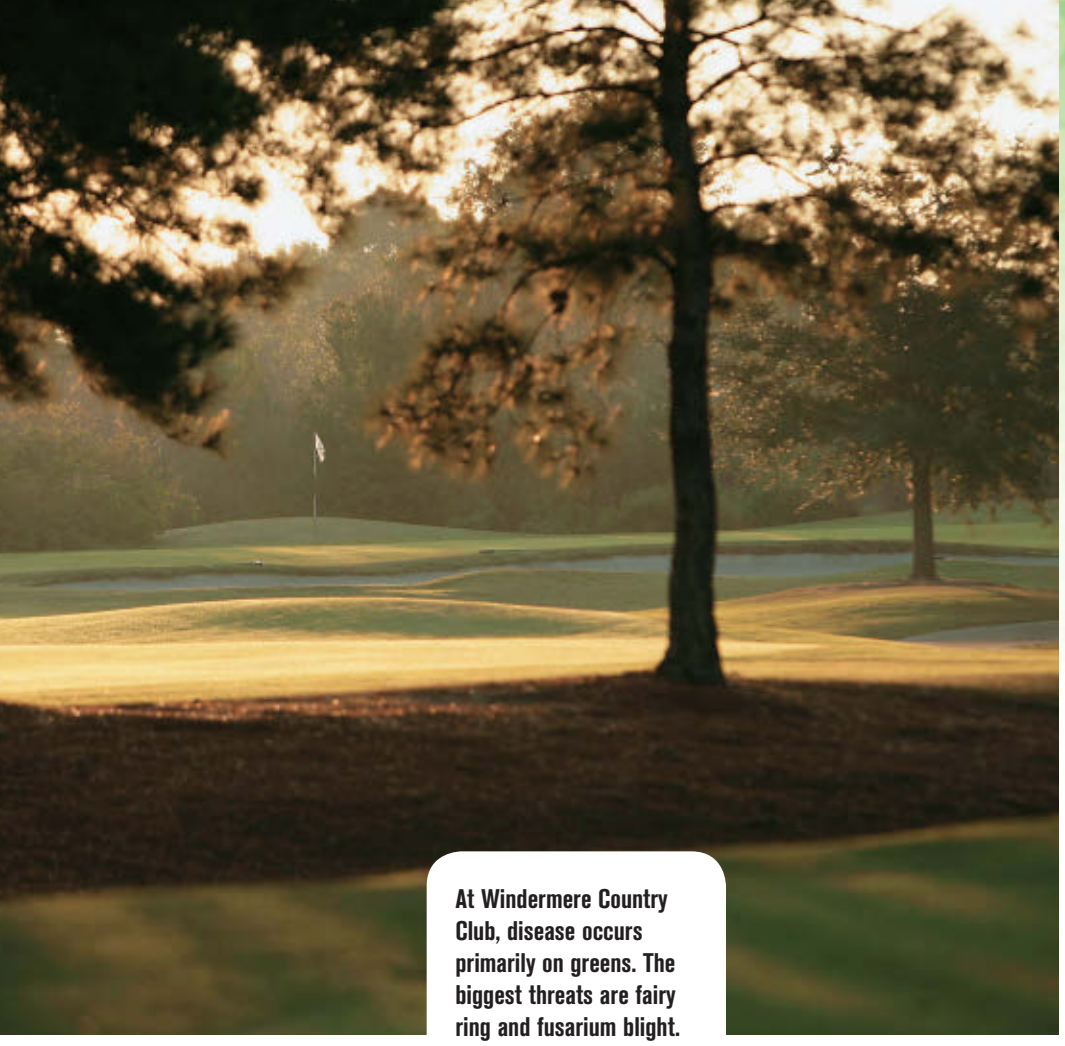

At Windermere Country Club, disease occurs primarily on greens. The biggest threats are fairy ring and fusarium blight.

Nothing did, so he scaled back applying fungicides on all greens and just applied product on the ones with disease and the two greens on either side of affected ones. Now he just treats affected areas and their surroundings and then watches closely to see if any disease spreads.

