NCERA-101

Station report

College of Agriculture University of Wisconsin-Madison

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This reports covers the College of Agriculture 2013.

New Facilities and Equipment: In anticipation of the loss of eight foot VHO T12 bulbs, the Plant Pathology department is transitioning to at least two scenarios: use of double 4 foot T8 bulbs Octron 850 in a 5:1 ratio with Sylvania Gro lux bulbs. They are also looking at Ceramic Metal halide bulbs. The criteria for evaluation, is published and measured spectra of each bulb type. vs. PAR for the individual plant genera. The department has several growth chambers in the basement; which are being converted to the various lighting schemes. The department's seed potato program is using several Nutrient Film Technique (NFT) hydroponic systems under HPS lighting for production/experimentation of potato minitubers.

Unique Plant Responses: After a recent upgrade from T-12 VHO cool white fluorescent to T-8 General Electric SPX41 bulbs, researchers noticed differences in growth and disease infectivity under the new bulbs. The cause is thought to be new high efficiency tri-phosphor bulbs were not delivering full spectrum light. Supplementing with specialty horticultural spectrum T-8 alleviated the problem.

Accomplishment Summaries

Experiments are underway to evaluate the Phillips ceramic metal halide 315W lamps for retrofit into a series of Percival walk in growth chambers as an alternative to florescent fixtures. These lamps are of interest because of their energy efficiency, long life time, and optimal spectral output. In pilot tests the 315W CMH lamp is paired with the dimmable Phillips Advance e-vision electronic ballast, and output can be reduced by up to 50% with some shift in spectrum. Accommodating the increased height of these new fixtures into existing chambers with narrow light plenums designed for fluorescents and the increased installation cost are potential obstacles.

Impact Statements

Russell Labs growth chamber staff is exploring open source microcontrollers like the Arduino platform as a low cost alternative to upgrade and integrate the control and alarm functions of 1960's Percival walk in plant growth chambers. These chambers were

formerly controlled by remote bulb electro-mechanical thermostats which were later upgraded to Ranco Electronic Temperature Controls. The original mechanical lighting time clocks have also been upgraded to Intermatic digital controls. Alarm functions are currently handled by a separate temperature alarm module connected to monitoring and a telephone dialer. By integrating the alarm and temperature control into one networked device, the alarm parameters can be automatically set based on the desired operating temperatures. The same network used to relay the alarm signal would also be used to monitor the chamber conditions over a wired or wireless Ethernet connection for data logging. Set points for the chambers could be changed over the network. This upgrade should also make the chambers more efficient by implementing the optimum control strategy to achieve a given temperature regime, for example by running the supplemental night heaters only when necessary to achieve temperature, instead of a manual option. The goal is to provide better control and monitoring for these chambers with a more user friendly control interface on a limited budget. Estimated cost of hardware is about $200 per growth chamber.