computer Science and Business Management.
- B.S. May 1986
Agricultural University in Wageningen, the Netherlands. Major: Agricultural Engineering.

PROFESSIONAL EXPERIENCE

Sabbatical Leave

August 2011- July 2012. Wageningen University and Research Centre, Farm Technology Group. Activities: Teaching, student advising, research.

Associate Extension Specialist (equivalent to Associate Professor)

July 2007 - present. Rutgers, The State University of New Jersey.

Job description: Specialist in controlled environment engineering serving Extension clientele and the NJ greenhouse industry. Department of Environmental Sciences.

Assistant Extension Specialist (equivalent to Assistant Professor)

January 2000 - June 2007. Rutgers, The State University of New Jersey.

Director, Center for Controlled Environment Agriculture

July 2000 - present. Rutgers, The State University of New Jersey.

Center of Excellence, School of Environmental and Biological Sciences

Research Associate and Project Coordinator

June 1997 - December 1999. Cornell University.

Department of Agricultural and Biological Engineering. Job description: Project coordinator for the construction and operation of a commercially scaled hydroponic lettuce production greenhouse facility.

Post Doctoral Associate

December 1994 - May 1997. Cornell University

Departments of Floriculture and Ornamental Horticulture, and Agricultural and Biological Engineering. Topic: Hydroponic vegetable production in Controlled Environment Agriculture greenhouses with an emphasis on bibb lettuce production in a floating hydroponic system.

HONORS

The Honor Society of Agricultural, Food, and Biological Engineering: Alpha Epsilon. March 1999.
The Honor Society of Agriculture: Gamma Sigma Delta. May 1993.

AWARDS

ASHS (American Society for Horticultural Science) Kenneth Post Award for Graduate Research in Floriculture for the 2012 paper by M.G. Blanchard, E.S. Runkle, A.J. Both, and H. Shimizu titled: Greenhouse energy curtains influence shoot-tip temperature of new guinea impatiens. *HortScience* 47(4):483-488. July 2013.

ASHS (American Society for Horticultural Science) Outstanding Extension Publication Award in the category Fact Sheets (9-30 pages) for the publication titled 'Greenhouse Energy Conservation Strategies' authored by E.S. Runkle and A.J. Both (MSU Extension Bulletin E-3160). July 2013.

NCERA-101 Committee on Controlled Environment Technology and Use, 20 Year Member Award. March 2013.

Merle V. Adams Award for Outstanding Achievement as a Junior Faculty Member. December 2005. Department of Extension Specialists, Cook College, Rutgers University.

Blue Ribbon Award, ASAE 2005 Educational Aids Competition. July 2005. Workbook: Lighting up profits: Understanding greenhouse lighting. P.R. Fisher, E. Runkle (eds.), and A.J. Both (significant contributor).

Gold Star Award for the paper: Goudarzi, S. and A.J. Both. 2004. Accounting for performance decrements in crew time calculations for space missions. Presented at the 34th International Conference on Environmental Systems, July 19-22, Colorado Springs, Colorado. SAE Technical Paper No. 2004-01-2362. As a result, this paper was also published in the *SAE 2004 Transactions Journal of Aerospace*. pp. 630-634. (published July 2005).

Extension Specialist of the Year. December 2003. Department of Agricultural and Resource Management Agents, Cook College, Rutgers University.

Blue Ribbon Award, ASAE 2003 Educational Aids Competition. July 2003. Horticultural Engineering Newsletter (previous issues can be downloaded from: <http://aesop.rutgers.edu/~horteng>).

ASAE Standards Developers Award. July 2002. ASAE. (Revision of Engineering Practice EP411).

Rutgers Cooperative Extension Team Award, Presented to the Vegetable Working Group. December 2001.

Blue Ribbon Award, ASAE 2001 Educational Aids Competition. July 2001. Horticultural Engineering Web Site: <http://aesop.rutgers.edu/~horteng>.

Honorable Mention in the Select Paper Award Program, sponsored by IET Division of ASAE. July, 2000. Kang, S., Y. Ozaki, K.C. Ting, and A.J. Both. 2000. Identification of appropriate level of automation for biomass production systems within an advanced life support system. ASAE paper No. 003075. ASAE, 2950 Niles Road, St. Joseph, MI 49085-9659, USA. 12 pp.

PROFESSIONAL SOCIETIES AND ACTIVITIES

Member of NE-1335 (formerly NE-1035) Regional Committee on Commercial Greenhouse Production: Component and System Development. 2009-present (served as secretary in 2014 and chair in 2015).

Secretary, Chair of the NE-1017 (formerly NE-164) Regional Committee on Developing and Integrating Components for Commercial Greenhouse Production Systems. 2006-2008.

Member of SE-406, Nursery and Greenhouse System Engineering, ASABE. 2004-present.

Associate Editor, Transactions of the ASABE and Applied Engineering in Agriculture. 2003-present.

Secretary, Chair International Committee for Controlled Environment Guidelines. 2002-present.

Member of the International Society for Horticultural Science (ISHS). 2002-present.

Officer of SE-303, Committee on Environment of Plant Structures, ASABE. 2001-2004.

Member of P-208, Extension Committee, ASABE. 2001-2004.

Secretary, Vice Chair, Chair of the NCR-101 Regional Committee on Controlled Environment Technology and Use. 2000-2002.

Secretary, Chair of the NE-164 Regional Committee on Decision Support for Design and Control of Plant Growth Systems. 2000-2001.

Member of the American Society of Agricultural and Biological Engineers (ASABE). 1990-present.

Participated in the development of the “Minimum guidelines for measuring and reporting environmental parameters for experiments on plants in growth rooms and chambers” and “Guidelines for measuring and reporting environmental parameters for experiments in plant tissue culture facilities” that were published by the International Committee for Controlled Environment Guidelines in 2004 and 2008, respectively. The “Guidelines for measuring and reporting environmental parameters for experiments in greenhouses” is scheduled to be published in 2015.

Coordinated a revision of the ANSI/ASAE Engineering Practice EP411 titled: “Guidelines for measuring and reporting environmental parameters for plant experiments in growth chambers”. 2001.

Reviewer

- Books and book chapters

NRAES Publication No. 158. “Total Crop Management: A Guide to Greenhouse Crop Production”. 2002.

ASHRAE’s HVAC Applications Handbook Chapter 21. “Environmental Control for Animals and Plants”. 2002.

NRAES Publication No. 3. “Energy Conservation for Commercial Greenhouses”. 2001.

- Journals and Conference Proceedings

Transactions of the ASABE

Applied Engineering in Agriculture

Journal of the American Society for Horticultural Science

HortTechnology

HortScience

Acta Horticulturae (ISHS)

Computers and Electronics in Agriculture
Illuminating Engineering Society of North America Conference Proceedings
Society of Automotive Engineers
Journal of Life Support and Biosphere Science
COSPAR (Committee on Space Research)
Waste Management
BioSystems

- Grants

USDA SBIR Panel on Plant Production and Protection (Engineering). 2013 (3 proposals).
The Danish Council for Strategic Research (Programme Commission for Health, Food and Welfare). 2010 (1 proposal).
USDA SBIR Panel on Plant Production and Protection (Engineering). 2010 (1 proposal).
USDA SBIR Panel on Plant Production and Protection (Engineering). 2009 (1 proposal).
NASA Fundamental Space Biology Panel on Plant Gravisperception and Life Support. 2008 (3 proposals)
United States-Israel BARD Fund. 2008 (1 proposal).
USDA SBIR Panel on Plant Production and Protection (Engineering). 2005 (2 proposals).
United States-Israel BARD Fund. 2003 (1 proposal).
USDA SBIR Panel on Plant Production and Protection (Engineering). 2003 (15 proposals).
Reviewer for the OARDC International Collaboration Competition, The Ohio State University. 2002 (1 proposal).
USDA SBIR Panel on Plant Production and Protection (Engineering). 2002 (13 proposals).
Reviewer for the OARDC Research Enhancement Competitive Grant Competition, The Ohio State University. 2001 (1 proposal).

- Competitions

Special Award Judge: Feeding Future Cities competition. 2015 (75 participating schools)
Reviewer for the ASABE Educational Aids Competition: Web sites. 2010 (one submission).
Judge, ASAE Educational Aids Competition, Publications: Manuals and Workbooks. 2002
NASA MarsPort Engineering Design Student Competition. 2002 (2 proposals).

