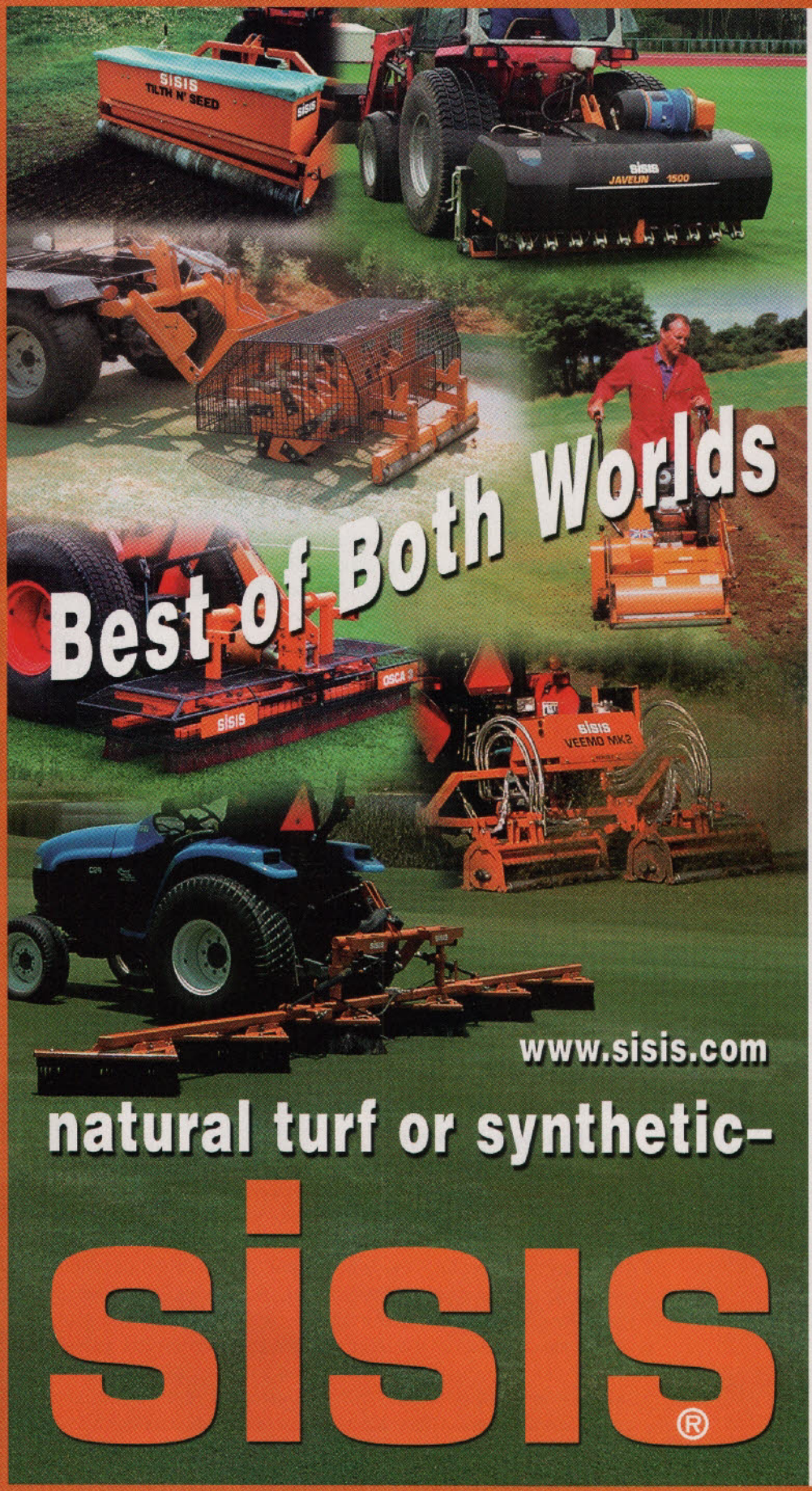

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develop irrigation scheduling practices to maintain quality turf with limited water resources.

PGRs

It is obvious that irrigation is the most effective practice to manage drought stress if there is plenty of water available for irrigation. However, irrigation water is limited in many areas. Recently, plant growth regulators (PGR) have received increasing attention in promoting turfgrass tolerance to stresses. PGRs (synthetic) or hormones (endogenously produced in plants) are substances that regulate plant growth and development at very low concentrations. Abscisic acid (ABA) accumulates in plants in response to drought stress. It has been found to protect plants from drought damage by inducing stomatal closure and reducing water loss through transpiration, which is considered as anti-transpirants.

