NCERA 101 2012 Station Report

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Impact Nuggets:
Cornell University has continued a series of workshops and student internships to train potential employees, managers, and owners of Controlled Environment Agriculture facilities. Three workshops have been presented to secondary school teachers, six to the general public, three for current greenhouse operators, and three for students. Two students completed internships in hydroponics during the summer of 2012.

Cornell University has continued to field test (beta test) controller in a commercial greenhouse that implements the daily light integral control algorithm patented by Cornell. Control suitability will continue to be monitored and quantified during the coming year.

The Cornell CEA website (www.cornellcea.com) has been significantly updated and continues to receive positive responses from users.

New Facilities and Equipment:
none

Unique Plant Responses:
Extensive experiments shown no significant difference between the final harvest fresh and dry weights of spinach plants grown hydroponically using standard Sonnevelt solution, compared to those of the plants grown with a mixture of standard components augmented and balanced by liquid fertilizer derived from worm castings.

Accomplishment Summaries:
Cornell University continued to expand the activities of the Center for Controlled Environment Agriculture (CEA) and Modified-Environment Agriculture (MEA) for New York State. Fifteen workshops were presented during the year, ranging from overview presentations for the general public, to workshops focused on potential and current CEA and MEA owners and managers. Additionally, two summer internships were completed to continue the process of training employees and managers of CEA facilities in colder climates, such as New York State.

Cornell University has worked with Cycloptics Technologies, LLC (http://cycloptics.com/), to design luminaires optimized for research and teaching greenhouses. Manufacturing difficulties slowed fabrication of the luminaires a but the problem appears to have seen solved during the summer of 2012 and six assemblies of luminaires will be installed and tested in the Cornell greenhouses during the fall of 2012.

An extended white paper was completed to identify areas of useful application of LEDs for plant lighting. The report was initiated to identify specific research topics that can be useful as a basis for collaboration between the Lighting Research Center of the Rensselaer Polytechnic Institute and the CEA program of Cornell University.

Impact Statements:
One of the most difficult problems for those wishing to create and operate a successful CEA facility is to find head growers able to manage large hydroponic facilities. The Cornell CEA Technology Transfer Center was created to begin to meet this need. In particular, the student internships that are planned will advance young growers beyond the level of training and specialization available in local agricultural colleges.

Controlled Environment Agriculture (CEA) farming in cloudy climates is an obvious application that can benefit from energy efficiency, beam control, and PPF uniformity provided by supplemental lighting systems. The CEA challenge is to implement supplemental lighting systems at a cost making local plant production competitive with large, centralized farms and long-distance shipping. Cycloptics reflector technology ("one bounce and out") has been demonstrated to reduce electricity required for supplemental lighting for optimized plant growth, making it a potential enabling technology to encourage local, CEA farming to expand throughout the world. The technology is expected to enhance plant lighting research by providing more uniform irradiation with less light waste and higher lighting efficacy.

Consistent productivity of greenhouse vegetables is important to hold market place. Of all the environmental variables, the Daily Light Integral (DLI) is central to predictable and consistent daily growth and production. The DLI can be controlled in a greenhouse when supplemental lighting and movable shades are installed and used. However, supplemental lighting is expensive to operate, so control that does not waste energy, and takes advantage of the least cost times of day, will be critical to profits. A DLI control algorithm has been patented by Cornell and is moving toward commercial availability, after extended tests of prototype controllers.

Published Written Works:

Vanek, F.M., L.D. Albright and L.T. Angenent. 2012. Energy Systems Engineering: Evaluation and Implementation. Second Edition. McGraw-Hill, New York. ISBN 978-0-07-178788-9.

De Villiers, D.S., L.D. Albright and R, Tuck. 2012. Next generation, energy-efficient, uniform supplemental lighting for closed-systems plant production. Acta Horticulturae 952:463-470.

Scientific and Outreach Oral Presentations:

Albright, L.D. 2012. Vertical Greenhouses. Presented at the 2012 annual meeting of the AERGC, Toronto, Canada.

Other Relevant Accomplishments and Activities:

None to report