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Fan and Pad Greenhouse Evaporative Cooling Systems[1]

R. A. Bucklin, R. W. Henley and D. B. McConnell[2]

Without cooling systems, temperatures in Florida greenhouses during the summer can easily exceed 100°F. Temperatures this high reduce the quality of many crops and will greatly reduce worker productivity. Almost all greenhouses cooling systems use some form of evaporative cooling to operate. Air conditioning or refrigeration systems can be used, but their installation and operating costs are usually too high to justify their use.

EVAPORATIVE COOLING

Evaporative cooling is a process that reduces the temperature of air by the evaporation of water into the airstream. As water is evaporated, energy is lost from the air reducing its temperature. Two temperatures are important when dealing with evaporative cooling systems. The first is the dry bulb temperature. The dry bulb temperature of the air is the temperature that we usually think of as air temperature. It is the temperature measured by a regular thermometer exposed to the airstream. A second air temperature is important in evaporative cooling systems. This temperature is referred to as the wet bulb temperature. The wet bulb temperature is the lowest temperature that can be reached by the evaporation of water. The wet bulb temperature is the temperature you feel when your skin is wet and is exposed to moving air. The dry and wet bulb temperatures can be used to calculate the relative humidity. The equipment used to evaporate water, move cooled air through the greenhouse, and exhaust warm air from the greenhouse comprises the fan and pad cooling system.

It is the wet bulb temperature and not the relative humidity that determines to what temperature air can be cooled by evaporation of water. During the heat of the afternoon when the dry bulb temperature is normally at its peak, the difference between the dry bulb and wet bulb temperature is the greatest. Thus the greatest potential for cooling is obtained during the heat of the day when it is needed most. Wet bulb temperatures can be determined by checking with your local weather station or by investing in an aspirated or sling psychrometer. These psychrometers consist of two thermometers. The end of one thermometer is covered by a wetted wick. The other thermometer is a conventional thermometer. These two thermometers are exposed to a moving airstream so that they measure the wet and dry bulb temperatures. The difference between sling psychrometers and aspirated psychrometers is the way the airstream is provided. A sling psychrometer is mounted on a swiveled handle and whirled rapidly, while an aspirated psychrometer uses a small fan to provide air movement.

Weather data collected by the weather bureau for many years indicates that afternoon wet bulbs in Florida are about 79-80°F during hot weather conditions. The most critical time to check wet bulb temperatures is in the afternoon when solar radiation and outside temperatures are highest. With an

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2. R.A. Bucklin, associate professor, Agricultural Engineering Department; R.W. Henley, professor, Central Florida Research and Education Center, Apopka, FL; D.B. McConnell, professor, Environmental Horticulture Department, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville FL 32611.