Photo courtesy of LebanonTurf

The use of ABA and other anti-transpirants has been used in drought protection for various agronomic and horticultural plant species. We found that exogenous application of ABA (100 (M) prior to exposing Kentucky bluegrass to drought stress delayed turf quality decline and maintained a better turf quality than untreated plants. ABA application reduced drought injury of Kentucky bluegrass by protecting cell membrane and photosynthesis apparatus. Other plant growth regulators, such as trinexapac-ethyl, may also be effective in reducing water consumption and delay drought stress injury. Trinexapac-ethyl has been widely used for growth reduction in turfgrasses, which reduces the amount of leaf area for transpiration, and thus may help plants to utilize available soil water for a longer period of time. In general, any cultural practices that reduce water consumption may be beneficial for improving turf performance in water-limiting environments.

Heat stress and growth

Heat stress may cause damages in turfgrass by affecting many physiological processes. One of the typical symptoms of heat injury in turfgrasses or the most visible symptom is leaf senescence or yellowing of leaves due to loss of chlorophyll (a green pigment for light absorption in photosynthesis). Several physiological parameters including the content of leaf chlorophyll content, photochemical efficiency, and cell membrane stability are often used to evaluate physiological health of the plant exposed to environmental stresses. Our recent study found that heat stress tolerance of Kentucky bluegrass was highly correlated to high chlorophyll content and photochemical efficiency. These are two essential components of photosynthesis, the process producing carbohydrates. Therefore, any cultural practices that can alleviate leaf senescence or increasing

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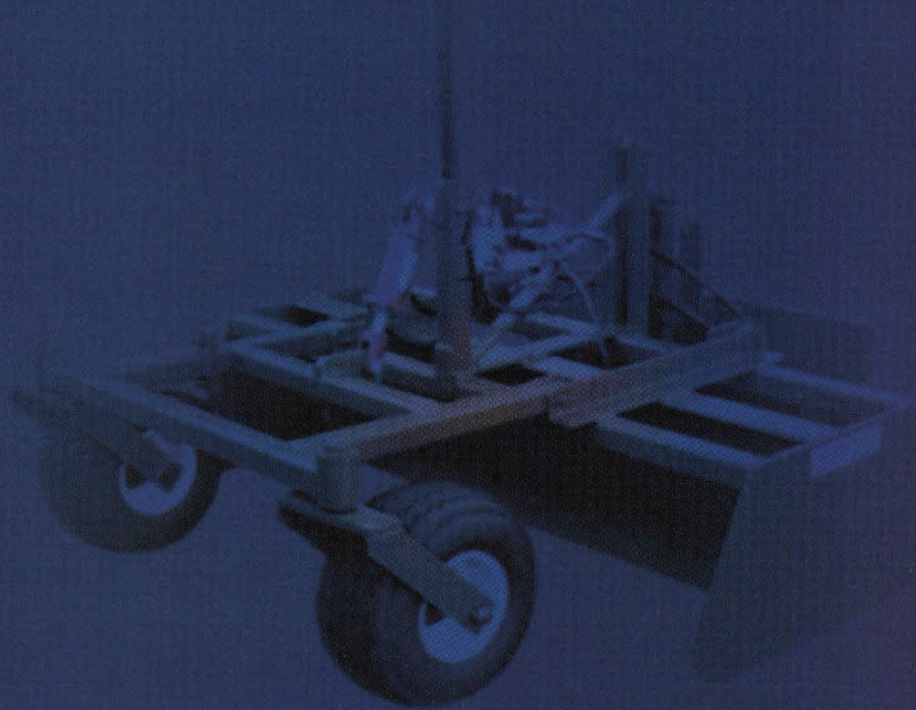

