Of Temperature and Turfgrass

BY KARL DANNEBERGER

Temperature is the driving force for all biological activity. It defines the optimum range for turfgrass growth. Turfgrass stress occurs outside those ranges. With summer temperatures upon us, I thought it might be a good time to look at the impact of temperature on the turf.

Solar radiation is the source of heat buildup in the turf, which helps explain why snow melts at temperatures below freezing on bright, sunny days. Conversely, the processes of transpiration and conduction/convection dissipate the heat from solar radiation, lowering the turf or canopy temperature.

We can predict turf canopy temperatures under various environmental conditions by using solar radiation, transpiration and conduction/convection. Listed below are common scenarios that occur during summer:

1. On a clear, sunny day, with no breeze (still conditions) and adequate soil moisture (for transpirational cooling), the canopy temperature will be 15 degrees Fahrenheit higher than the air temperature.

2. On a clear, sunny day, with a slight breeze (4 to 5 mph) and adequate soil moisture present, the canopy temperature will approximate the air temperature.

3. On a cloudy day with no breeze and adequate soil moisture, the canopy temperature will approximate the air temperature.

From the above scenarios, you can see the impact of solar radiation on canopy temperatures. Solar radiation can raise the canopy temperature 15 degrees F above the air temperature. On cloudy days with less solar radiation, the temperature of the canopy doesn't raise much above the air temperature.

The impact of air movement is extremely important in canopy temperatures. A slight breeze can reduce canopy temperatures by as much as 15 degrees F on sunny days. In research studies looking at the impact of fans on cooling turf, that 15-degree reduction is not uncommon.

In the previously mentioned examples, the assumption was made that soil moisture was not limiting and transpiration wouldn't be expected. In cases where soil moisture is limiting, the canopy temperature can well exceed 20 degrees F.

SOLAR RADIATION CAN RAISE CANOPY TEMPERATURE 15 DEGREES ABOVE AIR TEMPERATURE

Soil temperatures can greatly affect turfgrass health during summer heat. Soil temperatures are more important in determining the health status of turfgrass plants than air temperatures. When the average daily soil temperatures exceed 70 degrees F, the potential exists for a 50 percent loss/reduction in the root system of a cool-season turfgrass, such as creeping bentgrass.

The "70 degree rule" is a good indicator that once soil temperatures reach this level, management practices — especially mechanical practices — need to be adjusted for the fact that the turf is entering the summer temperature stress phase. By knowing the impact of soil temperature on root growth, we can introduce management practices to delay the onset of root decline. Coring prior to the stress period may delay the rise in soil temperatures. At this time, nighttime temperatures might still be relatively cool. By coring, the cooler night temperatures may delay the increase in soil temperatures.

On warm-season turfgrasses, soil temperatures that average 75 degrees F can help define the start of optimum growing conditions. For example, the establishment of hybrid bermudagrass by sprigging coincides with 75 degrees.

Managing turf under temperature stress is difficult during the summer. Temperature, however, is predictable and can provide us with a few hints of what it's doing to the turf.

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