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ents from the nutrients. Otherwise, you can't clearly identify the cause and effect."

Karnok concurs. "It leads some of us to wonder if you could get the same results by tweaking your nutritional program instead of purchasing the extra materials."

Erik Ervin, a turfgrass professor who followed in the footsteps of Dick Schmidt, a biostimulant advocate at Virginia Tech, says he would be happy to supply Karnok with his research studies. Ervin, who has replicated and refined much of Schmidt's work, says the evidence is clear that biostimulants have a positive effect on turfgrass systems separately from the nutritional components of the products.

"I came to the whole biostimulant issue as a skeptic, so I did an experiment where I burned off all the organic materials so only the nutrients remained," Ervin says. "When we applied them to the test pots, we saw no effects at all."

Ervin adds that the amount of macronutrients supplied when using these products at label rates would often not be adequate for even spoon-feeding purposes. Biostimulants should be used to supplement a good fertility program — not replace one. "The levels of nutrients in the seaplant or humic acid extracts used in our studies aren't high enough to produce the benefits we see by themselves."

Bill Byrnes, president of Floratine Products, empathizes with academic researchers' objectives.

"But delivering product value demands recognition of the many nutritional and 'non-nutritional' elemental interrelationships in plant growth processes and addressing them with synergistic components," Byrnes says. "They are interconnected."

While Karnok concedes that Byrnes may be right, he says he'd still like to test the active ingredients separately. "It would remove some of the doubts that still remain for superintendents."

The debate over research

One of the thorniest questions in the biostimulant debate is what constitutes appropriate research. When explaining the benefits of their products, companies often cite internal testing by their research-and-development departments as well as university research they've funded.

Byrnes says Floratine has supported and cooperated with more than 15 universities in many trials and continues to do so. "Even so, all our product development research is on real-life turf stress conditions because helping superintendents is what matters," he adds.

Weltzein says Novozymes/Roots has done more than 100 studies at 16 universities.

Geoff Simril, sales manager for Milliken Turf, scoffs when critics say there hasn't been enough research. He says there's plenty of basic and applied research that shows that the use of seaplant extract, humic acids and amino acids can help keep turf healthy under stressful conditions, and that similar products have been used in agriculture for years with success. "The body of scientific evidence is actually pretty overwhelming, so I don't understand that line of argument," he adds.

Weltzein says he believes the current research proves biostimulants work, but he wishes it would explore the relationship between biostimulants and traditional nutrition programs. "We believe biostimulants allow superintendents to reduce nutritional inputs significantly, but we've had a hard time finding a researcher willing to push it that far," Weltzein says.

But critics, and even some supporters, acknowledge that at least some of the research might not hold up in the field. Christina Wells, a professor at Clemson University, says she doesn't doubt the research that proves biostimulants provide benefits to turfgrass under controlled greenhouse conditions. But she wonders about whether the research adequately mirrors what actually happens on golf courses.

"There's been some controlled science that shows promise," Wells says. "That doesn't make the research any less valid in its conclusions, but it's not real-world conditions."

Even Ervin, who says his greenhouse research proves that biostimulants work, says he'd like to duplicate his results in the field but has had trouble doing it.

"Right now, it's a fairly accurate representation to say that most published biostimulant research has been done under controlled environment circumstances," Ervin says. "We've been able to see some successes in field trials — small increases in root mass under moderate stress conditions — but nothing I'd want to stake my professional reputation on."

Karnok says the available research shows some biostimulants work with certain varieties under certain conditions, but that doesn't mean they would work for *all* varieties under *all* conditions. "With so many different varieties of turf, it's hard to see how biostimulants could be treated as a one-size-fits-all solution to any problem," he says.

Wells says more research needs to be funded so products can be tested under actual golf course conditions, but she says the money for such research is scarce. "As researchers, we're always constrained by the priorities of the funding agencies," she adds.

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Backing for Biostimulants?

