NCERA-101:
Committee on Controlled Environment Technology and Use
Michigan State University 2010 Station Report

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Impact Nugget

In 2010, Michigan State University quantified how average daily temperature influenced production time of 19 different varieties of ornamental plants. Together with recently developed, research-based information on other crops, and the Virtual Grower software program, greenhouse growing temperatures can be identified that consume the least amount of energy for heating.

New Facilities and Equipment

Construction of a new $43 million plant science facility started in April, 2010. This 80,000 ft^2 building will connect two existing plant science buildings and will primarily provide additional laboratory research and research support space. The lower level of the facility will feature space and capabilities for state-of-the-art growth chambers. The building should be completed in early to mid-2012.

We now have 167 controlled environment chambers housed in 5 buildings that are managed centrally, plus around 25 walk-in chambers that are managed separately. Chambers have various levels of sophistication, including capabilities for high light, low temperature, high or low CO_2, etc. The newer "flex" chambers are can be configured to grow small or large plants. Older equipment is continually being updated, including the phase out of T12 lighting systems with T8 or T5 lights.

Accomplishment Summaries

Nineteen species of bedding plants were grown in controlled-environment greenhouses at constant air temperature setpoints of 14, 17, 20, 23 or 26 °C and under a 16-h photoperiod to quantify the effect of average daily temperature on flowering time and plant quality. A variety of growth and flowering attributes were measured and recorded. As temperature increased from 14 to 26 °C, days to flowering decreased in a species-specific manner. Linear regression analysis was performed on the flowering rate (reciprocal of days to flower) data to estimate the base temperature for each species. This information can be used by growers to group crops with a similar temperature response together for energy-efficient greenhouse production.

Eighteen varieties of herbaceous perennials were provided with different cold treatments and then grown in greenhouses under different photoperiods to determine environmental flowering responses. Most of the perennials studied did not require a cold treatment for flowering, but long days were either required for, or accelerated, flowering of *Coreopsis* (all five varieties studied), *Leucanthemum*, *Prunella*, and *Sedum* (all three varieties studied).

Impact Statements

Expanded and updated the research-based MSU Floriculture Production Website, which contains over 100 articles on greenhouse production of floriculture crops written by MSU faculty,

staff, and graduate students; dozens of articles on managing greenhouse energy; and links to several other MSU-directed greenhouse programs. According to GoogleAnalytics, from April through December, 2010 there were 3,071 visits with 2,097 unique visitors and 8,860 page views to this website.

Published Written Works (*denotes peer reviewed)

*Blanchard, M. and E.S. Runkle. 2010. Effects of emerging shoot size, temperature, and benzyladenine on growth and flowering of *Zygopetalum* Redvale 'Fire Kiss'. Acta Hort. 878:302-309.

Blanchard, M. and E.S. Runkle. 2010. Energy-efficient annuals, Part 12: Pentas & verbena. Greenhouse Grower 28(2):32-37.

Blanchard, M. and E.S. Runkle. 2010. Energy-efficient annuals, Part 11: Angelonia & browallia. Greenhouse Grower 28(1):30-34.

Blanchard, M. and E.S. Runkle. 2010. Ready research results: Daily light integral & flowering of annuals. Greenhouse Grower 28(13):22-23.

*Blanchard, M.G. and E.S. Runkle. 2010. Influence of NIR-reflecting shading paint on greenhouse environment, plant temperature, and growth and flowering of bedding plants. Trans. ASABE 53:939-944.

*Blanchard, M.G. and E.S. Runkle. 2010. Intermittent light from a rotating high-pressure sodium lamp promotes flowering of long-day plants. HortScience 45:236-241.

*Blanchard, M.G., E.S. Runkle, and Y.-I. Lee (Eds.). 2010. Proceedings of the First International Orchid Symposium (Acta Hort. 878). Taichung, Taiwan.