Professional meetings organized (since January, 2000)

Farm Energy IQ meeting. NJ EcoComplex, Columbus, NJ. April 8-10, 2015. (10 participants).
SCRI-LED Project annual stakeholder meeting. New Brunswick, NJ. June 24, 2014. (12 participants).
NE-1335 Multi-state Project. Committee on Resource Management in Commercial Greenhouse Production. New Brunswick, NJ. June 3-4, 2014. (17 participants).
Member of the organizing committee for the joint UK CEUG (Controlled Environment Users Group) and the NCERA-101 (Committee on Controlled Environment Technology and Use) meeting at University of Cambridge, Cambridge, England. September 9-12, 2012. (90 participants).
Member of the organizing committee for the Annual Extension Conference meeting. New Brunswick, NJ. September 14, 2010. (200 participants).
Chair of the organizing committee for the First IGERT International Summer Symposium on Biofuels and Bioenergy. New Brunswick, NJ. June 2-4, 2010. (85 participants).
ASABE Historic Landmark Dedication Event for the first air-inflated double-layer polyethylene greenhouse. New Brunswick, NJ. June 4, 2004. (65 participants).
NE-1017 Multi-state Project. Committee on Developing and Integrating Components for Commercial Greenhouse Production Systems. New Brunswick, NJ. June 3-4, 2004. (35 participants).

Member of the organizing committee for the joint UK CEUG (Controlled Environment Users Group) and the NCR-101 (Committee on Controlled Environment Technology and Use) meeting at the University of East Anglia, Norwich, England. September 9-12, 2001. (97 participants).
Greenhouse/High Tunnel session organizer for the annual New Jersey Agricultural Convention and Trade Show. Atlantic City, NJ. 2001-present. (50-100 participants annually).
Co-chair of the Norman J. Smith Memorial New Jersey Tour of Plasticulture Systems and Grower Operations. September 19-23, 2000. (20 participants).

RUTGERS UNIVERSITY SERVICE

Department of Environmental Sciences:

Freshmen Advisor (Bioenvironmental Engineering Program), 2012-present.
Member of the Space and Facilities Committee, 2010-present.
Member of the Graduate Program Admissions Committee, 2009-present.

Extension Specialists Council:

Chair of the Awards Committee (Merle Adams Award, County Faculty Person of the Year Award, Wilbur Runk Awards), 2008-2011.

IGERT for Sustainable Fuels:

Chair of the International Activities Committee, 2010-2014.

Rutgers University School of Environmental and Biological Sciences:

Member of the SEBS Sustainable Energy Working Group. 2009-present.
Member of the Peer Evaluation Committee for the Faculty Compensation Program in the Department of Extension Specialists. 2008.
Member of the search committee for greenhouse manager at the NJ EcoComplex. 2005.
Co-chair and Chair of the NJ-EcoComplex Greenhouse Advisory Committee. 2003-present.
Member of the search committee for head greenhouse field technician. 2003.
Member of the search committee for the chair in Plant Biology and Pathology. 2001-2002.
Member of the awards committee for the (Department of) Extension Specialists. 2001-2002, 2006-2008.
Member of the proposal review committee for the PEG Program (NJAES & RCE). Spring 2001.
Member of the Rutgers Cooperative Extension Greenhouse Working Group. 2001-present.
Member of the search committee for an assistant professor in Horticultural Engineering. 2000-2001.
Member of the Rutgers Cooperative Extension Vegetable Working Group. 2000-present.

Rutgers University:

Faculty Advisor for EmPower, 2008-present.

RESEARCH INTERESTS

1. Controlled Environment Agriculture, environment control for crop production systems and the interaction of plants with the growing environment.
2. Supplemental lighting for greenhouse crop production.
3. Application of systems engineering to controlled environment plant production.
4. Renewable energy systems.

PUBLICATIONS

(Note: ‘*’ denotes supervised graduate student or post doc at the time of manuscript submission)

Theses

- Both, A.J. 1995. Dynamic simulation of supplemental lighting for greenhouse hydroponic lettuce production. Ph.D. Dissertation. Cornell University Libraries, Ithaca, NY 14853. 172 pp.
- Both, A.J. 1988. Modelvorming en computersimulatie van natuurlijke ventilatie in varkensstallen (Computer simulation of natural ventilation in pig barns). In Dutch. M.S. Thesis, Department of Agricultural Engineering, Agricultural University Wageningen, the Netherlands. 198 pp.

Book (translation)

- Spaargaren, J.J. 2001. Supplemental Lighting for Greenhouse Crops. Published by P.L. Light Systems, Inc., Beamsville, Ontario, Canada. 178 pp. (Translation of original text from Dutch to English and adaptation for the North American market). Co-translators: W. van Winden and T.J. Blom.

Book Chapters

- Both, A.J. 2011. Horticultural engineering. In ‘Encyclopedia of Life Support Systems’, Developed under the auspices of the UNESCO, Eolss Publishers, Oxford, UK, [<http://www.eolss.net>].
- Both, A.J. and D.R. Mears. 2008. Building and maintaining greenhouses for energy savings. In ‘Horticulture: Principles and Practices’, 4th ed. by G. Acquaah; included in Chapter 12 ‘Controlled-Environment Horticulture’. Prentice Hall, Inc. Upper Saddle River, NJ. pp. 406-417.
- Both, A. J. 2007. Controlled environment agriculture/Greenhouse production. In ‘Encyclopedia of Agricultural, Food, and Biological Engineering’; Heldman, D., Ed.; Taylor & Francis Group: New York. <http://www.informaworld.com/10.1081/E-EAFE-120043033>.
- 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.
- Fisher, P., A.J. Both, R. Heins, and A. Enfield. 2004. Lighting plugs and liners, Chapter 9. In ‘Lighting Up Profits, Understanding Greenhouse Lighting’, P. Fisher and E. Runkle, eds. Meister Media Worldwide, Willoughby, OH. pp. 57-61.
- Fisher, P. and A.J. Both. 2004. Photoperiod control through technology options and their costs. Chapter 8. In ‘Lighting Up Profits, Understanding Greenhouse Lighting’, P. Fisher and E. Runkle, eds. Meister Media Worldwide, Willoughby, OH. pp. 51-56.
- Both, A.J. 2004. Carbon dioxide enrichment in greenhouses. Chapter 7. In ‘Lighting Up Profits, Understanding Greenhouse Lighting’, P. Fisher and E. Runkle, eds. Meister Media Worldwide, Willoughby, OH. pp. 47-50.
- Fisher, P. and A.J. Both. 2004. Supplemental lighting technology and costs. Chapter 6. In ‘Lighting Up Profits, Understanding Greenhouse Lighting’, P. Fisher and E. Runkle, eds. Meister Media Worldwide, Willoughby, OH. pp. 43-46.
- Both, A.J. and J. Faust. 2004. Light transmission in greenhouse design and coverings. Chapter 4. In ‘Lighting Up Profits, Understanding Greenhouse Lighting’, P. Fisher and E. Runkle, eds. Meister Media Worldwide, Willoughby, OH. pp. 33-38.

Refereed Journal Articles

- 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. 20xx. Light-Emitting Diodes in Horticulture. Submitted for publication in Horticultural Reviews.

- Both, A.J., L. Benjamin, J. Franklin, G. Holroyd, L.D. Incoll, M.G. Lefsrud, and G. Pitkin. 20xx. Guidelines for measuring and reporting environmental parameters for experiments in greenhouses. Submitted for publication in *Plant Methods*.
- Johnson, M.*, T.S. Villani, A. Azmat, J.E. Simon, and A.J. Both. 20xx. Evaluation of algal biomass production on vertical aeroponic substrates. Submitted for publication in *Algal Research*.
- Blanchard, M.G., E.S. Runkle, A.J. Both, and H. Shimizu. 2012. Greenhouse energy curtains influence shoot-tip temperature of new guinea impatiens. *HortScience* 47(4):483-488.
- Zinati, G.M., J. Dighton, and A.J. Both. 2011. Fertilizer, irrigation and natural ericaceous root and soil inoculum (NERS): Effects on container-grown ericaceous nursery crop biomass, tissue nutrient concentration, and leachate nutrient quality. *HortScience* 46(5):799-807.
- Mears, D.R., A.J. Both, L. Okushima, S. Sase, M. Ishii, and H. Moriyama. 2009. Some alternatives to burning fuels for greenhouse heating (*in Japanese*). *Journal of Agricultural Meteorology* 65(3):303-308.
- Lefsrud, M., D. Kopsell, C. Sams, J. Wills, and A.J. Both. 2008. Dry matter content and stability of carotenoids in kale and spinach during drying. *HortScience* 43(6):1731-1736.
- Both, A.J., E. Reiss*, J.F. Sudal, K.E. Holmstrom, C.A. Wyenandt, W.L. Kline, and S.A. Garrison. 2007. Evaluation of a manual energy curtain for tomato production in high tunnels. *HortTechnology* 17(4):467-472.
- 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.
- 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.
- 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.
- 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.
- Goudarzi, S.*, A.J. Both, J. Cavazzoni, and A. Kusnecov. 2005. Dynamic modeling of crew performance for long-duration space missions. *Journal of Human Performance in Extreme Environments* 8(1-2):1-9.
- Goudarzi, S.* and A.J. Both. 2005. Accounting for performance decrements in crew time calculations for space missions. *SAE 2004 Transactions Journal of Aerospace*, pp. 630-634.
- Kang, S.* and A.J. Both. 2002. A management information system for food nutritional analysis and biomass production in an advanced life support system. *Journal of Life Support and Biosphere Science* 8(3/4):191-197.
- Goudarzi, S.*, J. Cavazzoni, and A.J. Both. 2002. Dynamic modeling of crew performance for long duration space missions. *SAE Technical Paper No. 2002-01-2497*.
- Kang, S.*, K.C. Ting, and A.J. Both. 2001. Systems studies and modeling of advanced life support systems. *Agricultural and Biosystems Engineering* 2(2):41-49.
- Ciolkosz, D.E., A.J. Both, and L.D. Albright. 2001. Selection and placement of greenhouse luminaires for uniformity. *Applied Engineering in Agriculture* 17(6):875-882.
- Albright, L.D., A.J. Both, and A.J. Chiu. 2000. Controlling greenhouse light to a consistent daily integral. *Transactions of the ASAE* 43(2):421-431.
- Thompson, H.C., R.W. Langhans, A.J. Both, and L.D. Albright. 1998. Shoot and root temperature effects on lettuce growth in a floating hydroponic system. *Journal of the American Society for Horticultural Science* 123(3):361-364.

