

Heat Stress

During nighttime healthy turfgrass canopy temperatures are close to the air temperature. Depending on the humidity and soil moisture, evaporation will make the canopy temperature a little cooler. At night, the evaporative effect can cool the grass by as much as 2-4 degrees.

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 is heating the turfgrass canopy. Very high solar radiances can raise the turf canopy temperature more than 20 degrees above the air temperature. But, depending on cooling from the evaporation of water vapor released during transpiration, daytime temperatures can be cooled, by as much as 12 degrees. If there is significant shade (from trees or clouds) the canopy temperature can be near ambient air temperature.

When cool season turfgrass canopy temperatures become hot, at about 94° photo respiration occurs which wastes energy and significantly decreases photosynthesis and the stoma close to conserve water. This leads to a loss of evaporative cooling and 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 more susceptible to other stresses such as pests, diseases, water deficits, and traffic.



Using Fans to Reduce High Heat Stress

During the daytime, a fan's breeze often increases evaporative cooling.

The cooling effect of a fan (increased evaporative cooling) will reduce high heat conditions caused by solar radiation, air temperature and dew point (aka relative humidity).

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

If used when the turfgrass doesn't benefit from the breeze;

it is wasting electricity,
and in some cases

It is increasing disease pressure by increasing moisture in the thatch.

Bottom Line: Use fans when cool season turf needs it to reduce stress and improve recovery.

The Hippocratic oath applies. DO NO HARM.

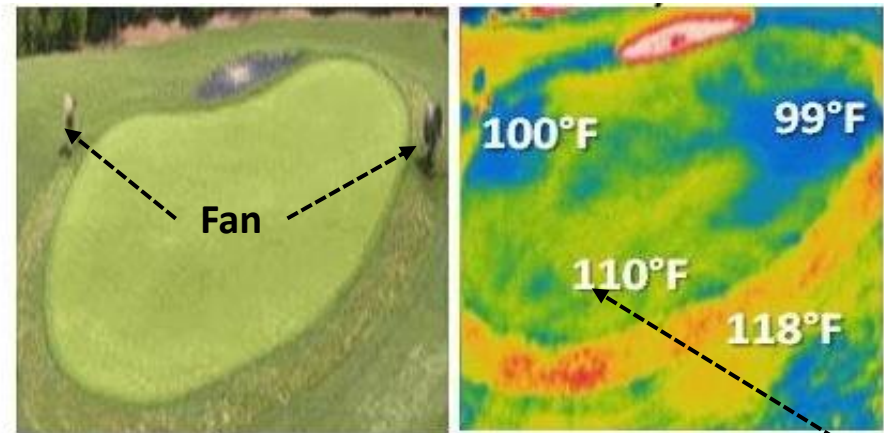


Fans

effective for cooling turfgrass

3:10 PM

air temp = 93.6°F
dew pt = 52°F
solar radiation = 920 W/m²

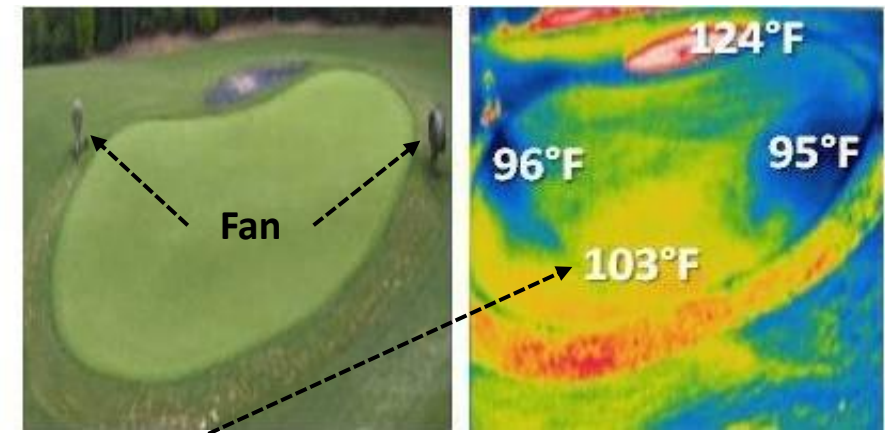


Cooling effect of fans during the day.

