NCR-101
MARYLAND AGRICULTURAL EXPERIMENT STATION REPORT - March, 2000

Existing Controlled Environment Facility Improvements

Over the last couple of months, we have been testing an upgraded Central Control System (CCS) by Conviron. This new system is based on a Pentium II running Windows 98. The computer has separate networks for both the chambers and the building Ethernet. This system has several advantages over the old.

1. First, and of most interest, is the ability to connect to the building network as well as the CCS network. This allows for easier data access and monitoring from anywhere on campus.
2. Second, we are able to run current versions of spreadsheet and graphing programs on the new computer. The migration from our old system to this new one was simple, and there have been no major problems since.
3. We have developed several software packages to work in conjunction with the Conviron CCS system for monitoring and notification of chamber alarms. The first program monitors for chamber alarm conditions that show up on the host. When an alarm is triggered, a text message is sent to a text pager and also to an email address. The information sent out includes the chamber number, time and date, and the exact alarm condition reported by the chamber. This has distinct advantages over the auto-dialer option that only informs you that an alarm has occurred.
4. The second software package allows users to quickly open and graph data files from the Conviron CCS system from their desktop PC. The old method was to open a data file in Excel and either manually graph it, or run a macro to graph it. With this new program, users are able to quickly select the variables that they want to view, and rapidly view day to day with the click of a mouse. This will hopefully be ported to a web browser in the near future.
5. Both of these programs are available for free distribution. They can easily work on the new Windows 98 host system, and can be used on the Windows 3.11 system through the addition of a second network card. Please contact Tim Mies at 301-405-6913 or Dr. Gerry Deitzer at 301-405-4335 if you are interested and would like more information.

New Instruments and Sensors

We are testing a new CO_2 sensor from Vaisala Inc. The model GMM222 is a NDIR solid-state detector inside a diffusion tube on a six-inch wand. This design is of particular interest because it has no moving parts, very little maintenance, and has the ability to be placed inside an aspirator box alongside other sensors. The sensor head is interchangeable for calibration or different ranges. The sensor we are testing has a range of 0 – 2000 ppm CO_2, but is available up to 20% CO_2. There is an offset in the sensor we received that is consistently 80 ppm +/- 5 ppm. We are working to determine the cause of this offset, but due to the consistency of the offset, it could be factored out through software. There is no long-term data yet, but in testing over a one-month period, there has been no significant drift. The cost of the base model tested was under $600.

New Facilities

The new greenhouse facility looks as though it might finally be built in 2000/2001 after a 10-year "planning" phase. As noted in the 1999 report, the plan is to replace the current (1940's) facility with a smaller, but much better controlled facility located on a 7-acre alternative site on the North side of the College Park campus.

1. We have received the 95% complete plans and we are close to reducing the estimated costs in the budget. The General Contractor will then give us a guaranteed cost to complete the project based on their cost estimates. This means that we will have to identify items that are above this cost estimate and remove them from the project in order to assure that the project can be built for this guaranteed cost. These items, which include some of the capabilities of the new greenhouse growth chambers, as well as some space within the greenhouse itself, will be prioritized and placed on an add-alternate list to be replaced, if and when, the actual costs drop below the estimated costs.
2. Based on the current estimates, we have reduced the number of 240 sq. ft. macrocosm rooms from four to two, with the remaining two being placed on the add-alternate list. These rooms, which were originally supposed to have microwave lighting will be bid with a combination of metal halide and incandescent lighting to produce a maximum of 1,200 μmol m^{-2} s^{-1} at a distance of 1 m from the barrier. If the microwave lamps become available again before the bids are requested we will return to an all microwave lamp requirement since it will cost less for the overall design than the HID system. Temperature will be controlled using an external chilled water system instead of individual compressors and humidity will be controlled below ambient using a water condensing/re-heating system. CO_2 will be monitored and controlled from ambient to 3,000 μmol mol^{-1}.
3. We will retain all six of the 40 sq. ft. chambers as standard growth chambers with 1,000 μmol m^{-2} s^{-1} of MH-Incandescent lighting. We will list the specifications for pairs of:
   a) very low chambers (-20 °C lights off to -4 °C lights on),
   b) CO_2 (ambient to 3,000 μmol mol-1) and
   c) low humidity (bypass dehumidification) to range from 35% to 90% at 20°C add-alternates.

   While these options will be listed as add-alternates, we are very confident that they will funded.
4. We hope to keep the specifications for the glasshouse portion of the greenhouse intact, but we may be required to give up some square footage. Briefly, the proposed glasshouse sections will be 33,600 NASF (plus 12,735 NASF for the headhouse and laboratories for a total of 46,335 NASF). The sections will be divided into one 3,000, eight 1500, and twenty-four 750 NASF sections in four ranges. Three of the 750 NASF sections (in separate ranges) will have the capacity to control CO_2. Two 750 NASF sections will be high-humidity mist houses with bench heating for propagation. One 3,000 and two 1500 NASF sections will be equipped with automated blackout cloth, and one full range (9,000 NASF) will have independently selectable nutrient fertigation in each compartment.
5. The entire greenhouse complex will be fog-cooled and have automated ventilation and shading. Temperature control will be through a centralized (3-stage) environmental control system. There will be a centralized multi-injector fertigation system that will provide general fertigation capabilities for the entire complex, plus a solenoid-controlled custom-blend capability in the specialist range (to enable nutrient exclusion research).