Clark Talks Turf

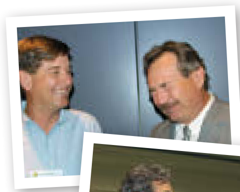
TIMELY TURF ADVICE

Tips for the Best Performing Winter Overseeded Turfgrass

David Kopec, Ph.D., Professor of Turfgrass Science at the University of Arizona shares his tips on providing high performing overseeded turf gained from years of experience conducting research and observing overseeded turf performance on numerous golf courses.

Q Winter overseeded turf should be performing its best right now. What options are there for thin or weak areas of overseeded turf? Weak areas can be seeded with pregerminated seed. By pregerminating the seed, superintendents will gain about two weeks in improving the weak area compared to using non-pregerminated seed. Pregerminating the seed can be done by soaking the seed in water overnight. Then on the following day change the water at 8 a.m., noon and 4 p.m. Let the seed soak overnight again. Right away on the following morning, put the soaked seed in a pyramid-like pile on the floor in the maintenance facility, and out of the sun. Turn the pile every few hours during the day. Let the seed dry for one more day before spreading. The soaked seed will double in size and should be spread before the root shows.

Q What are the symptoms that overseeded putting greens need fertilization? If the putting green shows several shades of green in irregular patches throughout the green, nitrogen is likely needed. Fertilize with up to 0.25 pounds actual nitrogen per 1,000 square feet and observe the response. Be careful not to exceed 0.25 pounds actual nitrogen per 1,000 square feet or the ball roll distance (green speed) will decline.



If the turfgrass is dark green but growing slowly, and you see purple on the underside of the leaf, phosphorus is most likely deficient. Use a phosphorus only fertilizer and apply approximately 0.5 pounds actual phosphorus per 1,000 square feet.

A potassium deficiency will appear as orange-bronze colored leaf margins, particularly near the tips of unmowed leaves. Potassium sulfate (K_2SO_4) can be applied (at 0.5 pounds actual K per 1,000 square feet) to address the potassium deficiency.

If you observe that the youngest leaves and leaf tips are bright yellow, and the older leaves are dark green, an iron deficiency is occurring. Ferrous sulfate ($FeSO_4$) applied at 6 ounces of product per 1,000 square feet (same as 16 lbs. product per acre) should solve the iron deficiency.

A chelated iron source can be applied before an important event to enhance green color and an application of iron will also enhance the stripping effect from the mowing pattern.

Q What about controlling weeds in the non-overseeded dormant bermudagrass roughs? In cooler weather, annual bluegrass and scattered plants of perennial ryegrass can be controlled using Round-up, or other products that contain glyphosate, Scythe (pelergonic acid) or Reward (diquat). In warmer weather, one of sulfonated urea herbicides can be used to control annual bluegrass, perennial ryegrass and depending on the herbicide applied, some broadleaf species.

Q Is traffic control necessary on overseeded turfgrass? In certain situations such as short par three holes where space is limited and other spots where traffic is confined to a small area, signs, painted lines and ropes are necessary to protect the turfgrass. Even though the overseeded grass is growing rapidly, traffic concentrated in a confined area will wear out the overseeded grass.

Q What grass should I manage for right now on my greens overseeded with a mixture of Poa trivialis and perennial ryegrass? Definitely manage for the *Poa trivialis*. To maintain ball roll distance and firmness, use a combination of grooming, brushing and light topdressing to get the *Poa trivialis* to provide ideal putting conditions. Don't over-fertilize which will make aggressive verticutting necessary. This will detract from playing conditions and top playing players won't like that. ■

Clark Throssell, Ph.D., loves to talk turf. He can be reached at clarkthrossell@bresnan.net.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Nutrient Interactions in Turf Management II

A closer look at the cell walls surrounding the protoplasts of plant cells. *By Richard J. Hull & Haibo Liu*

SECOND IN A SERIES

In the first article of this series (Hull & Liu 2010), we introduced nutrient interactions in turf management from a compartmental perspective. The balance among nutrient elements can be considered as it occurs within the soil, especially soil solution, in the root cell wall volume (apoplast) and within interconnected protoplasts of plant cells (symplast). Nutrient composition and pH of the soil solution are most influenced by cations occupying the cation exchange sites on mineral and organic soil colloids. The interaction of the cations K^+, Ca^{2+}, M^{g2+} and H^+ with exchange sites in determining the solute composition of the soil solution was discussed.

In this article, we will consider the interaction of mineral nutrient ions within the cell wall phase of plant roots and how it is influenced by the composition of soil water.