"We were wasting product and didn't need to spray all 18 greens," Boe says. "Fifty percent of the time, we don't treat the entire course. Other times, after two days of seeing disease, we have to treat other greens. If no disease appears elsewhere in two days, we're OK."

Boe estimates he has saved between $2,000 and $5,000 per year on product and manpower because of this wait-and-see approach, which was implemented about a year and a half ago. The fairy ring treatment alone [pyraclostrobin and flutolanil is $2,000 (to treat all greens). Boe uses thiophante methyl for the fusarium blight but doesn't rotate it that much because the disease doesn't appear as much.

Boe also applies chlorothalonil (targeting blue-green algae) once a month to help dry the greens. He applies it every two weeks during the rainy season (May through September).

Additionally, Boe's use of beneficial soil microbes, which he mixes with water and sprays on greens, helps combat fairy ring. Since he's applied the microbes, he hasn't had to treat for fairy ring.

Equipment, too, factors into a well-rounded disease-management approach. Corcoran has tweaked his equipment to get the biggest advantage to maximize each fungicide application. He switched from rain-drop nozzles to flat-fan nozzles about five years ago.

"Equipment is a huge part of our disease management program," he says. "We make sure the spray rig is calibrated every day before it goes out on the course. That aspect of a disease management program is commonly overlooked."

Don't overdo it

In addition to fungicides, fertility goes hand in hand with disease management, helping superintendents manage disease better and affecting how well turf combats stress that causes disease. The healthier the plant, the better it will fend off disease.

Brickley has changed his approach throughout the years. He used to apply fertilizer at a higher rate than he does currently. Now on the lean side, his smaller rates in the fairways are one-tenth to two-tenths of a pound per 1,000 square feet.

"Be sure to check your organic matter so you know what you're dealing with," he says. "Curtail your fertility program based on that."

Brickley previously used more granular fertilizer when he started at Bunker Hill. Now he spoon-feeds greens more to make sure the plant doesn't get stressed, applying 2 pounds to 2.5 pounds of nitrogen a year.

"I like the use of foliars for better control of my program," he says.

Hamilton spoon-feeds about every two weeks and hand-waters his greens to keep them lean. He applies ammonium sulfate, molasses and compost teas for microbial growth. He monitors clippings daily.

"If I put food out, the plant will wolf it down," he says. "Spoon-feeding helps the overall vigor of the grass, so it'll be more resistant to stress. Sometimes you can make your own hell and create an environment for disease by over-fertilizing and over-watering."

Boe reduces water and fertilizer application signifi-

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"Fifty percent of the time, we don't treat the entire course. Other times, after two days of seeing disease, we'll have to treat other greens. If no disease appears elsewhere in two days, we're OK."

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cantly when disease flairs up to harden the plant a bit. He spoon-feeds the greens, totaling between a quarter and half a pound per 1,000 square feet a year.

Fertility and some diseases are more closely related. For example, anthracnose is directly tied to fertility levels. However, you can't counter anthracnose without applying a fungicide, Corcoran says.

Cox says he could increase fertilizer amounts to combat dollar spot, but that would make pythium and brown patch worse. He applies about 2 pounds of nitrogen on the greens annually.

H2 no

Much like fertilizer, water use is tied to turf disease. Brickley, for example, hand-waters more than he did in the past because it makes a significant difference — saving water and growing healthier turf.

Corcoran, like Hamilton, warns superintendents about over-watering because it can provide an environment for disease to thrive.

"I like to have dry greens in the morning as quickly as possible," he says.

Watering greens depends on when they need it and the weather. For example, watering every other night is likely during the middle of summer. Watering deep and infrequently is recommended typically.

Hamilton aims to keep greens as dry as possible for as long as possible. He waters in the late night and early morning.

"Too much water will get you into too much trouble," he says.

For Boe, some greens at Windermere can go a week or more without irrigation and others need watering every night because they're out in the open, are mounded and have high sand content.

Lessons learned

Over his career, Hamilton has learned he doesn't have to overprotect the turf.

"If it's struggling, I'm here to help," he says. "I'll just hit it with compost tea and molasses."