*Bradford, E., J.F. Hancock and R.M. Warner. 2010. Interactions of temperature and photoperiod determine expression of repeat flowering in strawberry. J. Amer. Soc. Hort. Sci. 135:102-107.

*Newton, L.A. and E.S. Runkle. 2010. Effects of paclobutrazol sprays on inflorescences of three potted moth orchid clones. HortTechnology 20:892-895.

*Oh, W., E.S. Runkle, and R.M. Warner. 2010. Timing and duration of supplemental lighting during the seedling stage influence quality and flowering in petunia and pansy. HortScience 45:1332-1337.

*Runkle, E. 2010. Environmental and hormonal regulation of flowering in *Phalaenopsis* orchids: A mini review. Acta Hort. 878:263-267.

Runkle, E.S. 2010. Technically speaking: Do it yourself. Greenhouse Product News 20(5):42.

Runkle, E.S. and M. Blanchard. 2010. Technically speaking: Greenhouse temperature considerations. Greenhouse Product News 20(10):50.

Runkle, E.S. 2010. Technically speaking: Height control for vegetable transplants. Greenhouse Product News 20(2):50.

Runkle, E.S. 2010. Technically speaking: How to avoid GA carryover. Greenhouse Product News 20(8):58.

Runkle, E.S. 2010. Technically speaking: Maximizing PGR spray applications. Greenhouse Product News 20(4):42.

Runkle, E.S. 2010. Technically speaking: Rapid flowering of pansy. Greenhouse Product News 20(3):42.

Runkle, E.S. 2010. Technically speaking: Supplemental lighting guidelines for young plants. Greenhouse Product News 20(1):50.

Runkle, E.S. 2010. Technically speaking: Sustainable production technologies – A Dutch perspective. Greenhouse Product News 20(12):46.

Runkle, E.S. 2010. Technically speaking: The fundamentals of temperature. Greenhouse Product News 20(11):58.

Runkle, E.S. 2010. Technically speaking: The future of greenhouse lighting. Greenhouse Product News 20(9):66.

Runkle, E.S. and M. Blanchard. 2010. Technically speaking: Greenhouse temperature considerations. Greenhouse Product News 20(10):50.

Runkle, E.S., Bugbee, B. 2010. Technically speaking: Correcting problems with HPS lamps. Greenhouse Product News 20(6):58.
Runkle, E. and Y.-I. Lee. 2010. First international orchid symposium. Chronica Horticulturae 50(3):41.
Runkle, E.S. and R.M. Warner. 2010. Bright ideas in the works. Greenhouse Product News 20(2):26-32.
Warner, R.M. and E.S. Runkle. 2010. Reducing greenhouse energy consumption. Greenhouse Product News 20(4):20-24.
*Warner, R.M. and A.E. Walworth. 2010. Quantitative inheritance of crop timing traits in interspecific hybrid *Petunia* populations and interactions with crop quality parameters. J. Hered. 101:308-316.
*Warner, R.M. 2010. Temperature and photoperiod influence flowering and morphology of four *Petunia* spp. HortScience 45:365-368.
Whitman, C. and E.S. Runkle. 2010. Grow perennials with your annuals. OFA Bulletin 924, 4-6.

