

# Alternative for turf

**Surprising materials such as silica and bacteria may offer new treatment options to solve difficult turfgrass problems**

BY DOUG BREDE, PH.D.

**F**or centuries, Chinese herbalists have been treating human ailments using ancient remedies extracted from plants and minerals. Over generations, these practitioners have developed naturalistic cures for diseases ranging from migraines and cancer to tennis elbow. Western medicine initially scoffed at acupuncture and tree branch extracts treating disease. But now modern science is taking a second look and finding some genuine benefits to these methods. Unfortunately for us, the Chinese never used their healing powers on lawns.

Recently, however, a cottage industry of alternative remedies has sprung up virtually overnight to treat many turf maladies.

I'm not talking about snake oil products of the past century — I'm talking about actual alternative cures discovered and refined by some of today's leading turf experts.

Once upon a time, silica was an obscure fertilizer component. Now, due to its curative

# medicine

properties on agronomic pests, it's entered the mainstream. Today, a large proportion of U.S. rice and sugarcane crops are sprayed with silica for protection from pests. In the last few years, major agricultural conferences have focused on this mineral's healing power.

## Surprising silica

Silica is a by-product of phosphate fertilizer mining. After phosphate is extracted, a water-soluble silica slurry remains. Initially, engineers had a tough time getting rid of it — until agronomists learned that applying it to crops enabled them to fight certain pests, particularly fungal diseases.

Strangely enough, silica is everywhere. Soil and sand are chock-full of silica. But plants can't get it because it's in a fixed form unavailable to them.

"Our soils are high in silica, but it's not soluble silica," explains Dick Schmidt, turf professor emeritus at Virginia Tech. "The plants have no way of taking it up." Soluble silica — applied to the foliage via spraying — is the only way of getting silica into the plant.

Recent work at several



Virginia Tech research associate X. Zhang examines a plant's response to applications of an alternative remedy. Zhang and VT professor Dick Schmidt are searching for treatments that can boost the plant's natural ability to fend off diseases.

northeastern universities has shown that silica can be used to treat a range of common turf diseases (see Table 1). Schmidt concentrated his work on dollar spot disease. Other scientists have found activity of silica against pythium blight, gray leaf spot, brown patch and powdery mildew.

Schmidt advises not to expect miracles from these natural remedies. "It doesn't mean we can throw away our fungicides. Silica will reduce disease

but it seldom eliminates it."

Instead of killing pests, silica makes plants more repellent to them. "These silica products 'influence' — or as I like to say, 'condition' — the plant to ward off disease and prevent senescence. It doesn't kill the pathogen like a fungicide would," he says.

Schmidt wanted to learn how silica and other natural concoctions allow the grass plant to repel adversaries. He discovered that silica bolsters

the natural antioxidant levels in grass. "Foliar applications of silica enhanced super oxide dismutase — an important antioxidant in plants," he reported.

What's an antioxidant? Basically, it's a rust inhibitor. The cell machinery in plants can actually "rust" or oxidize. When it does, the plant becomes less vigorous. Boosting the antioxidant level is like spraying your grass with Rustoleum®.

Other studies have shown that silica can be used during



**Bioject system in operation** – Applications of mineral, herbal and biological treatments have been effective against this disease, *Sclerotinia dollar spot*. One word of caution though: These natural remedies may boost a plant's resistance to the pest, but they rarely offer the 100% effectiveness of a commercial pesticide.

best when used as a preventive, rather than curative. Apply them *before* the disease occurs, rather than in the midst of an active outbreak. During active disease, you're better off treating with a proven fungicide.

Alternative cures break the link in the so-called "Disease Triangle": Diseases occur when the right environment teams up with the right host and the right pest. "If we can make that host more fit," says Schmidt, "we can help it fend off pests."

#### Bug versus bug

In recent years, biological pest control has gone from the lab to the playing field, thanks in part to research work by Joe Vargas, professor at Michigan State University's Botany and Plant Pathology department. One day in the lab, Vargas came across a bacteria with incredible powers.

"We get a lot of turf samples in our diagnostic lab, and sometimes when we can't identify something, we isolate the pathogen in a petri dish. In this one sample, we got bacteria that didn't let anything else grow on the petri plate. I thought some day it might make a pretty good biological control," he says.

And sure enough, it worked. "When we put it on (turf) with repeated applications, we got control of dollar spot," says Vargas. Later, he got control of *Microdochium patch*,

(fusarium patch or pink snow mold).

But, it wasn't as simple as spraying it on one time and vaccinating the turf for life. Living organisms have a way of, well, dying.

