

3. Temperature, Relative Humidity, Vapor Pressure Deficit



Figure 3. Relative humidity and temperature sensors (left) need to be enclosed in a radiation shield (right) to ensure accurate measurements (Photos courtesy of Decagon Devices).

The effects of temperature, relative humidity, and vapor pressure deficit on plant water use are interdependent. The following definitions are useful in understanding the relationships.

Dry bulb temperature – actual temperature of the air

Relative humidity – ratio between the actual amount of water vapor in the air and maximum amount of water vapor the air can hold at a temperature (expressed as a percentage)

Dew point temperature – temperature to which air must be cooled to completely saturate the air with water vapor (100% RH)

From the dry bulb temperature and relative humidity (which can be measured by sensors in a weather station) the following can be calculated:

Vapor pressure – measure of the actual amount of water vapor in the air (expressed in pressure units such as kPa)

Saturation vapor pressure – measure of the maximum amount of water vapor the air can hold; function of temperature (warmer air can hold more water)(expressed in pressure units such as kPa)

Vapor pressure deficit – difference between saturation vapor pressure and vapor pressure (expressed in pressure units, kPa)

Evapotranspiration is driven by vapor pressure deficit (VPD) which is a function of temperature and relative humidity. VPD at a particular relative humidity increases with increasing temperature.

Air temperature and relative humidity should be measured in close proximity to each other. Sensors measuring temperature and relative humidity need to be enclosed within a radiation shield for accurate measurements. Radiation shields protect the sensor from exposure to sunlight (which would heat up the sensor) and allow for airflow around the sensor.

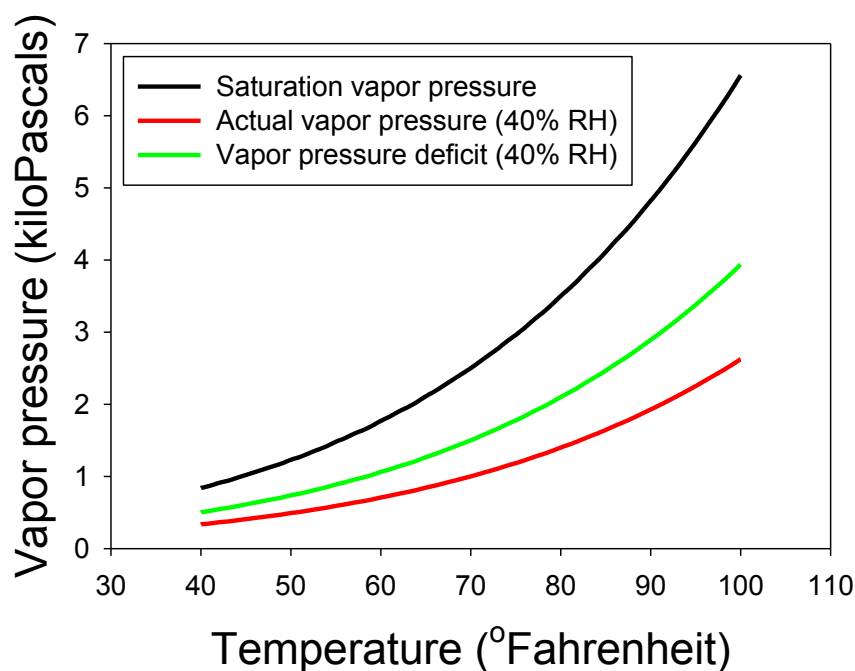


Figure 4. Saturation vapor pressure, actual vapor pressure (at 40% relative humidity), and vapor pressure deficit (at 40% relative humidity) in response to increasing temperature.