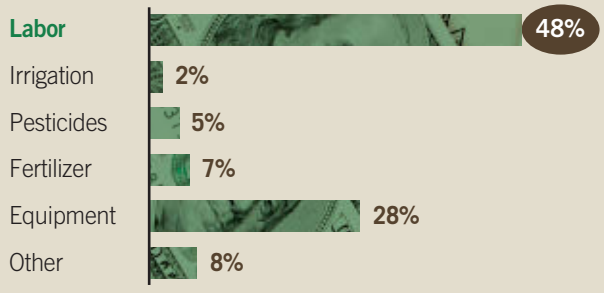
When Hamilton was younger and the superintendent of a Texas course with bentgrass greens, he was so protective of his course's turf that he applied fungicides every week. Now, Hamilton says that's unnecessary.

"The grass will tell you if it needs help," he says. "I pay attention to it. I let it do its thing. But I'm not willing to jeopardize my employment." ■

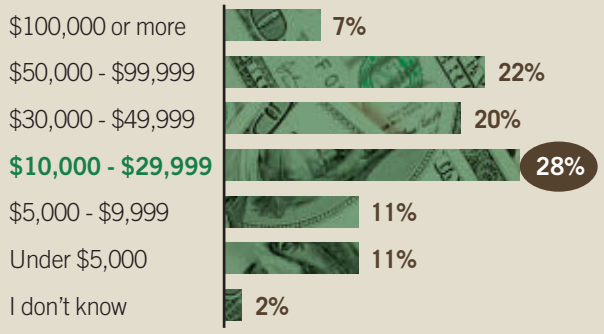
Walsh is a contributing editor to Golfdom and a freelance writer from Cleveland.

PESTICIDES & YOUR BUDGET

What is the area of your budget you're most likely to cut if asked to do so?



What was your total budget for fungicides in 2009?



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CONTEMPLATING Organics

By Ron Furlong,
Contributing Editor

Superintendent is open to using more of such products – as long as he doesn't have to look over his shoulder

When I told my wife Nikki there were actually organic fungicides available to superintendents to use on the golf course, she couldn't understand how I ever even thought of using inorganics anymore. Nikki's gone green. It can be a bit of battle in the household sometimes.

"You're going to recycle that, right?"

"Ah . . . yes, of course. Never thought otherwise."

But her question about why aren't we all using organic pesticides, and organic fertilizers for that matter, deserves some thought. Why aren't we?

Well, I had my answer ready, which I didn't hesitate in rattling off to her, but it did make me reconsider that argument, and why we, as superintendents, have tended to make the inorganic argument without second thought.

Our argument is, of course, that conventional chemical-based pesticides work better than organics. Simple as that. This is what we believe. Is it accurate? In most cases, it probably is. But in all cases? I'm not so sure.

There has been organic success in agriculture, but for some reason this hasn't trickled down much into turfgrass maintenance. But, as companies are bringing better organics to the playing field and developing more resistant grasses, do we need to reconsider this argument? Are there other reasons to start reconsidering it?

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PHOTO COURTESY: SOUTHWORTH DEVELOPMENT

Very few chemicals are used on courses such as Machrihanish Dunes in Scotland. But that's Scottish golf for you. Can American golfers handle the rugged look?

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Contemplating Organics

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The main thing is this: Superintendents tend to use conventional chemicals for one reason, a reason they may not even be conscious of on many levels. They use them because of job security. Let the guy down the street be the guinea pig. I'm not going to risk my job on going green. And this fear, in most instances, is justified.

And it goes deeper than just the superintendent fearing if he lets his greens go to pot he'll be out the door. It courses through the main artery of the whole problem: expectations — from golfers, general managers, owners and green committees. It's all about perception of what golf courses should be in 2010.

Everyone must be willing to accept a different type of product, one that returns to the very roots of golf and the links courses that started it all on the rugged coasts of Scotland years ago. The only way superintendents will be comfortable embracing this bold new world is once they feel all these other entities (owners, general managers, etc.) have embraced it first. The superintendents can't be the ones leading us all down this path. Because if they try and nobody embraces, superintendents could lose their jobs. Who's going to volunteer for that?

