

Curriculum Vitae

Arend-Jan Both

Associate Extension Specialist
Bioresource Engineering
Department of Plant Biology and Pathology
Rutgers, The State University of New Jersey
20 Ag Extension Way
New Brunswick, NJ 08901-8500
Phone: (732) 932-9534
Fax: (732) 932-7931
E-mail: both@aesop.rutgers.edu
Web site: <http://aesop.rutgers.edu/~horteng>

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

- 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. Primary department: Extension Specialists, secondary department: Plant Biology and Pathology.
- 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

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 (major 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

Associate Editor, Transactions of the ASAE 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.

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

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

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

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

Secretary, Chair of the NE-1017 Regional Committee on Developing and Integrating Components for Commercial Greenhouse Production Systems. 2006-2007.

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.

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.
- Journal articles
Acta Horticulturae (ISHS) (3)
Computers and Electronics in Agriculture (2)
Illuminating Engineering Society of North America Conference Proceeding (1)
Transactions of the ASAE (7)
Applied Engineering in Agriculture (2)
HortTechnology (3)
HortScience (1)
Society of Automotive Engineers (1)
Journal of Life Support and Biosphere Science (1)
COSPAR (Committee on Space Research) (1)
Journal of the American Society for Horticultural Science (6)
Waste Management (1)
- Grants
USDA SBIR Plant Production and Protection (Engineering). 2005 (2 proposals).
United States-Israel BARD Fund. 2003 (1 proposal).
USDA SBIR Plant Production and Protection (Engineering). 2003 (15 proposals).
Reviewer for the OARDC International Collaboration Competition, The Ohio State University. 2002 (1 proposal).
USDA SBIR 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
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)

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)
Session organizer, NJ Vegetable Growers' Association Meeting, Atlantic City. (2001-present)
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

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-present
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.

RESEARCH INTERESTS

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

PUBLICATIONS

(Note: '*' denotes current or former 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. 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

- 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

- 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.

Not-refereed Technical Publications

- 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.
- Albright, L.D. and A.J. Both. 1994. Comparison of luminaires: efficacies and system design. Proceedings of the International Lighting for Plants in Controlled Environments Workshop. University of Wisconsin, Madison, WI. March 27-30. NASA Conference Publication CP-3309. pp. 281-297.
- Both, A.J. 1994. Luminaire layout: design and implementation (short report). Proceedings of the International Lighting for Plants in Controlled Environments Workshop. University of Wisconsin, Madison, WI. March 27-30, 1994. NASA Conference Publication CP-3309. pp. 299-301.
- Both, A.J., L.D. Albright, R.W. Langhans, B.G. Vinzant, and P.N. Walker. 1992. Research on energy consumption of HID lighting. Proceedings of the 4th National CAEP Agricultural Demand-Side Management Conference. Syracuse, NY. October 20-22. Northeast Regional Agricultural Engineering Service, Publication No. 65. Cornell Cooperative Extension, Cornell University, Riley-Robb Hall, Ithaca, NY 14853. pp. 125-134.
- Albright, L.D. and A.J. Both. 1990. Screening materials for thrips exclusion in greenhouses. Proceedings of the fifty-second annual New York State Pest Management Conference. Cornell University, Ithaca, NY 14853, USA. November 12-15. 7 pp.
- Ooster, A. van 't and A.J. Both. 1988. Towards a better understanding of relations between building design and natural ventilation in livestock buildings. Proceedings of the 3rd International Livestock Environment Symposium, April 25-27, Toronto, Canada. ASAE, 2950 Niles Road, St. Joseph, MI 49085-9659, USA. pp. 8-21.

Technical Abstracts

- Zinati, G.M., J. Dighton, and A.J. Both. 2007. Fertilizer, irrigation, and mycorrhizal effects on container-grown nursery crop biomass accumulation and leachate nutrient content. HortScience 42(4):862.
- 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. Northeast Region of ASHS Annual Meeting, January 4-6, University of Maryland, College Park, MD.
- Both, A.J., L.S. Logendra, J. Cavazzoni, T. Gianfagna, T.C. Lee, and H.W. Janes. 2006. Effects of a two-week temperature perturbation during flowering of tomato (*Lycopersicon esculentum Mill.*). February 5-8, Orlando, FL. Habitation 10(3/4):131.
- Moraru, C., T.C. Lee, D.H. Fleisher, L.S. Logendra, A.J. Both, and H. Janes. 2004. Quality of hydroponically grown tomatoes subjected to a 14-day, 5°C temperature perturbation during fruit set. Institute of Food Technologists Annual Meeting. July 12-16, Las Vegas, NV. Paper No. 26012. http://ift.confex.com/ift/2004/techprogram/paper_26012.htm
- Fleisher, D., A.J. Both, L. Logendra, C. Moraru, T. Gianfagna, T.C. Lee, J. Cavazzoni, and H. Janes. 2004. Short-term temperature effects on hydroponically grown tomatoes – I: Production scheduling. Habitation 2004. January 4-7. Orlando, FL. Habitation 9(3/4):123.
- Lee, T.C., A.J. Both, C. Moraru, D. Fleisher, L. Logendra, T. Gianfagna, J. Cavazzoni, and H. Janes. 2004. Short-term temperature effects on hydroponically grown tomatoes – II: Quality of tomato fruits. Habitation 2004. January 4-7. Orlando Florida. Habitation 9(3/4):128.
- Rodriguez, L.F., A.J. Both, A.B.O. Soboyejo, K.C. Ting. 2001. The effect of uncertainty in analyses of advanced life support systems. Proceedings of the annual Meeting of the American Society for Gravitational and Space Biology, Alexandria, VA. Gravitational and Space Biology Bulletin 15(1):14.