Refereed Conference Proceedings

- M. Ishii, L. Okushima, H. Moriyama, S. Sase, N. Fukuchi, and A.J. Both. 2014. Experimental study of natural ventilation in an open-roof greenhouse during the summer. Submitted for publication in *Acta Horticulturae*.
- Both, A.J., T.O. Manning, A. Martin*, D.R. Specca, and E. Reiss. 2011. Operating a 250 kW landfill gas fired microturbine at a 0.4 hectare research and demonstration greenhouse. *Acta Horticulturae*. 893:397-404.
- Both, A.J., E. Reiss*, D.R. Mears, and W. Fang. 2005. Designing environmental control for greenhouses: Orchid production as example. *Acta Horticulturae* 691(2):807-813.
- Reiss, E.* , A.J. Both, S. Garrison, W. Kline, and J. Sudal. 2004. Season extension for tomato production using high tunnels. *Acta Horticulturae* 659:153-160.
- Mears, D.R. and A.J. Both. 2002. A positive pressure ventilation system with insect screening for tropical and subtropical greenhouse facilities. *Acta Horticulturae* 578:125-132.
- Both, A.J., D.E. Ciolkosz, and L.D. Albright. 2002. Evaluation of light uniformity underneath supplemental lighting systems. *Acta Horticulturae* 580:183-190.
- Both, A.J., L.D. Albright, S.S. Scholl, and R.W. Langhans. 1999. Maintaining constant root environments in floating hydroponics to study root-shoot relationships. *Acta Horticulturae* 507:215-221.
- Albright, L.D., A.J. Both, R.W. Langhans, and E.F. Wheeler. 1999. Dimensionless growth curves as a simple approach to predict the vegetative growth of lettuce. *Acta Horticulturae* 507:293-300.
- Both, A.J., L.D. Albright, and R.W. Langhans. 1998. Coordinated management of daily PAR integral and carbon dioxide for hydroponic lettuce production. *Acta Horticulturae* 456:45-51.
- Ciolkosz, D.E., L.D. Albright, and A.J. Both. 1998. Characterizing evapotranspiration in a greenhouse lettuce crop. *Acta Horticulturae* 456:255-261.
- Both, A.J., L.D. Albright, R.W. Langhans, B.G. Vinzant, and P.N. Walker. 1997. Electric energy consumption and PPF_i output of nine 400 watt high pressure sodium luminaires and a greenhouse application of the results. *Acta Horticulturae* 418:195-202.
- Both, A.J., L.D. Albright, R.W. Langhans, R.A. Reiser, and B.G. Vinzant. 1997. Hydroponic lettuce production influenced by integrated supplemental light levels in a controlled environment agriculture facility: Experimental results. *Acta Horticulturae* 418:45-51.
- Both, A.J., L.D. Albright, C.A. Chou, and R.W. Langhans. 1997. A microwave powered light source for plant irradiation. *Acta Horticulturae* 418:189-194.
- Both, A.J., A.R. Leed, E. Goto, L.D. Albright, and R.W. Langhans. 1996. Greenhouse spinach production in a NFT system. *Acta Horticulturae* 440:187-192.
- Goto, E., A.J. Both, L.D. Albright, R.W. Langhans, and A.R. Leed. 1996. Effect of dissolved oxygen concentration on lettuce growth in floating hydroponics. *Acta Horticulturae* 440:205-210.

Non-refereed Technical Publications

- Mitchell, C.A., A.J. Both, C.M. Bourget, J.F. Burr, C. Kubota, R.G. Lopez, R.C. Morrow, and E.S. Runkle. 2012. LEDs: The future of greenhouse lighting! (feature article) *Chronica Horticulturae* 52(1):6-12.
- Brumfield, R.G., A.J. Both, and G. Wulster. 2009. How are greenhouse growers coping with rising energy costs? Southern Nursery Association Research Conference Proceedings. Georgia World Congress Center, Atlanta, GA. February 12-13, 2009. pp. 304-307. Available at: [http://www.sna.org/content/Economics and marketing 2009_1.pdf](http://www.sna.org/content/Economics%20and%20marketing%202009_1.pdf)
- Fang, W., D. Mears, and A.J. Both. 2007. Story of air-inflated double-layer polyethylene greenhouse and its recent applications in Taiwan. International Seminar on Agricultural Structures and Agricultural Engineering (IS-ASAE). National Taiwan University, Taipei, Taiwan, R.O.C. December 8th-9th, 2007. 6 pp.

- Both, A.J., D.R. Mears, T.O. Manning, E. Reiss, P.P. Ling. 2007. Evaluating energy savings strategies using heat pumps and energy storage for greenhouses. ASABE paper No. 07-4011. ASABE, 2950 Niles Road, St. Joseph, MI 49085-9659, USA. 16 pp.
- Reiss, E.*, A.J. Both, and D.R. Mears. 2005. Comparing greenhouse floor heating designs using CFD. ASAE paper No. 05-4136. ASAE, 2950 Niles Road, St. Joseph, MI 49085-9659, USA. 19 pp.
- Sager, J.C., J.H. Norikane, A.J. Both, and T.W. Tibbitts. 2005. Quality assurance for environment of plant growth facilities. ASAE paper No. 05-4137. ASAE, 2950 Niles Road, St. Joseph, MI 49085-9659, USA. 11 pp.
- Reiss, E.*, A.J. Both, and D.R. Mears. 2004. Greenhouse floor heating. ASAE paper No. 04-4040. ASAE, 2950 Niles Road, St. Joseph, MI 49085-9659, USA. 13 pp.
- Reiss, E.*, D.R. Mears, and A.J. Both. 2003. Greenhouse floor heating. ASAE paper No. 03-4039. ASAE, 2950 Niles Road, St. Joseph, MI 49085-9659, USA. 14 pp.
- Fleisher, D.H., A.J. Both, C. Moraru, L. Logendra, T. Gianfagna, T.C. Lee, H. Janes, and J. Cavazzoni. 2003. Manipulation of tomato fruit quality through temperature perturbations in controlled environments. ASAE paper No. 03-4102. ASAE, 2950 Niles Road, St. Joseph, MI 49085-9659, USA. 9 pp.
- Sase, S., E. Reiss*, A.J. Both, and W.J. Roberts. 2002. A natural ventilation model for open-roof greenhouses. ASAE paper No. 02-4010. ASAE, 2950 Niles Road, St. Joseph, MI 49085-9659, USA. 9 pp.
- Hsiang H.*, S. Kang*, A.J. Both, and K.C. Ting. 2001. Analysis tool for food processing and nutrition (FPN) subsystem in an advanced life support system (ALSS). ASAE paper No. 01-3020. ASAE, 2950 Niles Road, St. Joseph, MI 49085-9659, USA. 16 pp.
- Kang, S.* and A.J. Both. 2001. A management information system for food nutritional analysis and biomass production in an advanced life support system. ASAE paper No. 01-3021. ASAE, 2950 Niles Road, St. Joseph, MI 49085-9659, USA. 10 pp.
- Reiss, E.*, W.J. Roberts, and A.J. Both. 2001. Design and construction of an open-roof greenhouse with heated ebb and flood floor irrigation system. Presented at the CSAE/SCGR-NABEC Meeting in Guelph, Ontario, July 8-11, 2001. NABEC Paper No. 01-916. 13 pp.
- Both, A.J., E. Reiss*, D.R. Mears, and W.J. Roberts. 2001. Open-roof greenhouse design with heated ebb and flood floor. ASAE paper No. 01-4058. ASAE, 2950 Niles Road, St. Joseph, MI 49085-9659, USA. 13 pp.
- Kang, S., K.C. Ting, and A.J. Both. 2000. Systems studies and modeling of advanced life support system. Proceedings of the 3rd International Conference on Agricultural Machinery Engineering (ICAME 2000). November 13-16, Seoul, Korea. pp. 623-631.
- Mears, D.R. and A.J. Both. 2000. Insect exclusion from greenhouses. Proceedings of the 15th Workshop on Agricultural Structures and ACESYS (Automation, Culture, Environment, and Systems) IV Conference. December 4-5, Tsukuba, Japan. pp. 18-26.
- Kang, S., Y. Ozaki, K.C. Ting, and A.J. Both. 2000. Automation for biomass production within advanced life support systems. Second IFAC/CIGR International Workshop on Bio-robotics, Information Technology, and Intelligent Control for Bioproduction Systems. November 25-26, 2000. Osaka, Japan. pp. 275-280.
- Kang, S., Y. Ozaki, K.C. Ting, and A.J. Both. 2000. Identification of appropriate level of automation for biomass production systems within an advanced life support system. ASAE paper No. 003075. ASAE, 2950 Niles Road, St. Joseph, MI 49085-9659, USA. 12 pp.
- Both, A.J., L.D. Albright, and R.W. Langhans. 1999. Design of a demonstration greenhouse operation for commercial hydroponic lettuce production. ASAE paper No. 994123. ASAE, 2950 Niles Road, St. Joseph, MI 49085-9659, USA. 12 pp.

