

26 March 2020

## **White Paper: Efficient and Effective Use of Fans on Golf Course Greens**

This white paper is provided to highlight the application of persistent Hawk-Eye™ System measurements and alerts to guide large fan use on cool season putting greens to improve the efficiency (reduce cost) in use of the fan and to reduce potential disease pressures (reduce cost) due to moisture in the turf canopy.

On many golf courses that have cool season grass greens, large fans are set-up during summer months to help maintain the health of these high value assets. Often more than one fan/green is used to help keep the canopy temperature from exceeding temperatures that would over stress the turf and severely impact its health. Often the fans are run day and night. But as observed and measured with a Hawk-Eye™ System there are periods in the day, even when air temperatures are well above 95° F and humidity is high, when the fan isn't needed due to cloud cover or shade. It is also possible that the practice of running a fan when not needed, during the day and especially at night, can cause water vapor to condense in the canopy and increase disease pressure. Having the fan off during periods when it isn't needed will save electricity and prevent the potential for increasing disease pressure.



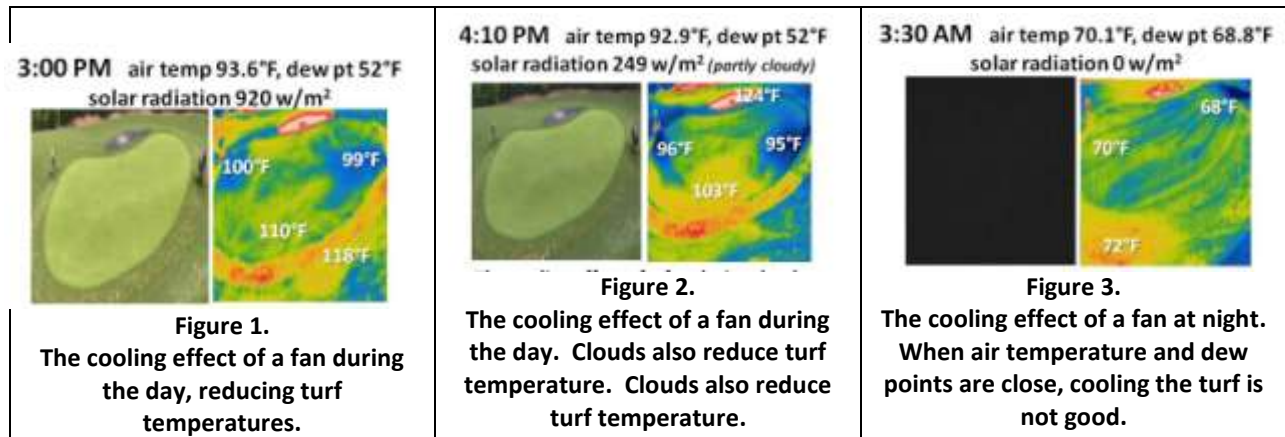
### **Background:**

Temperature and water are extremely important considerations in the health of plants. The temperature of the canopy leaves during the day is primarily a factor of the air temperature, the intensity of solar radiation on the leaf surface, the evaporation of water vapor released through the stomata via transpiration, and to a lesser amount the evaporation of water/moisture in the soil near the surface. The temperature of the canopy leaves during the night is primarily a factor of the air temperature, residual heat radiated back from the turf surface to the air, the evaporation of water vapor released through the stomata as a byproduct of respiration, and to a lesser amount heat from respiration. On cool season grasses during the daytime high canopy leaf temperatures, above 94° F - 98°F, causes photorespiration which significantly reduces photosynthesis. High temperatures and high moisture in the canopy also increase disease pressures, day and night.

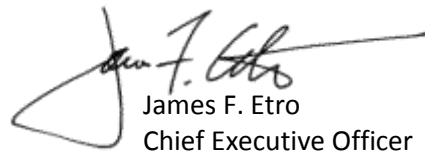
The purpose of fan use is primarily to create a breeze to facilitate evaporative cooling of the canopy. The breeze also moves water vapor near the surface of the canopy away from the canopy but transpiration, evaporation of water in the soil, and the replacing air quickly replaces the water vapor near the surface of the canopy. Well aimed fans are effective at lowering the canopy temperature and changing the moisture content in and very near the canopy. Leaf temperature/moisture balance is delicate and if fan use is not managed correctly it can waste electricity and increase disease pressure by increasing the moisture in the canopy.

See Figures 1 – 3. Attached here-in.

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The Hawk-Eye™ System is a unique tool that is able to measure plant canopy color for quality assessments, and plant canopy temperatures for stress assessments and prescribing irrigation. The System can be programmed to guide real-time fan operation with a set of actionable Alerts that will improve the efficiency in use of the fan and ensure the effectiveness of fan use based from real time measurements of the turf's canopy and the local weather.

  
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alerts you when the conditions you wanted to know about occur.

### Hawk-Eye™ Systems

Autonomously, 24/7/365.

You See Turf.

Hawk-Eye™ Measures It.

and Tells You About It.

Measure Stress, and be informed  
Measure Quality, and be informed  
Irrigate, be informed when, where, and how much

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