It's all about perception of what golf courses should be in 2010.

It has to come from above. And in the cases where it has come from above, like the Mike Hurdzan-designed Widow's Walk Golf Course in Scituate, Mass., which calls itself America's first environmental demonstration course, the superintendent can comfortably fight this battle using organics, figuring out what works and what doesn't, and not be looking over his or her shoulder all the time.

Perception? Perception from above is the key.

When you see headlines like "America's 18,000 Golf Courses are Devastating the Environment" (actual headline from a 2004 article from organicconsumers.com) you know the path we're headed. It may not matter when we say we use chemicals responsibly and don't harm the environment, which is true. Common sense and even science don't always prevail.

It wouldn't take Nostradamus to tell us where golf course plant protection will be in 20 years. The writing is on the wall.

I mentioned companies developing better, more dis-

ease-resistant grasses for us in the future. This may be key in the future of turfgrass management. Just as important is the work that basic manufacturers have been doing in researching and developing reduced-risk pesticides that may be an area of some sort of compromise in the future.

As for myself, I'm hoping to give another organic a try this summer—maybe creating a test area on a nursery or practice green is the best way to ease into it. I've always been more behind the approach of letting the guy down the street be the guinea pig, but I think that needs to change. It starts with helping to educate golfers and the powers that be at our golf courses that things do, indeed, need to change. Weeds are a good place to start. For one, it's a lot easier to convince someone to live with some clover or chickweed in the fairways than it is some disease on the greens.

To my knowledge, although I haven't tried them myself, organic herbicides haven't been incredibly successful. Perhaps this is a good place to start with changing perception — allowing some weeds into the turfgrass. Or I should say, allowing someone to allow you to let some weeds into the turfgrass.

Organic is a word that has changed in recent years, in so much as the way we react when we hear it. Maybe I shouldn't speak for everyone. It has changed for me when I hear it. I used to roll my eyes at the word and even cringe a little. I'd avoid the organic vegetable section of the produce area in the grocery store like the plague. But I've softened. I buy organic food now, even veggies.

