TOPICS COVERED

WEATHER

Summer begins… can Fall be far behind?

The summer solstice, our longest day of the year in the Northern hemisphere, occurred on 6/20/2008. For many turf managers, the 91 days until September 22 (the autumnal equinox and the beginning of Fall) will slip by all too slowly.

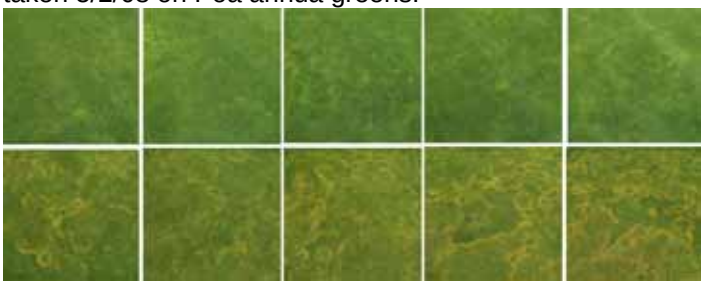
The PACE Member website (www.paceturf.org) has extensive archives that contain information on management practices, weather and even communication tools that help explain summer stresses to golfers. And your PACE Weather Update will keep you on top of forecasts of weather, turf growth, nitrogen demand and pest outbreaks.

DISEASES

Brown ring patch (Waitea) and nitrogen: a surprising benefit

Results of our now-completed brown ring patch (BRP or *Waitea circinata*) trial (which we conducted with investigators Frank Wong and Chi-Men Chen of UC Riverside), shows that BRP symptoms are very successfully suppressed by application of nitrogen, as Figure 1 shows.

Figure 1. Brown ring patch suppression with nitrogen. Top row of photos treated with ammonium sulfate (0.5 lb N/1000 sq ft) on 4/7 and 4/21/08. Bottom row were not treated with nitrogen. No fungicides were applied. Photos taken 5/2/08 on Poa annua greens.



While the poa that was treated with nitrogen showed little or no signs of disease for most of the trial (the maximum % disease was less than 10%, but more frequently hovered around 2-3%), the untreated plots were eaten up by disease, exceeding 30% disease ratings on some dates. These results were seen with all 3 nitrogen sources tested — ammonium sulfate, calcium nitrate and urea. Urea produced a somewhat faster drop in disease symptoms. But by the end of the trial, all nitrogen sources produced similar results.

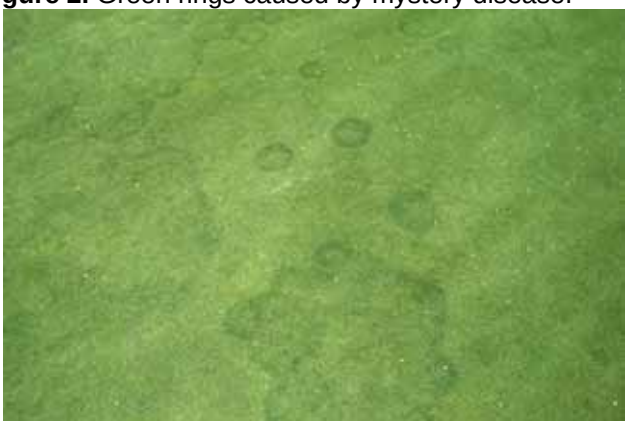
These results are impressive because what we are seeing is that applications of nitrogen were as powerful as a fungicide application for suppression of this disease. While we don't yet know the mechanism responsible for this, application of nitrogen (weekly application at 0.2 lbs N/1000 sq ft) is a no-brainer if you are suffering with BRP.

Thanks to cooperators Wayne Carpenter and Jon Maddern (Torrey Pines GC) for generously making the poa greens on the North Course available for research.

Mystery disease

Though we have diagnosed thousands of turf disease samples over the years, we have been confronted this summer by symptoms that we have never seen before, nor are they described in any of the turf pathology texts.

Figure 2. Green rings caused by mystery disease.



The host is Poa annua on greens in the San Diego area. In our first look at the problem, we saw the green rings shown in Figure 2 above showing up following fungicide applications that were made to control brown ring patch (*Waitea circinata*).

An application of Heritage (azoxystrobin) failed to control the rings, and seven days after the Heritage treatment, the turf began to discolor. When we examined the diseased turf in the lab, we saw loads and loads of black sclerotia* in the thatch, as well as on the foliage, and even completely surrounding the stems (Figures 3-4). Leaves of some plants in the affected patches had a curious banding pattern (Figure 5).

When we canvassed the APS Turf Disease Working Group (a listserv of turf disease researchers and diagnosticians from around the US), we got back lots of

comments, including "How exciting! You guys in California have all the fun!" to "WOW!", but the group was as puzzled as we were.

Figure 3. Sclerotia form in thatch

Figure 4. Sclerotia form on foliage and stems as well

Figure 5. Leaves have a curious banding pattern.

Dr. Frank Wong at UC Riverside has taken the lead to sort out this interesting development, and will be looking into whether this represents a new disease, or simply different signs and symptoms of an already-described disease.

