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IDEAS IN PLAY

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# Bentgrass Summer Stress

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In the USGA Green Section Record, in national newspapers and on Internet sites the talk has been the summer heat and how it has influenced creeping bentgrass and *Poa annua* greens. Records were set across North America and into Europe for number of days above 90 and 100° F, number of days with low temperatures above 70° F, days with an average dew point above 70, days when the average wind speed was 10 mph or less, and days when the average soil temperature has been above 86° F. When all five of these factors occur at the same time, cool season grasses can no longer maintain their basic functions.

Turfgrass breeders have been working for 30 years to improve the heat and summer stress resistance of creeping bentgrass. Breeders have collected new germplasm from high stress environments and used stress conditions as part of the selection process. Significant progress has been made in stress resistance but additional new challenges have arisen as mowing heights have been reduced. Other factors that can contribute to struggling bentgrass include reduced aerification, use of certain herbicides and fungicides, reduced fertility levels and even growth regulators. *Poa annua* is even more prone to heat related problems than creeping bentgrass.

High soil temperature is the most critical factor in the decline of bentgrass and other cool season grasses during the summer. Multiple studies have shown that high soil temperatures, whether the air temperature is low or high, are detrimental to root growth. Research by Huang et al (2004) showed even a decrease in soil temperature from 95° F to 90° F at 0.125 to 0.157 inch cutting height maintained acceptable turf quality for L-93 and higher turf quality for Penncross over 21 days. Significant increases in tiller density, clipping yield and root number were observed when soil temperatures were reduced to 85° F. Cooling the soil at night was more effective than daytime cooling in maintaining turf quality. At high soil temperatures plant respiration increases and uses up the energy reserves of the plant stored in the roots and crowns. Young stands of bentgrass suffer more since they are more upright, have less leaf surface with less extensive crowns and stolons, so fewer reserves.

One of the most serious signs of extreme stress on creeping bentgrass were the many reports of Bacterial Wilt on multiple cultivars of bentgrass, including Penn A-1, Penn G-2, Penn A-4, L-93, and Tyee. Most pathologists at this time think that this wilt was a secondary pathogen that moved into already weakened plant. One of the best clues that this is a secondary pathogen was a report by the USGA of greens that did not have wilt where fans were cooling the surface and wilt was present on the rest of the green. Another example is Tyee with Bacterial Wilt on greens in the Southeast where there were 84 days above 90° F from June 1 to Sept. 1. The airflow was poor and heavy rains occurred and yet, the Tyee nursery from the same course was in good condition and was used to resod the damaged greens. Dr. Richard Latin of Purdue stated, “most reports seem to involve a few cultivars (Penn A-4, L-93) that

are more intensively managed. The likelihood that these varieties have a genetic susceptibility to infection or invasion by these bacteria is low." The intensive management under extreme conditions can put further stress on the plants. Fans and fan placement seem to be critical to bentgrass survival. During the summer on the Turf Disease Blog (www.turfdiseases.blogspot.com or the Turf Disease Facebook page) the pathologists came up with the equation: No Wind + Heat = Dead Grass. Fans and syringiing have been documented to be the best solutions for bentgrass summer stress, in addition to raising the cutting height and other management changes. Guertal and Han (2002, 2006, 2009) did a series of studies on using fans, syringing and irrigation to reduce the soil temperature of creeping bentgrass during the summer in Alabama. In the first part of the summer, using fans throughout the day reduced soil temperature but during the hottest time, it was beneficial to run the fans 24 hrs a day. Syringing or irrigation provided added benefit to using fans but were not as effective as fans alone. If no fans were used morning irrigation cooled the roots better than afternoon irrigation. Observations have shown fans are most beneficial if used in the direction of the prevailing wind and are helped by thinning brush or trees, especially to optimize this flow. It is critical to have sun in the mornings under these conditions since this is the time of day photosynthesis may occur.

The second equation the turf pathologists developed was: Rain + Heat = Dead Grass. The rain had the same effect as over-irrigation which can lead to scald or wet wilt. Scald occurs when you have standing water or overly wet thatch with sunny, hot weather. The water rapidly heats up and stays hot and the plant dies, with oxygen depletion playing a significant role. The death of roots in the summer increases the retention of water in this organic layer. Wet Wilt occurs when the roots, often already reduced due to heat, cannot absorb enough water for the transpiration. This causes the stomates to close, raising the internal plant temperature and the plant dies.

## Management Recommendations

1. Buy a Crystal Ball (Watch long range forecast to anticipate when the heat will come).
2. Core aerify before Memorial Day and regularly topdress before the stress period.
3. Prestress (moisture stress) the plants to grow more roots prior to heat stress.
4. Use a thermometer or sensor to monitor soil temperatures.
5. Raise your mowing height for more carbohydrates and more leaf area for transpiration and cooling and use solid front rollers as temperatures rise.
6. Use rolling to obtain desired green speed with higher height of cut. As growth decreases change to alternate mowing and rolling.
7. Remove brush or trees restricting airflow, especially from the prevailing wind direction or that block morning sun.
8. Use fans during the day during early summer and 24 hours / day when stress is highest. Make sure you have fans that cover critical areas and place with prevailing winds.
9. Venting the greens by using 1/4 inch spikes, slits or hydrojets every 21 days improves gas exchange, water infiltration and stimulates new roots.
10. Syring the greens with fine mist three times per day.
11. Prior to heat period use infrequent, heavy irrigation. During heat, irrigate in the morning if possible. Hand water if needed.
12. Cytokinin containing seaweed and humic acid extracts as well as certain fungicides can improve root growth and stress tolerance. Primo applications increase a bioactive cytokinin, but care should be taken that growth rebound does not occur.
13. Use foliar fertilizers with N and in particular K for growth and repair of injury.
14. Applied before stress some fungicide products have been shown to help reduce stress. Other fungicides, such as the DMIs (fenarimol, metconazole, myclobutanil, propicoazole, tridimefon and triticonazole), can cause thinning of bentgrass and further soil heating.
15. Spike and seed when the hottest part of summer is over but before soils cool too much.