In a recent online survey, *Golfdom* asked its readers how they use biostimulants.

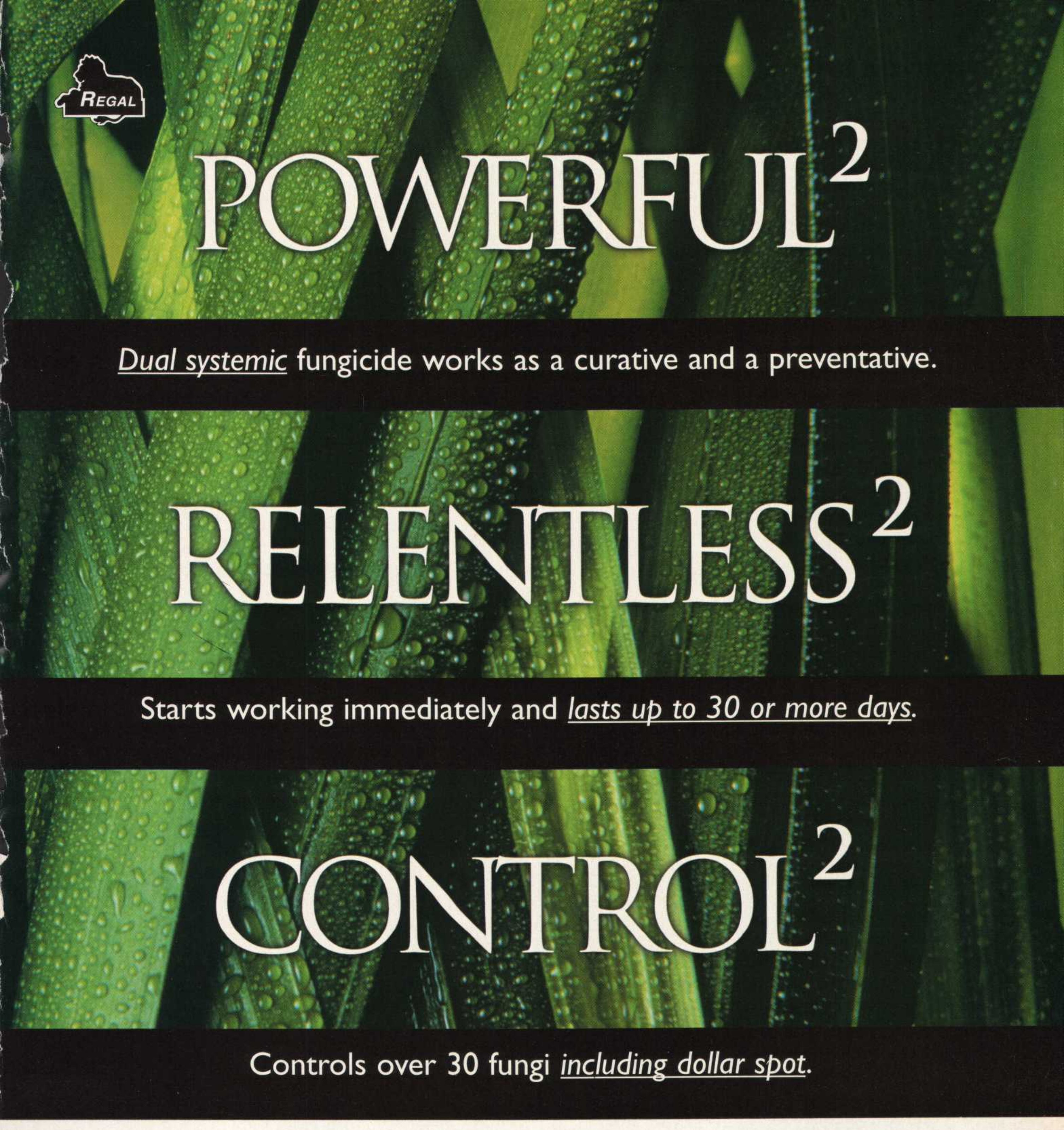
49% use them as part of their regular maintenance programs.

