



Using Fans to Reduce High Heat Stress in Cool Season Turfgrass



During the daytime, a fan's breeze on the turfgrass will increase evaporative cooling. The cooling effect of a fan (increased evaporative cooling) will reduce high canopy heat conditions caused by solar radiation, air temperature and the relative humidity.

If used when the turfgrass benefits from the breeze, the fan is a grass saver.

If the fan is used when the turfgrass doesn't benefit from the breeze; it is wasting electricity and may be increasing disease pressure.

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Heat Stress

During nighttime healthy turfgrass canopy temperatures are close to the air temperature. Depending on the humidity and soil moisture, evaporation will normally make the canopy temperature a little cooler. At night, the evaporative effect can cool the grass by as much as 1-3 degrees Fahrenheit below the air temperature.

During the daytime healthy turfgrass canopy temperatures are mainly governed by the intensity of sunlight, air temperature, humidity, and wind. The amount/intensity of sunlight (solar radiance) is the most significant factor in heating the turfgrass canopy. Very high solar radiances (cloud free days) can raise the turf canopy temperature more than 20 degrees Fahrenheit above the air temperature. But, depending on cooling from the evaporation of water vapor released during transpiration and evaporation due to low relative humidity, daytime canopy temperatures can be cooled, by as much as 10° - 12° Fahrenheit. If there is significant shade (from trees or clouds or stadium structures) the canopy temperature, of healthy turfgrass, can be near ambient air temperature. Some shade during periods of the day are a terrific heat stress reliever.

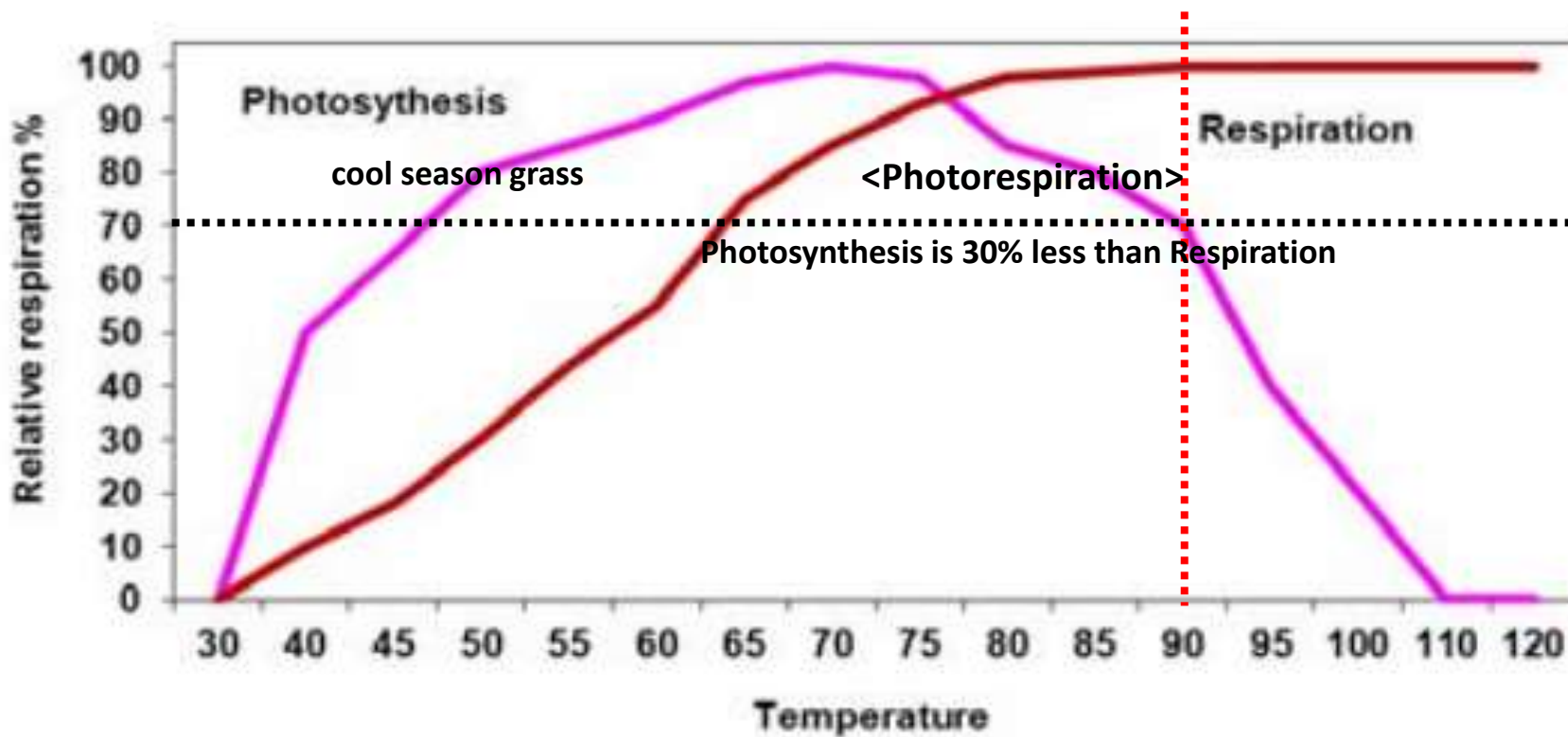
The chart on the next page shows the relationship between temperature and photosynthesis and respiration.