*Sclerotia (sclerotium is the singular version of this word) are structures produced by some common pathogens such as: *Sclerotium* (southern blight), *Rizoctonia* (brown patch), *Waitea circinata* (brown ring patch), *Poculum*, *Rustromia* (dollar spot) and *Sclerotinia* (dollar spot - old genus). Sclerotia consist of a mass of fungal mycelium that is compacted and hardened, and that can survive adverse conditions.

Improved Pythium prediction

Thanks to those of you who responded to our request for information on the timing of Pythium at your location. There were two examples that we thought were particularly enlightening.

Figure 6. Pythium outbreak on overseededturf. Areas not treated with Heritage (azoxystrobin) and Subdue (mefenoxam) at the time of overseeding were trounced by Pythium at this Palm Springs, CA area golf course. The green and portions of the surrounds were treated, and were disease-free. The heavy watering schedule required for overseeding provided sufficient humidity to spur the outbreak, even though relative humidity in this desert climate was low.

David Major, CGCS (Shady Canyon Golf Club) manages ryegrass fairways a few miles from the Southern California coastline. He reported a Pythium outbreak on June 23, 2008 . Symptoms were seen the day after a leaching event, and occurred primarily in swales and low spots. When we looked on the PACE Turf website at David's Weather History, we saw several days of conducive weather (maximum air temps greater than 85F or 29C and maximum relative humidity greater than 90 %) starting on June 18 —five days before Pythium symptoms were noticed. The leaching event at Shady Canyon no doubt accelerated the symptoms.

A different situation was described by Gerry Tarsitano, CGCS (The Hideaway), who manages turf in one of the hottest and driest locations in the U.S. — the Palm Springs area. Following the fall overseed of his bermudagrass fairways last September, he saw symptoms of Pythium on areas of turf that had not been preventively treated with azoxystrobin (Heritage) and mefenoxam (Subdue) (see Figure 6). Temperatures were nice and high (well over 85F/29C) throughout September of 2007, but relative humidity never got higher than about 60%. Low humidities are expected for desert areas, but why did Pythium strike, then, if it was so dry? The answer, of course, has to do with overseeding, and the high volumes of water that are

necessary to insure survival of ryegrass seedlings. In other words, frequent irrigation supplied the humidity that Mother Nature did not, and Pythium in the desert was the result.

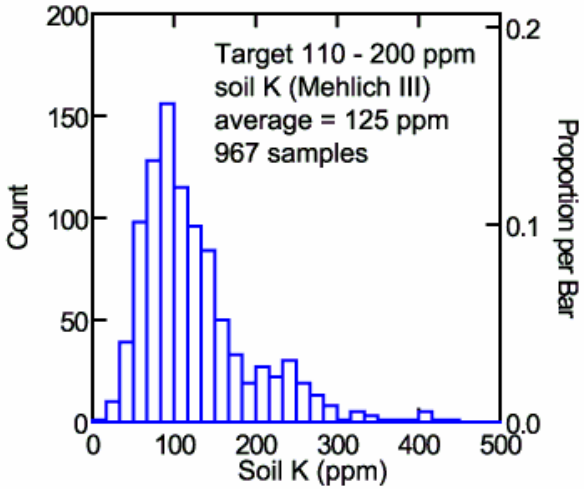
There are a few take-home messages that these examples highlight. First, that there is a fairly consistent weather pattern (3 or more consecutive days of maximum air temps greater than 85F/29C and maximum relative humidity greater than 90 %) that gives rise to Pythium within two weeks of its occurrence. And secondly, that although weather patterns are very important in forecasting disease, they are not the only factor to consider. You will need to incorporate the specific cultural conditions at your location (irrigation patterns, tournament preparations, etc) in order to get the most accurate forecast possible.

CULTURAL PRACTICES

How important is potassium?

Some of you have heard Dr. Frank Rossi of Cornell University speak on the topic of potassium as a supplemental fertilizer, most recently in the "Rossi's Rants" video on Turfnet. Rossi feels that potassium is seriously over-used on golf courses, and that in most cases it is not necessary to apply it at all.

Figure 7. The average soil potassium level seen in PACE's database of soil samples from 967 good performing greens is 125 ppm. Based on this data and on results from paired soil and tissue studies, the PACE soil guidelines target 110 ppm soil potassium.



Our data suggests otherwise, however. While we agree with Rossi that potassium (or any other nutrient) should not be applied unless it is needed, there is strong evidence that it is indeed needed, for both high quality turf and for disease suppression on greens.

At PACE, we base our soil nutrient recommendations for sand based greens on soil survey data collected from across the country. Based on analysis of 967 soil samples, we have found that good performing greens are characterized by soil potassium levels that ranged from 110 to 200 ppm (using Mehlich III soil extraction for calcareous or sand based greens), as Figure 7 shows. This is a strong piece of evidence that potassium is indeed required for good turf performance. But where in that range of 110 to 200 ppm should we be targeted?

