Temperature / Humidity and Plant Growth

Temperature and humidity are two environmental factors which affect

- the rate of plant growth,
- development and
- yield potential of any crop.

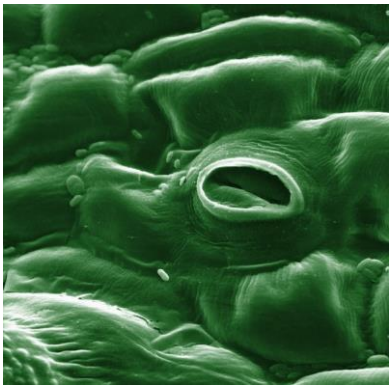
Often, in a protected cropping situation, we carefully adjust temperature and supply heating or cooling, but humidity gets overlooked, and it is actually the combination of the two that needs to be taken into consideration.

Temperature

The biochemical functions in plants that are required for growth and survival are "temperature dependent" – that is there is an *optimal* temperature range within which a particular plant species will be carrying out photosynthesis at its maximum rate (given that sufficient CO_2, water and light are also present). Outside this range, photosynthesis and other plant processes begin to slow down, to the point where they stop and growth ceases. Within a greenhouse, where control of all plant growth factors – light, temperature, CO_2, water and nutrition, is possible, the objective is to provide a temperature range that will maximize plant growth, rather than restrict it. Since different plant species have different ideal temperature ranges, this needs to be matched to the crop being produced. Cool season crops such as lettuce, many herbs and salad greens etc. have an optimum temperature range of approximately $16^{o} – 22^{o}$ C ($60^{o} – 72^{o}$ F). Warmer season crops such as tomatoes, capsicum and cucumbers have a higher range of $18^{o} – 28^{o}$ C ($63^{o} – 82^{o}$ F).

Humidity

Relative humidity is the amount of water vapor in the air relative to the maximum amount of water vapor that the air can hold at a certain temperature. If the relative humidity level is 75% at 80° F, this means that every kilogram of the air in the respective space contains 75% of the maximum amount of water that it can hold for the given temperature.



Stoma in a tomato leaf shown via colorized scanning electron microscope image

Relative humidity levels affect when and how plants open the stomata on the undersides of their leaves. Plants use stomata to transpire, or "breathe." When the weather is warm, a plant may close its stomata to reduce water losses. The stomata also act as a

cooling mechanism. When ambient conditions are too warm for a plant and it closes its stomata for too long in an effort to conserve water, it has no way to move carbon dioxide and oxygen molecules, slowly causing the plant to suffocate on water vapor and its own transpired gases.

As plants transpire, the humidity saturates leaves with water vapor. When relative humidity levels are too high or there is a lack of air circulation, a plant cannot make water evaporate (part of the transpiration process) or draw nutrients from the soil. When this occurs for a prolonged period, a plant eventually rots. When surrounded by warm temperatures in low relative humidity levels, transpiration rates in a plant increase, reducing the need for a grower to fertilize it.

The Importance of Climate Control for Plant Growth

As seedlings grow or when a grower propagates plants from leaf or stem cuttings, the young or collected plants automatically close their stomata as a protective measure to prevent water losses. To support cuttings and young plants, growers often uses plastic tents or propagation chambers that increase relative humidity levels surrounding the leaves and ensure proper air circulation.

In addition to water and air, plants use light energy for the transpiration process, as it causes liquid water to turn to vapor (evaporation). Greenhouses often maintain relative humidity levels below threshold values during the day and night by controlling the water content in air to maintain a minimum transpiration rate in plants.

Climate control for plant growth is an essential consideration in regards to pest and disease management. When conditions are too humid, it may promote the growth of mold and bacteria that cause plants to die and crops to fail, as well as conditions like root or crown rot. Humid conditions also invite the presence of pests, such as fungus gnats, whose larva feed on plant roots and thrive in moist soil.

Conclusion Questions

1. **List THREE things that are affected by temperature and humidity?**
2. **What happens if the temperature range is not optimal (less than ideal)?**
3. **Define “relative humidity”.**
4. **List TWO functions of stomata.**
5. **What happens to stomata when the conditions are too warm?**