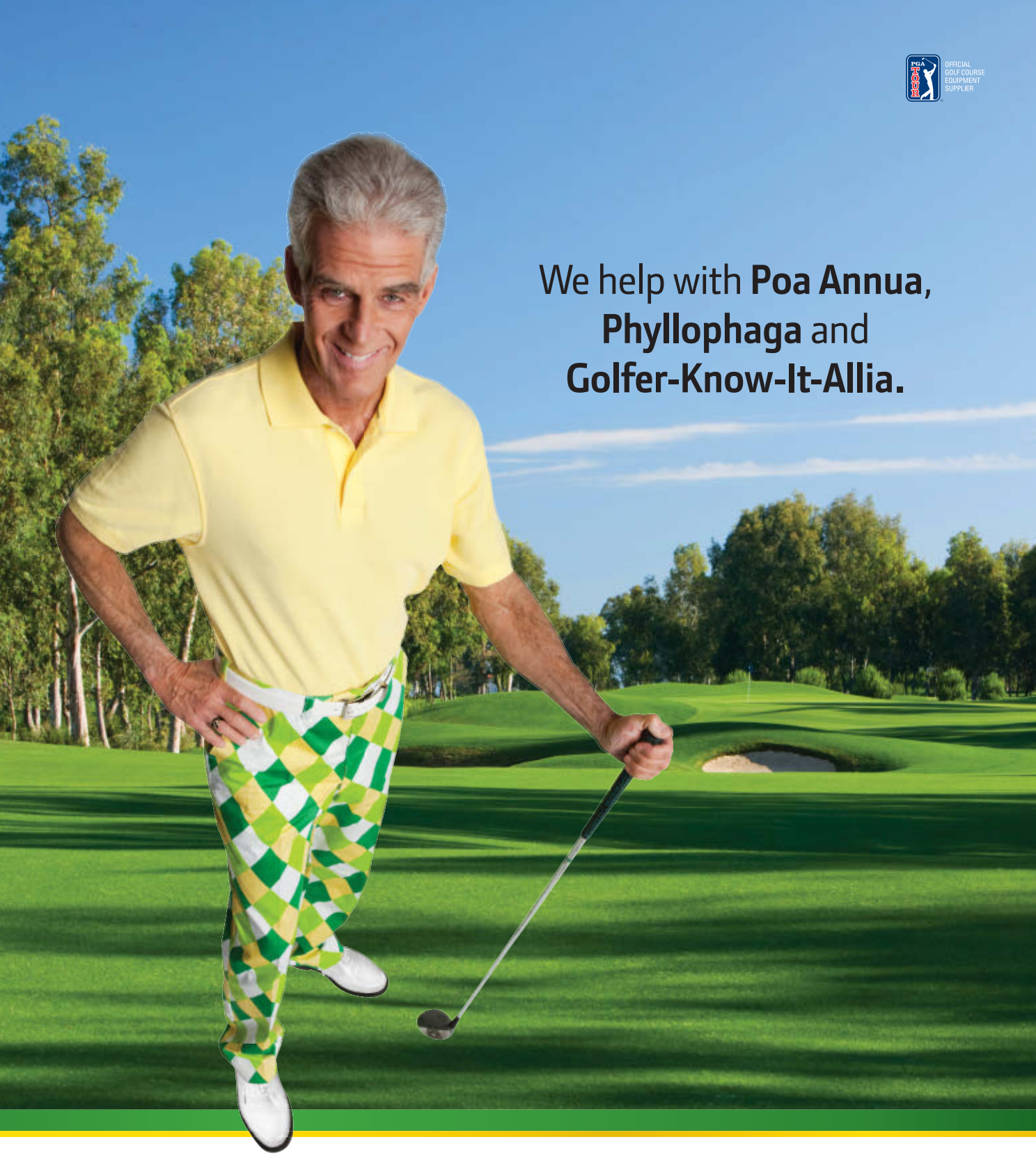
I've spread organic fertilizers a couple times a year and have even experimented with an organic fungicide. But I'm not in position to roll the dice and go 100-percent organic.

I'm still, like most superintendents, looking over my shoulder and worrying too much about fusarium and anthracnose and how the greens are rolling. The perception around me hasn't changed.

Am I now realizing this is part of my job? Yes. As an environmental steward, I must help change that perception.

So, next time I'm sitting on the couch with Nikki watching the Planet Green Channel, and she turns to me and asks how I'm doing on the organic front at work, I'll smile and say, "It's coming along." ■

Furlong, a Golfdom contributor, is golf course superintendent of Avalon Golf Club in Burlington, Wash. He can be reached at Rfurlong5@gmail.com.



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TURFGRASS TRENDS

HERBICIDE RESEARCH

Spring-Applied Pre-emergent Herbicides Can Impact Nitrogen Uptake

By Benjamin Wherley

One area where caution has often been advised is selecting the proper pre-emergent herbicide for newly established or heavily trafficked turfgrass. This is because numerous studies have shown that some pre-emergent herbicides may inhibit or delay rooting in these situations (Johnson, 1976; Bingham and Schmidt, 1983). However, often little regard is given to selecting the best-suited product for established turfgrass.

Although soil mobility of pre-emergent herbicides is generally low, pre-emergence herbicides may move downward in soil following application under certain conditions such as high soil moisture or low organic matter content, which inhibits not only seedling growth, but also root initiation from rhizomes in established stands of turfgrass (Fishel and Coats, 1993). Root mass reductions have been reported for established cool-season species Kentucky bluegrass and tall fescue following application of the dinitroanaline herbicide prodiamine (Hummel et al., 1990; Han et al., 1995).

Established warm-season turf stands may be particularly vulnerable to spring root inhibition from pre-emergent herbicides in areas where seasonal growth and dormancy cycles occur. Turfgrass researcher Joe DiPaola et al. (1982) observed that warm-season turfgrasses undergo significant dieback of old roots and replacement by new roots arising from existing rhizomes or stolons during the spring transition period, which typically coincides with the presence of pre-emergent herbicides.

