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On the cover: The Virginia Tech Turf Team: Row one, L to R: Mike Goatley, Whitnee Askew, Xunzhong Zhang; row two, Hokie Bird, Shawn Askew, Erik Ervin, Nate Reams; row three, Shaohui Wu, Julie Keating, Angela Post, Michael Cox, Sam Doak, Chantel Wilson, Richard Wade; row four, Rory Maguire, Emerson Pulliam, Tyler Brewer, Tyler Knight, Logan Horne, Kate Venner; back row, Adam Smith, Chad Kropf, Kevin Steele, Jeremy Atkins, David McCall.


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From the Sidelines

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Scenes from Daytona Beach

EIGHTY DEGREES AND SUNNY may never have felt so good as it did for many in the sports turf industry who attended last month's STMA 24th Annual Conference & Exhibition in Daytona Beach, FL, especially for those of us who returned to single-digit temperatures and wind chills. Kudos to the STMA Board for selecting a great site for the show; all Conference activities and most nightspots were at the host hotel or within a few minutes' walk.

The Board tweaked this year's schedule to add education sessions and encourage attendance at general sessions and on the trade show floor. Most notable was introduction of the STMA Academy, which was a direct response to members' request for deeper educational opportunities both before and after the Conference. Education Subcommittee Chairman Jeff Fowler, an extension director and turfgrass specialist for Penn State, said, "Members asked that we offer chances to go beyond the traditional 1 hour sessions so they could learn more about a subject. So we developed the Academy, which allows students and instructors to get more in-depth on a particular topic. The feedback I've received so far has been very positive."

Also for the first time there was both a full-day and half-day Seminar on Wheel tour offered. Jeff Salmond, CSFM, director of athletic field management at the University of Oklahoma and Tours Subcommittee chair, said the half-day tour enabled attendees to arrive Tuesday and still make a tour. "Both full and half day attendees were thrilled with sites we selected, especially the Daytona Speedway," he said. "Even if you're not a NASCAR fan it was a memorable experience. The tour bus went onto the track and we got an up close look at just how steep the bank is, and how narrow the racetrack is itself." More than 200 attendees were part of the tours.

Another change was the SAFE Charity golf tournament's being moved to Tuesday with a tee time set to allow late Monday arrivers like me a chance to sleep in; my partners, Boomin' Boyd Montgomery, Deadeye Ed Hall, and Noel Hammerin' Harryman must have thought with my lackluster performance that I was still sleeping. But at least the cold beer tasted good in the sunshine.

Attendees who opted for a cold one with friends or just wanted a rest before Wednesday's Welcome Reception missed a dynamite keynote address by Ian Hill, who is best known for funding community projects in the name of our fallen soldiers. He noted that STMA members have an "irrational passion"—aka "crazy"— for turf. Hill, who emigrated to the US after an Army soldier-turned-father in Iran exchanged two cases of scotch for him, said that passion works well for turf managers because "you are in the memory business." He still knows the name of the man who maintained the football field he competed on in high school, and he pledged $1,000 to STMA's SAFE Foundation in the name of Angel Diaz. Hill then challenged the audience to donate $5, $10, or $20 immediately following his talk to STMA President Dr. Mike Goatley or Ed Chair Fowler and name a mentor or person who inspired them as they handed over their "legacy cash."

Hill asked the crowd, "When you reflect back about your life, will you think more about what you have gained or what you have given?" His own commitment to purpose was stimulating and I'm certain his call for us to put our time, fortune and sacred honor toward the betterment of others still rings in our ears. ■

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The Official Publication Of The Sports Turf Managers Association

SportsTurf MANAGERS ASSOCIATION

SportsTurf (ISSN 1061-687X) (USPS 000-292) (Reg. U.S. Pat. & T.M. Off.) is published monthly by m2media360, a Bev-Al Communications company at 1030 W. Higgins Road, Suite 230, Park Ridge, IL 60068. POSTMASTER: Send address changes to Sportsturf, PO Box 4290, Port Jervis, NY 12771. For subscription information and requests, call Subscription Services at (845) 856-2229. Subscription rates: 1 year, $40 US & Poss.; 2 years, $65 US & Poss.; 1 year, $65 Canada/Foreign Surface, 1 year, $130 Airmail. All subscriptions are payable in advance in US funds. Send payments to Sportsturf, PO Box 4290, Port Jervis, NY 12771. Phone: (845) 856-2229. Fax: (845) 856-5822. Single copies or back issues, $8 each US/Canada; $12 Foreign. Periodicals postage paid at Park Ridge, IL and additional mailing offices.