4:10 PM

air temp = 92.9°F
dew pt = 52°F
solar radiation = 249 W/m²

*Clouds (shade)
very helpful*

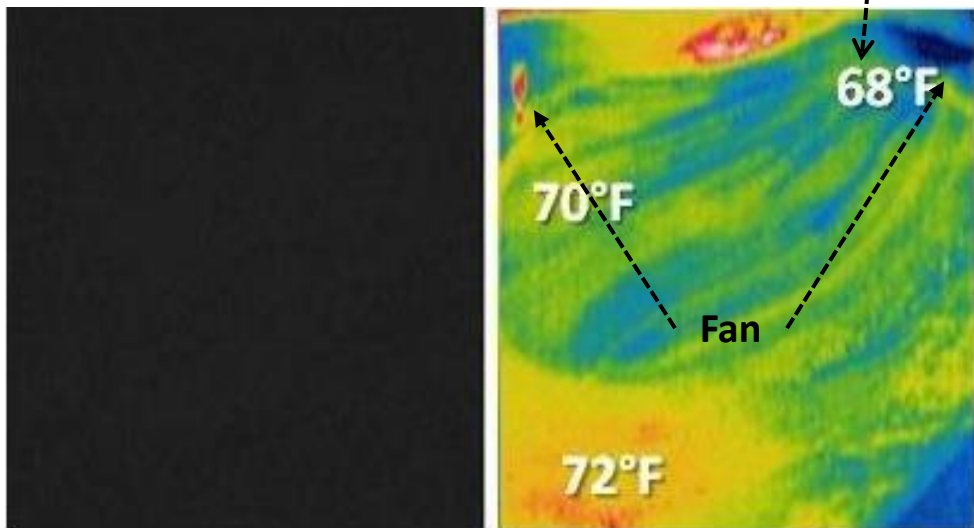


Cooling effect of fans during the day.
Clouds also reduce turf temperature.

*These fans could be aimed better.
Or
Add a fan?*

Fans

3:30 AM
 air temp = 70.1°F
 dew pt = 68.8°F
 solar radiation = 0 W/m²



Cooling effect of a fan at night and early morning.

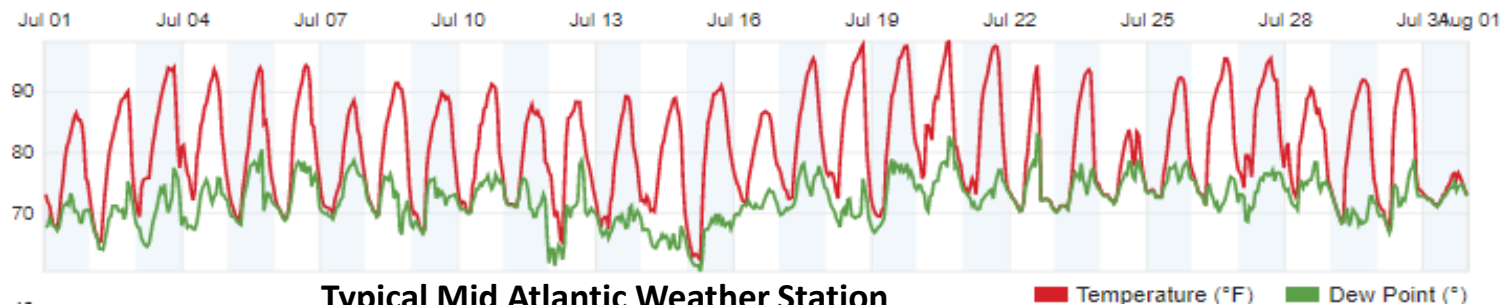
**cooling turfgrass
 can also increasing disease pressure**

Cooling the turf grass when the canopy temperature and dew point are within a few degrees of each other is a bad practice.

