SUPERINTENDENTS DIFFER IN WILT TREATMENTS

Can you imagine what would happen if bacterial wilt began attacting the Penncross and Penneagle bentgrasses?

Nasty thought, isn't it? Yet there have been unconfirmed reports that it's been found on Penncross, Penneagle, Seaside, and bermudagrass.

Dr. D.L. Roberts of Michigan State University, who along with colleague Dr. Joe Vargas discovered and initially researched the disease, says the wilt will eventually attack other turfgrasses including the Kentucky bluegrasses, ryegrasses, and fescues.

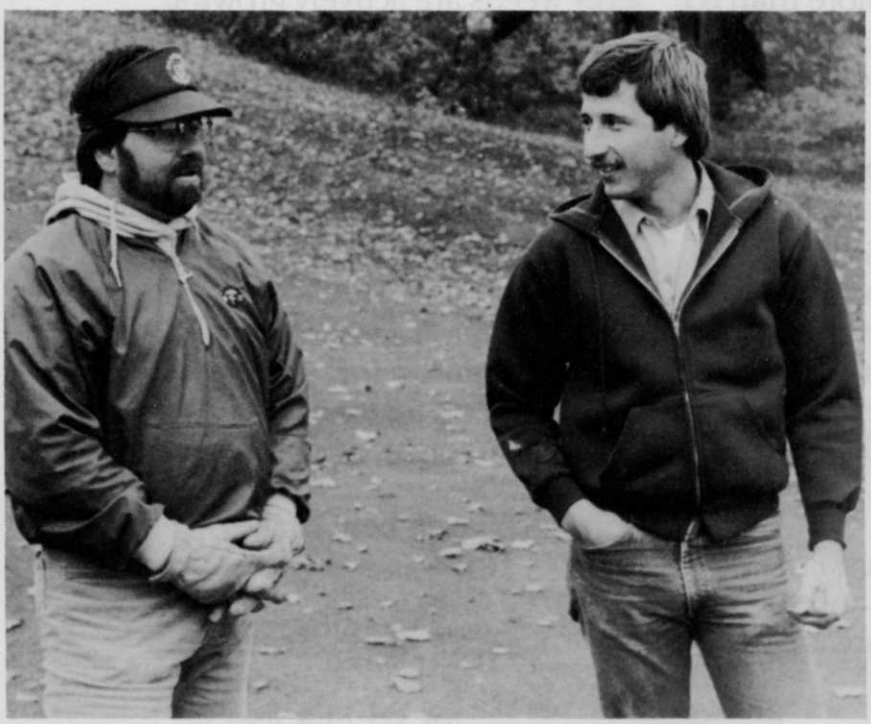
Prior to 1984, the wilt was reported on only the Toronto creeping bentgrasses. It's now been confirmed on annual bluegrass and Nimisilia creeping bentgrass.

The problem previously associated with the Toronto at Butler National near Chicago is now a problem for all courses.

WEEDS TREES & TURF visited two infected courses last fall to find out how each superintendent treated the disease. The treatments varied and for good reason. Firestone Country Club's South Course (Akron, Ohio), and Hazeltine National Golf Course (Chaska, Minn.) spent the spring and summer devising a game plan to combat the wilt and began the long recovery process in the fall.

Firestone

In 1984, Firestone's greens were sluggish, allowing no percolation.



Hazeltine superintendent Chris Hague (left) and Charles Taylor of the Hendricks and Dail Co. of Greenville, N.C. Hendricks and Dail applied methyl bromide to the Hazeltine course.

"They just never came around," general manager Don Padgett II says. "Anytime we disturbed the turf at all they regressed."

Padgett knew the greens were sub-standard by professional standards yet he and Firestone officials were at a loss to explain the problem. Bacterial wilt was ruled out: the greens were seeded with Nimisilia bent, not the C-15 Toronto.

Then came the 1984 World Series of Golf. Enter the "Golden Bear."

"On tournament Saturday, Jack (Nicklaus) came to me and said he thought we had the bacterial decline that they had at Muirfield," remembers Padgett.

Padgett thought that was impossible. The wilt had been reported only on the C-15.

"Jack came back to me on Sunday and said, 'Don, I'm almost sure that's it. I've been spending more time looking at the greens than playing golf.' Well, we sent a greens sample to Dr. (Philip) Larsen at Ohio State," says Padgett.

Dr. Larsen, now at the University of Minnesota, identified the disease and Michigan State University's Dr. D.L. Roberts confirmed.

Firestone *did* have the wilt. The decision? "We decided that, to maintain a world-class facility, a major renovation was needed—not a minor overseeding," says Padgett.

Firestone would wait it out, "baby" the greens through the summer of 1985, and begin work immediately after the World Series of Golf (Aug. 22-26).

