

I don't lose much sleep during freezing conditions in the grove!

By Pete Button

How do I do it?

I'm a commercial grower of lychees and longans. I have a five acre grove and I live in the grove. I have a temperature sensor which will sound an audio alarm when the temperature falls to a preselected level. The sensor is located in the grove and the alarm is in the house.

What temperature do I detect? There are two temperatures in the grove; air temperature and leaf temperature. When the sky is cloudy and there is a breeze or wind, the two temperatures are pretty much the same. But when the sky is clear and the air is calm the leaf temperature can be as much as six to seven degrees F below the air temperature (1). The reason for this is because the leaf, in terms of thermodynamics, is "black body" and has an emissivity (2) of about 1. Thus, on a clear calm night the leaf is very efficient in radiating its heat out into outer space and there is no air movement to mix its temperature with that of the air.

The temperature sensor of the alarm has the same heat transfer characteristics as a leaf and is essentially showing the temperatures of the leaves on top of the tree exposed to the sky. The leaves on the side and interior of the tree have a higher temperature since they don't see the sky. I also have a thermometer with a sensor having the same thermal leaf response so I can read leaf temperature. I mount both these sensors so that they "see" the sky.

On the evening of an anticipated freeze I will plot leaf temperature vs. time so I can "eyeball" the extrapolation of the time the plot might cross 32 degrees F. After the TV news I go to bed. When the alarm goes off I get up and assess the sky condition and the wind. My alarm is set for 35 degree F. This is an arbitrary choice on my part and allows me time to get dressed, read the temperature and make a decision. If I feel there is a danger of the leaf

temperature dropping below 32 degrees then I will turn on the irrigation and go back to bed. There is nothing more I can do. If the alarm goes off close to sunrise, I might just let it go and rely on the sun to pull the leaves out of a close freezing situation. In any case I'm not exhausted by staying up all night.

Literature Cited

1. Button P. A. Comparison of night leaf and air temperature-winter of 1981-82. Proc. Fla. State. Hort. Soc. 95:116-118. 1982
2. Office of Naval Research. 1965 Handbook Military Infrared Tech. 75 pp.