- Both, A.J., S.S. Scholl, L.D. Albright, and R.W. Langhans. 1998. Comparing continuous lettuce production in nutrient film technique and floating hydroponics. Proceedings of the 15th International Lettuce Conference and Leafy Vegetable Crops Workshop. September 23-26, 1998. Atlantic City, NJ. pp. 16-17.
- Ciolkosz, D.E., L.D. Albright, and A.J. Both. 1997. Evaluation of whole plant transpiration as affected by greenhouse air movement. ASAE paper No. 974029. ASAE, 2950 Niles Road, St. Joseph, MI 49085-9659, USA. 12 pp.
- Both, A.J. 1994. HID lighting in horticulture: a short review. Presented at the Greenhouse Systems, Automation, Culture and Environment Conference, July 20-22. New Brunswick, NJ. Northeast Regional Agricultural Engineering Service, Publication No. 72. Cornell Cooperative Extension, Cornell University, Riley-Robb Hall, Ithaca, NY 14853. pp. 208-222.
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- Both, A.J. 2004. Which structure is best for you? Proceedings of the Empire State Fruit and Vegetable Expo. February 9-12. Rochester, NY. pp. 43.
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- Both, A.J. 2000. Some thoughts on supplemental lighting for greenhouse crop production. Presentation at the Environmental Control and Design of Greenhouse Systems Short Course, January 10-11, 2000. Cook College, Rutgers University. NJAES Research Paper No. P-03130-35-99. 10 pp.

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- Both, A.J. and E. Reiss. 2007. Consider design with a new floor heating system. Greenhouse Management and Production (GMPro). December issue. pp. 35-37.
- Both, A.J. 2007. Greenhouse cooling basics. American Nurseryman. September 15 issue. pp. 20-24.
- Both, A.J. 2007. Maintain temperatures with evaporative cooling. Greenhouse Management and Production (GMPro). April issue. pp. 39-42.
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- Both, A.J. and D.R. Mears. 2006. Build and maintain greenhouses with energy conservation in mind. Greenhouse Management and Production (GMPro). May issue. pp. 54-56.
- Both, A.J. 2006. Keep your greenhouse cool this summer. Greenhouse Management and Production (GMPro). April issue. pp. 45-48.
- Both, A.J. 2005. Agricultural management practices aim to help resolve legal conflicts. Greenhouse Management and Production (GMPro). June issue. pp. 43-46.
- Both, A.J. 2005. Is your greenhouse strong enough? Greenhouse Management and Production (GMPro). May issue. pp. 38-41.
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- Fisher, P., A.J. Both, R. Heins, and A. Enfield. 2004. Lighting plugs and liners. Greenhouse Grower. September issue. pp. 22-26.
- Ross, D.S. and A.J. Both. 2004. Inventor of air-inflated double-layer polyethylene greenhouse honored. Mid-Atlantic Grower 6(10) August Issue. pp. 6-7.
- Both, A.J. 2004. Insect screening. American Vegetable Grower. June issue. p. 28.
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- Fisher, P. and A.J. Both. 2004. Photoperiod control: technology options and costs. *Greenhouse Grower*. March issue. pp. 42-49.
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- Both, A.J. and J.E. Faust. 2003. Light transmission: greenhouse design and coverings. *Greenhouse Grower*. December issue. pp. 82-86.
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- Both, A.J. 2003. Supplemental Lighting: Part 2. *OFA Bulletin*. September/October issue. pp. 1, 10-11.
- Both, A.J. 2003. Supplemental Lighting. *OFA Bulletin*. July/August issue. pp. 16-18.
- Both, A.J. 2003. Considering supplemental lighting? Here are some data that may help you decide. *International Cut Flower Growers Association Bulletin*. April issue. pp. 24-28.
- Both, A.J. 2003. Hydroponic lettuce research. *Practical Hydroponics and Greenhouses*. May/June issue. pp. 40-47.
- Both, A.J. 2003. Supplemental lighting. Can it help you grow better crops? *Greenhouse Management and Production (GMPRO)*. Spring Edition. pp. 34-37.
- Both, A.J., D.R. Mears, E. Reiss, and W.J. Roberts. 2002. Greenhouse floor heating. *Greenhouse Management and Production (GMPRO)*. August issue. pp. 60-63.
- Both, A.J. 2002. How to design a mechanical ventilation system. *Greenhouse Management and Production (GMPRO)*. May issue. pp. 67-73.
- Both, A.J. 2002. Greenhouse covering options. *Greenhouse Management and Production (GMPRO)*. April issue. pp. 49-50.
- Both, A.J. 2002. Optimize your production environment. *Greenhouse Management and Production (GMPRO)*. Spring Edition. pp. 46-50.
- Both, A.J. 2001. The quonset climate. *GrowerTalks*. August issue. p. 128.
- Both, A.J. 2001. Ten ways to reduce your energy bill. *Greenhouse Grower*. July issue. pp. 56-62.
- Both, A.J. 2000. It's Cold Out! So Why Ventilate? *GrowerTalks*. December issue. pp. 82-84.
- Both, A.J. 2000. Should you use supplemental lighting? *Greenhouse Management and Production (GMPRO)*. May issue. pp. 42-50.
- Both, A.J. and L.D. Albright. 2000. A controlled environment. Cover story in *Resource Magazine (ASAE)*. May issue. pp. 7-8.

(Rutgers) Cooperative Extension Fact Sheets, Bulletins, and Other Publications

- 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://njsustainingfarms.rutgers.edu/PDF/Assessing%20On-Farm%20Equipment%20Efficiency%20and%20Energy%20Use-1.pdf>
- Manning, T., A.J. Both, and J. Rabin. 2012. Lowering on-farm utility costs with electricity monitors (Rutgers Cooperative Extension Web Publication).
- Runkle, E. and A.J. Both. 2011. Greenhouse energy conservation strategies. *MSU Extension Bulletin* E-3160.
- Manning, T., A.J. Both, and J. Rabin. 2010. Understanding on-farm utility costs and billing (FS1128).
- Rabin, J. and A.J. Both. 2007. NJ agricultural at a glance - Floriculture. In *Sustaining Farming on the Urban Fringe*. NJAES. December Issue.
- Wyenandt, A., W. Kline, and A.J. Both. 2006. Important diseases of tomatoes grown in high tunnels and greenhouses in NJ (FS358).
- Both, A.J., E. Reiss*, and D.R. Mears. 2006. Root-zone heating systems for commercial greenhouses

(E208, in review).

Both, A.J. 2006. Environmental control of greenhouses (E213, in revision).

Barbour, B.M., A.J. Both, A.F. Capp, S.K. Rettke, J.D. Willmott, and G.J. Wulster. 2005. Agricultural management practices for permanent greenhouse production (submitted to the New Jersey Department of Agriculture and the NJ State Agricultural Development Committee).

Both, A.J. 2005. Creating a master plan for greenhouse operations (E221, revised edition).

Wheeler, E.F. and A.J. Both. 2002. Evaluating greenhouse mechanical ventilation systems (E277).

Both, A.J. and E.F. Wheeler. 2002. Instruments for monitoring the greenhouse aerial environment (E276).