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President's Message

Dr. Mike Goatley

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There is no 'I' in TEAM, but might there be a 'you'?

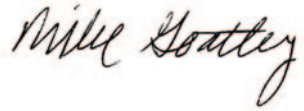
STMA's annual Conference is a highlight of every year and 2013 in Daytona Beach was no exception. The only way Conference is so successful is due to a great deal of teamwork (a tease for what is coming below). The camaraderie of our membership and the energy exuded from this annual gathering of professionals that hail from so many different backgrounds and locations serve as my springboard to tackle another year. I suspect it is similar for many of you as well. Special thanks to all of our vendors and sponsors as you are the primary reason for the financial success of our conference. Thanks to a phenomenal line-up of speakers and a new educational format that kept our participants actively engaged in learning for multiple days. Every conference is unique and I always wonder "Are we going to be able to top this next year?", and the answer is invariably "yes." I hope that you are already planning on joining us in 2014 in beautiful San Antonio.

I have the opportunity to do something a little different for this issue of *SportsTurf* in telling you about the value I place on teams and teamwork, especially my colleagues on the Virginia Tech Turf Team. But let me call a quick timeout and tell you about another team that I too often forget to mention (but is of utmost importance to me), my family. My wife Lisa is the coach, our kids Rachel and Adam are 5-star recruits, and I think I am the waterboy (H/T to Adam Sandler), but it works. Your STMA Board is also a very successful team and two members that just completed their terms deserve special recognition: Ron Hostick and Jay Warnick. A job well done, men. Your time and commitment has been invaluable to STMA. I welcome to our team our newly elected directors Andrew Gossel (K-12 Schools), Phil McQuade (Professional Facilities), and Tim VanLoo (At-large). Congratulations! The Board looks forward to the new insights and talents you bring to the group.

Another team that always gets a number one seed is our STMA Headquarters staff. Kim, Leah, Nora, Kristen, and our newest member, Shant—you all are the best and are a major reason we continue to be a thriving association. Thank you so much for everything you do every day.

And when I ponder the phrase "take one for the team," I think it applies to a former STMA Board member who was scheduled to be featured in this issue until a change in his job status altered his membership category: Martin Kaufmann. Marty demonstrated the utmost in professionalism in how he handled the entire situation and placed STMA firmly above his personal desires. Marty, I think you are our MVP for 2012; thanks for your service to the Board, but especially for how you handled a difficult situation.

Join the STMA team in some way in 2013. There are great things to be accomplished through a little teamwork. ■



Nothing minor about **micronutrients**

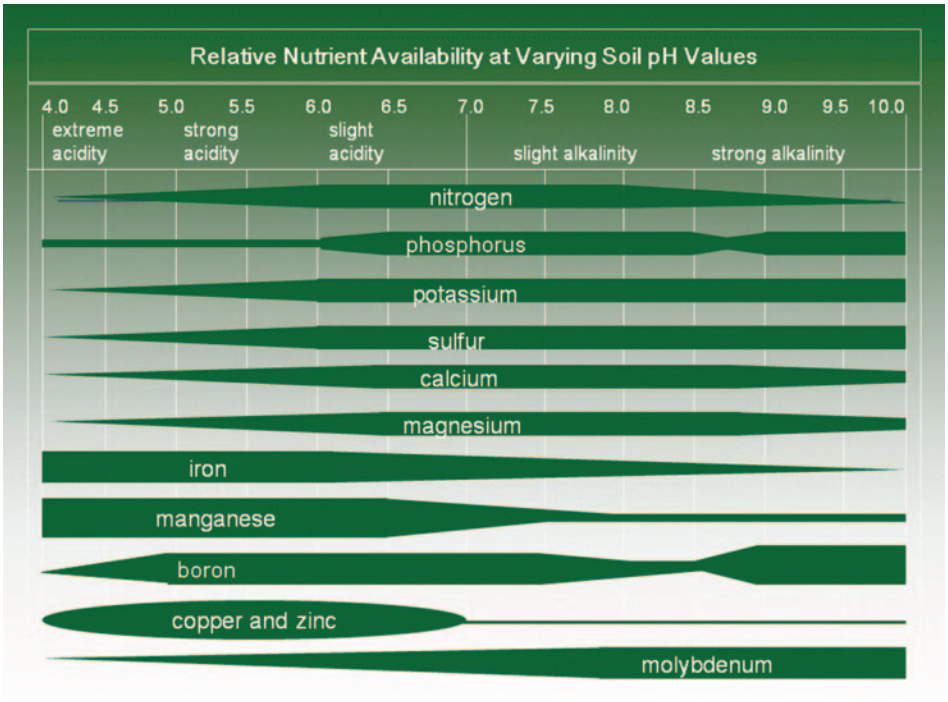
ALTHOUGH TURFGRASSES CONTAIN ONLY TRACE AMOUNTS OF BORON (B), chlorine (Cl), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), nickel (Ni) and zinc (Zn), these eight micronutrients are essential for plant growth and survival. When it comes to turfgrass nutrition, essential micronutrients deserve attention and should not be overlooked.

