Measuring Temperature in a Greenhouse

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Measuring Temperature

- There are different types of temperature to measure in a greenhouse as well as different tools for measurement
- To successfully measure temperature you must identify the type of temperature you want to measure

What Temperatures should you Measure in a Greenhouse?

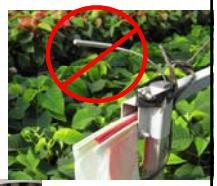
- Air
- Water
- Substrate
- Plant

Measuring Air Temperature

- Easiest to measure
- A good indicator of plant temperature
- Most common temperature measured
- Not always the most important – Why?

Measuring Air Temperature

- Sensor must be shaded
- Sensor must be aspirated
  - Air moved across
- Sensor should be at or near plant height



Measuring Air Temperature

- Measurements should be taken in multiple locations and throughout the day
- Units should be inspected at least weekly to check:
  - Fans are working
  - Reservoir and socks have water
  - Sensor has not moved

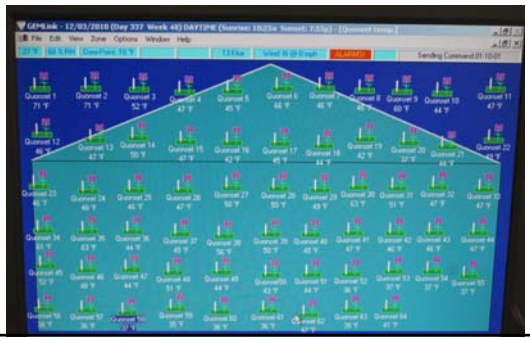
Measuring Air Temperature

- Min-Max thermometers

Is This Correct?

Is This Correct?

Measuring Air Temperature



Measuring Water Temperature

Cold water can damage foliage of certain species such as African Violets, Exacum and Gloxinia

Measuring Water Temperature

Can also influence substrate temperature which can be:

- Beneficial: excessive summer heat or reducing stem elongation
- Harmful: reduced growth and development of roots (especially during propagation)

Measuring Water Temperature

- Cold water can actually restrict water uptake
- Water should be at least 50 °F, but should not exceed 70 ºF


Measuring Substrate Temperature

- Substrate temperature impacts seed germination and cutting root growth and development
- Evaporation of water can reduce substrate temperatures by 3.5 to 5.5 °F compared to air temperature
- Sensors should be inserted in substrate for monitoring

Measuring Substrate Temperature

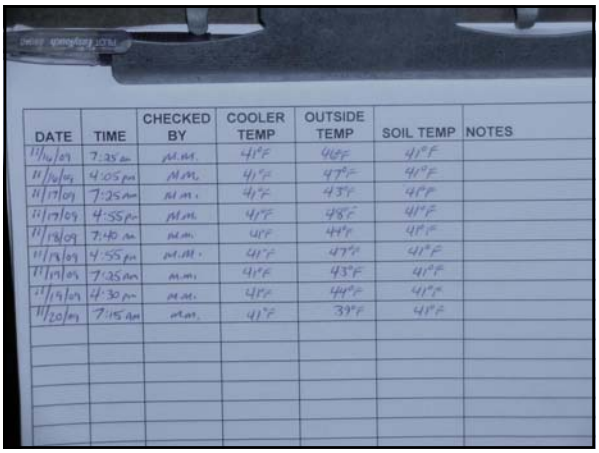
Root growth of Pansy is enhanced at substrate temperatures ≤65 °F

Measuring Substrate Temperature

Soil temperature probe

IR thermometer

Thermocouple inserted into substrate



DATE	TIME	CHECKED BY	COOLER TEMP	OUTSIDE TEMP	SOIL TEMP	NOTES
11/16/09	7:35 am	M.M.	41°F	46°F	41°F	
11/16/09	4:05 pm	M.M.	41°F	47°F	41°F	
11/17/09	7:25 am	M.M.	41°F	43°F	41°F	
11/17/09	4:55 pm	M.M.	41°F	48°F	41°F	
11/18/09	7:40 am	M.M.	41°F	44°F	41°F	
11/18/09	4:55 pm	M.M.	41°F	47°F	41°F	
11/19/09	7:25 am	M.M.	41°F	43°F	41°F	
11/19/09	4:30 pm	M.M.	41°F	44°F	41°F	
11/20/09	7:15 am	M.M.	41°F	39°F	41°F	

Plant Temperature is influenced by:

- Air, water and substrate temperatures
- Light intensity
- Greenhouse glazing and structures
- Humidity
- Air movement
- Water status

Measuring Plant Temperature

Thermocouple inserted in shoot apex to measure the growing point temperature

Infrared sensors pointed at plant canopy

Measuring Plant Temperature

Infrared sensor pointed at leaf and connected to a data logger

Handheld Infrared sensors pointed at leaf

Measuring Plant Temperature

- Plants exposed to direct sunlight can be 5 to 7 °F warmer than the air temperature
- On a clear night, plants can be much cooler than the air temperature!

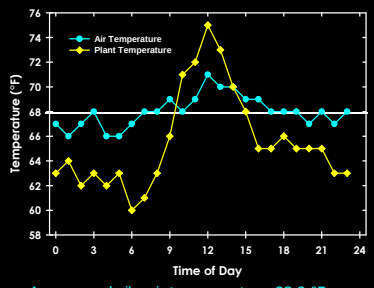
Measuring Plant Temperature

- Plants exposed to direct sunlight can be 5 to 7 °F warmer than the air temperature
- On a clear night, plants can be much cooler than the air temperature!

Why?

- During the night, plants are usually a few degrees cooler than air temperature due to the loss of long wave radiation and evaporative cooling from the substrate and plant tissues

Plant versus Air Temperature



Average daily air temperature 68.0 °F
Average daily plant temperature 66.5 °F

Take Home Message

- Important temperatures to measure in a greenhouse:
  - Air
  - Water
  - Substrate
  - Plant
- Plant temperature is the most important temperature to measure as:
  - it is influenced by air, water, and substrate temperatures
  - It influences the rate of plant development