It increases disease pressure by adding moisture to thatch.

East of the Mississippi, especially in summer, low dew point depressions (air temperature – dewpoint temperature) and canopy temperature - dew point temperature are typical at night into early morning.

July 1, 2020 - July 31, 2020



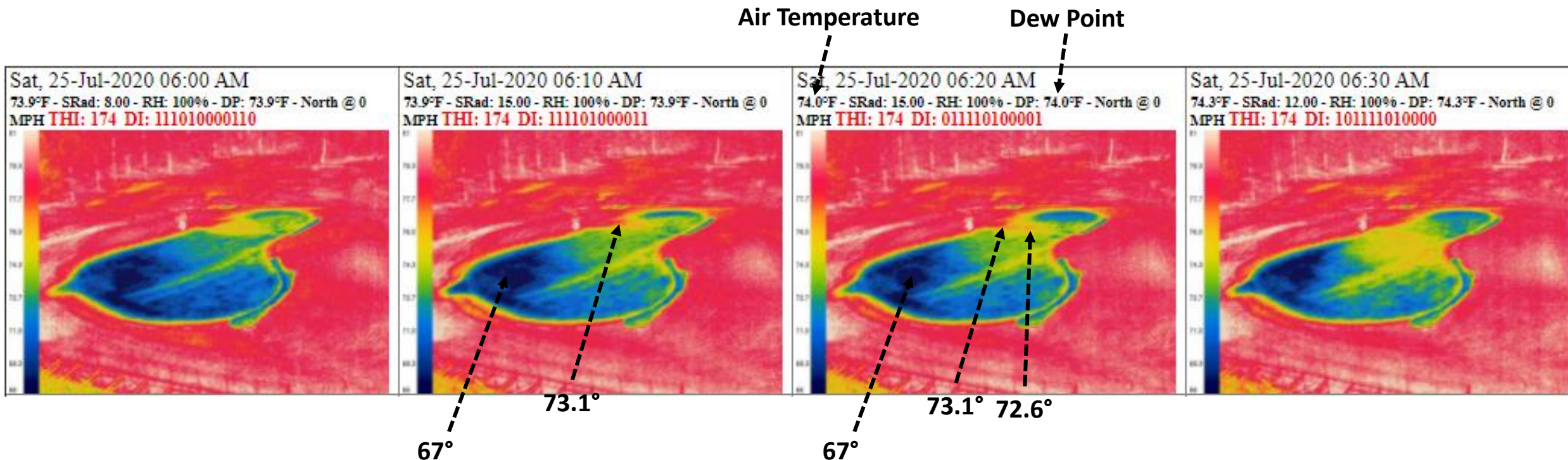
Typical Mid Atlantic Weather Station

Temperature (°F) Dew Point (°)

Using Fans & Hydronics

Both will cool turfgrass during the day.

During overnight and early morning, it will significantly increase disease pressure by increasing leaf wetness if not managed based on the ground temperature and the dew point.



Shows the unintended bad use of fan with hydronic cooling at night and into early morning.

The surface is cooled to well below the dew point by the hydronics and more humid air is added to the canopy by the fan.

This practice increases disease pressure by adding moisture (dew) to the leaf surfaces and into the thatch.