Both, A.J. and E.F. Wheeler. 2002. Principles of evaluating greenhouse aerial environments (E275).

Newsletters published

Horticultural Engineering Newsletter: six issues per year from 2000 through 2003. Back issues are available at <http://aesop.rutgers.edu/~horteng>

Center for Controlled Environment Agriculture Newsletter: four issues per year from 2000 through 2003. Back issues are available at <http://aesop.rutgers.edu/~horteng>

Videos

Both, A.J. 2014. A total of eight video presentations were delivered as part of the multi-institutional USDA-HEC project (Ohio State, University of Arizona and Rutgers University). 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.

Webinars

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'.

TEACHING

Applied Analysis of Successful Agricultural Enterprises (11:020:460). Number of students: 22. Guest lecture on Season Extension. March 9, 2015.

Greenhouse Systems (11:776:321). Number of students: 16. Guest lecture on Greenhouse Energy Use and Conservation. February 18, 2015.

Bioenvironmental Engineering Design II (11:117:489; co-teaching). Number of students: 18. Supervised three student teams working on their senior design projects on solar energy. Two credit course. Spring 2015.

Core Seminar in Plant Biology (16:765:622; co-teaching). Number of students: 27. One credit course. Spring 2015.

Integrated Energy Challenges and Opportunities (16:335:501). Number of students: 20. Guest lecture on Environment, Energy and Greenhouses: Toward Increased Sustainability and Efficiency. November 20, 2014.

Engineering Orientation Lectures (14:440:100). Number of students: 90. Lecture on BioEnvironmental Engineering. November 7, 2014.

Intro to Bioenvironmental Engineering (11:117:100). Number of students: 19. Guest lecture on Energy. October 15, 2014.

Byrne Seminar (11:090:101). High-Tech Sustainability: Food for Thought. Number of students: 11. One credit course, Fall 2014.

Energy Technology and its Environmental Impact (11:375:322). Number of students: 23. Three credit course, Fall 2014.

Bioenvironmental Engineering Design I (11:117:488; co-teaching). Number of students: 18. Supervised student teams working on their Raspberry Pi computer projects. Fall 2014.

On-Farm Energy Quality Assurance Program. Number of students: 35. Presented two 90-minute webinars (Greenhouse Heating and Ventilation Considerations; Evaporative Cooling, Supplemental Lighting and Shading). April 9 and 30, 2014.

Bioenvironmental Engineering Design II (11:117:489). Number of students: 7. Supervised two student teams working on their senior design projects on solar energy. Spring 2014.

Intro to Horticulture (11:776:211). Number of students: 40. Guest lecture on Controlled Environment Horticulture. February 25, 2014.

Annie's project. Number of students: 25. Two lectures (Greenhouse Structures and Systems; Greenhouse Energy & Irrigation Issues) and one webinar (Supplemental Lighting and Shading). January 28, 30, 2014.

Byrne Seminar (11:090:101). High-Tech Sustainability: Food for Thought. Number of students: 7. One credit course, Fall 2013.

Energy Technology and its Environmental Impact (11:375:322). Number of students: 10. Three credit course, Fall 2013.

Water and Wastewater Treatment (11:375:302). Number of students: 30. Guest lecture on Water Treatment for Greenhouses and Nurseries. October 25, 2013.

Intro to Bioenvironmental Engineering (11:117:100). Number of students: 19. Guest lecture on Energy. October 16, 2013.

Engineering Orientation Lectures (14:440:100). Number of students: 105. Lecture on BioEnvironmental Engineering. October 4, 2013.

Environmental Sustainability: Life-cycle Assessment (16:375:534). Number of students: 18. Guest lecture on Energy and the Environment. October 4, 2013.

Ten lectures on Energy Systems and their Environmental Impact. Number of students: varied between 20 and 100. Invited lectures for the South China University of Technology, Guangzhou, China. May 30-31, 2013.

Core Seminar in Plant Biology (16:765:622; co-teaching). Number of students: 22. Two credit course. Spring 2013.

Intro to Horticulture (11:776:211). Number of students: 35. Guest lecture on Controlled Environment Horticulture. February 27, 2013.

Engineering Orientation Lectures (14:440:100). Number of students: 100. Lecture on BioEnvironmental Engineering. February 21, 2013.

Byrne Seminar (11:090:101). High-Tech Sustainability: Food for Thought. Number of students: 16. One credit course, Fall 2012.

Energy Technology and its Environmental Impact (11:375:322). Number of students: 8. Three credit course, Fall 2012.

Quantitative Analysis of Innovative Biosystems (FTE-34206; Wageningen University and Research, the Netherlands; co-teaching; I developed and taught a greenhouse case study). Number of students: 24 (6 worked on the greenhouse case study). Equivalent to a 4-credit course. Fall 2011.

Portals to Academic Study Success (PASS, 11:015:103). Number of students: 7. One credit course. Spring 2011.

Core Seminar in Plant Biology (16:765:622; co-teaching). Number of students: 18. Two credit course. Spring 2011.

Engineering Orientation Lectures (14:440:100). Number of students (each session): 80. Lecture on BioEnvironmental Engineering. October 11, and November 1, 2010; February 17, 2011.

Intro to Horticulture (11:776:211). Number of students: 30. Guest lecture on Controlled Environment Horticulture. October 26, 2010; March 1, 2011.

Environmental Sustainability: Life-Cycle Assessment Tools (16:375:534). Number of students: 15. Guest lecture on Energy and the Environment. October 20, 2010.

Plants for Bioenergy (11:776:410). Number of students: 12. Guest lecture on Energy Physics. September 8, 2010.

Byrne Seminar (11:090:101). High-Tech Sustainability: Food for Thought. Number of students: 8. One credit course, Fall 2010.

Energy Technology and its Environmental Impact (11:375:322). Number of students: 9. Three credit course, Fall 2010.

Introduction to Horticulture (11:776:211). Number of students: 40. Guest lecture on Controlled Environment Horticulture, March 2, 2010.

Energy Technology and its Environmental Impact (11:375:322). Number of students: 13. Three credit course, Fall 2009.

Introduction to Horticulture (11:776:211). Number of students: 35. Guest lecture on Greenhouses, October 27, 2009.

Unit Processes in Bioenvironmental Engineering II (11:117:414). Number of students: 5. Guest lecture on Landfill Gas to Energy Project. October 12, 2009.

Byrne Family First Year Seminar: High-tech sustainability, Food for thought (11:090:101). Number of students: 7. One credit course, Fall 2009.

Incoming Freshmen Orientation Seminars. Number of students: 80. Presented three 30-minute lectures on High Tech Crop Production: June 30, July 14, July 21, 2009.

Core Seminar in Plant Biology (16:765:621; co-teaching). Number of students: 15. Two credit course. Spring 2009.

Unit Processes in Bioenvironmental Engineering II (11:117:414). Number of students: 7. Guest lecture on Landfill Gas to Energy Project. November 10, 2008.

Byrne Family First Year Seminar: High-tech sustainability, Food for thought (11:090:101). Number of students: 10. One credit course, Fall 2008.

First Year Seminar: High-tech sustainability, Food for thought (11:015:100). Number of students: 5. One credit course, Spring 2008.

Core Seminar in Plant Biology (16:765:600; co-teaching). Number of students: 18. Two credit course. Spring 2007.

Greenhouse Environment Control and Crop Production (11:776:321, George Wulster). Number of students: 15. Presented guest lectures on: Greenhouse design, light management, heating, ventilation, and cooling. Jan – Feb, 2007.

Design and Operation of Greenhouse, High Tunnel, and Nursery Systems Short Course: September 28, 2006 (co-teaching). Number of attendees: 21. Presented lectures on greenhouse heating, greenhouse ventilation and cooling, and high tunnels.

Greenhouse Environment Control and Crop Production (11:776:321, George Wulster). Number of students: 5. Presented guest lectures on: Greenhouse design, light management, heating, ventilation, and cooling. Jan – Feb, 2005.

Core Seminar in Plant Biology (16:765:600; co-teaching). Number of students: 19. Two credit course. Spring 2005.

Seminar in Plant Biology (16:765:610). Number of students: 9. One credit course. Spring, 2005.

Design and Operation of Commercial Greenhouse Systems Short Course: January 6-7, 2005. Number of attendees: 8. Course organizer and presented lectures on: Overview of major greenhouse components, ventilation & cooling, heating, supplemental lighting & shading, environment control, and high tunnels.

Perspectives on Agriculture and the Environment (11:015:101). Number of students: 20. Two credit freshmen course. Fall 2004.

Seminar in Plant Biology (16:765:610). Number of students: 7. One credit course. Spring, 2004.

Design and Operation of Commercial Greenhouse Systems Short Course: January 8-9, 2004. Number of attendees: 11. Course organizer and presented lectures on: Overview of major greenhouse components, ventilation and cooling, heating, supplemental lighting and shading, environment control, and high tunnels.

