Dealing With Bacterial Wilt on *Poa*

By Nathaniel Mitkowski

Within the past decade, bacterial wilt of annual bluegrass has become a pernicious problem in the Northeast. While it is not observed as frequently as anthracnose or dollar spot, the disease can usually be found at low levels on most golf courses with a significant level of annual bluegrass infestation.

The University of Rhode Island Turfgrass Disease Diagnostic Clinic has isolated the pathogen from golf courses in Connecticut, Massachusetts, Montana, New Hampshire, New York, Pennsylvania, Rhode Island and Canada. When the disease does become aggressive, it is extremely difficult to manage. Under optimal conditions, the disease will move through a stand of annual bluegrass, killing existing plants and infecting newly emerged seedlings throughout the course of the growing season.

Bacterial wilt of annual bluegrass was originally identified in the United States in 1985 in the lab of Dr. Joseph Vargas (Roberts *et al.* 1995). At the time, it was considered a strain of *Xanthomonas campestris.* The same lab also identified *Xanthomonas campestris* pv. *graminis* affecting only the creeping bentgrass cv. Toronto in the early 1980s.

In 1995 a major revision of the genus *Xanthomonas* was published and reclassified those Xanthomonads that attack grasses as *Xanthomonas translucens,* a group of organisms that had been most previously revised under that name in the 1940s (Hagborg 1942).

The causal agent of bacterial wilt of annual bluegrass is *Xanthomonas translucens* pv. *poae* (Mitkowski *et al.*, 2005). Researchers in Japan have been studying the pathogen since the early 1990s and have made significant progress in understanding its biology and pathogenicity. As the name implies, its host range is restricted to the genus *Poa.* It will not attack any other grass genus and only goes to a few *Poa* species. While it is most aggressive on the annual form of *Poa annua,* it can also kill *Poa trivialis.* It has been observed multiplying in the leaf tips of *Poa compressa* and *Poa pratensis* but has not been observed to cause disease on either of these species.

Its specificity for *Poa annua* led some researchers to investigate its use as a *Poa annua* biocontrol. Unfortunately the pathogen is extremely difficult to artificially inoculate, requiring extremely large numbers of bacteria to initiate a successful infection, thus limiting its potential as a biological control.

Xanthomonas translucens pv. *poae* grows optimally at about 30 degrees Celsuis, but it is observed from early April until October in the Northeast. It can be active anytime infected plants are not dormant. It is often seen in the spring following serve winter damage. Although the reason for this is unknown, it is likely that large amounts of decaying tissue, caused by winterkill, provide an excellent nutrient source for the pathogen.

Eventually populations of the bacteria living epiphytically or saprobically will reach the minimum threshold necessary to incite disease. Infection occurs and plants begin to wilt and die. It is also likely that the stress of severe winter damage predisposes many plants to the pathogen. Bacterial wilt of annual bluegrass has also often been seen in conjunction with cool season *Pythium* in the spring. It is unclear what relationship may exist between these two organ-

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The two containers to the left feature greenhouse-grown Poa annua plants inoculated with bacterial wilt of annual bluegrass. The pair of containers on the right are uninoculated control plants for comparison.

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isms or if the association is simply coincidental.

After the spring flush of disease, plants tend to rebound until July or August. Temperatures are approaching the bacterial optimum in these months and disease predictably resurges. Bacterial wilt resurgence usually coincides with anthracnose resurgence, devastating affected *Poa annua* greens. As temperatures decline in the fall, disease usually recedes. However, warm fall days can cause additional outbreaks.

Symptoms of the disease begin as small yellow spots. Often etiolation (bleaching caused by failure to photosynthesize) will occur, although this symptom is much more pronounced if plants are not mown for two or three days. In the diagnostic lab, etiolated plants are commonly observed after a day of incubation and produce significant amounts of bacterial streaming.

Following etiolation, plants wilt, collapse and ultimately die. Sometimes, leaf-tip necrosis can be observed. Although the time course of disease is variable based on temperature, strain virulence and presumably genotype resistance, infected plants usually begin to show symptoms within two weeks of inoculation in the greenhouse. Greenhouse experiments using very virulent isolates at extremely high inoculation levels have produced symptoms in as little as four days (Mitkowski, *unpublished data*). Once symptoms are observed, plants begin to die rapidly.