Fans

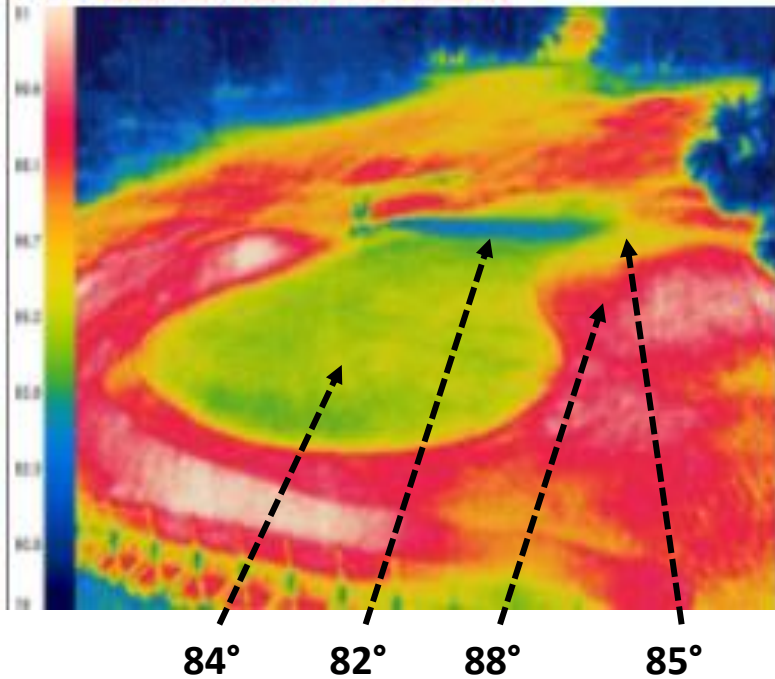
Measuring the Canopy Temperature to Determine Need During Sunny/Cloudy Days

Turfgrass temperatures are below 94° (start of photo respiration) stress is quickly recoverable.

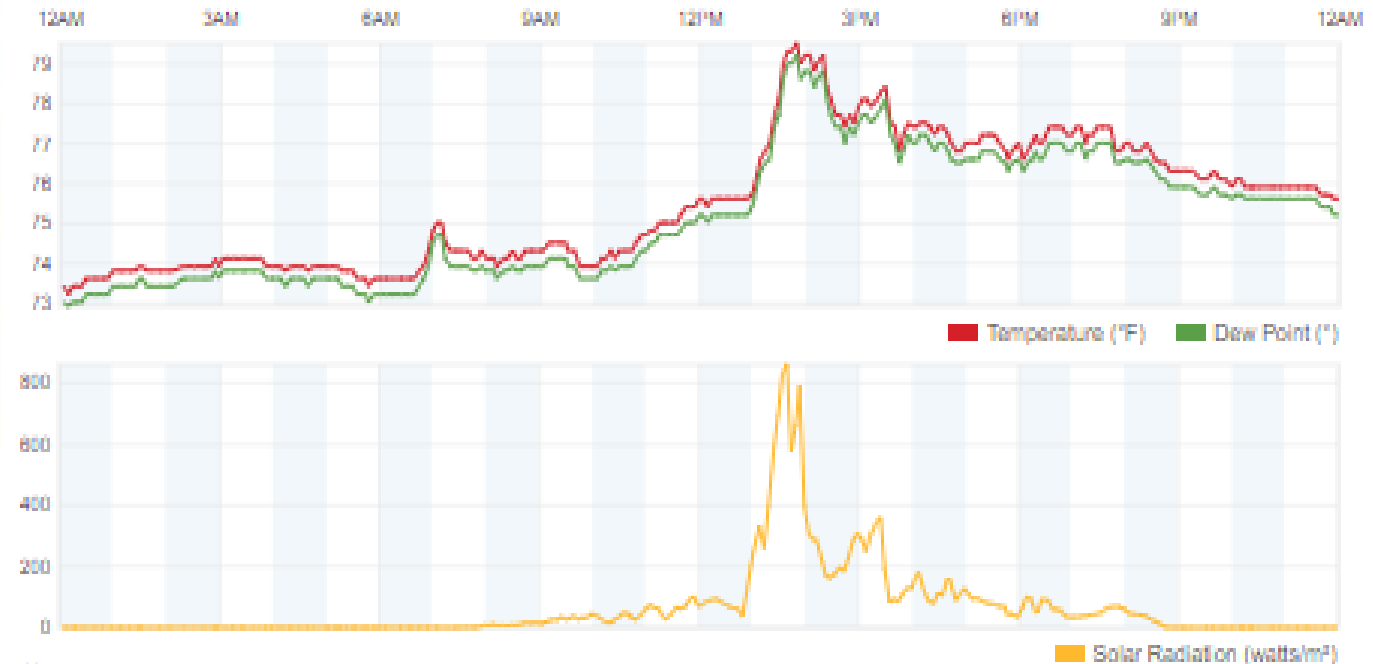
There is no need for a fan.