When cool season turfgrass canopy temperatures become hot, at about 86° - 91° Fahrenheit (30° - 33 ° Celsius), photosynthesis shuts down and photorespiration (depicted in next page) takes over. The stoma close to conserve water and the turfgrass can't make carbohydrates. This leads to stressed/weak turfgrass, and a loss of evaporative cooling so the canopy temperature will rise further. This high heat stress negatively impacts turfgrass health, decreases quality and playability, and decreases turfgrass recovery when the sun starts to set. This 'weakened' turfgrass is also more susceptible to other stresses such as pests, diseases, water deficits, and traffic.





Photosynthesis vs Respiration



Zac Reicher
<http://turf.unl.edu>

Turfgrass Science
University of Nebraska





Fans

Are effective for cooling turfgrass

3:10 PM

air temp = 93.6°F

dew pt = 52°F

solar radiation = 920 W/m²

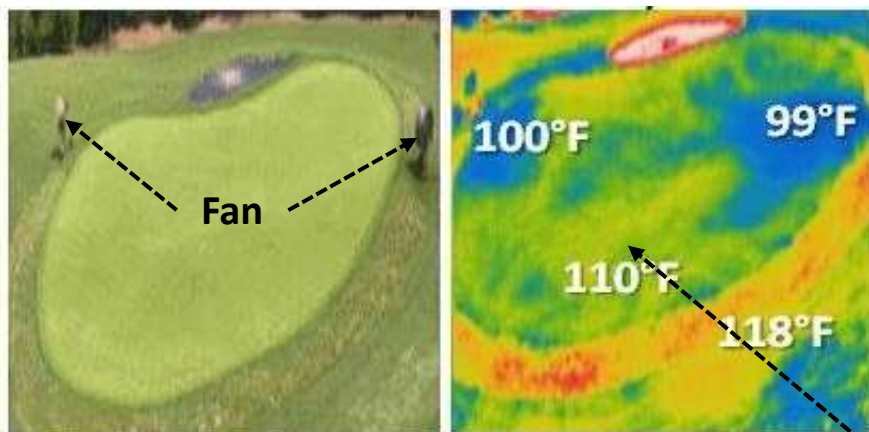
4:10 PM

air temp = 92.9°F

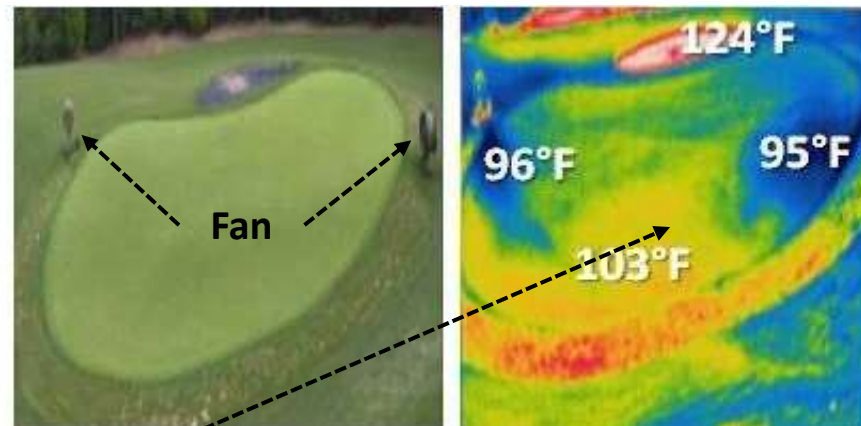
dew pt = 52°F

solar radiation = 249 W/m²

*Clouds (shade)
very helpful*



Cooling effect of fans during the day.