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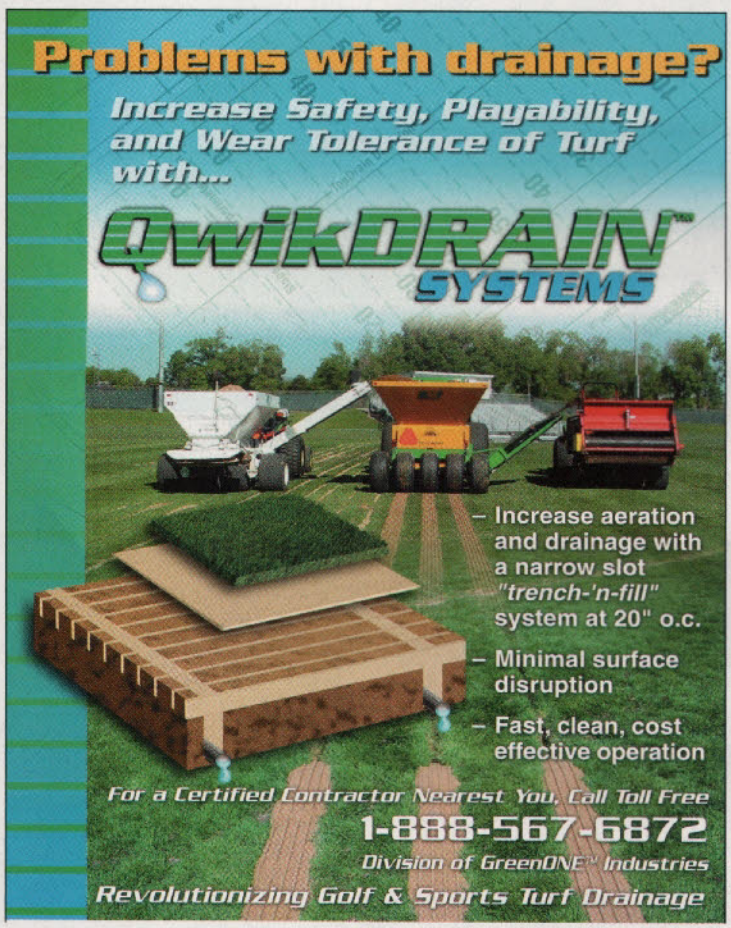
APPLYING NITROGEN IN SMALL AMOUNTS BUT FREQUENTLY MAY HELP TURF TO SUSTAIN GREEN COLOR DURING SUMMER.



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photosynthesis capacity or carbohydrate accumulation during hot summer months would help to maintain healthy, green turf.

One of the most effective practices to maintain green leaves or delay leaf senescence is through application of nitrogen. Nitrogen is an essential nutrient element forming chlorophyll molecules. Therefore, adequate nitrogen supply to plants during high temperature periods may prevent or delay leaf senescence by continuing support of chlorophyll synthesis. However, Kentucky bluegrass may be burned during summer months if too much nitrogen is applied at one time, particularly if the fertilizer is not watered in immediately after application. No more than one pound of soluble nitrogen per 1,000 sq. ft. should be applied in one application. Applying nitrogen in small amount but frequently may help turf to sustain green color during summer.

Increasing mowing height may also help turfgrass to better survive heat stress. Mowing removes large amount of leaves that are otherwise used for light absorption in photosynthesis. It is generally accepted that higher mowed turf is better able to tolerate heat stress by promoting carbohydrate production through photosynthesis than closely mowed turf. High-mowed turf may also promote deep rooting, resulting in higher water use efficiency and facilitating transpirational cooling.

Combined heat and drought

Heat and drought stresses often occur simultaneously during summer months, severely limiting turfgrass growth. Simultaneous drought and heat stress is more detrimental than either stress alone for plant growth. This is large due to the fact that plants under dry and hot environments have increased water demand, causing rapid soil moisture depletion than either stress alone.

For example, in a controlled-environment study with Kentucky bluegrass, we found that soil volumetric water content declined from 28% to 5% after 12 days of combined heat and drought stress, but soil moisture did not drop to 5% until 25 days if plants were exposed to drought stress alone. Our study demonstrated that the decline in turf quality for Kentucky bluegrass under the combined stress was mainly due to decreases in leaf water content or dehydration when plants were exposed for a short period of time, and prolonged heat and drought stress induced leaf senescence. Dry and hot environments cause rapid closure of stomata, resulting in suppression of transpirational cooling that may induce internal heat stress. Drought combined with heat causes permanent damage to the photosynthetic system.

The combined drought and heat stress not only increases evapotranspirational demand, but also has more negative impact on root growth than either stress presence alone. Kentucky bluegrass subjected to the combined stress had significantly smaller root system, limiting water uptake to meet the high transpirational demand of shoots and thus, plant desiccation.

