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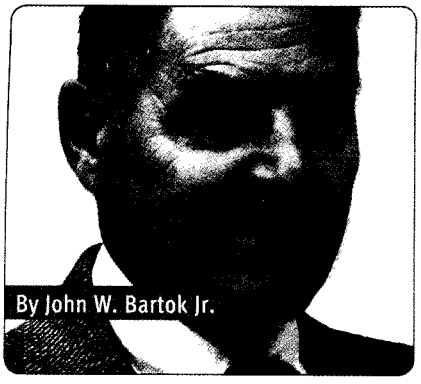
ENVIRONMENTAL SENSORS CAN PROVIDE THE OPTIMUM CROP TEMPERATURE



Upgrade your environmental-control sensors before winter

WITH THE PRICE OF FUEL about double what it was last October, it is important to pay more attention to energy-conserving measures. One area often overlooked is environment-control-system sensors. These black boxes, as they are frequently called, need to be located and maintained properly to accurately provide the optimum crop temperature.

Best location

I have seen thermostats and sensors located on a cold north wall, attached to the heater, above fin radiation, in the direct line of the heat from a furnace and in direct sunlight. If yours are in these locations, they should be changed. They will not provide accurate sensing there.

In your home, thermostats are usually located on an interior wall, 5 feet above the floor. This provides a good comfort level for human habitation. In a greenhouse, growers are trying to keep the plants comfortable. This means that sensors should be at plant level to sense what temperature the plants feel.

Locating the sensor near the center of the greenhouse is best as it reduces the effect of the heat loss through the wall glazing. Locate the sensor away from an aisle, dripping water, moving equipment or a dusty location. Use a chain to hang thermostats so they can be kept at plant level as the crop grows.

Shielding is important

Thermostats and sensors should be shielded so that they are not in direct sunlight as this can give false readings. Locating the heating and cooling system thermostats in one location is desirable as it reduces the chance of both heating and cooling systems operating at the same time.

The best solution is to place all the thermostats inside a closed aspirated box that has been painted white. The box has a screen on one end and a small muffin fan on the other end that draws air past the sensors. This technique is standard with the thermistor sensors used in controllers and computer control systems. Tests at Rutgers University showed that the temperature spread (difference between high and low) in the greenhouse was reduced from 8°F to 2°F when the heating thermostats were aspirated. Energy is wasted anytime the greenhouse air temperature is heated above the setpoint.

Clean your sensors

I have seen thermostats covered with a ¼-inch-thick layer of dust. This will provide inaccurate sensing.

Use a can of compressed air to blow the dust off the sensor and the box. Purchase thermostats with a sealed box and use watertight electrical connections with a drip loop. If the controller has a photocell to switch from day to night setting, it should be cleaned several times a year.

Loss of accuracy

Thermostats and controller sensors tend lose accuracy over time. They should be checked for accuracy at least once a year. I have had growers tell me that even new thermostats were inaccurate by 10°F.

It is easy to check the accuracy of a thermostat. Start by checking the accuracy of a thermistor or thermocouple thermometer. These are inexpensive and work well because they are fast acting and have an easy readout. Insert the probe into an ice water bath. The reading should be 32°F.

After allowing the thermometer to reach room temperature, place it next to the thermostat sensor. Slowly move the dial until the heater turns on. The reading should be the same temperature as the thermometer reading. If not, determine the temperature difference and mark the thermostat accordingly. Next time the heating system is serviced have the service person recalibrate the thermostat.

Thermostat or controller

The harsh greenhouse environment requires a good thermostat. Select one that has a hydraulic sensor activated by pressure from the expansion of a liquid or gas in a closed tube coil.

The movement of the switch between the On signal and the Off signal is called differential. This can vary from 3°F to 6°F for mechanical thermostats.

If you want to maintain a minimum 60°F setpoint in the greenhouse, and you have a thermostat with a

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5°F differential, the furnace will start when the temperature falls to 60°F but doesn't shut off until it reaches 65°F. This override increases both heat loss from the greenhouse and heating cost. It is important to select a thermostat with a small differential.

A better choice is to install an electronic thermostat or controller. These have differentials of 1°F to 2°F. Although the heating system cycles more frequently, today's modern heaters and furnaces take less time to reach peak efficiency. A disadvantage may be that there is slightly more wear on the motor starter.

The advantage is that a savings in energy results from lower heat loss from the greenhouse surfaces as the heating system shuts off at only a couple of degrees above the setpoint. For example, for a 30-by-100-foot greenhouse, the savings between a 6°F differential with a mechanical thermostat and a 2°F differential with an electronic thermostat will be about 500 gallons of fuel oil, 750 gallons of propane or 700 therms of natural gas over the heating season. This is significant and at the price of fuel today, it will provide a very short payback.

Good controls that are maintained properly provide heating systems with a means of operating at peak performance and efficiency. Take the time before the heating season to maintain, calibrate or replace the controls in your greenhouses.

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