These newly formed roots play a vital role in nitrogen acquisition during spring greenup (Wherley, 2007). And while spring nitrogen applications are not advised for two to three weeks following bermudagrass green-up (Beard, 2002), pre-emergence herbicide-induced root inhibition may persist well beyond this time frame.

The questions we wanted to address with this research were:

- What are the effects of commonly used pre-emergent herbicides on spring root regrowth and development in established bermudagrass?
- Do these changes influence the efficiency at which nitrogen is acquired following spring fertilizer applications?

This study was conducted at the University of Florida's G.C. Horn Turfgrass

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Spring root dieback in common bermudagrass. Note that the old root system has turned brown and a new root system is developing.

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Field Laboratory. A 3-year-old native, sand-based stand of Tifdwarf bermudagrass (*Cynodon dactylon* Pers. X C. *transvaalensis* Burt-Davy) was selected for the study because it had never been treated with pre-emergent herbicides. The plots were maintained at 0.5 inch mowing height throughout the study period. Soil at the site had a pH of 6.4 and organic matter content of the upper 8 inches of soil was 1.04 percent.

Treatment plots were arranged in a completely randomized design with three replications. On Feb. 16, 2009, granular formulations of either dithiopyr [3,5 pyridinedicarbothioic acid, 2-(difluoromethyl)-4-(2-methylpropyl)-6-(trifluoromethyl)-S,S-dimethyl ester] applied at 0.37 pounds of active ingredient per acre, prodiamine [N3,N3-Di-n-propyl-2,4-dinitro-6-(trifluoromethyl)-mphenylenediamine] applied at 1 pound of active ingredient per acre, or oxadiazon [2-tert-butyl-4-(2,4 dichloro-5-isopropoxyphenyl)-2-1,3,4-oxadiazoline-5-one] applied at 2 pounds of active ingredient per acre were applied to plots and watered in. At the time herbicides were applied, plots were in the early stages of greenup, although new root growth was not yet evident.

Tifdwarf plots previously treated with various pre-emergent herbicides were injected with ^{15}N-labeled nitrogen fertilizer.

Periodically over the three months (four, eight and 13 weeks) following herbicide treatment, a 4-inch diameter (12.6-square-inch surface area) times 12-inch deep core was removed from each plot using a cup cutter and washed to evaluate root development. Despite the unusually cold spring, all plots had acceptable surface visual quality, with no apparent differences between treatments throughout the study. However, significant differences in root development became apparent within four to eight weeks after herbicide application, primarily within the upper 10 centimeters (cm).

Prodiamine, a dinitroanaline herbicide, reduced root mass and caused root tip swelling, particularly from new roots initiating from stolons and shallow rhizomes. However, it did not appear to have an effect on root initiation from rhizomes that were positioned deeper (greater than 2 cm) in the soil. This may indicate that stoloniferous species such as St. Augustinegrass or centipedegrass could be even more prone to root injury from springtime dinitroanaline applications than rhizomatous species like bermudagrass or zoysiagrass.

Oxadiazon application resulted in no evidence of a loss in root mass relative to untreated controls. Although dithiopyr reportedly acts similarly to dinitroanaline herbicides, it too had minimal impacts on root development during the course of the study.

On these same sampling dates, 4-inch diameter x 12-inch deep polyvinylchloride tubes were installed into treatment plots. A double-labeled ammonium nitrate solution was introduced into the soil in these tubes at a depth of 0.25 inches. The amount of nitrogen of the injection was equivalent to 1 pound of nitrogen per 1,000 square feet.

Twenty-four hours after injection, the tubes were removed and the soil immediately rinsed from plant tissues. The plant tissues were then oven-dried for 72 hours, finely ground using a ball mill, and analyzed using ratio mass spectrometry to determine the total ^{15}N that had been acquired by turf over the 24-hour period. Because the predominant form of nitrogen in the environment (greater than 99 percent) is the ^{14}N isotope, the stable isotope ^{15}N serves as a useful tracer for determining rates of nitrogen

PHOTOS COURTESY: BENJAMIN WHERLEY