Greenhouse Cost Management Workshop. Number of attendees: 13. Course co-organizer and presented lectures on: 2003 NJ Greenhouse Survey, greenhouse systems, high tunnels, and open-roof greenhouses. October 20, 2003.

Greenhouse Design and Operation (11:015:276). Number of students: 4. One credit course. Fall, 2003.

Biosystems Engineering Measurements (11:127:290, David Fleisher). Number of students: 6. Presented a guest lecture on: Greenhouse Environment Control. April 1, 2003.

Design and Operation of Commercial Greenhouse Systems Short Course: January 13-14, 2003. Number of attendees: 10. Course organizer and presented lectures on: Overview of major greenhouse components, ventilation and cooling, heating, supplemental lighting and shading, environment control, economics, and high tunnels.

Greenhouse Design and Operation (11:015:276). Number of students: 7. One credit course. Fall, 2002.

Applied Instrumentation and Control (11:127:450, David Fleisher). Number of students: 7. Presented a guest lecture on: Greenhouse Environment Control. September 26, 2002.

Greenhouse Environment Control and Crop Production (11:776:321, George Wulster). Number of students: 12. Presented guest lectures on: Greenhouse components, heating, ventilation and cooling, environment control, and glazing. Jan – Feb, 2002.

Design of Greenhouse Systems Short Course: January 14-15, 2002. Number of attendees: 13. Course organizer and presented lectures on: Overview of major greenhouse components, ventilation and cooling, supplemental lighting and shading, and greenhouse environment control.

Energy Conservation for Biological Systems (11:127:492, David Mears). Number of students: 3. Presented a guest lecture and a lab on photo-voltaics. Spring 2001.

Design of Greenhouse Systems Short Course: January 8-9, 2001. Number of attendees: 21. Course organizer and presented lectures on: Overview of major greenhouse components, ventilation and cooling, and supplemental lighting and shading.

Plastics and Greenhouses (11:015:276, Gene Giacomelli). Presented a guest lecture on hydroponic lettuce production. Spring 2000.

Phytomation (11:127:491, David Mears). Presented guest lectures on growing media, nutritional requirements and control, fertigation system design and automation, and plant factory concept and engineering requirements. Spring 2000.

PRESENTATIONS (without publication; since January, 2000)

Invited, national and international

Measuring LED lamps used for applications in horticulture. Presented at the LED Symposium organized by the research project titled 'Developing LED Lighting Technologies and Practices for Sustainable Specialty-Crop Production'. Tucson, AZ. February 20, 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, 2015.

The greenhouse industry and its design standards in the USA. Presented for the Korean Society for Bio-Environment Control, Chuncheon, Korea. May 16, 2014.

Controlled environment agriculture, research and thoughts. Department of Landscape Architecture and Rural Systems Engineering, Seoul National University, Seoul, Korea. May 14, 2014.

Converting biologically derived methane gas to energy. Invited lecture at the South China University of Technology, Guangzhou, China. May 29, 2013.

Efficient use of natural resources in greenhouses. Invited lecture at the South China Agricultural University, Guangzhou, China. May 28, 2013.

Population growth and greenhouse production. Invited presentation as the Robert Langhans Visiting Scholar. Cornell University, Ithaca, NY. November 12, 2012.

Greenhouse guidelines. Controlled Environments: Technology and Practice Meeting. Cambridge, England. September 9-12, 2012.

Efficient use of natural resources in greenhouses. Keynote speech at the GreenSys2011 symposium, Halkidiki, Greece. June 5-19, 2011.

Greenhouse heating; Greenhouse cooling; Greenhouse technology developments (three separate presentations). 20th Annual Greenhouse Tomato Short Course. Raymond, MS. March 9-10, 2010.

Alternative energy applications; Floating hydroponic lettuce (two separate presentations). 9th Annual Greenhouse Crop Production and Engineering Design Short Course. Tucson, AZ. April 27-28, 2009.

Crop production in cooler environments. Canadian Greenhouse Conference. Toronto, Canada. October 9, 2008.

Technology and a green thumb make for great partners. Department of Plant and Soil Sciences. Michigan State University. East Lansing, MI. May 15, 2008.

The role of technology in commercial plant production. Department of Horticulture and Landscape Architecture. Purdue University. West Lafayette, IN. April 24, 2008.

Optimizing plant growth through environmental control. Agricultural Structure and Environment Seminar No. 34. Hiroshima Prefecture Agricultural Research Center. Organized by the National Institute for Rural Engineering, Tsukuba, Japan. December 13, 2007.

Technologies for greenhouse energy conservation. 25th Anniversary Perennial Plant Symposium organized by the Perennial Plant Association, Columbus, OH. August 9, 2007.

Surviving the energy crisis part 3: Conservation in the greenhouse. OFA Short Course, Columbus, OH. July 14, 2007.

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

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

Greenhouse energy considerations. Greenhouse Energy Efficiency Workshop. University of New Hampshire, Durham, NH. February 15, 2006.

Lighting technology. OFA Short Course, Columbus, Ohio. July 10, 2004.

Continuous canopy gas exchange measurements in controlled environments. Annual NCR-101 meeting, Brisbane, Australia. March 16, 2004.

Supplemental lighting as an integral part of the greenhouse system. OFA Short Course, Columbus, Ohio. July 14, 2003.

Hydroponic lettuce production. Three lectures during the Lettuce Mini Workshop. Crop Physiology Lab, Utah State University. May 28, 2002.

Designing greenhouse supplemental lighting systems. Demonstration of design software at the Greenhouse Engineering Workshop organized by Ohio State University, Wooster, OH. February 27-28, 2001.

Optimizing the production environment, Mistakes that costs you \$\$\$. New England Greenhouse Conference in Worcester, MA. October 17, 2000.

Invited, neighboring states and in-state

Greenhouse environment control. Presented at the NJNLA Greenhouse Growers Conference. EcoComplex, Columbus, NJ. June 18, 2015.

Indoor agriculture. Guest lecture for students at the Bridgewater-Raritan High School, Bridgewater, NJ. January 6, 2015.

Urban agriculture. Guest lecture for students at the Stuart County Day School of the Sacred Heart, Princeton, NJ. November 5, 2014.

Engineering and energy conservation for controlled environment agriculture. Presented at the annual Biofuels-IGERT meeting, New Brunswick, NJ. July 22, 2014.

Controlled environment agriculture and energy conservation. Presented at the Bioenergy and Bioproducts Education Program meeting organized at the EcoComplex, Columbus, NJ. July 9, 2014.

LED lighting for greenhouse crops. Presented at the NJNLA Greenhouse Growers Conference. EcoComplex, Columbus, NJ. June 28, 2014.

Sustainable greenhouse production. Presented at the Bioenergy and Bioproducts Education Program meeting organized at the EcoComplex, Columbus, NJ. July 31, 2013.

Energy conservation in greenhouse production. Presented at the NJNLA Greenhouse Growers Conference. EcoComplex, Columbus, NJ. June 20, 2013.

Water treatment for nurseries. Presented at the Topics in Nursery Production meeting in Millville, NJ. February 20, 2013.

Using landfill gas to generate electricity and heat. 55th Atlantic Coast Ag Convention and Trade Show. Atlantic City, NJ. January 13, 2010.

Understanding basic energy principles. Agricultural Energy Training Seminar. EcoComplex, Columbus, NJ. December 15, 2009.

Controlled environment agriculture. Global Eco-Innovation Forum on Sustainable Development of Hot Deserts. Columbia University, New York, NY. October 31, 2009.

Landfill gas to energy project. SEBS Discovery Tour at the NJ EcoComplex. Columbus, NJ. September 21, 2009.

Greenhouse energy considerations. 28th Long Island Agricultural Forum. Riverhead, NY. January 8, 2009.

Controlled environment crop production: Food, flowers, photons, and flow. Department of Environmental Sciences, New Brunswick, NJ. April 30, 2008.

Designing greenhouse systems for reduced run-off. Emma Lausten Horticultural Symposium. NJ-EcoComplex, Columbus, NJ. February 22, 2006.

Controlled environments: The future of NJ agriculture? Emma Lausten Horticultural Symposium, Cook College, New Brunswick, NJ. April 4, 2005.

Greenhouse technology for the small farm. Small Farm and Rural Living Expo, New Paltz, NY. September 19, 2004.

Which structure is best for you? Empire Expo, Rochester, NY. February 12, 2004.

Updating high tunnel research at Rutgers University. Mid Atlantic Fruit and Vegetable Convention, Hershey, PA. January 27, 2004. Note: prepared by A.J. Both, presented by Eugene Reiss.