Bacterial wilt has been observed on fairways sporadically. Fairway symptoms, however, tend to be far milder than symptoms on putting greens. The most common fairway symptom is profuse etiolation. Frequently superintendents will notice that a sizable portion of plants on an affected fairway produce etiolated shoots, growing as fast as an inch per day. Plants appear to be otherwise healthy but require frequent mowing to keep the stand from appearing ragged. We have isolated both *X. t.* pv. *poae* and *X. t.* pv. *graminis* from affected fairways. *X. t.* pv. *graminis* has very low virulence on *Poa annua* and we have never isolated it from putting greens.

The only truly effective management strategy is to eliminate annual bluegrass.

Virulence within *X. t.* pv. *poae* appears to be variable. Research from both American and Japanese isolates suggests that some strains of the pathogen are not very aggressive and produce minimal damage. Other isolates or strains are extremely aggressive and can quickly kill entire stands of *Poa annua*. This provides a likely explanation as to why some superintendents have such difficulty managing the disease while others experience little noticeable damage.

Similar to anthracnose, bacterial wilt favors plants that are severely stressed by low heights of cut, compaction, under-fertilization and excessive wear. Shaded plants and those found in low-lying areas are also more prone to the disease.

Control options

Remediating cultural problems can mitigate bacterial wilt but once it has taken hold on a putting green, it is very difficult to eliminate. Chemical control options are virtually nonexistent. Because the pathogen is bacterial in nature, fungicides have no effect. Antibiotics that target bacteria are not available for use on turfgrass.

There are anecdotal reports of superintendents experimenting with an oxytetracycline antibiotic, but the chemical can be very phytotoxic and most of these reports indicate that more harm was done than good. Additionally, the use of such products on turf is contrary to its labeling and ille-

TABLE 1

Host range of the M-1 isolate of *Xanthomonas translucens* pv. *poae*, isolated from Torrington Country Club in Torrington, Conn., 2001.

Host Species	Host Reaction*
Poa annua var. *annua*	+
Poa annua var. *reptans*	- (+)
Agrostis palustris cv. Providence	-
Agrostis capillaris cv. Exeter	-
Poa pratensis cv. Lofts 1757	-
Festuca rubra	-
Lolium perenne cv. Night Hawk	-
Poa nemoralis	-
Poa attenuata	+
Poa compressa cv. 95-29	-
Poa compressa cv. Harmony	-
Poa trivialis cv. Sabre	- (+)

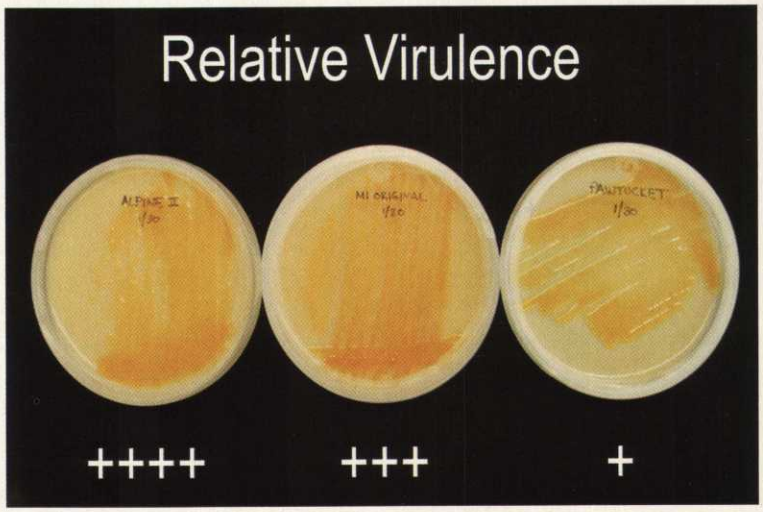
* "+" = positive host, "-" = negative host, "- (+)" indicates no disease observed but limited bacterial reproduction occurred in leaf tips at inoculum level of ~108 cfu/ml.

To the left, growth of chamber-grown Poa annua plants inoculated with bacterial wilt of annual bluegrass. In the container to the right are uninoculated control plants for comparison.

gal. The product is only labeled for peaches, pears, nectarines and with a number of state-specific Section 18 registrations for use on apple. General biocides can be used against bacterial wilt. Kocide and Junction (copper hydroxide and mancozeb, respectively) are often mentioned for controlling the pathogen and can reduce bacterial population on leaf surfaces. However, these chemicals do not penetrate leaves (and can be very phytotoxic), so only bacteria on the surface of the leave or in the soil will be affected.