Scientific and Outreach Presentations

Blanchard, M.G. and E.S. Runkle. 2010. Effects of emerging shoot size, temperature, and benzyladenine on growth and flowering of *Zygopetalum* Redvale 'Fire Kiss' orchids. ISHS I International Orchid Symposium (Taichung, Taiwan), January.
Barrett, J., J. Latimer, and E.S. Runkle. 2010. Plant growth regulators: New products & concepts. OFA Disease, Insect & Plant Growth Management Conference (St. Louis, MO), September.
Craig, D., E.S. Runkle, and M. Olrich. 2010. Abscisic acid improves the drought stress tolerance of chrysanthemum and aster. American Society for Horticultural Science Annual Conference (Palm Desert, CA), August.
Dole, J., J. Erwin, J. Faust, P. Fisher, J. Frantz, and E.S. Runkle. 2010. Working together to find research-based growing solutions. OFA Short Course (Columbus, OH), July.
Erwin, J. and E.S. Runkle. 2010. Lighting and shade cloth management using new data and software. Floriculture Research Alliance annual meeting (Denver, CO), September.
Latimer, J. and E.S. Runkle. 2010. Alternative plant height management strategies. OFA Disease, Insect & Plant Growth Management Conference (St. Louis, MO), September.
Runkle, E.S. 2010. Energy efficient crop production. ProGreen Expo (Denver, CO), February.
Runkle, E.S. 2010. Energy-efficient greenhouse production of floriculture crops. Wageningen UR Greenhouse Horticulture (Wageningen, the Netherlands), November.
Runkle, E.S. 2010. Energy-efficiency in greenhouse crop production. Energy conservation in greenhouses and alternative fuels for heating webinar, Univ. of Wisconsin-Madison, January.
Runkle, E.S. 2010. Energy-efficiency in greenhouse crop production. Energy conservation in greenhouses and alternative fuels for heating webinar, Univ. of Wisconsin-Madison, April.
Runkle, E.S. 2010. Energy-efficient production of greenhouse crops. Taiwan - USA Symposium on Technology of Cultivation and Molecular Breeding for Ornamental Crops (Taichung, Taiwan), August.
Runkle, E.S. 2010. Environmental and hormonal regulation of flowering in *Phalaenopsis* orchids: A mini-review. ISHS I International Orchid Symposium (Taichung, Taiwan), January.
Runkle, E.S. 2010. Environmental flowering physiology of floriculture crops. Department of Horticulture & Crop and Soil Science Seminar Series (East Lansing, MI), February.
Runkle, E.S. 2010. Flowering physiology of herbaceous ornamental crops. Department of Horticultural Sciences, Texas A&M University (College Station, TX), February.
Runkle, E.S. 2010. MSU Research Update. Michigan Greenhouse Growers Expo (Grand Rapids, MI), December.
Runkle, E.S. 2010. Robert Langhans Visiting Scholar: Environmental flowering physiology of floriculture crops. Department of Horticulture, Cornell University (Ithaca, NY), April.
Runkle, E.S. 2010. The practical implications of saturating DLI values and base temperatures of floriculture crops. MSU Floriculture Research Meeting (East Lansing, MI), September.
Runkle, E.S. 2010. The real world of propagating cuttings: A grower panel. Michigan Greenhouse Growers Expo (Grand Rapids, MI), December.

Runkle, E.S. and J. Erwin. 2010. Practical scheduling of bedding plants and using Virtual Grower. Floriculture Research Alliance annual meeting (Denver, CO), September.

Runkle, E.S. and M. Blanchard. 2010. Investigating reciprocity of light intensity and duration for photoperiodic lighting. MSU Floriculture Research Meeting (East Lansing, MI), September.

Runkle, E.S. and M. Blanchard. 2010. Using Sumagic on vegetable transplants. MSU Floriculture Research Meeting (East Lansing, MI), September.

Runkle, E.S. and M. Blanchard. 2010. Sustainable crop practices. Kalamazoo Valley Plant Growers Co-Op Grower Meeting (Kalamazoo, MI), January.

Runkle, E., M. Blanchard, and R. Warner. 2010. Station report, Michigan State University. NCERA-101: Committee on Controlled Environment Technology and Use annual meeting (Madison, WI), March.

Tychonievich, J. and R.M. Warner. 2010. Development of resources for marker-assisted selection in Petunia. 28th International Horticulture Congress (Lisbon, Portugal), August.

Warner, R.M. 2010. A combined genetic mapping and candidate gene approach to define the genetics of crop timing traits in petunia. 11th World Petunia Days (Lyon, France), September.