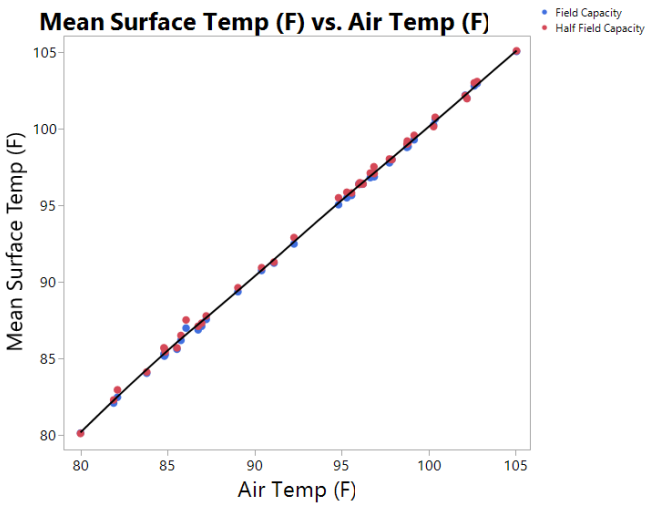
How hot is the turf canopy during the day?
August 10, 2017

Every sports fan has watched a sideline reporter on an artificial turf field during a hot game. The reporter usually has a big round thermometer to measure the air temperature above the field and is amazed by the high temperature reading. Some even carry a hand-held infrared thermometer to measure the temperature of the artificial turf. On a hot and sunny day, that temperature may exceed 140°F. So, how hot does a real grass area (field, green, lawn) get during the afternoon? The Turf-Vu Hawkeye system is helping understand this question.

How close is the surface temperature of natural grass to the air temperature?

It's been pretty close when the grass is not wilting. This year the canopy temperature has been within 1°F of the air temperature for June, July, and early August. On very sunny afternoons, it was closer to 1°F above, but the two had similar temperatures when it was cloudy in the afternoon. If the air temperature was 105°F then the canopy temperature was around 105°F. These observations occurred on an exposed creeping bentgrass green. Less than ideal growing environments can be quite different, especially with respect to air movement.



What effect did air movement have on surface temperatures?

Airflow had a large impact on surface temperature. Turf areas with limited airflow were warmer than highly exposed areas. For example, our research green from 2017 is elevated with great air movement. The green we used last season was at the same grade as the surrounding turf. That green was several degrees warmer than the air temperature. Add trees, shrubs, structures, or hills around a turf stand and expect even more heat to accumulate.

These observations continue to support good pruning and the use of fans to cool turf in the summer. Without air movement, high humidity settles over the turf and reduces evaporative cooling. We have all experienced this on a hot day. Your body would rather be in the wind on a hot and humid day than a stagnant and humid environment.

How does mowing height affect surface temperature and cooling?

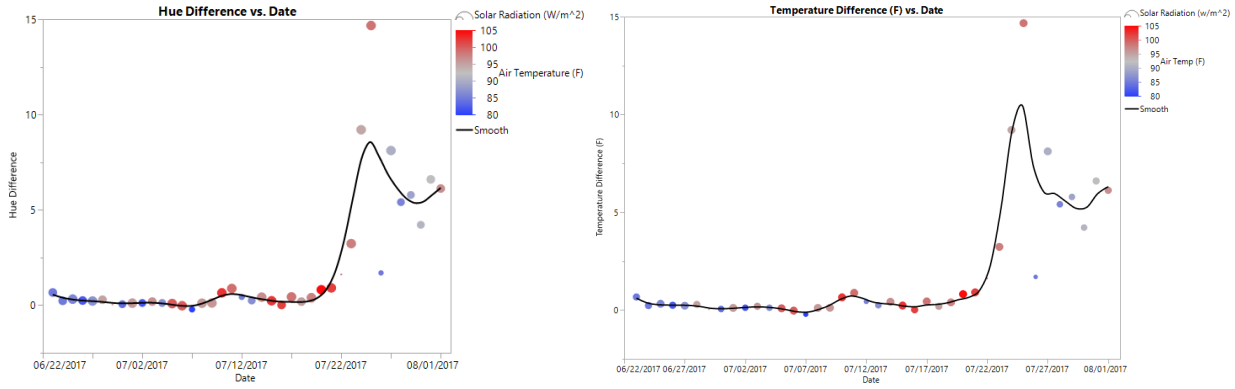
While we've only extensively studied greens height turf, we have looked at the surrounding fairway height creeping bentgrass and lawn height tall fescue areas. Generally, the lawn height turf was a few degrees cooler than the fairway turf which was a few degrees cooler than greens height turf. On cloudy afternoons, the different areas are all the same temperature.

Does the turf heat up as soil moisture is reduced?

If wilt is not visible, then our research suggests the answer is no. That is relative to both the ambient air temperature and the surface temperature of well-watered turf (near field capacity). Evaporative cooling is remarkably efficient and controlled by the plant. The only time we measured a big increase in surface temperature was when the turf began to wilt.

On our sand-based research green, the Turf-Vu Hawkeye system takes a visual and thermal image every ten minutes. The average temperature of each irrigation treatment was recorded from the thermal image. Hue, the numeric representation of color appearance, was also logged from within the visual image. We looked at the difference in hue and surface temperature of the plots at field capacity and the plots that were never watered this summer. There were no major differences between those two irrigation treatments from mid-June until July 21. During that time, the soil moisture content of the non-irrigation treatment was greater than 8% VWC. The well-watered treatment ranged from 15-20% VWC.

On July 22nd, when afternoon air temperature averaged 102°F, the soil water content of the non-irrigated plots dropped below 8% and wilt occurred. The hue difference and surface temperature differences spiked. That spike continued to intensify as the plots continued to dry-down. On July 25th, the surface temperature of the non-irrigated plots averaged 14°F greater than the surface temperature of the well-watered turf (which was similar to the air temperature at 99°F). That means the non-irrigated treatments had an average surface temperature of a lethal 113°F from 1-4pm.



These graphs show the difference in the color/hue (left) and surface temperature (right) of well-watered and never-watered turf. The surface temperatures spike above the temperature of the well-water turf only after visible drought was detected on July 22.

Our continued research with the Hawkeye system is revealing a lot of great information about how soil water content, irrigation management, and air movement impact turf temperature and water use rate. The ultimate goal is to develop an automated algorithm to calculate actual water use.

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