"That's the big drawback with all of these microbes," he says. "Everybody envisions having the world's greatest microbe for pest control — you simply put it out there and it pushes all the others out of the way and you never have any more disease. Let me tell you, it doesn't work that way."

Vargas soon learned that without repeated applications of his TX-1 super bacteria, there was too little of it around to control the pest. His next project was to determine how many repeated applications were enough to do the job.

First, he teamed up with engineers at Ecosoils Inc., a biotech startup company dealing in biological controls. They found that by infusing the microbe into the irrigation system, the grass could be bathed in a daily disease-controlling brew. Later, they refined their technique, applying the bacteria only during the morning 'syringe' cycle — a short splash of irrigation that coats the plant but doesn't rinse the microbe into the soil.

Unfortunately, efforts to introduce their invention into the non-irrigated segment of the

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These alternative medicines work best when used on a preventive, rather than curative, basis.

turf establishment to hasten growth and slow seedling diseases. Eric Nelson and his Cornell University colleagues found that establishment rate (biomass) could be doubled by silica applications, and *Pythium aphanidermatum* reduced damping-off disease.

Their report concluded: "Applications of soluble silica can hasten establishment, but pythium controls may (still) be necessary." In other words, silica worked. But it did not offer the *picture-perfect control* we've come to expect with commercial fungicide products.

#### Living with less control

In an industry that's come to expect the perfect lawn, it's logical to ask: Can we tolerate less-than-ultimate pest control?

A good rule-of-thumb is: Alternative medicines work

## TABLE 1. ALTERNATIVE MEDICINES FOR YOUR TURF

Though these products don't guarantee the 99% effectiveness we've come to expect from chemical pesticides, they do offer alternative control solutions when pests are not at their max.

### PRODUCT

### HOW TO APPLY IT / WHAT IT CONTROLS

#### MINERAL REMEDIES

**Silica** Soluble forms of silica such as potassium silicate, calcium silicate, or silicate (SiO<sub>2</sub>) can be sprayed at a rate of 7 lb. per 1000 ft<sup>2</sup>. Dick Schmidt used Kasil #1 at 20 to 40 fl. oz. per 1000 ft<sup>2</sup>. (information on the product can be found at [www.pgcorp.com/Lines/PS.htm](http://www.pgcorp.com/Lines/PS.htm).)

**Lawrence Datnoff found silica fights** gray leaf spot, Marty Petrovic found activity against pythium blight, and Schmidt found it works against dollar spot. In other studies, silica applications reduced brown patch disease by 10 to 20%, and also had activity on powdery mildew.

**Sulfur** Sulfur is an inexpensive yellow powder available through many horticulture supply houses. It can be sprayed or dusted on the foliage at a rate of 1 to 2 lbs. per 1000 ft<sup>2</sup> for control of fungal pests.

**Roy Goss found that sulfur controls Microdochium patch.** Pete Dernoeden found good control of take-all patch. Bruce Clark and Jim Murphy found a 23% to 42% reduction in take-all patch from using ammonium sulfate fertilizer. Sulfur is also used to treat powdery mildew. Goss concocted a sulfur regiment for *poa annua* control in creeping bentgrass turf, though Vargas admits, "it might do the job, but God help the patient."

**Manganese** Microelements like manganese (not to be confused with magnesium) are usually applied as a spray solution in either the mineral or chelate form.

**Charles Peacock and his associates discovered that foliar applications of manganese reduce brown patch disease and even bentgrass summer decline.**

**Iron** Iron chelate is a safer but more expensive alternative to iron sulfate. Both forms are generally applied as a spray because of the small quantities required.

**Tara McLeod, agronomist for the New Zealand Turf Institute, discovered** that monthly applications of iron sulfate at 1.7 lbs. per 1000 ft<sup>2</sup> effectively eliminated clover, slender speedwell, dandelion, and daisy from sports turf. Iron applications also control moss and cow grass and can mask the symptoms of fairy ring and yellow tuft.

**Nitrogen** Fast-release nitrogen fertilizer can be used to grow a turf out of many pest problems. N can be sprayed as a liquid or applied as a dry granular and irrigated to activate. A rate of 1 lb. per 1000 ft<sup>2</sup> solves many problems; a half rate is recommended for delicate turf areas.

**Dollar spot, rust, red thread, pink patch, anthracnose, necrotic ring spot, summer patch, melting out and leaf spot** can be reduced by nitrogen applications, according to Vargas. Nitrogen even benefits so-called "high-nitrogen diseases" like pythium and stripe smut, when applied after the disease has run its course, aiding recovery. Nitrogen can similarly help repair damage from insect outbreaks. Daniel Potter and his colleagues found it vital in promoting recovery from grubs. Legume weeds, like clover and black medic, can be reduced or eliminated by periodic nitrogen treatments.