Nutrient interactions in the root apoplast

The cell walls surrounding the protoplasts of all plant cells constitute a nonliving space that extends throughout plant tissues and provides a route by which water-soluble nutrient ions can be transported throughout a plant especially from roots to shoots. This transport route is referred to as the apoplast to distinguish it from the network of interconnected living protoplasts (symplast) through which solutes also can move. In roots, the apoplast of epidermal cells is literally bathed in the soil solution that contains all nutrient ions on which the plant depends to support its growth and well-being. The apoplast is composed of cellulose macrofibrils imbedded in a matrix of gel-like hemicelluloses. Both of these components are long-chain polymers of five- or six-carbon sugars and some sugar acids that are all highly hydrated. Thus, the apoplast constitutes a hydraulic continuum from soil water throughout the cell wall volume of the roots.

This cell wall network contains pores of free water through which solutes can pass. The size of these pores varies with plant species, but the maximum values are in the 5.0 nm (nanometer = 1 billionth of a meter) range. By comparison, a hydrated K^+ has a diameter of 0.66 nm, Ca^{2+} = 0.82 nm and a sucrose molecule

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Think Ahead.

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= 1.0 nm. Consequently apoplastic pores offer little size restriction to the free movement of nutrient ions or small metabolites. On the other hand, larger molecules such as metal chelates, nucleic acids, proteins and viruses would encounter substantial resistance or be restricted completely from moving through cell walls (Marschner, 1995).

The middle region of a cell wall between adjacent cells is known as the middle lamella and consists of pectins (polymers of galacturonic acid). Depending on the pH of the apoplastic aqueous phase, the carboxylic groups (organic acids) will lose a H^+ and become a negatively charged cation exchange site that can ionically bind with any cation.

These exchange sites preferentially bind Ca^{2+} and Mg^{2+} ions in preference to monovalent cations (K^+ & Na^+) much as soil cation exchange sites do. Calcium ions especially can bind with carboxyl anions on adjacent pectin polymers, thereby stabilizing the structure of the first-formed cell walls, the middle lamella.

This is recognized as a major function of Ca in plants (Carrow et al., 2001). Since divalent cations are preferentially bound to exchange sites, monovalent cations (especially K^+) remain comparatively free in the apoplastic solution at a higher concentration than in the soil solution. The presence of cation exchange capacity (CEC) in cell walls causes anionic nutrients (NO_3^-, $H_2PO_4^-$, SO_4^{2-}) to be repelled and become less concentrated than cations in the apoplast water.

The cell wall CEC in grasses is about half that of dicotyledonous plants (Marschner, 1995). Thus, the cation concentration within the apoplast of grass roots is less than it is in other plants, nutrient anions will be slightly more concentrated and the negative binding sites on ion transport proteins on the cell's plasma membranes will have less competition from apoplastic CEC for cationic nutrients.

Nutrient ions move within the soil toward root surfaces and into the apoplasm with the flow of soil water drawn to the roots to replace that lost from plant leaves via transpiration. This mass flow of water to roots, of course, operates mainly during daylight hours when leaf stomata are open and transpiration occurs.

The absorption of some nutrient ions by root cells is sufficiently rapid that a depletion zone occurs at the root surface creating a nutrient concentration gradient between the root surface and the bulk soil solution. Such a gradient provides the energy for the diffusion of nutrient ions toward the root. Diffusion is most likely to be important during times of darkness when mass flow is minimal. Highly mobile readily absorbed ions such as K^+ and NO_3^- are most dependent on diffusion as their delivery mechanism to turfgrass roots.

Carrow et al. (2001) make a strong case for the interaction of NO_3^- and K^+ in turf nutrition. Even though they have opposite charges, both NO_3^- and K^+ are comparatively free within the soil solution and thus are subject to leaching during heavy rain and excessive irrigation. They are also readily absorbed by grass roots, translocated to leaves and are lost when clippings are removed. Thus, they recommend that both nutrients are most efficiently applied during times of greatest demand (rapid growth and recovery from stress) by numerous light fertilizations often known as "spoon feeding," particularly for sand-based turf such as most putting greens and newly built sports fields with a low soil CEC.

However, Woods et al. (2006) tested the effectiveness of this K application method on a calcareous sand green planted to L-93 creeping bentgrass and fertilized every 14 days with N and six rates of K ranging from

0 to 6 g/m^2 over two growing seasons in Ithaca, N.Y. Soil analyses showed a progressive decline in available K at all application rates < 2 g K/m^2 reaching low levels (< 1.25 mmol/K/kg soil). Nevertheless, K applications had no beneficial effects on turfgrass quality or performance. Turf disease incidence was not increased under lower K levels and gray snow mold actually was more prevalent each spring on the higher K turf. The authors concluded satisfactory bentgrass green performance can be achieved over a broad range of soil K levels and tissue concentrations when grown in calcareous sand root-zones. They suggested excessive K applications may be in common practice on greens management (Woods et al., 2006). We will comment on this further in the next section.

