

NCERA-101
Committee on Controlled Environment Technology and Use
2011 Annual Station Report

State of Maine, USA

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1. Impact Nugget: Virtual Grower software was updated with an additional 600 US sites and is now compatible with Mac, Linux, and 64-bit processors; over 10,000 copies have been distributed since the original release of the software.

2. New Facilities and Equipment. A glass greenhouse was upgraded to include 12 400-W HPS lamps and improved cooling/heating systems. USDA-ARS lab in Orono, Maine was shut down on March 18, 2011 eliminating 17 full-time positions and requiring those employees to be relocated. All employees are awaiting reassignment as of 4-27-2011.

3. Unique Plant Responses. Intumescence/Oedema was observed on Russet potatoes grown in pots in a greenhouse with double-walled acrylic cladding, but was not observed in a glass-glazed greenhouse. Potatoes were grown in a variety of soil moisture contents, but was only correlated with greenhouse cladding.

4. Accomplishment Summaries. Virtual Grower software was developed to allow a user to easily build, in software, a greenhouse that closely matched their facility so that energy simulations could be run conveniently. Virtual Grower 2.6 was released in 2010, which had plant growth simulation capabilities, as well as improved user interface, additional energy curtain options, more descriptions of air infiltration (leakage) and heating system efficiency, and real-time weather interface/predictions. Latest changes, now in beta-testing, include additional US sites (now totalling over 800 sites), predictions of planting time or finish time, dual-system heating capabilities, and compatibility with more operating systems. These changes allow a user to see the impact that optimizing in one area (heating efficiency) may have on plant growth and scheduling. The software has enabled growers and engineers to more easily obtain energy audit information with which owners can seek funding for energy efficiency improvements. Over 10,000 copies of VG have been distributed, primarily through the website www.virtualgrower.net.

5. Impact Statements. Virtual Grower software continues to be developed by the USDA-ARS team in Toledo, OH. The software allows a user to design greenhouses and simulate heating and plant growth for 12 greenhouse crop species. Users can optimize management strategies to save energy and improve scheduling. Over 10,000 copies have been distributed, with typical, easy-to-implement savings of around 20% on average.

6. Published Written Works.

Refereed Journal Articles

Zellner, J.M., J. Frantz, and S. Leinser. 2011. Silicon delays tobacco ringspot virus systemic symptoms in *Nicotiana tabacum*. *J. Plant Phys.* In press.

Frantz, J.M. and P. Ling. 2011. Growth and partitioning of *Petunia × hybrida* Vilm. are influenced by altering light, CO₂, and fertility. *HortScience*. 46:228-235.

Ranger, C., Winter, R., Singh, A., Reding, M., Frantz, J., Locke, J., and Krause, C. 2011. A rare excitatory amino acid from flowers of zonal geranium responsible for paralyzing the Japanese beetle. *Proc. Nat. Acad. Sci.* doi:10.1073

- Kim, S., G. Inyer, A. Nadarajah, A. Spongberg, and J.M. Frantz. 2010. Polyacrylamide hydrogel properties for horticultural applications. *International Journal of Polymer Analysis and Characterization*. *In press*.
- Johnson, I., J.H.M. Thornley, J.M. Frantz, and B. Bugbee. 2010. Modelling photosynthetic enzyme level and distribution through canopies in relation to canopy photosynthesis and its acclimation to light, temperature and CO₂. *Annals of Botany*. doi: 10.1093/aob/mcq183
- Frantz, J.M., B. Hand, L. Buckingham, S. Ghose. 2010. Virtual Grower: Software to Calculate Heating Costs of Greenhouse Production in the U.S. *HortTechnology*. 20:778-785.
- Davis, K.I., C.E. Niedziela Jr., M.R. Reddy, B.E. Whipker, and J.M. Frantz. 2010. Nutrient disorder symptomology and foliar concentrations of *Clerodendrum thomsoniae*. *J Plant Nutrition*. *Accepted 7-27-09*.
- Omer, M., J. Locke, J. Frantz, C. Krause, and L. Horst. 2010. Reaction of *Calibrachoa* to infection with selected root and foliar pathogens common in greenhouse settings. *Acta Hort*. *Accepted 3-14-2010*.

Trade Magazine Articles

- Frantz, J.M. and J.C. Locke. 2011. Research ready results: Silicon in floriculture fertility programs. *Greenhouse Grower*. Feb, 2011 pp. 26-27.
- Nelson, P., K. Jeong, J. Frantz. 2011. Root substrate testing with the Rhizon soil moisture sampler. *Greenhouse Product News (GPN)*, February, 2011.

Book Chapters

- Frantz, J.M., B. Larkin, G. Trusty, C.W. Honeycutt, Z. He, M. Olanya, and J. Halloran. 2011. Comparing modelled productivity to historical data in New England potato production systems. In "Sustainable Potato Production: Global Case Studies" Zhongqi He (ed). Springer Publishing, NY.
- Olanya, O.M., C. W. Honeycutt, Z. He, R.P. Larkin, J.M. Halloran, J.M. Frantz. 2011. Early and late blight potential on Russet Burbank potato as affected by microclimate, cropping systems and irrigation management in North-eastern United States. In "Sustainable Potato Production: Global Case Studies" Zhongqi He (ed). Springer Publishing, NY.
- He, Z., C.W. Honeycutt, O.M. Olanya, R.P. Larkin, J. Halloran and J.M. Frantz. 2011. Comparison of soil phosphorus status and organic matter composition in potato fields with different crop rotation systems. In "Sustainable Potato Production: Global Case Studies" Zhongqi He (ed). Springer Publishing, NY.
- Frantz, J.M., J.C. Locke, D. Sturtz, S. Leisner. 2010. Silicon in ornamental crops: detection, delivery, and function. *Silicio na Agricultura: Anais do V Simposio Brasileiro sobre Silicio Agricultura*. Editor: Fabricio Rodriguez. pp.111-134.

Poster Presentations

3 poster presentations throughout the fiscal year.

7. Scientific and Outreach Oral Presentations

10 scientific or outreach presentations throughout the fiscal year

8. **Other relevant accomplishments and activities.** None