de Villiers, D.S., R.W. Langhans, A.J. Both, L.D. Albright, and S.S. Scholl. 1999. Intermittent CO₂ enrichment for hydroponic lettuce production. *HortScience* 34(3):532.

Abstracts for Extension Meetings

- Both, A.J. 2007. Greenhouse Ventilation. Proceedings of the Annual NJ Vegetable Growers' Association Meeting. January 16-18. Atlantic City, NJ. pp. 76-79.
- Both, A.J., E. Reiss, J. Sudal, K. Holmstrom, W. Kline, S. Garrison. 2006. Rutgers high tunnel research update. Proceedings of the Annual NJ Vegetable Growers' Association Meeting. January 10-12. Atlantic City, NJ. pp. 121-124.
- Kline, W.L., A.J. Both, S.A. Garrison, J.F. Sudal, E. Reiss. 2005. High tunnel tomato production in New Jersey. Proceedings of the 32nd National Agricultural Plastics Congress. March 5-8. Charleston, SC.
- Both, A.J. 2005. Rutgers high tunnel research update. Proceedings of the Annual NJ Vegetable Growers' Association Meeting. January 11-13. Atlantic City, NJ. pp. 40-41.
- 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.
- Both, A.J. 2004. Updating high tunnel research at Rutgers University. Proceedings of the Mid Atlantic Fruit and Vegetable Convention. January 27-29. Hershey, PA. pp. 6-8.
- Both, A.J. 2003. Crop production in high tunnels. Proceedings of the Annual NJ Vegetable Growers' Association Meeting. January 14-16. Atlantic City, NJ. pp. 89-90.
- Both, A.J. 2002. Options in greenhouse coverings. Proceedings of the Annual NJ Vegetable Growers' Association Meeting. January 15-17. Atlantic City, NJ. pp. 99-100.
Also published in Long Island Horticulture News, December 2001 issue.
- Both, A.J. 2001. Making sure your greenhouse is ready for spring. Proceedings of the Annual NJ Vegetable Growers' Association Meeting. January 16-18. Atlantic City, NJ. pp. 98-99.

Article Discussion

- Both, A.J. 2004. Discussion accompanying the paper: *The phytometric system: a new concept of light measurement for plants* by G.J.C. da Costa and J.L. Cuello. *Journal of the Illuminating Engineering Society*. Winter 2004:34-42.

Posters

- 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. Northeast Region of ASHS Annual Meeting, January 4-6, University of Maryland, College Park, MD.
- Fleisher, D.H., A.J. Both, L. Logendra, C. Moraru, T. Gianfagna, T.C. Lee, J. Cavazzoni, and H. Janes. 2004. Short-term temperature effects on hydroponically grown tomatoes – I: Production Scheduling. Presented at the Habitation Conference on Space Habitation Research and Technology Development in Orlando, FL. January 4-7, 2004.
- Rodriguez, L.F., A.J. Both, A.B.O. Soboyejo, and K.C. Ting. 2001. The effect of uncertainty in analyses of advanced life support systems. Presented at NASA's PI and the American Society of Gravitational and Space Biology meeting in Alexandria, VA. November 7-10, 2001.
- Rodriguez, L.F., H. Hsiang, Y. Ozaki, S. Kang, S. Goudarzi, D.H. Fleisher, K.C. Ting, and A.J. Both. 2000. Top-level modeling of an ALSS utilizing object oriented techniques. Presented at NASA's Life Support and Biosphere Science meeting in Baltimore, MD. August 7-9, 2000.
- Cavazzoni, J., D.H. Fleisher, T. Gianfagna, L. Logendra, A.J. Both, and G.A. Giacomelli. 2000. Biomass production projects for the NJ-NSCORT. Presented at NASA's Life Support and Biosphere Science meeting in Baltimore, MD. August 7-9, 2000.