7% use them frequently as a supplement during times of severe turf stress.

24% use them occasionally as a supplement to normal cultural practices.

20% never use them because they have too many questions about their effectiveness.

BASED ON 118 RESPONSES Golfdom



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Superintendents could push for more funding from the USGA and other funding organizations. "If superintendents demand research, then the money will follow," she says.

Gary Grigg, former superintendent and vice president/agronomist of Grigg Bros., a foliar fertilizer and biostimulant manufacturer, says the industry segment won't boom until suppliers provide more independent university research.

"The bottom line is that the people superintendents listen to — the university professors — are still skeptical about the products in many ways," Grigg says. "Companies need to involve them more aggressively if they want to succeed."

Grigg is quick to add that he's not saying university researchers have a monopoly on good research.

"There are a lot of former academics in the research-and-development departments at these companies that do good work," he says. "But superintendents are more likely to trust research done by outsiders."

The ideal use

Floratine's Byrnes says anyone labeling any product as a cure-all is both unethical and economically unsound.

"Well-designed biostimulants are simply tools which can supplement turf's resources to handle stress," Byrnes says. "There are no silver bullets."

The manufacturers say biostimulants should be used as part of a regular maintenance program to build up the plant's tolerance for stress.

Milliken's Simril says today's greens are always under stress because of lower mowing heights, so superintendents shouldn't wait until a drought or other environmental factors force them to go to biostimulants.

"The question of when stress begins for turf has changed significantly over the years," Simril says. "Low-mowing itself stresses the turf by eliminating photosynthetic areas. You can't decide at the last minute to use these products because they don't give you instant results."

Biostimulants make the plant tougher by stimulating antioxidant production. They also may stimulate root growth, increase photosynthetic rate and capacity, and increase stress tolerance and disease resistance, Simril says.

But not everyone believes superintendents should use biostimulants so broadly. Instead, Wells suggests that biostimulants may be more like prescription medications.

"Under specific stress conditions, biostimulant use may be beneficial," Wells says. "But without further research under real-world conditions, we don't have enough information to write specific prescriptions."

Which brings the debate back to Karnok. He says that in an era when superintendents are looking for every angle to give them an edge, biostimulants are a nice safety net.

"I wouldn't rely on them to take care of all your problems, but they're not hurting anything," Karnok says. "As long as you're not skimping on other items like fertilizer and pest control materials and you can afford them, I'd cautiously consider them."

Ultimately, each superintendent will have to evaluate how useful biostimulants are in their individual situations.

"Superintendents will have to try them to see if they work for them," Grigg says. "That's the best kind of testing there is." ■

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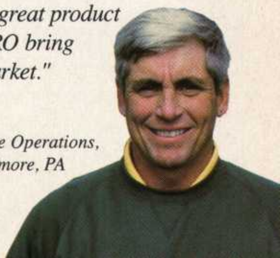

Matt Shaffer
Director of Golf Course Operations, Merion Golf Club, Ardmore, PA

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The Dog Days of Summer (Patch)

Reducing turfgrass stress and promoting healthy root development are keys to controlling difficult disease

BY MIKE BOEHM AND JOE RIMELSPACH


THE OHIO STATE UNIVERSITY

This photo depicts colonization of summer patch on creeping bentgrass.

Turfgrass patch diseases such as summer patch, take-all patch and spring dead spot are difficult to diagnose and manage. They are caused by a group of fungi known collectively as the ectotrophic root-infecting (ERI) fungi. The ERI fungi produce darkly pigmented runner hyphae along the surface of, and ultimately inside, the vascular tissue of roots. They typically colonize roots, crowns and stolons during periods favorable for turfgrass growth and result in compromised root function during periods of stress.

