

MANAGING PERENNIALS IN OPEN OR RETRACTABLE ROOF GREENHOUSES

Presented By:

Richard Vollebregt

Cravo Equipment Ltd

30 White Swan Road,

Brantford Ontario Canada N3T 5L4

www.cravo.com

BACKGROUND FACTS ON CROPS AND THE ENVIRONMENT

- To control timing of flowering, optimizing soil and leaf temperatures is more important than air temperatures.
- Many growers tend to manage crops based on air temperatures, not soil temperatures.
- Soil and leaf temperatures can drop faster outside than when plants are in a greenhouse.
- Soil and leaf temperatures warm up faster outside when conditions are sunny than inside a poly covered greenhouse (soil temperatures tend to stay cold in a greenhouse).
- Daytime air temperatures in the greenhouse increase faster than leaf temperatures causing condensation to form on leaves and transpiration rates to drop.
- Soil temperatures in a container can reach 120F outside when outside conditions are sunny and air temperatures are only 85F.
- Infra-red radiation (sunlight) is more effective at increasing plant temperatures than air.
- If plants are in a greenhouse environment for an extended period of time, the lack of water stress causes plants to stretch, have a smaller root to shoot ratio, be more disease susceptible, and be less resistant to the higher water stress of the outdoor environment.

BACKGROUND FACTS ON CONVENTIONAL CONTROL STRATEGIES

- conventional computer control programs manage vents based on air temperatures measured inside the greenhouse using a shielded and aspirated temperature sensor
- a temperature sensor that is shielded cannot measure the heating effect of infra-red radiation (direct sunlight) when plants are outside
- a temperature sensor located **inside** the greenhouse can **never** determine when **outside** conditions are superior to those inside the greenhouse
- a conventional ventilation program will cause the roofs to stay closed too long in the morning and retract fully when plants may need to be protected from excessive temperatures.

BEST PRACTICES WHEN GROWERS CAN OPEN AND CLOSE THE GREENHOUSE ROOF

- Use both a greenhouse and the outdoor environment to create the best possible growing conditions to optimize plant quality and timing
- Minimize heating costs by using the warming effect of the sun to increase plant temperatures when desirable.

- Expose plants to direct sunlight to increase leaf and soil temperatures by retracting the roof
- Protect plants from cold temperatures by closing the roof
- Protect plants from excessive leaf and soil temperatures by closing the roof 85% when outside conditions are too hot

HOW TO OPTIMALLY MEASURE THE ENVIRONMENT

- Use a temperature sensor that will read the net temperature based on the air temperature, the wind and the infra-red radiation. To accomplish this, attach a temperature sensor to a piece of horizontal piece of black or green sheet metal that is exposed to direct sunlight all day. This sensor will read **temperatures up to 50F warmer** than outside air temperatures.
- Locate the temperature sensor outside on the weather station
- Locate another temperature sensor inside a pot to measure and monitor the soil temperatures.
- Rain and wind sensors can be used to override the roof to protect plants from adverse weather conditions.

PROGRAMMING THE SET POINTS (Set points are examples. Actual set points will be determined by crop type etc)

- if the outside temperature drops below 53 for 5 minutes, close the roof and operate the greenhouse using conventional control strategies
- if the outside temperature rises above 58F for 15 minutes, retract the roof completely. (The air temperature may be only 52F, but the sensor and plants will be warmed up by the sunlight)
- if the outside temperature exceeds 70F for 10 minutes, retract the sidewalls
- if the outside temperature exceeds 90F or 110F for 10 minutes, close the roof 85% or the curtain system to reduce the infra-red radiation. This temperature set point needs to be determined based the types of crops, the size of crops and the type of sensor used.
- If the outside temperature drops below 105F for 20 minutes retract the curtain system or roof.

BENEFITS OF THIS CONTROL STRATEGY

- Plants are outside whenever outside conditions are beneficial
- The roof will not be constantly be cycling open and close
- Plants will be naturally compact and acclimated to outdoor conditions
- The same sensor will determine when plants are going to be too hot or too cold
- The greenhouse roof is going to be used to protect plants from excessive temperatures
- Crop growth can be naturally slowed down by using the roof to keep root temperatures cold by retracting the roof at night and closing the roof 85% during the morning to reduce the plant exposure to infra red radiation.
- Growers can now manage the environment more effectively and naturally to influence plant development.