High tunnel research update. Invited lecture for the educational program for training extension professionals and vocational agriculture teachers on high tunnel technology (SARE professional development workshop), Penn State high tunnel research and education facility, Rock Springs, PA. September 4, 2003.

Controlled Environment Agriculture. Seminar. Department of Plant Biology and Pathology, Rutgers University, New Brunswick, NJ. September 27, 2002.

Greenhouse components and open-roof greenhouses. Cornell Cooperative Extension of New York City, NY. May 1, 2002.

Greenhouse energy conservation. Pennsylvania Capital Region Greenhouse Grower Meeting, Ephrata, PA. January 25, 2001.

Designing a modern greenhouse system: hydroponic lettuce production as an example. Rutgers Agricultural Research and Extension Center in Bridgeton, NJ. February 2, 2000.

Extension, out-of-state

Greenhouse energy efficiency. Farm Energy IQ project. Penn State University, State College, PA. March 10-12, 2015.

Greenhouse energy efficiency. Farm Energy IQ project. University of Vermont, Fairlee, VT. February 23-25, 2015.

Extension, in-state

Greenhouse energy efficiency. Farm Energy IQ project. NJ EcoComplex, Columbus, NJ. April 8-10, 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, 2015.

Natural and supplemental lighting for plant production. Short course: Hydroponic fruit and vegetable production, practical information for novice growers. NJ EcoComplex, Columbus, NJ. March 7, 2014.

Hydroponic lettuce production. 59th New Jersey Agricultural Convention and Trade Show. Atlantic City, NJ. February 4, 2014.

Water treatment for nurseries. Topics in Nursery Production Meeting. Millville, NJ. February 20, 2013.

High tunnel construction. Strawberry and Vegetable Crop Management Twilight Meeting. Bridgeton, NJ. April 22, 2008.

Greenhouse energy conservation. South Jersey Commercial Greenhouse Growers Conference. Clayton, NJ. February 19, 2008.

Greenhouse energy conservation. Bedding Plant Grower Day. Randolph, NJ. March 3, 2006.

Rutgers high tunnel research update. Tomato Advisory Committee. NJ-EcoComplex, Bordentown, NJ. January 25, 2006.

Energy conservation from the engineer's point of view. South Jersey Greenhouse Conference. RCRE, Clayton, NJ. January 24, 2006

Minimizing your greenhouse fuel heating bill. Vegetable Integrated Crop Management Twilight Meeting. Landisville Produce Cooperative, Landisville, NJ. October 19, 2005. Note: prepared by A.J. Both, presented by Eugene Reiss.

Farm safety for children. Farm Safety Twilight Meeting. Toyland Farm, Jobstown, NJ. September 21, 2005.

Greenhouse operation. Twilight Fruit, Vegetable and Flower Meeting, Secor Farms, Mahwah, NJ. April 27, 2005.

Temperature and humidity control and DIF. Spring Flower Crop Conference, Clayton, NJ. March 3, 2005.

Greenhouse systems and sensors. North Jersey Ornamental Horticulture Symposium and Bedding Plant Day, Randolph, NJ. February 18, 2005.

Rutgers high tunnel research update. Tomato Advisory Committee. NJ-EcoComplex, Bordentown, NJ. January 19, 2005.

Open-roof greenhouse: floor heating and ebb and flood irrigation. Greenhouse Fall Crop Production, Mercer County Cooperative Extension. Holland Greenhouses, Hightstown, NJ. October 28, 2004.

Electrical safety on the farm and in greenhouses. Third annual Rutgers farm safety/health twilight meeting, Haunter Family Farm, Cinnaminson, NJ. September 15, 2004. Note: prepared by A.J. Both, presented by Ray Samulis (Agricultural Agent, Burlington County)

Construction of high tunnels for season extension. Grower Twilight Meeting. Piazza Farms and Greenhouses, Phillipsburg, NJ. June 9, 2004.

Environment control to reduce pest problems. North Jersey Ornamental Horticulture Symposium and Bedding Plant Day, Randolph, NJ. February 20, 2004.

Tractor safety. Second annual Rutgers farm safety/health twilight meeting, Russo's Orchard Lane Farm, Allentown, NJ. September 24, 2003.

Greenhouse technology for the small farm. NE small farm and rural living expo, Warren County Fairgrounds, Harmony, NJ. September 21, 2003.

High tunnel research update. Vegetable and specialty crops field day and heirloom tomato taste testing, RAREC, Centerton, NJ. August 25, 2003.

Greenhouse ventilation basics. Central Jersey Bedding Plant Meeting. Rutgers Fruit Research and Development Center, Cream Ridge, NJ. March 5, 2003.

Greenhouse heating. North Jersey Ornamental Horticulture Symposium and Bedding Plant Day, Randolph, NJ. February 21, 2003.

High tunnels. Alternative Food Production Project. Rutgers University. September 16, 2002.

Options in greenhouse coverings. New Jersey Annual Vegetable Meeting, Atlantic City, NJ. January 17, 2002.

Greenhouse energy conservation. North Jersey Ornamental Horticulture Symposium and Bedding Plant Day, Clifton, NJ. February 20, 2001.

Greenhouse energy conservation. Burlington County Vegetable Growers Update, Mount Holly, NJ. February 14, 2001.

Energy and labor savings & Getting ready for spring. Two presentations at the South-Central NJ Bedding Plant Conference, Mount Holly, NJ. February 9, 2001.

Getting ready for spring. New Jersey Annual Vegetable Meeting, Atlantic City, NJ. January 18, 2001.

Greenhouse structures and equipment. Mercer County Poinsettia Program in Trenton, NJ. October 24, 2000.

Supplemental lighting for greenhouse production. North Jersey Ornamental Horticulture Symposium in Clifton, NJ. February 16, 2000.

EXTERNAL FUNDING RECEIVED

USDA Specialty Crops Research Initiative: High Tunnel Berry Crops (2014) (Michigan State lead institution, total grant \$2,450,060 over 5 years)	\$252,452
NYSERDA: Optimizing LED Systems for Greenhouse Leafy Greens Production (2014) (Cornell University lead institution, total grant \$285,000 over 3 years)	\$24,000
NE-SARE: Farm Energy IQ Training Program (2013) (Penn State lead institution, total grant \$145,000 over 2 years) Rutgers co-investigators: T. Manning and Z. Helsen	\$13,500

USDA Specialty Crops Research Initiative: LED Lighting for Horticulture (2011) (Purdue University lead institution, total grant \$4,880,000 over 4 years)	\$187,000
USDA Higher Education Challenge Grant: On-line Hort. Eng. course modules (2011) (Ohio State University lead institution, total grant \$976,400 over 3 years)	\$107,000
Greater Philadelphia Innovation Cluster for Energy Efficient Buildings (2011) (Penn State University lead institution, total grant \$129,000,000 over 5 years)	\$58,040
NJ Board of Public Utilities. Rebate check for microturbine installation at the EcoComplex. (2010)	\$194,805
NSF IGERT, Solutions for renewable and sustainable fuels in the 21st Century (2009-2014; PI: E. Lam; co-investigator: --among many others--: A.J. Both)	\$3,198,175
Northeast SunGrant Initiative, Hydrogen, natural gas, electricity, and heat from landfill gas: Integration of emerging technologies for a quad-generation demonstration project (2009-2010; PI: D. Specca; co-investigator: --among many others--: A.J. Both)	\$150,000
NRCS-USDA, Energy audits as a tool for reducing greenhouse gas emissions in intensive agriculture. (2008-2010; PI: T. Manning; co-investigators: A.J. Both and J. Rabin)	\$61,191
American Floral Endowment, Improving energy efficiency of greenhouse crop production (2008-2010; PI: E. Runkle (MSU); co-investigators: M. Blanchard, J. Frantz, A. Cameron, S. Harsh, and A.J. Both)	\$40,000
NJ Board of Public Utilities, Waste and bioenergy assessment for a state wide (bio)energy master plan (September 2006-June 2007; PI: Margaret Brennan; co-investigator: --among many others--: A.J. Both)	\$210,841
NJ Department of Environmental Protection, Microturbine at NJ-EcoComplex (August 2006-July 2008)	\$ 500,000
NASA Special Grant, Growth Chamber Studies (July 2005-June 2006)	\$ 5,000
NASA Special Grant, Growth Chamber Studies (July 2004-June 2005)	\$ 5,000
NASA Special Grant, Growth Chamber Studies (October 2003-June 2004)	\$ 11,000
NJ State Agricultural Development Committee, Agricultural Management Practices for Permanent Greenhouse Production (2003; co-investigators: Jim Willmott, George Wulster, and A.J. Both)	\$ 22,500
NASA, Systems Studies and Modeling (September 30, 2002 – September 30, 2003)	\$ 65,000
NASA Specialized Center of Research and Training, Systems Studies and Modeling (January 1 – June 30, 2002)	\$ 29,320
NASA Specialized Center of Research and Training, System Studies and Modeling (May 1, 2001 – December 31, 2001)	\$ 80,514
NASA Specialized Center of Research and Training, System Studies and Modeling (May 1, 2000 – April 30, 2001)	\$ 125,518
Center for Controlled Environment Agriculture (CCEA, 2000-present)	\$ 35,050