The characteristic patch or ring spot symptoms associated with these diseases are typically not observed until the turfgrass is stressed by a change in environmental conditions or as a result of cultural management practices. Before 1984, the only confirmed turfgrass disease of this type in North America was take-all patch (formerly known as *Ophiobolus* blight or patch) caused by *Gaeumannomyces graminis* var. *avenae*. Today, at least six different patch diseases of turfgrass are recognized and include: necrotic ring spot (caused by *Leptosphaeria korrae* and recently renamed *Ophiosphaerella korrae)*; summer patch (caused by *Magnaporthe poae*); spring dead spot of bermudagrass (caused by *Leptosphaeria narmari*); bermudagrass decline (caused by *Gaeumannomyces graminis var. graminis*); bentgrass dead spot (caused by *Ophiosphaerella agrostis*); and take-all patch.

Summer patch is most often associated with Kentucky bluegrass, annual bluegrass and various turf-type fine fescues. It has also been reported as a problem on other *Poa* and *Festuca* species and most recently on creeping bentgrass. The disease was first described in 1984, and the summer patch pathogen *M. poae* was identified in 1987.

Symptoms of summer patch are most prevalent and severe during hot (65 degrees Fahrenheit to 85 degrees F), humid or wet weather on stressed turfgrass grown in poorly drained soils. Frequent irrigation also increases disease pressure. Soil pH does not appear to influence summer patch the way it does take-all patch.

Colonization of the host begins when soil temperatures reach 65 F to 70 F, but symptoms don't generally appear until later in the season when temperatures peak (85F to 95 F). Optimal temperature for growth of *M. poae* in the laboratory is reported as 82 F to 87 F.

Summer patch can be confused with other diseases caused by ERI fungi. Although not entirely valid from a scientific standpoint, many field diagnoses of turfgrass patch diseases are based on the type of grass affected (take-all patch if on creeping bentgrass; summer patch if on *Poa annua* putting greens). Although somewhat useful for field diagnoses, the only sure way to know which disease one is dealing with is to have it analyzed by a turfgrass disease specialist or clinician.

On high-cut turfgrass, such as in roughs and clubhouse surrounds, the disease appears as irregular patches, rings and crescents. It appears similar to necrotic ring spot, even to a trained eye. Patches are typically about 1 foot in diameter but often coalesce.

On low-cut turfgrass, such as putting greens, the patches and rings are better defined. Yellowing and decline is often restricted to the *P. annua* in mixed bentgrass/*P. annua* swards. The roots, crowns and stolons of heavily infected turfgrass is often severely darkened because of the presence of a large amount of ectotrophic runner hyphae — a key diagnostic sign of this and other diseases caused by ERI fungi.

The pathogen *M. poae* is believed to survive unfavorable periods as dormant mycelium in thatch and in infected roots. During cool, moist weather, typical of April and May in the Midwest, the pathogen breaks dormancy and penetrates roots, crowns and stolons. As mentioned previously, primary infections occur when daily average soil temperatures reach between 65 F and 70 F. During this time, the pathogen quietly colonizes and compromises the integrity of turfgrass roots and crowns.

During seasons dominated by ideal turfgrass growing weather, symptoms may not be evident. However, under periods of increased stress, such as those brought about by heavy play, agronomic maintenance practices or the heat of the summer, plants with compromised root systems simply cannot maintain themselves and die.