When compared effects of drought stress with heat stress, we found that prolonged periods of drought stress was more detrimental than heat stress alone for Kentucky bluegrass growth and

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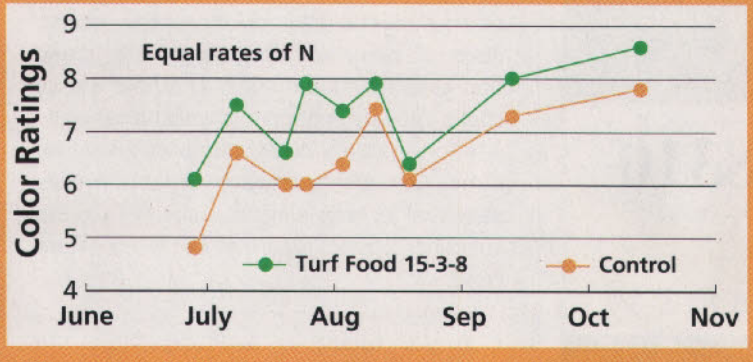

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physiological functions. Kentucky bluegrass is able to maintain good turf quality even under high temperature conditions as long as it is frequently supplied with adequate water. Therefore, sufficient, frequent irrigation can be an effective means in alleviating summer stress, especially during extended, dry and hot periods.

Water for irrigation, however, is becoming increasingly limited in many areas due to the decline in availability of fresh water and increasing demand, which have provided the impetus to seek for alternative methods to maintain high quality turf with limited irrigation.

One approach is to increase water retention in leaves during dry and hot periods. As discussed earlier, stomatal pores must stay open for transpiration to continue, which help cooling plants at high temperatures. Potassium as the major osmoregulants in turfgrass plants is known to help stomata stay open through maintaining cell turgor pressure. The maintenance of guard cell turgor pressure with high potassium supply under conditions of low water availability has been correlated with drought resistance in various grass species, because it facilitates cooling of turf canopy though transpirational water loss. Turfgrasses grown under high potassium fertility have also been shown to recover more quickly from drought stress injury than those maintained under low potassium fertility programs. High potassium fertility may provide a means of maintaining turf quality during heat and drought stress periods.

Rapid recovery from the combination of those stresses is important for the persistence of perennial turfgrasses. We found that simultaneous drought and heat stress could cause permanent physiological damage for Kentucky bluegrass, particularly for stress-sensitive cultivars. Irrigation was essential for physiological recovery from the combined stress, regardless of temperature conditions.

Bingru Huang is a Professor in the Department of Plant Biology and Pathology at Rutgers University.

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Bengals' turf manager tests SILICON FERTILIZER

Darian Daily, head turf manager at Paul Brown Stadium in Cincinnati (and a member of the STMA Board of Directors), became interested in turf after he was cut from his high school baseball team. The coach told him, "There were other ways of making it to the big leagues and field maintenance is one of them."

Daily graduated from Middle Tennessee State University with a Plant and Soil Science Degree in 1992. After college, he got his first Head Sports Field Manager position with Class A Winston-Salem Spirits (now Warthogs). He then returned to his alma mater to care for their fields, and later joined a municipal parks department.

"I wanted to get back into professional sports. In 1999, a once-in-a-lifetime opportunity came along and I was hired as Sports Field Manager for the nation's first professional 'soccer specific Stadium,' the Columbus Crew Stadium. I still count that as my biggest professional highlight," says Daily.

In 2003 he moved down I-71 to become Head Sports Field Manager for Paul Brown Stadium. Daily recently answered some questions about his testing and use of a specialty turf fertilizer product in Cincinnati.

"I was reading articles about silicon and calcium and how they increase the rigidity of the grass plant, as well as helping the plant during times of stress. I liked the fact that the Excellerator product has 24% calcium and micronutrients," Daily says. "Using it allowed us to apply a combination of benefits in one application and at a lower cost than the products we were using.

"Since it was a new product to us, we set up an experiment with different rates in an area where we practice the offensive linemen. Our thought was that space is the toughest spot on our practice fields because of the huge men that work there, and if the grass showed improvement, then it would work on the less trafficked areas," Daily says. "In about one month, we noticed the grass blades were more erect and stiffer.

"When we walked on the grass, you could feel how stiff the grass was under your feet and with the help of a PGR, the grass cut much more evenly. Once the players started to practice on it, the area held up great and recovered more quickly."

