Dry Leaves and HAF

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Moving air past leaves reduces the thickness of the boundary layer of gases next to the leaf. This means that moisture from transpiration (and condensation) is moved away and the foliage is drier.

In a review by Ann Reilly (1987) the statement is made that "drier leaves absorb more heat from the sun and remain warmer". Is this really the way it happens?

When a leaf absorbs radiant energy from the sun, it becomes warmer than the air surrounding it. The vapor pressure of the water increases and evaporation speeds up. Evaporation of the water cools the leaf (a pound of water requires 1060 BTU's to vaporize). The leaf also loses heat by radiation and by conduction to the surrounding cooler air.

Horizontal air flow (HAF) affects leaf temperature in two ways. It removes moisture from the boundary layer of the leaf speeding water vaporization. It also brings cooler air closer to the leaf speeding loss of heat by conduction. It could be said that radiant heat loss is less because the leaves are cooler but this is of little consequence.

There are several papers that give data on how much moving air will cool leaves. Hanan reports that red carnation flowers can be 15° warmer than the air under direct sun. Carpenter and Navtiyal (1969) found that an air flow speed of 53 feet per minute reduced sanseviera leaf temperature from 7.2°F down to 2.1°F above air temperature. In collecting her information, Ms. Reilly was misled to report that the leaves will be drier and warmer under HAF. They will be drier and cooler when the sun is shining. At night they will be drier and perhaps a tad warmer.

This does not resolve the question of dry leaves absorbing more heat from the sun. Perhaps they do. But it doesn't matter since the HAF keeps them cooler.

References

Reilly, Ann. 1987. Turning on the right heat. Greenhouse Manager 6(2):96-105.

Carpenter, W. J. and J. P. Navtiyal. 1969. Light intensity and air movement effects on leaf temperatures and growth of shade-requiring greenhouse crops. J. Amer. Soc. Hort. Sci. 99:212-214.