— REPRINTED FROM THE AUGUST 1998 ISSUE —

for effective turf management...

Work Both Sides

by Joel Simmons

Managing the leaf helps assure the plant gets what the soil can't always provide.

The golf course superintendent has arguably the most difficult soil management challenge in all of agriculture. After speaking recently to a group of farmers on the issues of balancing soils, I was sitting at lunch with a few who were complaining about soil compaction. As I was listening, I started to chuckle to myself (or so I thought). One fine gentleman looked at me somewhat disturbed by my grin, so I quickly explained to him that most of my work is with golf course superintendents, who average 40,000 pairs of feet per year over small areas of around 3,000 square feet — not to mention the physical pressures of daily maintenance. They were concerned about running a plow over their fields *twice a year*; which is a serious problem but nothing like what a superintendent faces on a continual basis.

When a soil gets the kind of physical pressure a golf course green receives each and every year, there is simply no way to avoid damage to the soil structure, even given proper mechanical aerification. Movement of air and water is severely restricted. Consequently, microbes cannot function effectively. The over-use of salt fertilizers can actually add to the physical damage of the soil by creating an imbalance in the carbon-to-nitrogen relationship. This will also affect the activity of beneficial bacteria, further restricting nutrient mobility and ultimately leading to plant stress and potential disease pressures. Perhaps the ultimate resolution for the golf course superintendent, agronomically speaking, is to get rid of the golfers!!!

greens when compared to the fairway soils. This is clearly due to the intensified physical pressure that a green receives compared to the same area in the fairways. No golf course superintendent will find this surprising, but the level at which even a good green is able to mobilize nutrients may be an eye opener.

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Nutrient mobility within the plant can be evaluated in a variety of ways, including a LaMotte water-soluble soil test or a good tissue test. The LaMotte test is a "weak Bray extraction", which uses an acidification process intended to replicate the level of acidification that may be found in the soil. This is just another tool — not an exact science by any means— but it can reveal some interesting things. Standard soil tests may not demonstrate nutrient mobility as dramatically, since they show what nutrients are present on the soil colloids but give no indication of their availability. Tissue testing, on the other hand, can reveal that even when the soil chemistry is in balance, nutrient mobility may be inadequate to provide the plant all it requires for proper growth.

The level of nutrient mobility (as indicated by the LaMotte test) on any given golf course will vary significantly from green to fairway. Nutrient mobility on a green is usually significantly less than that of a fairway. Biological indicators are also significantly reduced on

While tissue testing can be of great value when trying to determine what is actually being taken up by the plant, neither a LaMotte test (kits are available from agronomic supply stores) or tissue tests should ever replace a good soil testing program. It is imperative that you work both sides of the equation. Managing the soil on the basis of a good soil testing program will help to balance the basic nutrients on the soil colloids. This will help to open the soil physically, allowing for better infiltration of air and water, and in turn provide a better environment for microbial activity.

All good soil management addresses the chemistry, physics and (most importantly) the biology of the soil as one entity. Once this is done, managing the leaf will help assure the plant gets what the soil cannot always provide. Again, with the incredible physical pressures that a golf course soil suffers it becomes an important management practice for the superintendent to take

(Continued on page 5)

Work Both Sides... *(Continued from page 4)*
care of both the soil and the plant as separate programs. Foliar feeding provides a viable tool for the superintendent to help battle an incredibly difficult agronomic environment.

Knowing that golf course soils, in the best of situations, are not mobilizing all that the plant needs is an integral factor when developing a foliar feeding program. The same foot traffic that affects nutrient mobility in the soil also creates tremendous stress on the leaf blade. Foliar feeding can not only provide what the soil cannot, but it can also help to reduce the simple physical stress that the grass blade suffers every time a golfer walks over it, or each morning after mowing. The ideal foliar program provides a complete package of NPK, calcium, magnesium, trace nutrients, carbohydrates and other biostimulants to help feed beneficial bacteria and the plant. The most important aspect here, however, is these applications are made in a "small but frequent" manner.

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"Spoon feeding" can be done in a number of ways. Many courses are installing fertigation systems that can provide the mechanism to supply nutrients to the entire course at one time. This can be a tremendous labor savings, and many of the better systems offer the flexibility of multiple supply and mix tanks to blend small batches of nutrients or bio-stimulants for better control. These tools can be especially effective during a grow-in situation when it is so important to keep nutrient levels up since the plants and their root systems are so young. However, these systems don't come without a price tag and not every course can justify the expense.

A simple spray tank can provide all that is needed to work an effective foliar spray program. This method will apply the nutrients exactly where you want them, while saving money by not spraying unneeded areas. Flexibility is the key with a good foliar program; it provides you control and the safety of using only small amounts of nutrients.

