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## 2012 Heat and Drought Stress Effects on Sports Turf Management

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The extreme heat and drought of the summer of 2012 is wreaking havoc on cool-season athletic fields across the nation. Even non-irrigated bermudagrass fields are entering dormancy in many locations. The bulk of problems clearly lie with bluegrass, ryegrass, and fescue fields. Persistent heat and moisture stress results in the grass becoming weakened to the extent that it becomes much more vulnerable to both mechanical and biological stress. The result is summer decline, which is a complex of individual factors that can interact to cause more summer problems than each individual stress acting alone.

Persistent daytime temperatures over 90 degrees, nighttime temperatures above 70 degrees, and humidity extremes (both high and low), have combined to place cool-season turf under significant summer stress across the country. The fact that these conditions have relentlessly persisted since mid-June has resulted in direct heat stress injury as well as making the turf more vulnerable to damage from other summer related stresses (e.g.; close mowing, traffic and wear, warm weather fungal diseases, poor water quality, poor soil drainage, poor air movement, insect damage etc.). As a result, heat related injury and the associated decline in turf quality is often a result of a complex of individual factors acting together. For this reason it is often difficult to get a handle on specific causes of summer decline. Put quite plainly, during a period of mid-summer heat stress like we have had since mid-June, the grass plants are more vulnerable to anything that can cause damage, i.e. damage from foot and mower traffic. During cooler times of the year these stresses are either non-existent or the grass is healthier and more tolerant to short-term stress periods. Besides air and soil temperatures, relative humidity has an important environmental influence on the plants ability to cool itself

through transpiration. At high relative humidity the plant is much less able to effectively cool itself and as a result is even more prone to heat buildup and direct heat injury.

Watering restrictions (and in some cases even bans) have also been put in place in many locations due to the extreme drought. In addition, some areas have been experiencing triple digit temperatures with low relative humidity and a daily ET rate of 0.3 to 0.38 inches per day. Sports turf managers are challenged to keep up with water requirements with and without restrictions and still provide safe playing surfaces. The importance of water quickly becomes realized from three perspectives: growth, safety, and economics. The first (and most logical) is that plants require water to sustain growth. The survival mode for turfgrasses is to enter dormancy under extreme moisture stress conditions and under non-trafficked, low input management regimes, grasses almost always rebound when cooler temperatures and fall rains arrive. But what about trafficked athletic fields where one likely has little control in restricting their use? This is a completely different situation and the traffic on these dormant fields can actually kill the turf by mechanical wearing of the leaves and crown.

A second and equally important factor for having water is the management of surface hardness of athletic fields. Think about it: if a field is hard, the quickest and most efficient way for us to reduce surface hardness is irrigation. One of the strongest arguments for permission (or waivers) to continue water use on athletic fields is field safety. Finally, consider the economics of losing a natural grass field due to lack of water. Loss of fields has significant costs in both direct re-establishment costs of sod, seed, fertilizer, etc., but also in the time that the field

## 2012 Heat and Drought Stress Effects on Sports Turf Management

is removed from use to allow for proper turf maturation. These situations lend themselves to the expanded use of synthetic turf, but remember that even these systems have significant limitations during extreme heat periods (discussed later).

Heat stress is not simply measured by monitoring forecast daily highs. Remember that standard meteorological weather data records temperature at 5 ft. above the ground and that temperatures at the turf canopy level will likely greatly exceed the recorded high. Air temperatures of 90 degrees Fahrenheit will likely result in canopy temperatures of 105-110 degrees Fahrenheit. Note that concerns with the heat are not only limited to natural grass systems – many artificial turf fields have (or should have) been rendered unfit for play because field surface temperatures have reached 160 degrees Fahrenheit levels during the day with several readings in the 170s during triple digit days. These temperature levels present direct health concerns to field users. In addition, high air temperatures are only part of the cause of reduced plant vigor. Prolonged heat stress significantly increases soil temperatures and soil temperatures greatly influence root growth, root health, and function. Spring high temperatures are less damaging since the root is in a cooler soil environment. As summer arrives the night temperatures are less cooling on the soil and soil temperatures rise. High soil temperatures result in less root production, rapid root maturation, and die-back. Above ground the turf thins and individual plants become more spindly.