Course superintendent Brian Mabie and crew controlled the disease with the antibiotic Mycoshield, applying at night because of the chemical's phytotoxicity. They upped the nitrogen application rate, raised the cutting height to $^{3}/_{16}$-inch from $^{1}/_{8}$, and made weekly applications of iron with the normal fungicide.

On August 26, the practice greens were stripped. The other greens followed the next day, the same day coring began. Mabie says it took 11 days to core all greens to the depth of 16 inches.

At the same time, drainage systems were built for all greens. By Sept. 18, all drainage systems were in and all mix (85 percent sand, 15 percent humus) was in place.

The crew seeded (Penncross bentgrass) from Sept. 27-30, took a short breather, and prayed that Mother Nature be kind.

She was. The greens, some reshaped and recontoured, took and were mowed on Oct. 28.

"I think the course will be in the best shape it's been in since the 60s," says Padgett.

Hazeltine

Superintendent Chris Hague noticed a problem with his C-15 Toronto bentgrass greens in May 1985. "I saw something that looked like fertilizer pellet burns," he recalls. "Four greens were particularly slow to come around."

continued on page 38

The greens of numbers 3 through 6, located in slightly shielded areas, have poor drainage capabilities, he says.

The C-15, original turf at Hazeltine, had held up well since the course was built 23 years ago.

The problem spread. "By process of elimination we finally determined that it was bacterial wilt," says Hague. "You hate to admit it because there's only two things you can do—fumigate and resod or fumigate and reseed."

(The other alternative is to tear out all greens to a sufficient depth, as Firestone chose to do.)

Drs. Vargas and Roberts at Michigan State confirmed the disease in late June. This information was relayed to the greens chairman.

Membership was informed on July 8 by bulletins explaining the history of bacterial wilt. "The bulletins helped people understand that we were not alone, that this wasn't a first incidence," says Hague.

On July 17, Dr. Vargas and a USGA greens section official attended an open membership meeting to better explain the problem. The members, somewhat angry over the problem, "really eased off" after the meeting, says Hague. "From then on, it was 'how are we going to take care of this?'"

They decided not to use a bactericide for expense reasons. "Luckily we had the kind of summer where all greens stayed very puttable," says Hague. Nine different options were hammered out.

Hague and Hazeltine took a novel approach—they chose to fumigate in the fall and resod Penncross bentgrass in the spring. It's a technique that has not been tried previously, claims Hague.

There was one catch—members decided not to give up the course until Sept. 23! In Minnesota, it snows in early to mid-October. Hague and crew were faced with a race against Mother Nature.

They won, sort of.

The Hendricks and Dail Co., North Carolina-based fumigators, handled the methyl bromide (hot gas) treatment. Methyl bromide sterilizes the soil and must be applied at soil temperatures of over 50 degrees Fahrenheit. The gas is forced into the soil, covered by tighly-secured plastic to prevent leakage and ensure penetration.

Half the greens were fumigated the week of Oct. 1 and three others later in October. The remaining six holes (numbers 11, 13, 14, 15, 16, 17) will get the gas in the spring.

Hague says he hopes to resod the front nine the first two weeks of April and the back nine as soon as possible.

Ideally, golfers will be playing the front nine by early June and the back by the 15th.

"If we get a break at all, we'll get the course back to snuff by June 15," says Hague.

—*Ken Kuhajda*

RECOGNIZING BACTERIAL WILT

by David Roberts and Dr. Joseph Vargas Jr.

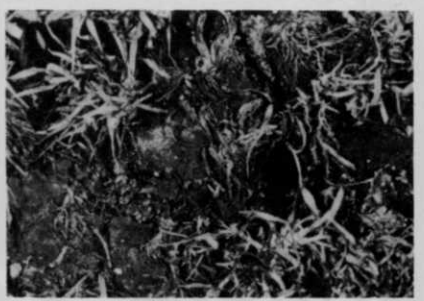


Fig. 1 left: bacterial wilt under an electron microscope

Fig. 2 above: turfgrass affected by bacterial wilt

Bacterial wilt is a relatively new disease of turfgrasses in North America. The disease was originally called C-15 problem and C-15 decline, a devastating and unresolved occurrence on Toronto creeping bentgrass (C-15) for more than a decade.

Since the 1930s, Toronto creeping bentgrass was propagated on golf course putting greens throughout the Midwest. During the 1970s, the C-15 problem destroyed many Toronto greens. And in 1980, it gained national recognition when Toronto putting greens were destroyed at Butler National two weeks prior to the Western Open.

An intensive investigation began at many universities. With the aid of Michigan State University's electron microscope, bacteria were associated with the xylem tissues of diseased Toronto creeping bentgrass (Fig. 1). Xylem vessels of plants are responsible for the uptake of water and nutrients. The plugging of these xylem vessels by large numbers of bacteria naturally resulted in rapid wilting and death of turfgrass plants. The disease was subsequently named "bacterial wilt" of Toronto creeping bentgrass.

