CORNELL UNIVERSITY
NCR 101 STATION REPORT 2000 - April 2002

EQUIPMENT AND FACILITIES

Commercial-scale Lettuce Production Module

Negotiations for transfer of the facility from AGWAY/NYSEG/NYSERDA to Cornell University are nearing completion. Funding for upgrades to the existing structure was provided by NYSERDA (New York State Energy Research and Development Authority). NYSEG (New York State Electric and Gas) has generously continued to provide funding for monthly power-usage costs. Upgrades include additional over-head-turbulation fans in the greenhouse, insect screening on the intake-vent, new nutrient-solution circulation pumps, replacement water-jacketed lamps, replacement polystyrene floaters (with optimized spacing for plants), and a replacement pond-liner for one of the four ponds. Light control and shade control for the greenhouse have been removed from the Q-Com system and are currently handled by the Cornell-LASSI program.

Root-zone-control deep-flow research tanks (for *Pythium* research)

Fabrication of three root-zone control tanks was completed in March 2002. The root zone control tanks (designed for research on the spinach root pathogen *Pythium aphanidermatum*) will allow control of root zone oxygenation, temperature, pH and EC. The stainless-steel root-zone control tanks are housed within a single walk-in growth chamber with cool-white fluorescent lighting.

Early fault-detection and Evapotranspiration modeling deep-flow research tanks

Fabrication was completed on three root-zone control tanks for early-fault detection and evapotranspiration modeling research. The three tanks are located in a greenhouse with temperature, CO_2, supplemental lighting, and shade control. Sensors allow continuous measurements of temperature, dissolved oxygen, pH, EC and 10 min interval measurement of nitrate. Two of the tanks are positioned atop scales to measure evapotranspiration.

Deep-flow/NFT hybrid research tank

A hybrid of the NFT and deep-flow system was designed and fabricated (by Jennifer Mathieu jjm36@cornell.edu) for evapotranspiration mechanistic modeling research. The system provides the water-buffer and equipment-failure-buffer of a deep-flow system, with the low-volume and easy-accessibility to nutrient reservoir of an NFT system. A tabletop pond that is waist-high provides easy-access to plants, floating on 5 - 6 inches (12 - 15 cm) of nutrient solution. The nutrient solution depth is maintained by a standpipe and is circulated from the tabletop pond into a reservoir. Nutrient solution from the reservoir is continuously pumped back up to the tabletop pond. Nutrient solution fluid level, EC, and pH are easily measured and adjusted in the reservoir. Plants are protected from temporary pump-failure by the pond water-depth controlled by a standpipe.

RESEARCH PROJECTS 2000 - 2002

- *Commercial demonstration of hydroponic lettuce production.
- *Commercial development of hydroponic spinach production.
- *Evaluation of importance of light control for greenhouse tomato production.
- *Early fault detection in hydroponic systems
- *Mechanistic modeling of evapotranspiration in lettuce
- *Modeling of nitrate and root/shoot partitioning in lettuce (NICOLET)

- High pressure sodium lighting analysis and design for growth chambers
- Baseline data collection on dry bean growth for NASA mission to Mars
- *Development of methods to reduce *Pythium* infection of spinach roots
- Marketing research and development -- value added products
- Marketing Research -- cost effectiveness of doing CEA in different regions of USA
- *Marketing Research – market analysis to identify potential CEA technology customers
- *Operations Research – labor and operations efficiency in the lettuce facility
- Cultivar comparisons - spinach time to flowering under 16 h photoperiod
- *Application of Pseudo-Derivative-Feedback (PDF) algorithm in greenhouse air temperature control

(* Ongoing)

PUBLICATIONS AND PRESENTATIONS

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WEBSITE: http://www.cornellcea.com

OTHER NEWS: Professor Emeritus Robert W. Langhans retired from Cornell University on December 31st of 2000. A fund was created in Bob's honor with donations from colleagues and friends from universities and from the floriculture and horticulture industries for the establishment of a visiting scholar program at Cornell University.

The first R.W. Langhans visiting scholar, Dr. Dick Craighead, the J. Franklin Styer Professor of Horticultural Botany at Pennsylvania State University, will come to Cornell University on April 15 - 17, 2002.

Although Professor Langhans officially retired in 2000, he has remained an active participant in the Cornell CEA program and continues a working relationship with Cornell. Bob has had two graduates this year and has yet another on the way!

Our thanks and congratulations to Professor Langhans.