Cooling effect of fans during the day.
Clouds also reduce turf temperature.

These fans could be aimed better.

Or

Add a fan?



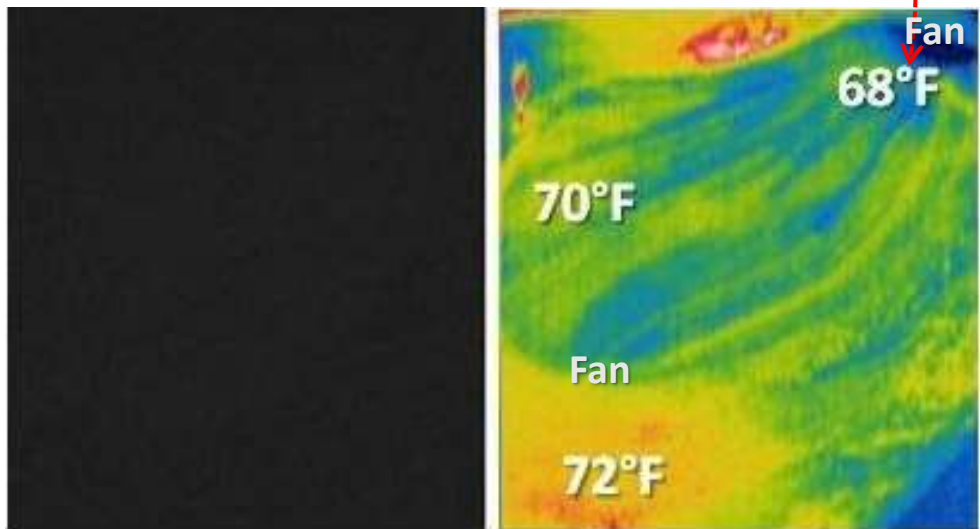


3:30 AM
 air temp = 70.1°F
 dew pt = 68.8°F

Fans

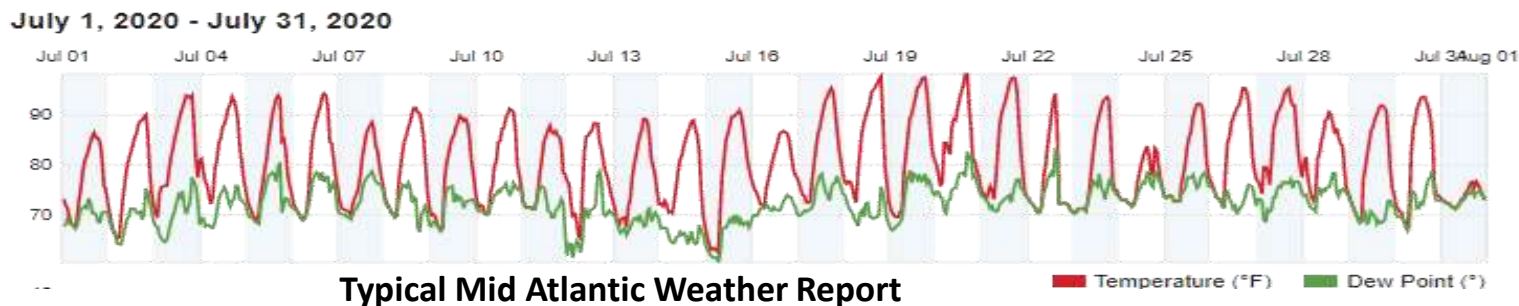
Cooling turfgrass

can also increase disease pressure



Cooling effect of a fan at night and early morning.

When the canopy temperature is cooler than the air temperature (typically late night/early morning) the fan breeze will decrease the canopy temperature further and in high humidity cases it can be close or below the dew point temperature. This will add dew to the canopy. When the dew point temperature is greater than or equal to the canopy temperature condensation/dew will occur. Its also likely that a strong fan breeze will push the new dew into the thatch.