The first line of defense to prevent or minimize summer patch is through the selection and/or use of disease-resistant turfgrass species/cultivars. Unfortunately, the use of genetically resistant turfgrass is limited to newly established or renovated turfgrass areas or in situations where overseeding is used. Many of the new Kentucky bluegrass varieties offer resistance to summer patch. Information regarding

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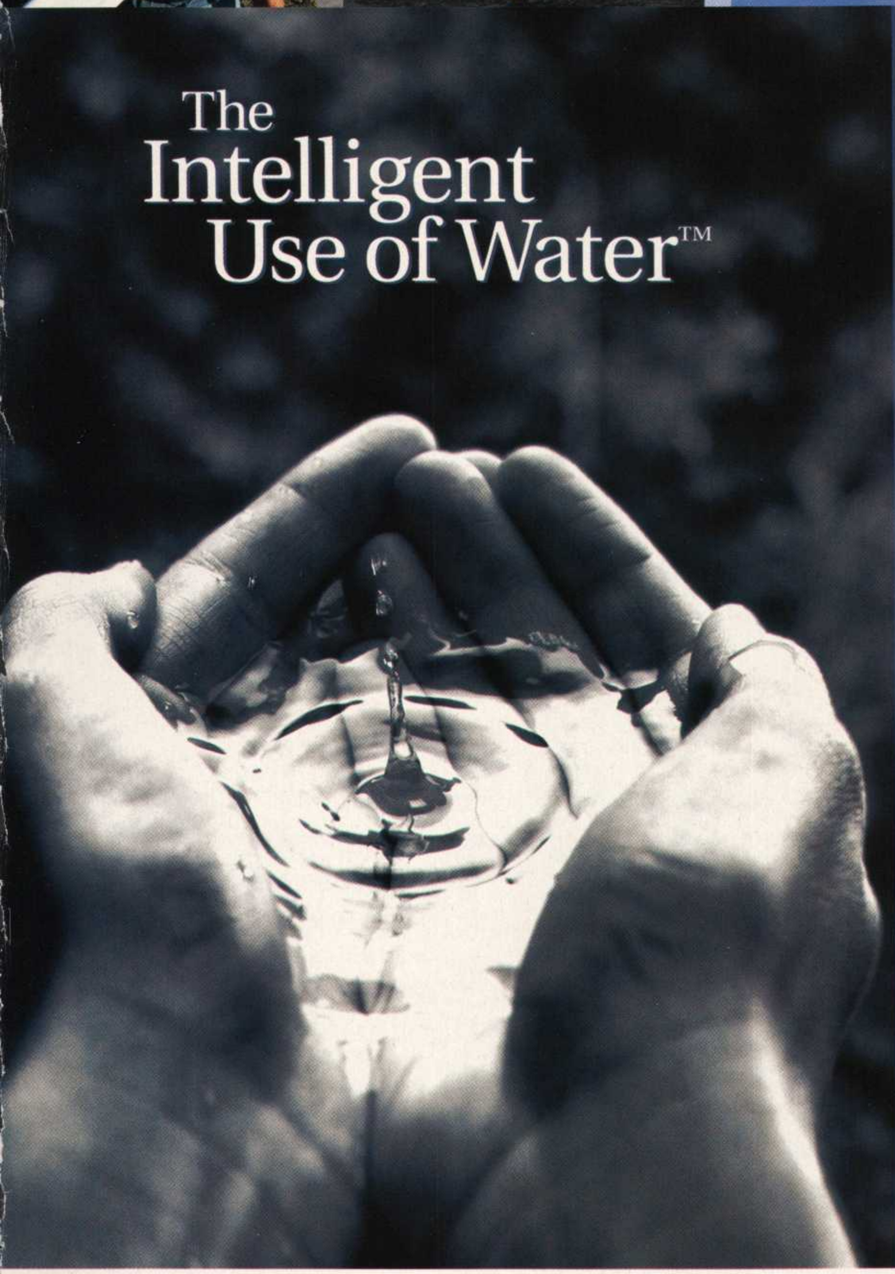

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disease resistance can be obtained by contacting seed distributors, extension specialists and through the National Turfgrass Evaluation Program (*www.ntep.org*).

