From Forest Nursery Notes, Winter 2013

130. Everything you wanted to know about fog: but were afraid to ask. Stanley, M. International Plant Propagators' Society, combined proceedings 2011, 61:104-105. 2012 .

Everything You Wanted to Know About Fog: But Were Afraid to Ask©

Mark Stanley
MicroCool, 72-128 Adelaid Street, Thousand Palms, California 92276, U.S.A.
Email: mark.stanley@microcool.com

WHAT IS MIST?

Mist nozzles generally produce large droplets in excess of 200 µm from low pressure (20–100 psi / 2–7 bar) nozzles and provide irrigation and water to plants.

WHAT IS FOG?

Fog is defined as a water droplet around 10 micron (µm) in diameter (1/10th diameter of a human hair). High pressure water at 1,000 psi / 70 Bar is used to create the fog. Nozzle output is around 5 gph (U.S.A.) / 5 lph, this quantity of water is not intended to irrigate the crops below.

How to Create a 10-µm Droplet: take clean city water; filter it to 5 µm; boost the water pressure to 1,000 psi / 70 Bar; distribute through pressure tubes and pipes; filter water again at the nozzle; fractionate the water with an impeller and force the water through a 0.008-in. / 0.2-mm orifice. Billions of water droplets are created to flash evaporate in the air. Repeat this operation as often as necessary to achieve the result (cooling or humidification).

Some points to remember:

- Water only evaporates from the surface.
- 10-µm droplet has a large surface to volume ratio exposing maximum surface to surrounding air.
- Water changes from a liquid to a gas.
- Extracts latent heat from the air as it changes.
- Water vapour is added to the air changing the humidity ratio (kg H_2O per m^3 of air).
- Minerals are left behind in the air that can collect on the plant leaves. At this point reverse osmosis should be considered as a pretreatment.

What do plants want?

- Ideal humidity
- Ideal temperature
- Ideal sunlight
- Ideal soil
- Ideal water content
- Ideal fertilizer
- Ideal growing conditions

FOG SYSTEMS HELP TO CONTROL THE ENVIRONMENT AROUND THE PLANT

The objectives of a fog system are to:

- Create a "lace glove" around the emerging leaves.
- Reduce the transpiration from the leaves so that the growth energy is "redirected" to the root system.
- Create a high humidity environment that equalizes pressure in the rooting media, keeping the plant moist.

FOG SYSTEMS CAN DO THE FOLLOWING

Greenhouse Cooling. Depending on the temperate zone, greenhouses can be cooled up to 15 °C (or more) by using the adiabatic cooling process. This however requires a good air exchange and fan systems and IS less expensive to maintain.

Humidification Balance. Humidity levels in the greenhouse can be maintained up to 95% RH with no "rain" or dripping to damage plant leaves or flowers.

The system maintains a constant environmental level in the plant zone. There is minimal cooling as there are limited air exchanges in the greenhouse.

High humidity levels equalize the osmotic pressure between the leaf and the surrounding air. Plant transpiration is dramatically reduced and plant energy returns to the root zone. Balancing the humidity levels controls the growth of the plant and optimizes propagation conditions.

Humidity Control Is More Difficult to Achieve Than Temperature Control. The better and faster is the sensor, the better and faster is the control. Standard humidity sensors are good to a maximum 60%–75%. Rapid cycling can allow humidity levels to be maintained ±2%.