UNIVERSITY of RHODE ISLAND
Turfgrass Program
The College of the Environment and Life Sciences
Golf Course Superintendents Factsheet Series

Heat

Vol. 6, No. 2 September 2010

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According the to The National Oceanic and Atmospheric Administration, the period of May through July 2010 has officially been deemed the hottest 3 month summer period in the Northeast and the Southeast since records were started in 1895.

Figure 1. During the high extended temperatures of the past summer, heat stress, drought stress, insect damage and disease were extremely prevalent, result in significant amounts of turf damage.

For the past 115 years, a span of 4 human generations, no one has seen a hotter summer in our region. During July, Manchester NH saw sixteen 90 degree days (four more were 89 degree days). Hartford, CT saw two 100 degree days, thirteen 90 degree days and four 89 degree days. Providence, RI saw one 100 degree day, seven 90 degree days and four 89 degree days. And while July was certainly the peak of the summer-long heat wave, even the temperatures in May and June were much higher than average across the region. Without exaggeration, spending the summer in Rhode Island this year felt just like a normal year in North Carolina or Virginia. And as hot as it was here, the temperatures in the South were even higher. Richmond, VA saw six 100 degree days (two were 105) and seventeen 90 degree days (most of them above 95 degrees). Out of 31 days, 70% were 90 degrees or warmer.

All this talk about weather and temperature is more than just interesting; this information is absolutely critical in understanding much of the decline and damage that has occurred on turf throughout the East Coast this summer.

In describing the level of extreme temperature this summer, it is important to examine the duration of the heat wave. While New England frequently experiences 90 degree days every summer, normally those warmer days are mixed in with many 70 and 80 degree days. This year, it was not unusual to get 3-4 consecutive 90 degree days with a single day of cooler temperatures before the heat returned. In Hartford during July, there was at least one stretch with 7 consecutive 90 degree days. In Richmond, there was a 16 day streak of 90 degree days. In general, the more 90 degree days we have in a row, the more dramatic the decline in turf quality. As the summer got underway, many superintendents reminisced about the summer of 1988, heretofore the worst superintendent summer of all time. Without a doubt, the summer of 2010 has surpassed it as the hottest and worst summer in the Northeast for growing grass.

A second factor also needs to be considered and that is the manner in which soil heats up and holds heat. Soil is an insulator. It takes longer to heat than air and it holds heat longer. In fact, the radiation of heat back into the environment from the soil has a significant impact on air temperatures. What this means is that if the air temperature is 90 degrees, the soil temperature will be at least that high and probably higher. When temperatures drop at night, soil temperatures drop much more slowly. The consequence of this phenomenon is that during continual high air temperatures, plant roots are constantly experiencing even higher and more

consistently high soil temperatures. This is a major problem for turfgrass plants. Extensive research at Rutgers and other locations has demonstrated that turf quality and plant health decline rapidly as plants are continually exposed to 24 hour a day hot temperatures- exactly what happened this summer. The physiological reasons for this are complex but well documented.

A final factor to consider is humidity and rain. When the air is dry, plants move water from the soil and into the air through evapotranspiration. This process also moves nutrients through the plant and more importantly, cools plants down. This past summer, high humidity shut down evapotranspiration, causing plants to get even hotter than if humidity had been low. When evapotranspiration shuts down, water remains in the soil. This then pushes oxygen out of the soil. We often think that nitrogen is the most important nutrient. Actually, oxygen in the soil is the most important nutrient. Plants can go along time without nitrogen. When oxygen is pushed out of the soil, plants die rapidly- within a few days. With no oxygen in the soil, soil becomes anaerobic, roots atrophy and plants die. And this whole thing is complicated by watering. When roots die plants wilt. In order to prevent plants from wilting, plants must be syringed. This adds water to the soil, increasing the level of root atrophy. This cycle is particularly vicious and nearly impossible to escape.

Despite the tremendous heat experienced this past summer, not all golf courses faired poorly, a few courses even thrived. However, the most successful courses were almost always those on USGA sand greens, with excellent drainage, a high percentage of bentgrass, little play and a lot of luck. While it is entirely possible to grow grass on a putting green under less than perfect conditions (i.e. poor drainage, heavy soils, pocketed environments, excessive shade and primarily *Poa annua*), this is the year that marginal putting greens failed. In fact, the summer was so severe that courses in Massachusetts, Pennsylvania, Virginia and Georgia closed entirely for weeks at a time, some to simply recover and others to completely regrass.

While bentgrass generally did better than *Poa,* it was certainly not immune from summer related problems, including a new bacterial wilt of bentgrass, localized dry spots, take-all patch and bentgrass summer decline. But *Poa annua* took the brunt of the damage this summer from both heat stress and disease. Summer patch, bacterial wilt, nematodes, and anthracnose were rampant. More *Poa annua* greens were partially or entirely lost this year than in any previous year in the last ten. Other diseases were also common, including *Pythium* blight and brown patch, neither of which has a preference as to which host it attacks. And for the first time in my career, copper spot was widespread.

Figure 2. Fairy ring and localized dry spot were also common during the summer of 2010.

In short, the summer of 2010 was a summer most of us would happily forget. However, we can all take some of the lessons learned from this year and apply them next year, hoping for better weather. We should also never forget that every golf course superintendent is a farmer, a grower of grass. Despite all the tools we have available to grow and manage grass, we should remember that we cannot always overcome nature and are often subject to its whims.

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