Using a fan this day is wasting electricity.

Tue, 07-Jul-2020 01:20 PM
 79.7°F - SRad: 199.00 - RH: 87% - DP: 75.5°F - EastSoutheast @ 0
 MPH THI: 167 DI: 000000011101



July 7, 2020



Fans

are **NOT FOR** mixing still & humid air

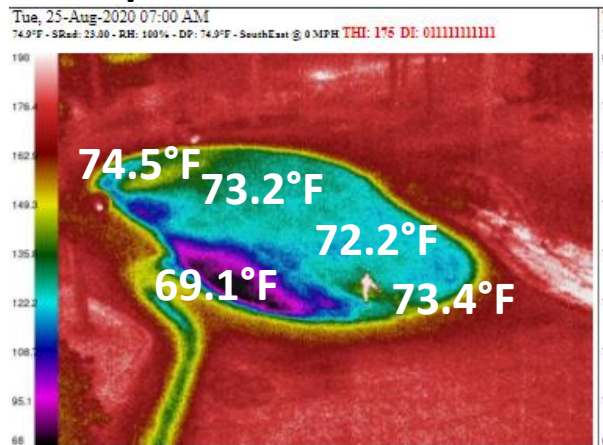
The fan breeze may mix the micro boundary layer above the turf surface, but it is mixing in the same high humidity air.

The breeze over the green does not change the air temperature, dew point, or pressure of the air blown on the turfgrass or just above it. It can change the temperature of the canopy.

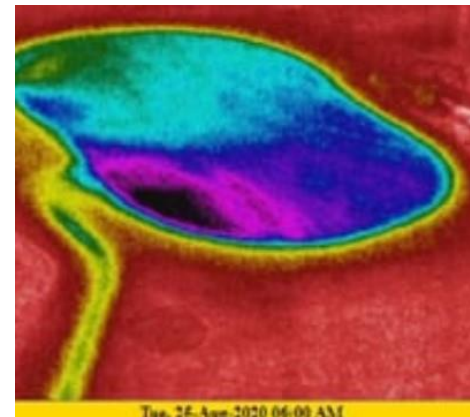
When the canopy temperature is cooler than the air temperature (typically at night/early morning) the fan breeze can increase the canopy temperature to ambient air temperature. There is a temperature increase where the breeze hits the canopy surface, and it brings more humid air to the surface. When the dew point temperature is greater than or equal to the canopy temperature condensation/dew will occur because that new moist air condenses quickly on the canopy that quickly returns to the cooler temperature as the breeze moves across it.

If the canopy temperature is less than 94° the fan isn't needed.