Research Reports

- Brennan, M., D. Specca, B. Schilling, D. Tulloch, S. Paul, K. Sullivan, Z. Helsel, P. Hayes, J. Melillo, B. Simkins, C. Phillipuk, A.J. Both, D. Fennell, S. Bonos, M. Westendorf, and R. Brekke. 2007. Assessment of biomass energy potential in New Jersey. New Jersey Agricultural Experiment Station Publication No. 2007-1. Rutgers, the State University of New Jersey, New Brunswick, NJ.
- Keren, R.D., C.M. Danis, W.P. Cowgill, A.J. Both, and D. Lewis. 2003. Enhancing the Hunterdon County agricultural economy. Final report to the Hunterdon Economic Partnership. 41 pp.
- L.D. Albright, I. Seginer, R.W. Langhans, R.M. Welch, L. Levine, W. Berry, R. Linker, J. Lea-Cox, R. Wheeler, A.J. Both, T. Englert, S. Black, D. deVilliers, J. Mathieu, C. Johnson. 2000. Modeling of the relationship between nitrate concentration and carbohydrate partitioning in hydroponic lettuce, *Lactuca sativa*, L. Nicolet Project Report, Experimental Results. Submitted to a consortium of collaborators in Israel and the Netherlands (European Union project FAIR6-CT98-4362).
- Langhans, R.W., L.D. Albright, and A.J. Both. 1999. Hydroponic vegetable production in controlled environment agriculture facilities. Final Report to NYSERDA, ESEERCO and NYSEG. March, 1999. Cornell University, Ithaca, NY 14853. 62 pp.
- Langhans, R.W., J. Bandy, A.R. Leed, D.J. Tennessen, B.G. Vinzant, T.C. Weiler, L.D. Albright, A.J. Both, E. Goto, E.F. Wheeler, C. Zou, B.A. Ingall, J. Kossowski, M.P. Pritts, L.D. Topoleski, D.E. Wilcox, J.D. Novak, G.B. White, and A.G. Taylor. 1994. A definition of problems involved in design and operation of the controlled environment life support system (CELSS) in the human-rated test facility (HRTF). Johnson Space Center. NASA Grant NAG 9-715. 144 pp.

Not-refereed Extension Publications

- Both, A.J. 2004. Rutgers high tunnel research. Proceedings of the 49th New Jersey Annual Vegetable Growers' Association Meeting, Borgata Hotel Casino and Spa, Atlantic City, NJ. pp. 83-90.
- Both, A.J. 2004. Greenhouse environment control. Proceedings of the 49th New Jersey Annual Vegetable Growers' Association Meeting, Borgata Hotel Casino and Spa, Atlantic City, NJ. pp. 91-95.
- 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.

Trade Journal Articles

- Both, A.J.. 2008. Maintain ventilation equipment before warm weather starts. *Greenhouse Management and Production (GMPro)*. April issue. pp. 21-24.
- 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.
- Both, A.J. 2006. Airflow options affect crop growth. *Greenhouse Management and Production (GMPro)*. May issue. pp. 59-64.
- 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.
- Both, A.J. 2004. Greenhouse becomes 43rd ASAE historic landmark. Resource magazine (ASAE). September issue. pp 19.
- Both, A.J. 2004. Supplemental lighting. Greenhouse Product News 14(12):48-53 (reprint from OFA Bulletin July/August 2003).
- 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.
- Both, A.J. 2004. Comparing greenhouse coverings. American Vegetable Grower. June issue. pp. 23-24.
- Both, A.J. 2004. Greenhouse temperature management. Greenhouse Management and Production (GMPRO). April issue. pp. 38-42.
- Fisher, P. and A.J. Both. 2004. Photoperiod control: technology options and costs. Greenhouse Grower. March issue. pp. 42-49.
- Fisher, P. and A.J. Both. 2004. Supplemental lighting: technology and costs. Greenhouse Grower. February issue. pp. 86-94.
- Both, A.J. and J.E. Faust. 2003. Light transmission: greenhouse design and coverings. Greenhouse Grower. December issue. pp. 82-86.
- Both, A.J. 2003. Oil or gas? Strategies to reduce greenhouse energy bills. Mid-Atlantic Grower (5)11 October issue. pp. 18-19.
- 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

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>

TEACHING

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 and cooling, heating, supplemental lighting and 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

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

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, in-state

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

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
Subtotal	\$ 1,129,743

INTERNAL FUNDING RECEIVED

Equine Science Center, Horse manure to bioenergy technology for on-farm or regional application (Oct. 2006 – Oct. 2011; PI: Donna Fennell; co-investigators: Chris Obropta, Mike Westendorf, and A.J. Both)	\$50,000
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
Regional Project (Hatch) Support (2000-2007; NCR-101, NE-1017 [NE-164])	\$ 27,000
Subtotal	\$ 250,820

ALL FUNDING COMBINED

Total \$ 1,380,563

CONSULTING

BHDP Architecture for The Scotts Company in Marysville, Ohio. Construction of a new \$5,000,000 greenhouse facility.

GRADUATE STUDENTS

- Matt Blanchard, Ph.D. student (Michigan State University). External member of dissertation advisory committee.
- Diyana Jamaludin, M.S. student in Bioresource Engineering. Major advisor for one year (started F06).
- David Specca, M.S. student. Project: Integrating aquaculture and hydroponics. Member of thesis advisory committee.
- 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 committee.

RESEARCH SUPERVISOR

- 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.