Perhaps the most important aspect of a foliar program is the concept of "small but frequent" applications. A typical fertility program that feeds the soil every month or two creates the "roller coaster" effect; high mobility in the beginning of the cycle and lower mobility toward the end. This can even be true with many slow release fertilizers. These kinds of 'peaks and valleys' create stress on the plant at both the high end and at the low end. Managing your fertility program in a more controlled fashion can help to reduce the plant stress associated with this uneven level of nutrient mobility.

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Although not always practical, the ideal situation would be to spray a nutrient mix *every week* at very low rates. The idea is not to apply more, but to apply less *on a more frequent basis*, so that you apply the same amount of nutrient as if you were spraying twice monthly, or even monthly. This "small but frequent" rate concept is very important on sand based greens where CEC's are low and nutrient availability is limited, but even on a healthy soil green nutrient mobility is not always strong enough to provide the plant what it needs.

The "soup mix" that you create for foliar application should include all that the plant and the soil may need: NPK, calcium, magnesium, traces and carbohydrates for the soil microbes. Available sources of nitrogen such as ammonium sulphate or urea at very low rates (1/10, 1/16 of a pound of N) are ideal. You should adjust these rates based on conditions without affecting the quantity of the rest of the mix.

One of the advantages of a foliar program is that these "small but frequent" rates will allow you to use less nitrogen in the long run, which is certainly beneficial agronomically. Do slow release liquid forms of nitrogen really fit into a program where *you* become the source of slow release? A good question that certainly has its own debate.

Phosphorous and potassium should be from clean sources such as phosphoric acid, potassium hydroxide or sulphate. Calcium is as important a foliar feed as any nutrient because it is used more in weight and volume than any other element. It is also extremely immobile and, even in the healthiest of soils, does not move into the plant well.

For this reason, any golf course can benefit from foliar feeding of this important nutrient. The application rate of calcium should be increased when the plant is under stress. Again, this shows the flexibility of a foliar program. Although not needed at the same rate as calcium, magnesium should be a small part of a good foliar program. Magnesium is critical for many photosynthetic reactions.

(Please turn to page 6)

Work Both Sides... *(Continued from page 5)*

A complete package of trace nutrients including boron, manganese, copper, and zinc should also be a part of any mix. Unfortunately, iron is often the largest constituent of trace packages and will dictate the rate of other, perhaps more important, nutrients. High levels of iron can actually restrict the mobility of other nutrients including nitrogen. If iron is needed or wanted, it should be used, but controlling its application rates will help prevent restricting mobility of other nutrients.

Trace nutrients should be in the form of a good chelate such as glucoheptonates or citrates. Although more expensive than sulfates or EDTAs, these chelated materials are much less reactive and will mobilize more effectively.

The other important addition to a proper foliar feeding program is a good source of carbohydrate or biostimulant. In addition to reducing the physical stress on the plant itself, they help to feed microbes which will in turn help to more efficiently mobilize nutrients to the plant. In general terms, the best way to increase the overall mobility of nutrients in a soil is to “feed the soil” and increase the beneficial bacterial activity. Sugars, humic acids, fish and kelp meals are all good choices to help round out your program. Again, they should be applied in very "small but frequent" rates.

To get a really complete "soup mix" you will often have to do some of your own mixing, which unfortunately may not always be practical. Premixed packages can be a good start but may not contain everything needed for your situation. Most of these packages are loaded with nitrogen and iron, the two nutrients that should be used most sparingly and whose rates should be dictated by you, not by a manufacturer. Remember: when preparing a mix, it's imperative that you always do a bench test first. If problems occur, most likely it will happen in the tank, and not as a phytotoxic reaction. When in doubt, spray your mix in a controlled area until you are comfortable with your blend. At low rates, with agitation, you can get a chelated calcium (positively charged cation) and phosphoric acid (a negatively charged anion) to tank mix with no problems.

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Even when soils are properly managed and balanced with optimum nutrient levels, external environmental factors often prevent turfgrass plants from taking up what they need for proper growth and disease resistance. A good foliar fertility program provides you with the ability to give the plant all that it needs even when a soil cannot. Since the golf course superintendent is faced with the most difficult agronomic environment in all of agriculture, managing both sides of the plant are beneficial and cost effective. Testing and managing the soil is critical and always the first place to start, but since we know that nutrient mobility is limited in these high traffic soils a foliar program is also very effective.

The real key is that this approach is "small but frequent," and you can increase or decrease application rates based on the conditions and stress factors you face. This puts you back in the drivers seat by giving you control and safety of application. There is no one “best” way to do this. There are as many foliar mixes as there are golf courses and superintendents. The bottom line is, “Do what works for you”.

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