For most, practical management of summer patch begins with the use of cultural practices designed to reduce stress and optimize turfgrass growth. Management practices that promote adequate drainage, reduce soil compaction and promote healthy root growth along with a balanced fertility program are key to avoiding summer patch. The use of quick-release nitrogen (N) fertilizers and frequent, light irrigation cycles should give way to the use of slow-release N fertilizers and deep, penetrating irrigation. Although often recommended but difficult to implement, avoid mowing turfgrass below recommended heights.

In general, do anything and everything possible to reduce stress and promote healthy growing grass. In addition, timely preventive fungicide applications are typically warranted to manage summer patch.

Fungicides labeled for use against summer patch include the stobilurins, the sterol inhibitors, thiophanate-methyl, iprodione and fludioxonil. Thiophanate-methyl also works well as a curative fungicide.

Although turfgrass pathologists may vary somewhat in their recommendations for when to begin fungicide applications, most agree that they should be made when soil temperatures (at 2 inches to 3 inches) reach 65 F. When making fungicide applications, it is critical to know the location (roots, crown, shoots and stolons) of the targeted pathogen and apply accordingly. No biological control products are available for managing summer patch. ■

Boehm is an associate professor and turfgrass pathologist at The Ohio State University. Rimelspach is an extension turfgrass pathologist at OSU.

Evapotranspiration

Offers Superintendents More Irrigation Control

BY ALAN CLARK

For more than 25 years, state-of-the-art central irrigation control systems have been computerized and have simplified how superintendents set run times for sprinklers. Whether the central system is programming a field satellite, paging a superintendent or activating a decoder, it still tells that sprinkler station to run for a certain amount of time.

Today, we have the capability of setting specific run times for individual sprinkler heads depending on how we choose to water: deep watering, frequent/short run times, or repetitive cycles and repeats. But despite using these precise computers, superintendents must still answer the vital question: How should we determine how long those run times should be?

Superintendents have two options to set run times for today's irrigation central-control systems. One method is to set specific run times in minutes and budget for each of those times from one day to the next, depending on weather conditions. The other and more scientific option is to let a weather station calculate evapotranspiration (ET) rate and let the central-control system set the run time itself. To understand how using ET values to set your run times can help your irrigation system run more efficiently, it's important first to understand exactly what ET stands for and why it's important.

ET rates are calculated by combining two separate plant processes — evaporation and transpiration. Evaporation is how water moves from the soil to the air, and transpiration is how water moves from the soil through the plant to the air. When the water loss of the two processes are combined (an ET rate), superintendents have a calculation that will tell them the precise amount of water needed to replace what the turf lost because of ET that day.

Weather stations play a vital role in calculating evapotranspiration values

RAIN BIRD

Many on-site weather stations can calculate ET rates automatically after collecting data from five sensors over a 24-hour period. The sensors measure the minimum and maximum temperatures; relative humidity; wind speed; sunlight; and rainfall amounts. The weather station averages the data and calculates an ET value based on a modified Penman equation. That rate is transmitted to the central-control system, which uses it, combined with the precipitation rates of the sprinklers to calculate the run time for each station, to set proper run times.

So why is using the ET method a better way to set run times than more traditional, time-based systems? ET maximizes water-distribution efficiency because of its precision. Superintendents avoid over- or underwatering certain areas of the golf course because they are replacing exactly the amount of water the plant lost during the day, meaning the plant can use the irrigation water immediately. That limits runoff and water waste.

It's difficult for superintendents to notice the difference between a day with .16 ET and a day of .15 on their own, but an ET-enhanced control system can save thousands of gallons of water because it *does* recognize the difference. This can reduce water costs and result in electrical savings because the pump station does not have to run as long.

Since golf courses are often made up of multiple microclimates, however, superintendents are often skeptical of how calculating ET rates off of one weather station can possibly control the irrigation system for the whole course. One option is to position multiple weather stations throughout the golf course, which allows for accurate determination of proper ET values for the different microclimates so the central-control system can calculate precise run times for the area.

Another option is to assign a different percentage value for each sprinkler station in the central control. This percentage would adjust the run time of