To answer that question, we conducted a paired test (193 soil and tissue samples) that looked at the relationship between potassium in the soil vs. potassium in plant tissues. We found that when soil levels were lower than 110 ppm, soil potassium and tissue potassium levels were correlated. In other words, when soil potassium went up, so did tissue potassium. However, when soil potassium levels were higher than 110 ppm, there was no correlation. In other words, if your soil potassium is higher than 110 ppm, you can keep shoveling on the potassium if you want, but it won't have any positive effect because the tissues already have all they need. Based on these studies, we target 110 ppm potassium (using Mehlich III soil extraction for calcareous or sand based greens) in the PACE soil guidelines.

How often should potassium be applied? Since potassium is an easily leachable element, it does not remain in the soil after a leaching rainfall or leaching irrigation. For this reason, when turf is actively growing, we suggest monthly applications of potassium on greens at a rate of 1 lb potassium per 1000 sq ft.

Finally, onto the topic of the role of potassium in disease control. A study from Cornell indicates that high rates of potassium resulted in a snow mold attack. This study has not yet been repeated, however. On the other hand, there have been repeated studies from the University of Arizona and Clemson University showing that potassium applications can help plants resist rapid blight attack. Can both observations be accurate? Certainly they could. But we would like to see the snow mold observations repeated before steering people away from what looks like a beneficial nutrient.

The bottom line? There is enough evidence supporting the positive effects of potassium to convince us that targeting 110 ppm in the soil is still a very good idea. If more data becomes available on its negative effects, we will certainly re-evaluate this position.

Surface hardness and bermudagrass greens

Maintaining the desired level of firmness on putting greens, day in and day out, is one of many demands faced by superintendents. We have written about the issues involved in managing firmness on cool-season greens. Now, Mississippi State University researcher Herbert Philley and colleagues have explored this

question on bermudagrass greens with their study, "Surface hardness varies with bermudagrass cultivar".

Table 1. Surface hardness of bermudagrass greens. Data from a study by H. Philley et. al., Mississippi State University, 2007. Firmness was measured in units of gravities (g) with a 2.25 kg Clegg soil impact tester. The higher the "g" level, the firmer the surface. In our experience, firmness levels of 70 - 125g are optimal.

Bermudagrass cultivar	Hardness (g)	Thatch thickness (mm)
Midlawn	103.5	9.1
Ashmore	99.5	11.1
Tifway	92.5	13.7
Mowhawk	89.9	14.1
Tifsport	89.5	10.6
Arizona Common	88.5	12.8
Sunstar	87.9	15.0
Yukon	86.7	10.7
Premier	85.3	17.6
Patriot	85.2	14.6
New Mex Sahara	84.9	14.8
Panama	84.2	14.9
Sundevil II	82.9	10.3
Princess 77	80.3	15.2
Riviera	79.7	17.1
Southern Star	79.4	17.7
GN1	78.0	16.9
Transcontinental	73.4	16.6
Aussie Green	70.4	22.3
Celebration	70.1	25.0
MS-Choice	64.2	19.1

The researchers looked at 21 different bermudagrass cultivars (mowed at greens heights) over a period of two years, and found big differences in firmness among them, as shown in the table above. When they explored the reason for these large differences, they found that thatch thickness was closely related to surface hardness among the different cultivars— the thicker the thatch, the softer the surface.

The bottom line? As always, it is critical to manage soil moisture, organic matter and thatch. In addition, when selecting a new turf type, keep in mind the different turf varieties can vary significantly in their production of thatch and therefore in surface hardness characteristics, and choose accordingly.

Knowing about Nostoc

We don't run into this problem every day, but every once in a while we receive a greens sample that is suffering from the cyanobacterium (blue-green algae), *Nostoc*.

Figure 8. Bentgrass colonized by *Nostoc.* At right, a close-up of the gelatinous bubbles that this microbe forms.

Usually, when we talk about cyanobacteria, we are warning you about *Oscillatoria*, which is much more common on bentgrass, poa and bermudagrass greens. But occasionally, the closely related *Nostoc* pops up.

Nostoc has the unusual —and for turf managers troubling— habit of forming large, slimy colonies that look like gelatinous bubbles, something like tapioca (we have read that in some Asian countries, Nostoc is cultivated and eaten, but that is another story). These colonies will seem to suddenly appear after a rainfall. The truth is, that the cyanobacteria were present before the rain, but that the excess water caused them to re-hydrate and swell into their characteristic jelly-like forms.

Nostoc is ubiquitous, and is found in almost any environment that you can think of. So, why does it only take over a green occasionally, while at most other times it is kept at bay? Our best guess is that it emerges as a problem only in areas where poor drainage or over — irrigation occur. It is also likely that over-use of organic fertilizers will promote *Nostoc* growth. Under normal conditions, however, these organisms cannot gain a foothold, since turf out-competes it for moisture and light.

If you are unfortunate enough to be dealing with *Nostoc*, your first step should be to address the reasons behind the wet conditions that are allowing it to thrive. Stopping the use of organic fertilizers will probably assist in quelling the infestation. And products such as chlorothalonil (Daconil) or mancozeb (Fore) may help in knocking the numbers back.

PACE Highlights features turf management information recently covered in PACE's weekly Updates. For more detailed information and electronic links to background materials, visit the PACE Member Edition website at www.paceturf.org.