In order for a nutrient to be considered 'essential', it must 1) be required for a turfgrass plant to complete its growth cycle; 2) perform a plant function that cannot take place without it; or 3) be directly involved in photosynthesis, respiration, or the production or breakdown of organic materials within the plant, or necessary for a critical chemical reaction.

Of the essential nutrients, carbon, hydrogen and oxygen are supplied to turfgrasses by carbon dioxide and water. The majority of carbon dioxide is taken up through minute pores, or stomates, on the surface of leaves and stems. In addition to moving nutrients from one plant part to another, water also provides turfgrasses with hydrogen and oxygen.

Turfgrasses primarily absorb the remaining essential nutrients from soil. The fibrous nature of the root system and the massive number of root hairs contribute to a turfgrass plants ability to extract these mineral nutrients from a soil solution. Due to the amount turfgrasses require, nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg) and sulfur (S) are categorized as macronutrients. The macronutrients are often further sub-divided according to the amount required by turfgrasses. Nitrogen, P and K are primary macronutrients, while Ca, Mg and S are secondary macronutrients. Results of analyses of macronutrients in tissue are often reported as percent on a dry-weight-basis. For example, bermudagrass turf is often considered nutrient deficient if shoot tissue contains less than 2% N, 0.3% P, 1% K, 0.5% Ca, 0.3% Mg and 0.2 % S on a dry-weight-basis.

Figure 1. Soil pH chart.



EFFECT OF SOIL PH ON UPTAKE OF MICRONUTRIENTS

Micronutrients, also referred to as trace or minor nutrients, are usually found in dry turfgrass shoot tissue at levels less than 1,000 ppm. Micronutrient applications are seldom beneficial to turfgrasses growing in fertile, mineral soils with a slightly acid pH (for example, 6.0 to 6.9). However, when turfgrasses are managed in high-sand-content soils, organic soils or soils with high- or low pH, the application of a micronutrient may be very beneficial. The availability of micronutrients in soil for uptake by turfgrasses is influenced by the level of soil acidity or alkalinity. Plant availability of Fe, Mn, Cu and Zn decreases as the soil pH rises above neutral (7.0), while that of Mo increases with increasing soil pH (Figure 1).

ROLE OF MICRONUTRIENTS IN TURFGRASSES

Boron affects the formation of plant cell walls and the transport of sugars. Chlorine influences photosynthesis, the division and length of plant cells, and the opening and closing of stomates. Copper is necessary for photosynthesis and influences the lignin content and strength of cell walls. Iron is involved in the production of chlorophyll. Several enzymes associated with the transfer of energy, N fixation and the production of lignin contain Fe. Manganese is necessary for photosynthesis and is involved in the formation and breakdown of N-containing compounds. Plants deficient in Mn for an extended period of time are, most often, very low in chlorophyll. Molybdenum is involved in the formation of proteins and the use of N and S by turfgrasses. Molybdenum also affects the production of pollen. Nickel, recently classified as an essential micronutrient, is a component of an enzyme.

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Table 1.
Copper recommendations for both new and established turfgrass areas (for organic soils only).[a,b]

	Application method	
Copper, Cu	Soil broadcast	Foliar Spray[c]
Soil test level	Amount of Cu to apply/1000 sq. ft.[d]	
ppm	Pound Cu	Ounce Cu
0 to 2.5	0.1 to 0.3	0.4
> 2.5	0.0	0.0

[a] From: Rosen, C.J., P.M. Bierman and R.D. Eliason. 2008. Soil test interpretations and fertilizer management for lawns, turf, gardens, and landscape plants. Department of Soil, Water, and Climate. Regents of the University of Minnesota (http://www.extension.umn.edu/distribution/horticulture/components/1731-complete.pdf)
[b] Applications are suggested on a trial basis only.
[c] Apply foliar sprays at the recommended rate 2 to 3 times per year.
[d] Multiply by 44 to convert the rate from lb./1000 sq. ft. to lb./acre; multiply by 2.7 to convert from oz./1000 sq. ft. to lb./acre.

