Michigan State University 2014 Station Report
NCERA-101: Committee on Controlled Environment Technology & Use

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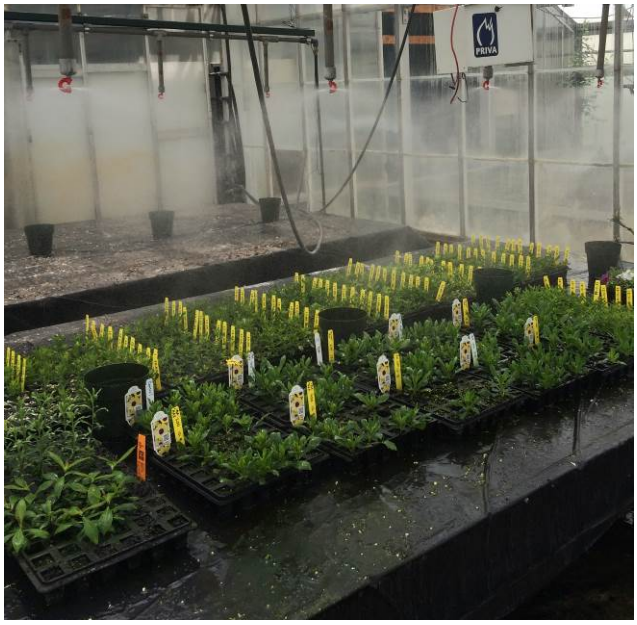
New Facilities and Equipment

- We renovated our propagation greenhouse including installation of new overhead misting, plumbing, bottom heating, and control systems (below left).
- We installed 440-volt Philips GreenPower LED toplighting to deliver supplemental lighting in four of our research greenhouse sections (below right). Each section has different ratios of red, blue, and/or white light and the PPF is 90 $\mu mol \cdot m^{-2} \cdot s^{-1}$ approx. 2 meters below. Six LED modules (each consuming approx. 200 W) were used per section but needed to be shaded to deliver the same intensity as from four 400-W high-pressure sodium lamps.



Accomplishment Summaries

- Qingwu Meng and Erik Runkle investigated whether flowering of ornamentals was controlled by blue radiation, alone or coupled with low-intensity red+white+far-red radiation in the middle of an otherwise long night. While low-intensity blue radiation was not perceived as a long day, blue light at a moderate-intensity promoted flowering of long-day plants and inhibited flowering of short-day plants. Adding moderate-intensity blue to low-intensity red+white+far-red radiation somewhat enhanced flowering in calibrachoa, petunia, and chrysanthemum, but not in other crops studied.
- Yujin Park and Erik Runkle investigated the impacts of using white light-emitting diodes (LEDs) for high-value ornamental seedling production and compared growth responses to dichromatic red+blue LEDs. Red+blue is more commonly used in horticulture but is not a pleasant light for people. Young plants grown under white LED treatments grew

similarly or were slightly taller and had greater leaf area than plants under red+blue LEDs. We conclude that white LEDs that emit ≥15% blue radiation can produce seedlings similar to dichromatic red plus blue LEDs while offering a more pleasant human environment.

- QiuXia Chen and Ryan Warner evaluated crop timing and quality traits in a large *Petunia axillaris* × *P. exserta* recombinant inbred line population at three different temperatures. The population exhibited a wide range of diversity for every trait quantified, including development rate. We have also developed a genetic linkage map for this population and are using the phenotypic data to genetically map traits of interest, particularly the influence of temperature on crop development rate.
- Planning continues for the 8th International Symposium on Light in Horticulture, to be held in East Lansing, MI from May 22 to 26, 2016. This symposium is held in coordination with the International Society for Horticultural Science and to date, is sponsored by 17 lighting, horticulture, or agricultural companies including several NCERA-101 industry members. For more information, visit www.lightsym16.com.

Impact Statements

- LEDs for plant applications typically only include red and blue radiation, which is difficult for people to see plants to evaluate growth. Research at MSU showed that there were few or no significant differences in plant growth grown under red+blue LEDs and white LEDs if they emitted ≥15% blue radiation. Although the electrical efficiency of white LED treatments tested in our research was slightly less than that of red+blue LEDs, results indicate that white LEDs has the potential for plant production lighting in completely enclosed environments.

Published Written Works (*denotes peer reviewed)

*Kohyama, F., C. Whitman, and E.S. Runkle. 2014. Comparing flowering responses of long-day plants under incandescent and two commercial light-emitting diode lamps. HortTechnology 24:490-495.

Lopez, R.G. and E.S. Runkle. 2014. Growing your crops above their base temperature. Greenhouse Grower 32(7)53-56.

*Meng, Q. and E.S. Runkle. 2014. Controlling flowering of photoperiodic ornamental crops with light-emitting diode lamps: A coordinated grower trial. HortTechnology 24:702-711.

Meng, Q. and E.S. Runkle. 2014. Control flowering with LEDs. GrowerTalks 77(11):62-64.

Meng, Q. and E. Runkle. 2014. Evaluating different colors of LEDs to control flowering. Greenhouse Product News 24(12):14-19.

Runkle, E. 2014. Cold-intermediate bedding plants. Greenhouse Product News 24(2):42.

Runkle, E. 2014. Cold-tolerant bedding plants. Greenhouse Product News 24(1):46.

Runkle, E. 2014. Dealing with high temperatures. Greenhouse Product News 24(5):50.

Runkle, E. 2014. Effective use of PGRs. Greenhouse Product News 24(7):62.

Runkle, E. 2014. Increasing plant height. Greenhouse Product News 24(10):50.

Runkle, E. 2014. Managing temperature during propagation. Greenhouse Product News 24(12):50.

Runkle, E. 2014. Non-chemical height control techniques. Greenhouse Product News 24(8):58.

Runkle, E. 2014. Replacing INCs with LEDs. Greenhouse Product News 24(11):54.

Runkle, E. 2014. The double-ended HPS lamp. Greenhouse Product News 24(9):70.

Runkle, E. 2014. Using chlormequat chloride with success. Greenhouse Product News 24(4):42.
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Runkle, E., J. Nelson, and B. Bugbee 2014. LEDs vs. HPS lamps: A reality check. Greenhouse Product News 24(6):54.
Wollaeger, H.M. and E.S. Runkle. 2014. Growing seedlings under LEDs: Part two. Greenhouse Grower 32(2):40-42.
Wollaeger, H.M. and E.S. Runkle. 2014. Growing seedlings under LEDs: Part one. Greenhouse Grower 32(1):80-85.
*Wollaeger, H.M. and E.S. Runkle. 2014. Growth of impatiens, petunia, salvia, and tomato seedlings under blue, green, and red light-emitting diodes. HortScience 49:734-740.
*Wollaeger, H.M. and E.S. Runkle. 2014. Producing commercial-quality ornamental seedlings under sole-source LED lighting. Acta Hort. 1037:269-276.
*Vaid, T.M., E.S. Runkle, and J.M. Frantz. 2014. Mean daily temperature regulates plant quality attributes of annual ornamental crops. HortScience 49:574-580.
*Zhu, C., P. Unachak, J.R. Llera, D.B. Knoester, E.S. Runkle, L. Xu, and E.D. Goodman. 2014. Robust multi-objective evolutionary optimization to allow greenhouse production/energy use tradeoffs. Acta Hort. 1037:525-532.

Websites Managed

8th International Symposium on Light in Horticulture
Developing LED lighting technologies and practices for sustainable specialty-crop production
Michigan Garden Plant Tour
MSU Floriculture Crop Production