Bacterial wilt enters plants through wounds, most commonly through mower wounds. Although an application of a general biocide may have some effect, new wounds will be produced as soon as the stand is next mowed. New wounds will be unprotected by applications of Kocide or Junction made previous to the most recent mowing.

While additional applications of these chemicals might seem prudent following every mowing, severe phytotoxicity would surely result long before any meaningful bacterial control was achieved. The frequency with which these chemicals must theoretically be applied to produce reliable control makes them a less than optimal solution to disease. Zerotol has been considered as a potential management option for bacterial wilt. As a contact biocide, however, it is unlikely to provide any more significant control than either Kocide or Junction. Its lack of residual activity may even provide less control when applied on a 7-10 day schedule.



Three isolates of Xanthomonas translucens pv. poae, all with a different level of disease virulence, as indicated by the number of plus signs.

During the 2004 field season, URI fungicide trials demonstrated that Zerotol provided no control of dollar spot at the 12 fluid ounces per 1,000 square feet rate and minimal control at the 6 fluid ounces per 1,000 square feet rate every 14 days. However, at low rates it is less likely to cause phytotoxicity than Kocide or Junction and might therefore be applied following every mowing.

This strategy has yet to be tested but has some merit. The time and effort required to

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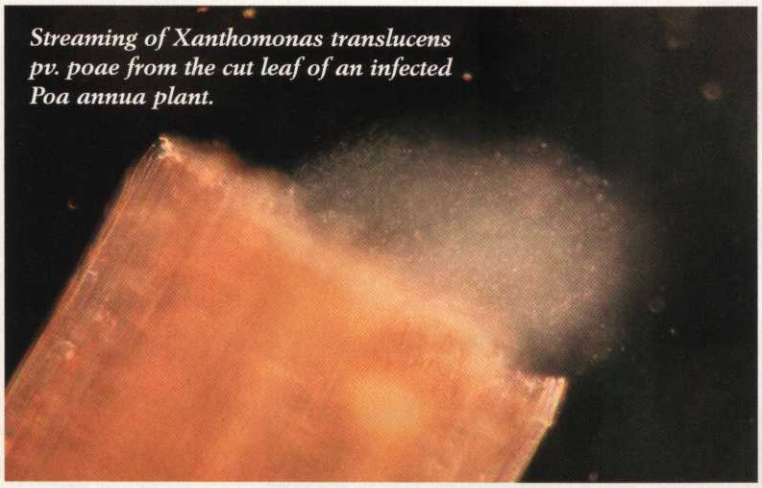

Streaming of Xanthomonas translucens pv. poae from the cut leaf of an infected Poa annua plant.

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spray all effected putting greens following every mowing, however, may be prohibitive.

Bacterial wilt of annual bluegrass is certainly not a new pathogen. It has a worldwide distribution and is likely to be found anywhere that annual bluegrass exists. The most important question regarding this pathogen is not even how to control it.

The only truly effective management strategy is to eliminate annual bluegrass.

While guaranteed to eliminate the pathogen, this technique is far easier said than done. What is most intriguing about bacterial wilt of annual bluegrass is why has it become so prevalent in the past decade. It is possible that it may have always been prevalent but simply overlooked or misdiagnosed as some other fungal pathogen?

The more likely reason for its prevalence, however, is an almost universal shift towards management techniques that favor annual bluegrass while consequently discouraging creeping bentgrass. Until this issue is addressed (and other high intensity management practices related to increasing ball rolling speed), it is probable that bacterial wilt of annual bluegrass will continue to pose an intractable threat to golf course putting greens.

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Dr. Nathan Mitkowski is an assistant professor in the Department of Plant Sciences at the University of Rhode Island. His research focuses primarily on stress-related diseases on amenity turfgrasses. He teaches Diseases of Turf and Ornamentals, Advanced Turf Management and Plant Improvement.