A profile of each field site and its isolated microenvironments will involve a number of “inventories” as they relate to susceptibility to prolonged heat stress. Conditions and brief explanations of how they might influence summer decline of cool-season turf follows:

### **Cutting heights:**

Taller mowed turf will logically perform better than grasses being mowed at heights that are ideal only during periods of optimal growth. Unfortunately, this is not something that offers much hope for the summer of 2012 now that we are firmly in the stress period, but it is food for thought for next year! Raising those cool-season cutting heights as high as possible for field use prior to the stress period can greatly improve summer survival

prospects. Some recovery in cool-season turf is already being noted following spotty rain events, but remember that in many areas summer stresses will continue into September. Another observation during these stress periods is how competitive summer annual grasses such as crabgrass, goosegrass, and foxtail can be with just a little bit of moisture. These grasses will die at first frost and will then lead to invasion by annual bluegrass and other winter annual weeds. Make plans now to initiate reseeding of these damaged areas in late summer to early fall and adjust any plans for fall preemergent herbicide applications appropriately for seeding events. Stocking up on seed now may be a smart idea as there are hints of shortages for the fall.

### **Traffic Stress:**

Heavily trafficked areas have logically suffered during periods of summer stress. Traffic damage will be slow to recover with reduced plant vigor. Higher mowing heights will help in this regard. Plan on reseeding these areas as described above, and where traffic continues, continue to apply small amounts of seed throughout the playing season of the fall.

### **Public Perception and Maintaining Maximum Aesthetics/Playability:**

The public ‘expects’ green grass 12 months out of the year on yards, athletic fields, golf courses etc. That obviously is not possible even in an ‘ideal’ growing season in most locations. Seasonal environmental conditions will often dictate what should and should not be done to the grass to maintain its ‘aesthetics’ and its ‘playability’. Don’t get hung up on delivering a ‘pretty’ field. Instead, focus on delivering a safe field for your clientele. This takes much education on your part. Consider that if you are losing the cool-season turf battle on a regular basis that you might want to discuss the possibilities of installing some bermudagrass athletic fields, at least for your predominantly summer to mid-fall sports. This has been a major point of emphasis in the transition zone. The fall season will provide the opportunity for significant cool-season turf recovery and the memories associated with the summer of 2012 will slowly fade, but this now marks the third consecutive summer that has been described by sports turf managers as ‘extremely difficult’ in growing cool-season athletic fields in the transition zone. There

## 2012 Heat and Drought Stress Effects on Sports Turf Management

is no easy answer in a transition zone climate and a turf management program should be flexible to “ebb and flow” with the vagaries of seasonal weather.

### Irrigation:

As a rule of thumb, continue to irrigate deeply and frequently (1” of water per week is a fairly standard guide, but it obviously can vary depending on your location) if you have been irrigating this summer. If a turf manager intends on applying sufficient irrigation to maintain a vigorously growing turf, they may want to consider applying enough moisture to match evapotranspiration rates (ET). Matching ET may help take the guesswork out and improve irrigation efficiency. ET may be the most easily found in conjunction with local weather stations or possibly local irrigation companies. If you are in an area of very high evapotranspiration rates, areas may require an added 2 inches or more of water per week to keep up with plant water losses. Irrigate early in the morning in order to reduce leaf wetness periods (i.e. reduce disease infection periods) and ensure your system is applying water efficiently (check heads and nozzles for application pattern, ensure water is not running off the soil, etc.).

If you have not been watering, apply no supplemental irrigation (i.e. allow the turf to remain dormant), try to restrict traffic as best you can, and wait for more optimal growing conditions this Fall.