Table 2.
The chemical symbol, plant available form and general sufficiency range in shoot tissue of eigh essential micronutrients.[a]

Micronutrient, chemical symbol	Form absorbed by plants	General sufficiency range, ppm- dry weight basis
Boron, B	H_3BO_3, BO_3^{-3}	5 - 60
Chlorine, Cl	Cl^-	200 - 400
Copper, Cu	Cu^{+2}, $Cu(OH)^+$, Cu-chelates	5 - 20
Iron, Fe	Fe^{+2}, Fe^{+3}, Fe-chelates	50 - 100
Manganese, Mn	Mn^{+2}, Mn-chelates	20 - 100
Molybdenum, Mo	MoO_4^{-2}, $HMoO_4^-$	1 - 4
Nickel, Ni	Ni^{2+}	< 1
Zinc, Zn	Zn^{2+}, $ZnOH^+$	20 - 55

[a] Summarized from: Carrow, R.N., D.V. Waddington and P.E. Rieke, 2001. *Turfgrass soil fertility and chemical problems: assessment and management.* Hoboken, NJ: John Wiley and Sons, Inc.

Several enzymes active in the production of carbohydrates and proteins contain Zn.

Many soil testing laboratories test for available B, Cu, Fe, Mn, Mo and Zn. More than one method (Mehlich II and III, DTPA) can be used to extract micronutrients from soil and results often vary from one method to the next. After testing soil, very specific recommendations may be made regarding the application of individual micronutrients (Table 1). Interestingly, it is not uncommon for turfgrasses to respond favorably to an application of Fe even though a soil test report indicates that the concentration of the micronutrient is in the High range. An analysis of plant tissue is recommended as a supplement to soil testing. Micronutrient levels in turfgrass tissue are usually reported as ppm on a dry-weight basis. For example, bermudagrass turf is often considered nutrient deficient if shoot tissue contains less than 100 ppm Fe, 30 ppm Zn, 25 ppm Mn and 10 ppm Cu on a dry-weight-basis. Information regarding specific micronutrient sufficiency ranges for individual turfgrass species or varieties is limited, however general or common sufficiency ranges have been published (Table 2).

POSSIBILITY OF A MICRONUTRIENT DEFICIENCY

Some micronutrients are more apt to be at low or deficient levels than others. A deficiency of Fe in turfgrasses maintained out of doors is much more common than a deficiency of the other micronutrients. Iron deficiencies are most likely to occur in poorly rooted and thatchy turfs maintained in calcium-rich soils with high P and pH (> 7.5) levels, and very little organic matter. Turfgrasses irrigated with water high in bicarbonates, P, Ca, Cu, Mn or Zn may also be deficient in Fe.

Although less commonly observed than a Fe deficiency, a Mn deficiency in turfgrasses is not unusual. A Mn deficiency, like that of Fe, may occur in plants maintained in soil with a high pH and Ca level. Extended periods of dry, warm weather reduce Mn availability in soil. Boron, Cu, Mo and Zn deficiencies are rare. High levels of Ca in soils can reduce the availability of B. Boron deficiencies are also more likely to occur in turfgrasses growing in porous, sandy soils with a high pH and high level of K. Since Cu can tightly bond with soil organic matter, deficiencies of Cu have been observed in turfgrasses growing in organic soils. Copper deficiencies have also occurred in turfgrasses maintained in sandy and alkaline soils, and soils with high N, P, Fe, Mn, Zn or pH levels. Molybdenum deficiencies are more prevalent in turfgrasses growing in acidic and sandy soils.

High levels of S, Cu, Fe and Mn may limit the amount of Mo turfgrasses absorb from soil. Zinc deficiencies have occurred more often in turfgrasses in shade, in alkaline or acidic soils, and during cool, wet weather. At present, no Cl or Ni deficiencies have been documented in turfgrasses.

Once inside a turfgrass plant, some micronutrients are much more mobile than others. Iron and Mn are immobile and Cl is mobile in turfgrass plants. Boron, Cu, Mo and Zn are somewhat mobile. The location of a deficiency symptom on a turfgrass plant is influenced by nutrient mobility. For example, due to the inability of a turfgrass plant to move the micronutrient from older to younger leaves, symptoms of a Fe and a Mn deficiency occur first on young leaves. Leaf tissue between veins of young leaves of a plant deficient in Fe often turns yellow then white. This condition is commonly referred to as interveinal chlorosis. The youngest leaves of a plant deficient in Mn usually develop small grayish-green spots before the leaf tips and the tissue between veins turn yellow. Turfs deficient in