TURFGRASS TRENDS

SECTION STAFF

Managing Editor
Curt Harler
440-238-4556; 440-238-4116 (fax)
curt@curtharler.com

Golfdom Staff Contact
Thomas Skernivitz
440-891-2613; 440-891-2675 (fax)
tskernivitz@advanstar.com

Online Editor
Lynne Brakeman
440-826-2869; 440-891-2675 (fax)
lbrakeman@advanstar.com

Chief Science Editor
Dr. Karl Danneberger
614-292-8491; 614-292-3505 (fax)
danneberger.1@osu.edu

Production Manager
Jill Hood
218-723-9129; 218-723-9223 (fax)
jhood@advanstar.com

Graphic Designer
Carrie Parkhill
440-891-3101; 440-891-2675 (fax)
cparkhill@advanstar.com

Publisher
Patrick Roberts
440-891-2609; 440-891-2675 (fax)
proberts@advanstar.com

General Manager
Tony D'Avino
440-891-2640; 440-891-2675 (fax)
tdavino@advanstar.com

Corporate & Editorial Office
7500 Old Oak Blvd.
Cleveland, OH 44130-3369

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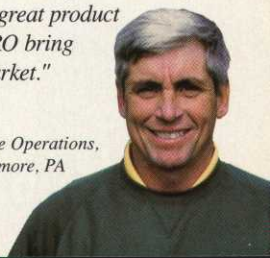

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Carlos Stimson, a territory manager for The Andersons, received the "Professional Service Award," the highest level of recognition offered by the South Dakota GCSA for service to the industry.

Novozymes made several hires within its Biologicals and Roots Plant Care Group: **Todd Settle,** North America sales manager; **Robert Bauwens**, national account manager, Roots Plant Care Group; **John Hunt,** northeast account sales manager; **Scott Inman**, field development specialist; **Lee West**, field development scientist; and **Mark Fields**, account manager, Roots Plant Care Group.

Arvesta Corp. named **David Baker**, **Lee Rogers** and **Brett Rush** sales representatives for Arvesta's turf and ornamental group, and **Doug Houseworth** technical service representative of the group.

Patti Niewoehner was named director of marketing services for Phoenix Environmental Care. She was formally manager of marketing services and herbicide product manager for Griffin LLC.

The John Deere Worldwide Commercial & Consumer Equipment Division promoted **Alexandra Nicole Galanek** to group brand marketing manager of John Deere Golf & Turf One Source. She will be responsible for all One Source and equipment marketing and advertising activities to golf course superintendents, owners, architects and builders.

Brian Payseno was named corporate communications manager for Nufarm Americas. He will be responsible for managing all projects and programs that promote the company, its products or people.

Officers and trustees elected at the annual Ohio Turfgrass Foundation meeting were: president **Chuck Darrah**, president of CLC LABS, a soil testing and green industry consulting group; vice president **Boyd Montgomery**, facilities and maintenance director for Sylvania Recreation Corp.; treasurer **Glen Pottenger**, certified superintendent and part-time instructor at Clark State Community College; and OTF trustee **Doug Gallant**, head groundskeeper of the Cincinnati Reds.


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Bradley

Hunter Industries promoted **Brandon Meadows** to vice president of sales. He will be responsible for overseeing Hunter's sales operations in both the domestic and international markets.

Bayer Environmental Science reorganized its Southern Golf Sales Region as follows: **Brian MacCurrach** – southeastern Florida and Puerto Rico; **Matt Bradley** – southwestern Florida; **Joe Conoly** – northern Florida and southern Georgia; **Trey Warnock** – northeast Georgia, South Carolina, western North Carolina and southwestern tip of Virginia; **Mike Willey** – eastern North Carolina, southern West Virginia, Virginia and Myrtle Beach, S.C. area; **Scott Harms** – Mississippi, Alabama, Tennessee and Atlanta. The company also named **Michael Daly** its director of marketing for the Chipco Professional Products Division. **Jim Fetter** is now the manager of the lawn and landscape sales region. **Ben Cicora** was named business manager, herbicides/PGRs for the Chipco Professional Products Division. And **Matthew Bradley** was named a golf sales representative for the Chipco division.

Aquatrols appointed **Tom Malehorn** as international accounts manager. He is a graduate of the Pennsylvania State University turfgrass

management program and has more than 26 years of experience in domestic and international turf and ornamental sales.

James J. Ciampaglio, a veteran of the golf and hospitality industries, was named general manager for the newly opened Trump National Golf Club. He recently served as club manager and director of golf for Panther Woods Country Club in Fort Pierce, Fla.

Dow AgroSciences promoted **Ryan Messner** to sales representative for the turf and ornamental business. He will develop and execute business plans, manage accounts, build awareness and increase trial of products from Dow AgroSciences in the mid-South.