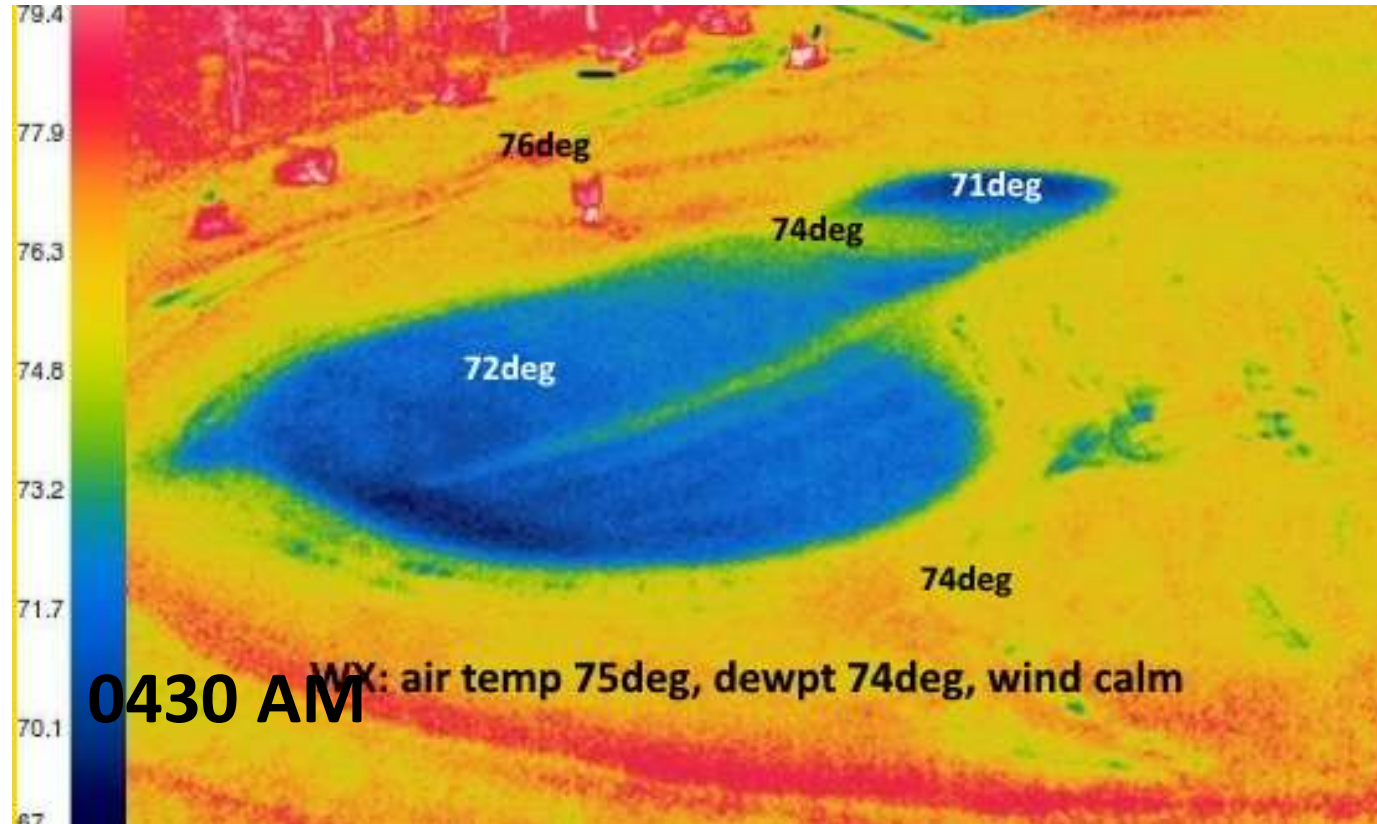
Fan mixing the boundary layer above the turf surface?

It is mixing in the same high humidity air and not breaking thru the boundary layer.





Fan On or Off ?