David Roberts is academic specialist and Dr. Joe Vargas is professor in the Department of Botany and Plant Pathology at Michigan State University.

Significance

Prior to bacterial wilt on Toronto, no bacterial wilts of turfgrasses were previously known in North America. Using various analytical techniques, the bacterial wilt pathogen has now been characterized as *Xanthomonas campestris* pv. *graminis*.

This bacterium measures approximately $^{1}/_{25,000th}$ of an inch long and $^{1}/_{50,000th}$ of an inch wide. It reproduces every four to six hours.

Until it was isolated from Toronto creeping bentgrass in the United States, this bacterium was only found in Europe. Originally discovered in Switzerland in 1975, the bacterium has now spread to the British Isles, Netherlands, Germany, France, Norway, Denmark and New Zealand.

We presume that the bacterium was introduced from Europe to the United States, where it has virtually

destroyed Toronto creeping bentgrass as a propagated turfgrass.

Affected areas

During the summer season of 1983 and 1984, bacterial wilt was found on Seaside and Nimisilia creeping bentgrass and annual bluegrass. Whereas Toronto, Seaside and Nimisilia are not propagated to any appreciable extent on home lawns, annual bluegrass is a naturally-occurring turfgrass found in most regions of the temperate zone.

Bacterial wilt has been found on turfgrasses in eight states: Indiana, Illinois, Kansas, Michigan, Minnesota, Ohio, Pennsylvania and Wisconsin. This indicates that the bacterium is not only spreading to new host plants, but also to new geographical locations. The occurrence of bacterial wilt on annual bluegrass and the bentgrasses strongly suggests that Kentucky bluegrass and other grasses may also succumb to the disease.

Bacterial wilt of turfgrasses is analogous to several other diseases. The accidental introduction of pathogens that cause Dutch Elm disease and chestnut blight has practically eliminated American species of these trees in the United States. Another pathogen, *Xanthomonas campestris* pv. *citri*, the cause of Citrus canker in the southern United States, is closely related to *Xanthomonas campestris* pv. *graminis*, the cause of bacterial wilt of turfgrasses.

Millions of dollars, along with very strict quarantines, eliminate the citrus canker bacterium whenever and wherever it is detected. Unfortunately, the turfgrass industry is not sufficiently organized to mount this kind of action. So bacterial wilt continues to spread to additional states and new varieties of turfgrass.

Cures?

Even though bacterial wilt can be suppressed with the antibiotic oxytetracycline, the chemical is both expensive and may not be effective for a long duration as resistance by the bacterium is highly probable. Except for fumigation, followed by seeding and sodding with alternative turfgrasses, no other control measures are feasible.

Diagnosis

Bacterial wilt undoubtedly occurs on other turfgrasses in many regions of the country. However, absence of knowledge of the disease usually prevents accurate diagnosis.

Unlike many turfgrass diseases, bacterial wilt does not occur in rings or patches; it is strictly random, affecting individual plants in large areas (Fig. 2).

One of the most important diagnostic features of the disease is a very rapid wilting. Leaf blades become shriveled, twisted and blue-green in color.

Unfortunately, accurate diagnosis can currently only be accomplished by trained personnel at university diagnostic laboratories, and then it can only be determined with fresh samples. Therefore, turf samples should be mailed through an overnight service. Accurate diagnosis is essential if management strategies are to be effective in combating this devastating disease.

If further information is desired, contact the authors at Plant Diagnostic Clinic, 141 Plant Biology, Michigan State University, East Lansing, MI, 48824-1312. Phone numbers are (517) 355-4536 and 353-9082. **WT&T**

Clubs affected by bacterial wilt

Some golf and country clubs where bacterial wilt has been diagnosed by Michigan State University:

INDIANA

Youche, Old Oak, Bloomington, Highland, Phil Harris, Crooked Stick, Hilcrest, Meridian Hills, Harbor Trees, Fort Wayne

ILLINOIS

St. Charles, Butler National, Cog Hill, Village Links, Kellogg, Timber Trails, Medina, Edgewood Valley, Glenn Oak, Riverside, Bloomington, Decatur, Park Hill, Olympic Fields, Midlothian, Pottawatomie, Glen Flora, Waukegan

MICHIGAN

Alpine, Bay Pointe, Leland, Goodrich, Maple Lane, Raisin River, Royal Oak, Evergreen, Birchwood Farms, Old Channel, Plymouth Park, Edgewood, Plum Hollow

OHIO

The Golf Club, TRW, Firestone, Muirfield Village, Silver Lake, Brandywine

WISCONSIN

Westmoor, Meadowbrook, North Hills

ELSEWHERE

Milburn (Kansas), Hazeltine (Minnesota), Alcoma (Pennsylvania)