Daily says, "We have a significant soil layer on top of our sand-based rootzone, a result of the sod that was laid during the construction of the practice fields in 1999 and subsequent lack of aeration. The layering problem creates a shear plane and the grass will divot up when a player makes a hard lateral move.

"The layering issue is being attacked through hollow tine aeration, removing the cores, verti-cutting, and topdressing with both sand and Profile. We have been aerating the fields 6-8 times a year to try and remove that layer," he says. "It has been a slow process. We have also been using a PGR over the past 2 years to assist with root mass and to promote lateral growth in the bluegrass.

"The traffic issue is tackled by continually overseeding with bluegrass before the season and ryegrass during the season. We also use a PGR to promote lateral growth and promote a much denser root mass, and work diligently with our equipment managers to move drills around."

Daily says, "Our goal is to manage the soil layer to a point where there is more porosity in the top layer, giving the roots more space to grab on and give support to the whole system. We just applied our second Excellerator application March 30. We are noticing the plant starting to stiffen ever so slightly. This is the first year we have used

"OUR GOAL IS TO MANAGE THE SOIL LAYER TO A POINT WHERE THERE IS MORE POROSITY IN THE TOP LAYER, GIVING THE ROOTS MORE SPACE TO GRAB ON AND GIVE SUPPORT TO THE WHOLE SYSTEM."

the product on the entire field. We are targeting the fields to be fully up to standards by our Rookie Mini-Camp in early May.

"We are applying the product every 4 weeks at a rate of 10 lbs. per 1,000 sq. ft. Last year during our test set-up, we applied 25 lbs./1,000 on one 40x40-foot plot and 50 lbs./1,000 on another 40x40-foot plot at one time in March 2005," says Daily. "We noticed no difference in the rigidity of the plant and the plant performed exactly the same. We applied one application @ 10 lbs./1,000 again on our entire 160x40-foot area in June 2005. We noticed a small amount of change in untreated area, but showed a continued strength in the early test plots throughout the football season."

Daily says, "I have not seen any change in pH. And, coupled with the price of this product and fewer man hours used to apply only once rather than twice has been a benefit.

"I will know better how it works this time next year after a full year of using the product over the 2 1/2 practice football fields. I am not sold on any product because of what it did on small test plots. I want to see how it performs in a real life situation like the one we are putting it through now."

This interview was conducted by Sheree Scarbrough from Excell Minerals, 866-401-5700. ■

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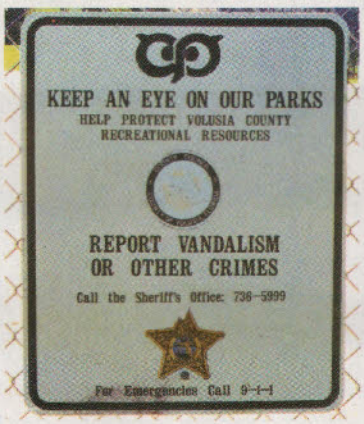
Public awareness attack!

By Floyd Perry



At many of the parks, athletic facilities and Little League complexes I have visited, problems with basic, general tasks that go ignored by "the average Joe" maintenance worker, come into sight. It may be an empty aluminum can or potato chip bag not discarded in the nearest waste container or a pet on the loose and making a mess inside the playing field fence, without the owner's concern or a mention from an attendant.

Some parks and communities have uniformed personnel on property daily to enforce city ordinances and create a positive environment for all age groups and visitors. What about the public facilities that aren't so fortunate? How can they handle daytime problems and create a viable and safe play area without an extensive support staff?

Some administrators have taken concerns to the streets in the form of properly placed signage in an attempt to generate a positive image and solve some public nuisance concerns. The examples shown here of quality signage have been seen at parks and competitive facilities across the country. The key to nonverbal communication is to keep the message to the point, short and direct, and position it where everyone can view it while entering or moving about the property. Some park administrators claim that signage isn't effective, that kids and visitors will ultimately do what they want, but let's try to change that thought in the 21st century.

Good luck with your public awareness attack. If we, as progressive groundskeepers, could eliminate one hour every day of trash pick-up, more time could be devoted to improving turf and game field playing surfaces.

Floyd Perry, Jr., is president of Grounds Maintenance Services in Orlando. He received the STMA's Dick Ericson Award in January, which honors a sports turf manager who positively impacts the sports turf industry and exhibits effective team leadership. He can be reached at 407-903-1220. ■