

Humidity in greenhouses

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Published in the Commercial Grower 52(1), 1997, p. 26

In greenhouse climate control, nothing is so complicated as control of humidity. Greenhouse air humidity is determined by various factors and controlling those is virtually impossible. A greenhouse operator can only adjust air humidity and try to avoid extremes. Moreover, humidity is expressed in various units: relative humidity, absolute humidity, vapour pressure, VPD, dew point, which all require different control settings. Even when everything is understood it is not easy to decide which level of humidity should be targeted in the control, as that depends on the weather and plant conditions.

This series of articles discusses many aspects of humidity: its effect on transpiration, plant growth and diseases, control by venting, heating, fogging, misting and roof sprinkling. This first article explains the terminology in relation to humidity.

Absolute (air) humidity: humidity in gram water vapour per m³ air. Conversion to relative humidity (RH) can only be made when the temperature is known. For instance 15 g/m³ at 17.5 °C equals 100 % RH, while 15 g/m³ at 25 °C equals 65 % RH, and at 30 °C it equals 50 % RH (see table in next article of this series).

Boundary layer: thin layer of air and water vapour close to the leaf surface. The boundary layer resistance is a barrier for transpiration. It is reduced by air movement (wind).

Condensation: transition of water vapour to liquid water. Water vapour condensates on glass or leaves that are cold (below the dew point).

Conductance (opposite of resistance): the ease with which water flows through a barrier. When leaf pores are wide open, the resistance for water vapour to go out is low and the conductance is high.

Conductivity, conductivity factor (CF): concentration of mineral salts in water (term used in hydroponics).

Dew point: temperature below which water vapour will condensate (indication for humidity of air). For instance air with 10 g/m³ has a dew point of 11 °C, air with 20 g/m³ has a dew point of 22.5 °C.

Evaporation: transfer of water vapour from a wet surface or from the soil to the air.

Evapotranspiration: transfer of water vapour from soil and plants to the air.

Guttation: water leaking from leaves, caused by high root pressure, mostly at night.

Osmosis, osmotic potential: pressure in water (or in plant sap) caused by salts. The more salts in the plant sap, the higher the osmotic potential in that plant.

Resistance: strength of hindrance for water flowing through a barrier. For instance when leaf pores are closed they are a strong resistance for transpiration.

Transpiration: transfer of water vapour from a plant to the air. Transpiration has two effects: cooling the leaves during sun shine and internal transport of nutrients.

Relative (air) humidity (RH): humidity in % of maximum humidity at a given temperature. For instance at 20 °C air can hold 17.3 g of water vapour per m³ at maximum. If it holds only 13 g/m³ at 20 °C, it has a relative humidity of 75 %.

Relative water content (RWC) of plants: water content in % of maximum water content.

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Root pressure: strength with which the roots press water upwards to the shoots. This is the mechanism that causes water uptake at night, while at day transpiration is the driving force.

Stoma / stomata: pore / pores in the leaf surface.

Stomatal conductance: ease with which water vapour can pass the leaf pores.

Stomatal resistance: strength of hindrance to water vapour by the leaf pores.

Saturation: saturated means filled to the maximum (with water).

Saturation deficit: a measure of air humidity: difference between actual and maximum vapour content (e.g. in gram water per m³ air).

Specific humidity: water content of air in kg water vapour per kg dry air.

Turgor: inward pressure of plant cell walls to withstand the outward pressure from the cell. Turgor gives the firmness to plant cells and plant tissue.

Vapour deficit: can be vapour pressure deficit (VPD) or saturation deficit.

Vapour pressure: pressure caused by a gas or a vapour. The vapour pressure of water in air normally ranges from 1 to 5 kPa or from 10 to 50 mbar.

Vapour pressure deficit (VPD): difference between actual and maximum vapour pressure. For water it is normally in the range 0.1 kPa (very humid) to 3 kPa (very dry air), or 1 to 30 mbar.

Water potential of a plant: water content expressed in units of energy or pressure.

Water uptake: the amount of water taken up by the plants. It equals the transpiration plus the water used for plant growth.

Water stress (drought stress): shortage of water in the plant, leading to wilting etc.

Water status: condition of the plant in terms of water content.