### Summer Diseases and Insect Pests:

*Rhizoctonia* Brown Patch is most active under warm day temperatures and warm nights (>70 degrees). Heat stress weakens plants and they can become more susceptible to disease activity at a time of year when the disease pressure is the greatest. Fungicides are often applied more frequently and at higher rates in an attempt to control the pathogens. Anticipate grub problems to be exacerbated on weakened turf and be prepared to address significant activity of fall armyworms and cutworms during late summer. On dormant turfgrasses, many managers will not realize they have a grub issue until cool season grasses recover in the fall. Consult your state’s cooperative extension service pest control guides for pest management recommendations.

### Weed control:

In general refrain from chemical weed control treatments during summer stress periods, especially on cool-season fields. Weeds must be actively growing for control and the turfgrass usually must be actively growing in order to tolerate the application. Applications of standard preemergent herbicides can be made this fall for the control of winter annual weeds, but remember that most of these products will also control any grass seed applied during renovation. If your turf is heavily infested with perennial broadleaf weeds (things like clover, dandelions, plantains, etc.), Fall is an ideal time to control these pests. Keep in mind that most broadleaf herbicides have re-seeding intervals of 3 to 4 weeks if applications are made prior to seeding.

### Soil Aeration:

The soil must be well aerated for plants to remain healthy. Soils that become sealed off at the surface as a result of compaction will impair root growth and function and reduce the ability of the turf to cool itself. Compacted soils will not readily absorb water and it can make efforts at irrigation difficult. Tight soils, once wet, can often stay wet too long. If soil moisture conditions are adequate, bermudagrass fields can still be core-aerated this summer, but be wary of extending significant aeration (or vertical mowing) events too late into the summer growing season if you are in an area where cool weather arrives early. For cool-season grasses, plan on utilizing core aeration to improve physical soil conditions this fall, and tie the aeration event to seeding or liming (as indicated by soil testing) applications. Also, topdressing native soils with ¼ inch depth of a quality compost or soil conditioner in conjunction with a core aeration event can further improve physical and chemical soil conditions.

### Fertilization:

Conduct a soil test if it has not been performed for the past 3 years. There are numerous private labs that offer this service or you might work with your land grant university if they have a soil testing lab. If irrigation or rainfall events are adequate, there is still time to benefit from summer fertilization of bermudagrass fields. Keep these fields actively growing with N fertilization, but reduce levels as cooler temperatures arrive in order to prepare the grass for winter dormancy and reduce possible

## 2012 Heat and Drought Stress Effects on Sports Turf Management

environmental concerns. As a rule of thumb, apply no more than 1 lb of N/1000 sq ft per growing month and when cooler conditions arrive, research in Virginia has found that reducing N levels to 0.25-0.5 lb N/1000 sq ft every 2-3 weeks on bermudagrass fields in early to mid-fall is a responsible way to both sustain bermudagrass growth and not increase winter damage potential. Fall is the ideal time to benefit from nitrogen applications on cool-season grasses, and after a stressful summer, it is an important part of a field recovery program. During the shorter, cooler days of fall, cool-season turfgrasses devote much of the food they produce in photosynthesis to root systems and storage for later use. Depending on the grass and the expectations/uses of the turf, up to 3 lbs N/1000 sq ft total might be applied during the fall months of September, October, and November. Apply fertilizers that deliver no more than 1 lb of N/1000 sq ft/month. Apply no more than 1 pound of water soluble N per 1000 sq ft in a single application, and when possible, split the application of water soluble fertilizer into two 0.5 lb N increments. Use phosphate-free fertilizers (example 32-0-10) if soil tests indicate no phosphorus is needed. And be sure to keep all fertilizer off hardscapes in order to protect water quality.

In conclusion, summer heat and drought injury is complex. However, one difference is that we notice the decline as it happens and try to respond in an appropriate manner. Maintaining turfgrass responsibly throughout the year (proper mowing, irrigation, fertilization, aeration, etc.) will assist in handling summer stress. I hope this information helps regarding the complexities of these stresses and the potential interactions involved. Please utilize the other resources available on the STMA website to assist you in delivering a safe, aesthetically pleasing playing surface.