Air Temp = 74.9°F Dew Pt = 74.9°F

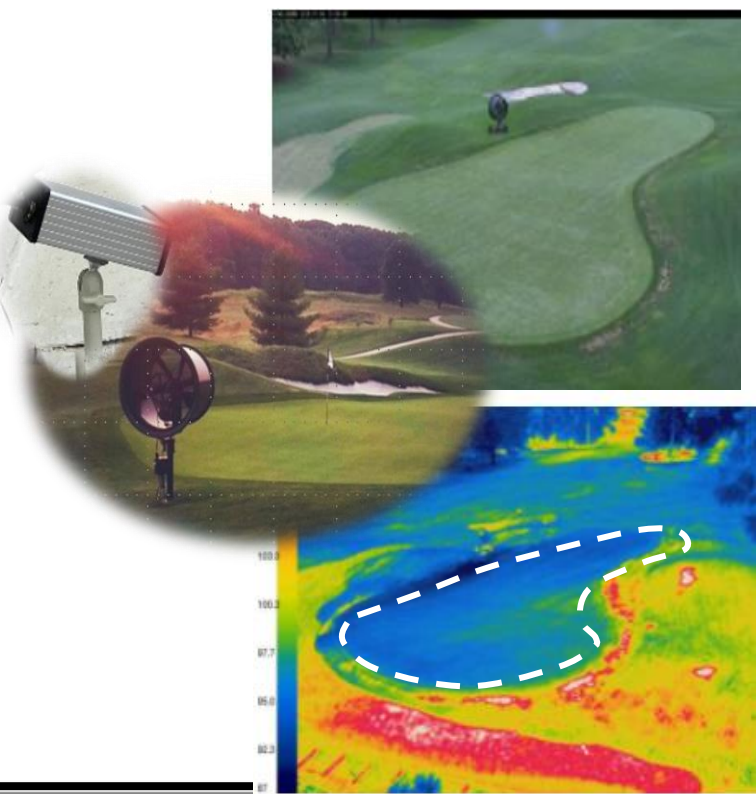


Blowing Humid Air



Using EYAS

to Measure Heat Stress & Actuate Fans



RnD-Cntr-Plot01 lab - Temperature Area: rnd-cntr:demo
Area Notification (New)

Criteria (1)

Trigger On: Dew Point-Canopy Temp (F)
 When: Greater Than or Equal To
 Value: -2
 Average value is maintained for: 30 Minutes (Value Period) ?

Schedule

Always Between (Time) Between (Solar)

Notify

Don't re-notify for at least 30 Minutes

Temperature - rnd-cntr:demo

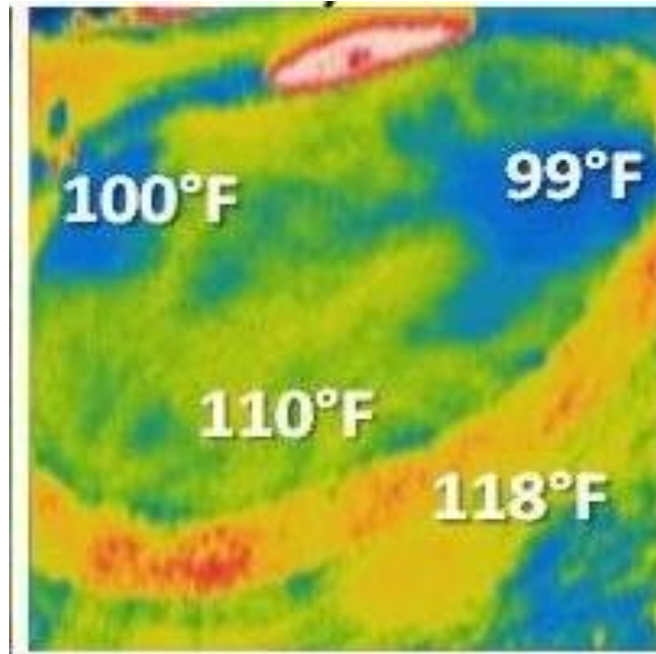
	Trigger On	When	Value	Value Period	Schedule	Notify	Re-Notify Threshold	Notify Subject	Notify Comment	Last Notification
Edit	Dew Point-Canopy Temp (F)	Greater Than or Equal To	-2	30 min	Always	j.etro@turf-vu.com	30.00 Min.	Dew Forming NO FAN		Tue, 18-May-2021 06:11 AM
Edit	Average Canopy Temperature (F)	Greater Than or Equal To	92	30 min	Always	j.etro@turf-vu.com	30.00 Min.	FAN ON		

e-mail & SMS text: Alert – FAN ON or NO FAN



Use fans when cool season turf needs it.

Measure the Turf.



**Daytime turfgrass temperature
> 94° F**

Save electricity, time, money.

Improve recovery from heat stress.

Save Turf.