Golf Course in Florida. As I suspected, he and his fellow superintendents in the south use a lot of soluble N. Tom informed me that Allied Chemical produces both regular and fine grades of ammonium sulfate for golf course use. Now all you have to do is find a fertilizer distributor that does or is willing to stock the Allied ammonium sulfate.

Q: I've heard colleagues talk about using "feed grade" urea. Not wanting to appear uninformed, I have been reluctant to ask. What is it anyway? Buffalo County

A: Feed grade urea, as the name implies, is manufactured as a feed additive. Animal researchers demonstrated years ago that adding the material to something like ensilage increases its nutritional value. To ensure uniform blending, the urea has to have a small particle size. It so happens that the feed grade urea particle size is very similar to that of a fine greens grade fertilizer. For example, a feed grade urea that I purchased locally has 85% of its particles in the size range of 0.5 to 1.0 mm, or the size of coarse sand particles. In contrast, a regular grade of urea purchased from a turf fertilizer vendor has nearly 75% of its particles larger than 2 mm. The obvious advantage of feed grade urea is that it produces no speckling in the closely mowed turf of greens and tees. If you do elect to apply granular feed grade urea, calibrate your spreader carefully. Because of its small particle size and the fact that it contains 45 or 46% N, I have to close my little drop spreader all the way down and still get an application rate of 0.8 lb N/M.

Q: How can I calculate from the pH of our very hard water how much acid to use to move the pH down in my spray tank? What should be the target pH for a spray tank? What kind of acid should I use? Where can I buy it? Waukesha County.

A: You can't calculate the amount of acid required based on the pH of the water. The water is hard because it contains high levels of dissolved calcium and magnesium carbonates. Carbon dioxide from air reacts with the water and carbonates to form bicarbonate in equilibrium with carbonic acid and carbonate ions. What this constitutes is a weak acid-weak base system in which the hydrogen ion concentration (measured as pH) represents only a small portion of the total amounts of acids and bases present. The direct analogy is soil. The pH of soil represents only a miniscule portion of the acidity that must be neutralized in order to change its pH. If this were not the case and all we had to neutralize are the hydrogen ions actually in the soil solution, the amounts of liming material required would be in the range of pounds per acre rather than tons per acre. The other thing you have to be aware of is that the pH of hard water depends on the temperature of the water. The colder the water, the more CO2 that dissolves in it. This shifts the equilibrium of the carbonic acid-bicarbonate system in favor of the carbonic acid. As the water warms up, CO2 concentrations in the water decrease and the concentration of bicarbonate increases.

Therefore, cold water drawn directly from the well may have a pH of 7.5. Let that water stand until it reaches air temperature and the pH may be in the range of 8.5. If you don't believe this, take a bottle of you favorite brew from the refrigerator and measure its pH. Let the brew come to room temperature and measure the pH once again.

To determine how much acid you need to add to you water to drop the pH to the level that you want, you have to take a known volume of the water and determine how much acid of a known concentration is needed. Alternatively, you can send a water sample to a commercial lab and have it titrated for you. To save having to do some calculations yourself, be prepared to tell the lab what pH you want and the concentration (normality) of the acid you'll be using. I'd request a pH in the range of 6.0 to 7.0, which is what you want in your spray tank for the vast majority of the tank mixes you'll be preparing. As for the acid to use, I recommend what is known as technical or commercial grade sulfuric acid. This can be obtained from distributors of industrial chemicals.

Q: Do late season iron applications on turf have any effect on winter hardiness or survival? Green County

A: In responding to this question I'm assuming that you're refering to foliar application of Fe to the non-Fe deficient turf that we grow in Wisconsin. If iron were to influence winter hardiness and survival, the most likely mechanism would be increased production of so-called total non-structural carbohydrates (TNC). For this to happen as a result of iron application, the Fe would have increase turfgrass chlorophyll content and, in response, increase photosyntheis and carbohydrate production late in the season when shoot growth is slowed by low temperatures. The problem with this line of reasoning is that foliar Fe applications on non-deficient turf do not increase leaf chlorophyll content. Unless the turf is iron deficient, N supply, not Fe, is the controlling factor in chlorphyll production. What happens instead is that the foliar applied Fe forms a black coating the leaves, particularly on cut and damaged portions. This gives the appearance of a darker color. In a recent study of the effects of foliar iron on winter injury in bermudagrass, no greening response was noted, the leaves were observed to be "stained", and at rates above 1.5 oz Fe/M leaf levels of TNC actually declined. The authors surmised that the iron coatings may have actually blocked sunlight from reaching the leaf surface and reduced photsynthesis accordingly.

Q: Do you believe a fertility program can effectively or successfully move the bentgrass/Poa annua population ratios in a green or fairway one way or another? Ozaukee County

A: Let's start with the understanding that Poa is really a weak competitor with something like bentgrass. To move into bentgrass, it needs invasion gaps that greatly reduce or eliminate competition from the bentgrass. Thus, anything that creates invasion gaps is an invitation for Poa. On golf courses, these gaps are being created continuously in the form of ball marks, divots, patches of disease, traffic wear, aerification holes, earthworm casts, etc. This obviously limits what effect fertilization can have on Poa populations. Furthermore, any differences between bentgrass and Poa in terms of their nutrient requirements are slight to none. There is no truth to the idea that high P levels favor Poa over bentgrass. The two grasses do appear to differ in their tolerances to low soil pH. Applying sulfur to drop soil pH to around 5.5 has been found to adversely affect the Poa more than the bentgrass, but don't try this as a control measure unless you want to see some very sad looking bentgrass. All fertilization can accomplish is to impart to the bentgrass the capacity to recover quickly from any type of mechanical or disease injury that may occur. In most instances, this means keeping nitrogen levels up where the bentgrass has good color throughout the season and

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