



Nursery & Garden Industry
Queensland

Weather stations

A weather station comprises a number of instruments that measure atmospheric, and in some cases, soil conditions, then records this information, allowing the data to be displayed and used to manage or control production nursery systems.

Weather stations can be used for a variety of purposes: irrigation scheduling, frost monitoring, pest management, recording environmental conditions when making chemical applications, and environmental control. Weather stations can be used to assist with irrigation scheduling by the use of evapotranspiration calculated from the weather station data. The use of degree day models in field cropping systems have been used to predict the date of flowering or progression of plant development to enable more accurate crop scheduling.

While it is possible to access information from other sources, such as Bureau of Meteorology websites, it's likely the environmental conditions in a particular nursery environment will be different to the officially measured data e.g. in shade houses. Gathering these measurements onsite improves the accuracy of the data collected, and enables better informed decisions to be made.

When purchasing a weather station, the first decision to make is which sensors are required. The

following are some that are available:

Rain gauges—rainfall amount and intensity.

Light sensors—sunlight or Photosynthetically Active Radiation (PAR).

Anemometers and wind vanes—wind speed and wind direction.



Evaporation

The process of turning water from liquid into vapour.

Evapotranspiration

The process by which water is transferred from the land to the atmosphere by evaporation from the soil and other surfaces, and by transpiration (water loss) from plants. A guide to the amount of water that needs to be applied to a crop to replace lost water.

Leaf wetness sensors—moisture on leaf surfaces.

Soil temperature sensors—soil or growing media temperature.

Soil moisture sensors—moisture levels in the growing medium.

Air temperature—maximum and minimum air temperatures, as well as logged data.

Relative humidity—maximum and minimum relative humidity.

Other components :

Radiation shields—protects sensors from the effects of direct sunlight.

Protection from animals—mainly birds sitting on sensors, but other animals may also cause damage.

Mounting hardware—to attach the sensors and logging equipment to the weather station and to structures.

Connectivity—manually download data or connect wirelessly.

Tipping bucket rain gauges gather rainfall into a funnel with the water then collected in measuring spoons. After a certain volume accumulates in the spoon it tips, and the number of tips is recorded to calculate the amount of rainfall. If heavy rainfall is common, rain gauges with two tipping spoons are preferred. A screen should be placed over the cup to prevent clogging by debris, and the screens need to be cleaned monthly. Obtain a gauge with

the greatest accuracy— many lower priced gauges are inaccurate.

Light and solar radiation sensors are used in the calculation of evapotranspiration. Shortwave radiation (total energy) of incoming light is measured using pyranometers, and is used in part to calculate the amount of evapotranspiration.

Lux light sensors measure how the human eye perceives light, but Photosynthetically Active Radiation (PAR) sensors measure wavelengths from 400-700 nm, which is the range of useful light for plants. PAR sensors can be used to measure the daily light integral (DLI) (a measure of light intensity and duration), which is then used to monitor the requirements for supplemental light or to control retractable screening. DLI can affect root and shoot growth, and influence finished plant quality and production times.

Light sensors should be kept level and clean, be located where they won't be shaded and need to be recalibrated regularly.

Anemometers measure wind speed. **Wind vanes** measure wind direction. Wind influences evapotranspiration by moving humid air away from the plant canopy. Consequently, the greater the wind speed the higher the evapotranspiration. Anemometers measure wind speed by cups, propellers, hot wires or ultrasonic signals. Some anemometers measure wind direction, but this is usually of less importance in irrigation management.

Leaf wetness sensors measure the moisture on leaf surfaces and in plant canopies, which can be used to predict the incidence of plant disease. These sensors may also be useful in propagation facilities where leaf surface moisture is critical to success rates.

Temperature and relative humidity should be measured within a radiation shield to protect the sensors from the heat generated by direct sunlight.

Air temperature and relative humidity make a significant contribution to the level of evapotranspiration.

Temperature and humidity terminology:

Dry bulb temperature—actual temperature of the air.

Relative humidity—ratio of the amount of moisture in the air and the maximum amount of water the air can hold at the same temperature (%).

Dew point temperature—the temperature to which the air must be cooled to have 100% relative humidity i.e. the temperature at which dew will form—important for disease control.

Soil moisture sensors may be an alternative to using evapotranspiration in soil based systems. However, it's been found that moisture sensors designed to work in soil may not work successfully when use in growing media due to the high Air Filled Porosity of nursery growing medias.

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