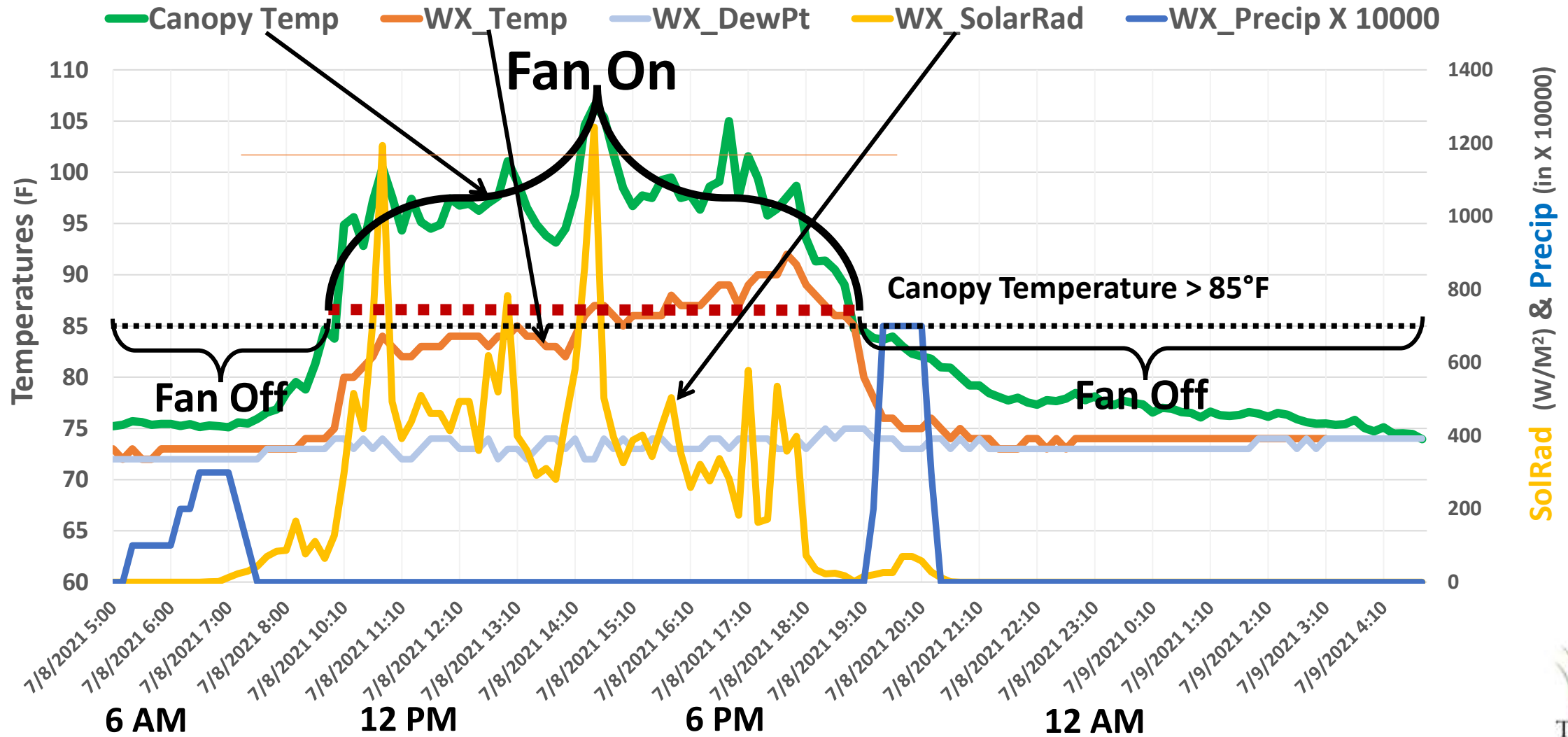


Off Please





When a Fan is Effective





Using EYAS System

Guiding Fan Use by Sending an e-mail or SMS notice when needed*.

EYAS Measures Turf all day, every day



2:18 PM nr11 Fan ON

5:35 PM nr11 Fan OFF

Use the Fan Only When the Turf Says it Needs it

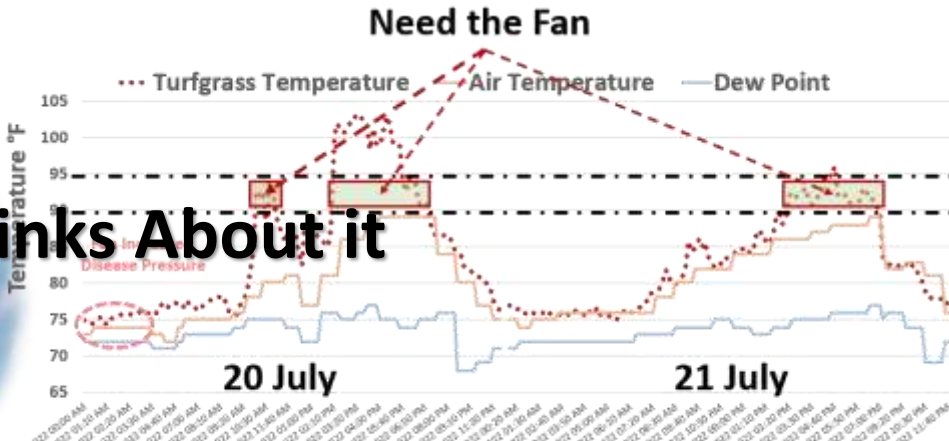
*** EYAS can also be configured to turn fans on and off.**