**Phosphorus** Most phosphate products take far too long to dissolve and activate to aid in pest control. Quickly soluble sources like diammonium phosphate (DAP) can be dissolved and sprayed for faster action and medicinal effects.

**Regular phosphate applications reduced crabgrass and dandelion** populations to 5% from 26%, according to work by Wayne Huffine. Foliar sprays of soluble phosphate have also been shown to have a mild curative effect on brown patch disease.

**Corn gluten** This livestock feed product exhibits pre-emergence activity on crabgrass and other annual weeds. It also functions as a slow-release, natural fertilizer, containing 10% N.

**Nick Christians discovered** the herbicidal side-effects accidentally and has gone on to patent it for turf. Rates of 100 lbs. per 1000 ft<sup>2</sup> are needed for 95% crabgrass control. Work by Tom Turner has found mixed results of gluten, depending on the year, rate, and weather.

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## HERBAL REMEDIES

**Salicylic acid** — Salicylic acid is the white dusting you find on the surface of many plants, most notably on the bark of aspen trees. Aspirin is a derivative of salicylic acid. It is a natural protectant in plants that shields against oxidation and stimulates healing.

**Xanthomonas** — Suspensions of *Xanthomonas* bacteria can be sprayed on the turf on weekly intervals or injected through the sprinkling system for control of *poa annua* (annual bluegrass).

## LIVE BIOLOGICAL REMEDIES

**Pseudomonas** — Michigan State University's TX-1 strain of *Pseudomonas* can be injected via a BioJet appliance into the irrigation system for disease suppression.

**Nematodes** — Seven different strains of beneficial nematodes are available for control of insect pests. Nematodes are microscopic pinworms, applied alive, that parasitize certain insect pests. However, when sprayed on, most will dry out and die. Granular applications are preferable. (A list of suppliers can be found online at <http://edis.ifas.ufl.edu/pdf/IN/IN09600.pdf>)

**Schmidt has used salicylic acid to improve fitness** against disease and even to enhance frost and cold tolerance. "We buy salicylic acid by the 10-lb. bag and it's cheap," he says. His recent studies have had more success with root applications — rather than foliar.

**Japanese researchers, led by S. Imaizumi, found** reductions in annual bluegrass populations of up to 75% from certain strains of *Xanthomonas*. Kentucky bluegrass, bentgrass, and zoysia were unharmed. Recent work by Vargas confirmed these findings. He found additional *Poa* control by mixing PGR (plant growth regulator) with the bacterial suspension. Work at the University of Massachusetts found that *Xanthomonas* works better against the annual strain of *Poa annua* than the perennial strain.

**Pseudomonas bacteria has shown activity against dollar spot, brown patch, and pythium diseases.** It also shows minor activity against anthracnose, leaf spot, take-all patch, bermudagrass decline, necrotic ring spot, summer patch, pink snow mold, and gray leaf spot, according to Vargas. However, under severe disease pressure, fungicides are still required. Graham Davis reported a 27 to 33% reduction in dollar spot severity from TX-1, when tallied across an entire growing season.

**Nematodes are effective against** grubs, mole crickets, caterpillars, and soil inhabiting larva. Beneficial nemas are particularly "host specific," meaning that a given strain of nematode is picky, preferring certain insect pests over others. Be sure to get the right strain for your intended critter.

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turf market have met with frustration. "If you don't spray at least every other day, it won't work. That's the big secret nobody wants told," he says. Vargas envisions no effective way to apply the microbes through traditional landscape spreaders or sprayers. Only applications through a sophisti-

cated, computer-based irrigation injection system have proven successful.

"As far as I'm concerned, TX-1 is the end of the line," says Vargas. "What needs to be done now is to make better fermenters, injectors or even irrigation systems specifically for applying biological controls."

It's only a matter of time

until systems are perfected and landscape architects and irrigation engineers embrace the radical idea of customizing their installations for the optimum daily coating of biologicals.

"These microbe products are effective. It's now a matter of getting a system to apply them," he adds.

— The author, research director for Jacklin Seed/Simplot Turf & Horticulture in Post Falls, ID, recently authored the book, "Turfgrass Maintenance Reduction Handbook — Sports, Lawns and Golf," which is at the presses. Order a copy by visiting ([www.sleepingbearpress.com](http://www.sleepingbearpress.com) or 734 475-8787). He can be reached at [dbrede@jacklin.com](mailto:dbrede@jacklin.com)