Stephen Briggs will represent BASF Corp. and **Stanton Howell** will represent Dow AgroSciences as newly elected members of the RISE (Responsible Industry for a Sound Environment) governing board.

Chris Petersen, president of Tom Irwin Inc., was re-elected to serve as president of the Independent Turf and Ornamental Distributors Association. Also re-elected were vice president **Brian Feury** of the Terre Company of New Jersey Inc., and secretary/treasurer **Chad Will** of Tenbarge Seed Co.

Profile Products hired **Walter Butman** as vice president of distribution and international sales. He is responsible for all Profile Products national and international distribution and sales efforts.

The Environmental Institute for Golf elected **Michael J. Hurdzan**, of Hurdzan/Fry Golf Course Design Inc., its chairman and **Bill Kubly**, owner and CEO of Landscapes Unlimited LLC, its vice chairman/treasurer. Golf Course Superintendents Association of America secretary/treasurer **Ricky D. Heine**, CGCS, was added to the board of trustees and will serve a three-year term as secretary of The Institute. ESPN/ABC broadcaster **Roger Twibell** and Nike Golf President **Bob Wood** were also added as trustees and will each serve three-year terms.

The Chicagoland Association of Golf Course Superintendents announced its new board: **Mike Matchen**, Wilmette Golf Club, past president; **Charles Anfield**, CGCS, Heritage Bluffs Public Golf Club, president; **Rick Bowden**, Bob O'Link Golf Club, vice president; **Dan Charlton**, Evanston Golf Club, treasurer; **Alan Perkinson**, Broken Arrow Golf Club, secretary; **Dan Dinelli**, CGCS, North Shore Country Club, education director; **Jon Jennings**, CGCS, Chicago Golf Club, arrangements director.

Michael J. Benkusky has formed his own firm, Michael J. Benkusky Inc. Golf Course Architecture. Benkusky spent the past 17 years as the senior project architect with Lohmann Golf Designs in Marengo, Ill., where in recent years he worked almost exclusively on new course projects.

NOTABLE ACHIEVERS

Winners of the Bayer Superintendent Grants visited the Bayer Environmental Science booth at the Golf Industry Show in Orlando, Fla., in February. Pictured are (left to right): Matthew H. Roos, Hickory Sticks, Ann Arbor, Mich.; Edward M. Goodhouse, Torrington Country Club, Torrington, Conn.; Eric Kalasz, business manager-fungicides for Bayer; Chuck Gay, Gainesville, Fla.; Dan W. O'Brien, Newburg Village Golf Club, Cherry Valley, Ill.; and Ward Pepperman, Faldo Golf Institute by Marriott, Orlando.

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Videos

Superintendent's Video Workshop (SVW) recently added two new titles – "Guide for Tee Renovation" and "Basics of Understanding Irrigation Repair & Maintenance" – to its video-based training series designed for superintendents and their staff. The series is produced by EPIC Creative Communications. The "Guide for Tee Renovation" covers the complete step-by-step procedure for planning and executing a successful tee renovation. The second title, "Basics of Understanding Irrigation Repair," explains how an irrigation system operates and shows basic repair techniques on PVC pipe, gate valves, control valves, swing joints and irrigation heads. Available in either VHS or DVD formats, each title includes employee handbooks, tests, answer keys, sign-off sheets and instructor guidelines.

For more information, contact 800-938-4330 or www.svwonline.com.

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Robert A. Brame is director of the United States Golf Association Green Section's North-Central Region. In his talk, Brame will provide a year-end review of the region from an agronomic standpoint.

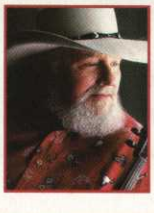
Paul B. Latshaw is in his third year as certified superintendent of Muirfield Village Golf Club in Dublin, Ohio. In his talk, Latshaw will provide the ins and outs of tournament preparation, whether it's for the PGA Championship or the member-guest.

Mark Wilson is the certified superintendent of Valhalla Golf Club in Louisville, where he has been for 17 years. Wilson, known for his strong management style, will speak on the art of employee motivation.

Bobby Weed is the president of Weed Golf Course Design in Ponte Vedra Beach, Fla. Weed, a former superintendent, will speak on the trials and tribulations of project management.

Larry Aylward is the editor-in-chief of *Golfdom*. He will speak on how to deal with the media. Aylward's basic message: Don't ever run from a reporter, but be careful of what you say.

ENTERTAINMENT AT THE EXPO:



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