In general, the availability of nutrients in the soil water influences the quantity and composition of nutrients within the cell wall space of turfgrass roots. However, moderate nutrient selection occurs within the apoplast with divalent cations becoming concentrated due to their binding with cation exchange sites and anions being partially repelled. Still, the concentration of free (non-bound) ions remains sufficiently low in cell wall water that precipitation of low solubility salts rarely occurs.

We mentioned earlier the cell walls constitute a non-living continuum through which water and nutrient ions can travel from the roots into and throughout the shoots. If that were really true, the plant would have no way to discriminate among or control which mineral ions enter and are transported throughout the plant. That clearly is not the case. Ion discrimination is achieved by bands of cells (the endodermis) that encloses the root's vascular cylinder (xylem and phloem) and has a waxy material (suberin) impregnated in its walls. These endodermis cells block the inward flow of water and minerals in their apoplast forcing them to cross a cell's plasma membrane and enter its protoplast (symplasm). To enter the xylem (part of the apoplast) and move into the shoot, water and minerals must again cross the plasma membrane of a cell in the vascular cylinder and reenter the apoplast. Any mineral ion that cannot enter the symplast at the endodermis can go no further and remains within the roots. In this way, a plant's stems and leaves are protected from potentially toxic elements.

Cell walls are a non-living continuum with which water and nutrient ions travel from roots to and throughout shoots.

Greatest selectivity for and potential interactions in nutrient uptake and distribution within turfgrass plants is centered at plasma membrane transport: loading into the symplast and unloading into the xylem (apoplast). That will be considered in our next article.

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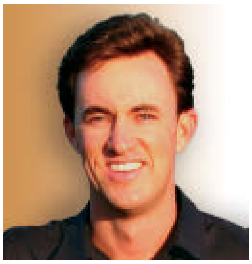
The Blog Grows Up

THE BLOG HAS BECOME THE IDEAL COMMUNICATIONS TOOL FOR A GOLF COURSE SUPERINTENDENT.



BY GEOFF SHACKELFORD

Conventions have the effect of energizing you as a professional. Seeing your peers, looking at the latest stuff and taking in the energy of companies selling the next big thing invariably make most superintendents want to jump back into their work. And that's why there is no better time to start a blog.

I know what you're thinking: 'Didn't he write about this just a couple of years ago?' Yes, but that was when the blog was still just the plaything of political junkies, sports fans and *Golfdom* columnists. Since then hundreds of thousands of online gathering places for thoughtful commentary and delusional bickering have come and gone, yet the blog has become the ideal communications tool for a golf course superintendent.

Still, many in the golf industry are reluctant to start a "web log" because they are not writers. Many others say they've resisted a blog because they are not techies — which is why God created interns.

The first rule of blogging: it must be personal. Let the interns and tech-savvy assistant supers handle the tech side, and yes I know it's painful to write. However, no matter how bad you are at slapping some sentences together, the compositions must come from you, the head man.

Now, about those sentences. Rule two: keep them short. You only get into trouble when you start writing really long sentences that meander on and try to make multiple points while still trying to sound informational. Like that last sentence.

Rule three: don't worry about content. A lot of supers have told me they don't start a blog because they feel they'd have to post something every day. Nonsense. Post when there's news and something to say about a maintenance practice. But don't over-post, you can only get yourself in trouble. That said…

Use a blog to promote what you are doing to make the course better and don't hesitate to bore the reader with details about the most minor of projects. Not only is this educational for the golfer, it demonstrates knowledge of your course, your desire to make it better and best of all, cuts off questions when you happen to run into your golfers at the halfway house or the local Italian restaurant.

Rule five: no comment sections. Most of the best blog hosting companies allow you the option of turning off comment sections. You have better things to do than to read and monitor the rants of your readers.

As for writing, two last tips: read your posts out loud -- that's why you have an office door -- and spend most of your time editing. Don't fret about the first draft. The follow-up edits are where you make the text sing.

"Try to have someone proofread it before posting, and definitely spell check," recommends Stanford University golf course superintendent Ken Williams who blogs from tech industry central in Palo Alto, Calif., where he produces one of the best blogs in the industry. "Photos or videos also improve it. Nobody wants to read a lot of text on their computers."

Another great example is Stone Creek Golf Club super David Phipps' graphic, photo and even video-rich blog. Phipps can attest to the improvement the website has made in communications, awareness and his own role at the course.

"I think blogging has been good for me personally and professionally," he says, noting the site is collecting nearly 2,000 hits a week. "I feel it has increased my value not only as a superintendent but also as a promotional resource for the club."

If it sounds like too much pressure, don't hesitate to start the blog but keep it "unpublished" for a while. Let only a few people see it, then roll it out when you feel comfortable with the process of writing and hitting the publish button.

And if you can't find the publish button, just ask the intern.

You can reach Shack, Golfdom's contributing editor, at geoffshack@me.com. Find his blog — now a part of the Golf Digest family — at www.geoffshackelford.com.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