INTERNAL FUNDING RECEIVED

SEBS Instructional Computing Fund (for BEE senior design course), 2015	\$5,000
SEBS Instructional Computing Fund (for BEE senior design course), 2014	\$5,000
EcoComplex (from the NJ Commission on Science and Technology), 2009 Student labor for a project on greenhouse cooling for orchid production	\$5,000
EcoComplex (from the NJ Commission on Science and Technology), 2008 Equipment purchases for a project on greenhouse cooling for orchid production	\$5,000
Equine Science Center, Horse manure to bioenergy technology for on-farm or regional application (Oct. 2006 – Oct. 2011; PI: Donna Fennell; co-investigators:	\$50,000

Chris Obropta, Mike Westendorf, and A.J. Both)	
Cook College, Office of the Executive Dean (2004; ASAE Historic Landmark)	\$ 5,000
DES Innovative Educational Grant (2003; PI: A.J. Both; co-investigators: Robin Brumfield and George Wulster)	\$ 5,000
NJAES, Program Development Grant (2003; PI: Donna Fennell; co-investigators: Joe Ponessa, Jim White, Gedi Mainelis, and A.J. Both)	\$ 4,000
NJAES, Program Enhancement Grant (2001-2006; PIs: Steve Garrison and Wes Kline; co-investigator --among many others--: A.J. Both)	\$ 125,000
Department of Plant Science and NJAES, upgrade environmental control system (2001)	\$ 17,820
NJAES, Program Development Grant (2000; PI: A.J. Both; co-investigators: Jim Willmott and George Wulster)	\$ 3,000
NJAES, Operating Support for CCEA and greenhouse maintenance (2000-2002)	\$ 14,000
Multi-State Project (Hatch) Support (2000-2014; NCERA-101, NE-1335)	\$ 62,000

GRADUATE STUDENTS

- Isabel Armas Gutiérrez, M.S. student in Plant Biology (2015-). Project: Nutritional enhancement of lettuce using mutation breeding. Member of the thesis advisory committee.
- Michael Johnson, Ph.D. student in Environmental Sciences (2013-). Project: Algae production for biofuels. Dissertation advisor.
- Yuan Li, Ph.D. student in Plant Biology (2013-). Project: hydroponic crop production. Dissertation advisor.
- Tom van Zundert, M.S. 2013 (Wageningen University). Thesis title: Life cycle assessment of the Dutch greenhouse tomato production system. Thesis advisor.
- Ariel Martin, Ph.D. 2013. Dissertation title: Development of a decision support system to operate the greenhouse lighting and shading systems powered by a distributed generator. Dissertation advisor.
- David Babson, Ph.D. 2010. Dissertation title: Enhancing energy recovery from biomass waste streams: from mega-landfills and biorefineries to microbial communities. Member of dissertation advisory committee.
- Matthew Blanchard, Ph.D. 2009 (Michigan State University). Dissertation title: Manipulating light and temperature for energy-efficient greenhouse production of ornamental crops. External member of dissertation advisory committee.
- Brian Wartell, M.S. 2009. Thesis title: Anaerobic digestion of equine waste. Member of thesis examination committee.
- Sung Won Yoon, Ph.D. 2009. Dissertation title: A measure of soil structure derived from water retention properties: A Kullback-Liebler distance approach. Member of dissertation examination committee.
- David Specca, M.S. 2008. Thesis paper title: Opportunities for agricultural-based bioenergy in New Jersey: a case study of switchgrass and field corn. Member of thesis advisory committee.
- Diyana Jamaludin, M.S. student in Bioresource Engineering. Major advisor for one year (started F06).
- Mark Lefsrud, Ph.D. 2006 (University of Tennessee). Dissertation title: Environmental manipulation to increase the nutritional content in leafy vegetables. External member of dissertation advisory committee.
- Eugene Reiss, M.S. 2006. Thesis title: Modeling greenhouse floor heating using computational fluid dynamics. Major advisor.
- Tom van der Walle, M.S. 2005. Tom conducted a six-month research project as part of the degree requirements from Wageningen Agricultural University, the Netherlands. Project advisor.

Jennifer Mathieu, Ph.D. 2004 (Cornell University). Dissertation title: Lettuce crop evapotranspiration, nitrate uptake, and growth mechanistic simulation modeling: for use in fault detection in hydroponic production systems. External member of dissertation advisory committee.

Lina Friis, M.S. 2004. Thesis title: Canopy CO₂-exchange measurements for *Lactuca sativa* L. 'Waldmann's Green'. Lina conducted a five-month thesis project as part of the degree requirements from the University of Agricultural Sciences in Alnarp, Sweden. Project advisor.

Meenal Gogte, M.S. student in Bioresource Engineering. Major advisor for one semester (F03).

Konomi Kumasaka, M.S. 2003. Thesis title: Canopy gas exchange of soybean [*Glycine Max* (L.) Merr., cv. Hoyt] in response to air temperature, light intensity, and aerial CO₂ concentration in controlled hydroponic environments. Major advisor.

Christer Wretfors, M.S. 2003. Thesis title: Growth chamber experiments and modeling for dwarf tomato varieties. Christer conducted a five-month thesis project as part of the degree requirements from the University of Agricultural Sciences in Alnarp, Sweden. Project advisor.

Sara Goudarzi, M.S. 2003. Thesis title: Dynamic crew performance model for long-duration space missions. Major advisor.

Hsien-Hsing Hsiang, M.S. 2002. Thesis title: Top-level modeling of a food processing and nutrition (FPN) component of an advanced life support system (ALSS). Member of the thesis advisory committee.

RESEARCH SUPERVISOR

Hassan Chughtai (Bridgewater High School, Bridgewater NJ). Project title: LED lighting for horticultural applications. Summer 2014 and 2014-2015 school year.

Claude Wallace, B.S. Bioenvironmental Engineering (Rutgers University). Project: LED lighting for horticultural applications. July 2014-current.

Greg Haring, undergraduate student in Bioenvironmental Engineering. Project: Quantifying light output and power consumption of supplemental lighting systems for horticultural applications. Spring 2014.

Alayna Famble, undergraduate student in Bioenvironmental Engineering. Project: Solar energy applications. Spring 2014.

Matthew Bara, undergraduate engineering student (Rowan University). Project: LED lighting for horticultural applications. Summer 2013.

Claude Wallace, B.S. Bioenvironmental Engineering (Rutgers University). Project: LED lighting for horticultural applications. Summer 2013-March 2014.

Caroline Yu (Byram Hills High School, Armonk, NY). Project title: Determining the Effects of the Ratio of Red and Blue Light-Emitting Diodes on the Anthocyanin Content in Red Lettuce as a Possible Crop for Vertical Farming. 2010.

Gail Bradbury and Anthony Lopez. Cook Honors project. Title: Constituent Analysis of Composting as a Form of Waste Management for Solid Waste Generated On-Campus. 2010.

Daryl Strom, Undergraduate summer intern. 2009.

Tarik Zebib, Undergraduate capstone design project. Summer 2009. (co-supervisor with Donna Fennell)

Lisa Evans, Undergraduate work-study student. October 2005-May 2006.

Max Dubin, Undergraduate student. Independent Research in Biology (01:119:406). June-December 2005.

Jeff Akers, Head Greenhouse Field Technician. January 2004-present. (co-supervisor with Joe Florentine)

Xavier Sosa, Undergraduate work-study student. October 2003-May 2004.

Sara Goudarzi, M.S. Hourly employee. February 2003-September 2004.

Dr. Luis Rodriguez, Post Doctoral Associate. November 2002-January 2003.
Timothy Vadas, Cooperative Education student. Summer 2001, 2002.
Thanh Nguyen, Undergraduate work-study student: web site development. June 2000-May 2001.
Dr. Sukwon Kang, Post Doctoral Associate with the NJ-NSCORT project. July 2000-August 2001.
Steve Kania, M.S. Technician, Center for Controlled Environment Agriculture. July-December 2000.
Eugene Reiss, Program Associate/Research Project Coordinator II. January 2000-December 2005.

VISTING SCIENTISTS

Hosted Dr. S.W. Nam (Associate Professor, Chungnam National University, South Korea). February 2010-January 2011.

Mobolaji Omobowale, M.S. Mobolaji studied (tropical) greenhouse applications and greenhouse engineering curriculum development during a three-month stay funded by the MacArthur Foundation. He is a lecturer at the University of Ibadan, Nigeria. Served as host and supervisor, Fall 2009.