The Cloud Thinks About it

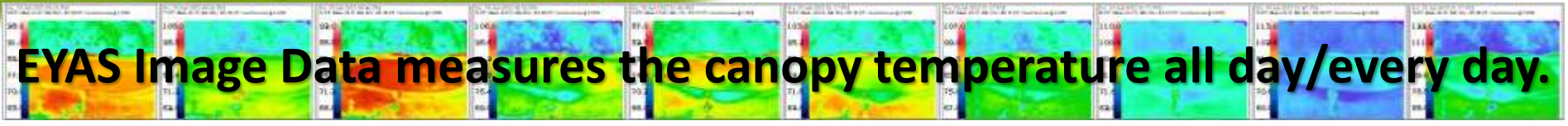
Image Data to the Cloud



The Cloud Talks to the Fan's Power When Needed



Fan ON when the turfgrass needs it
&
Fan OFF when it doesn't.



EYAS Image Data measures the canopy temperature all day/every day.



Smart & Effective Fan Use

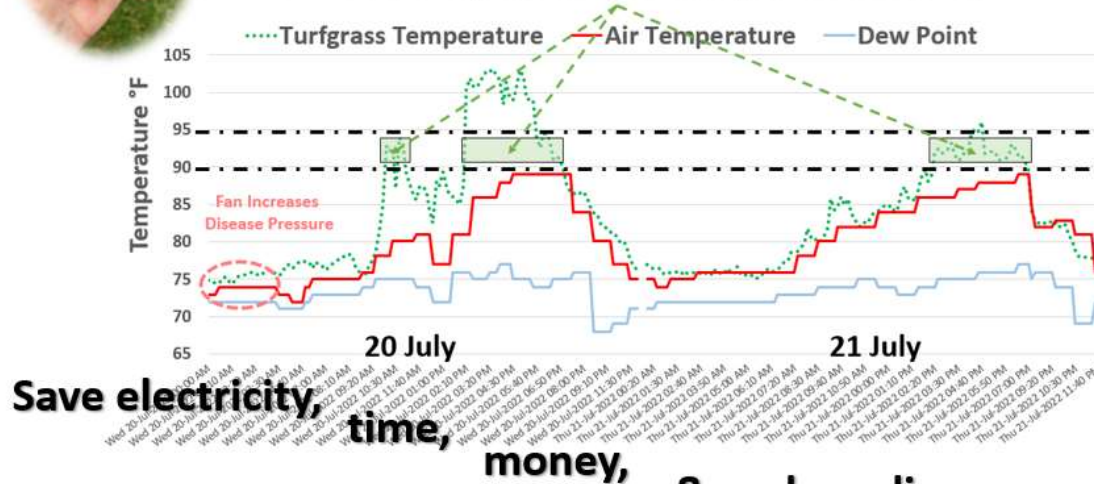
Measure
Aim
Results



Autonomously & Continuously

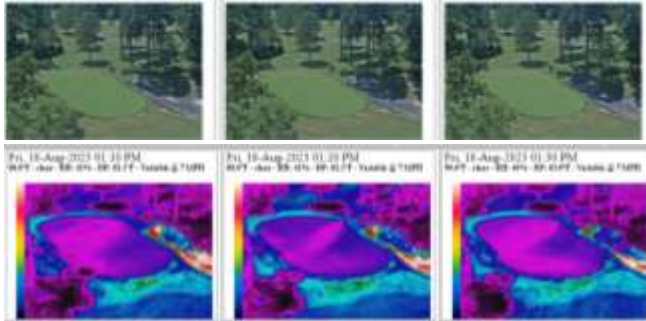
Measure the Turf

Use fans only when the turfgrass needs it.

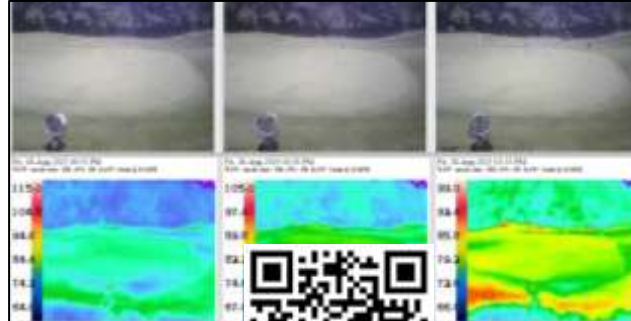


And Make Sure They are Aimed and Oscillate Well

Well Aimed



Could be Better



See the Movie

Poorly

