FEATURE ARTICLE II

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Photo credit D. Settle

A 'Family Doctor'

The idea that became the CDGA Turfgrass Program

The Chicago District Golf Association's (CDGA) Turfgrass Program began in September 1985, when Dr. Randy Kane returned to Illinois from New York. Randy had completed his education, a Ph.D. at Cornell University under Dr. Richard Smiley. Dr. Smiley, a thorough scientist, had pioneered the idea that patch diseases were caused by previously unknown turfgrass pathogens. He showed that a suspected above-ground fungus, Fusarium, did not cause the dead patch symptoms of Kentucky bluegrass. Instead, Fusarium *was a secondary colonizer, or* saprophyte*, and not responsible for the disease. Dr. Smiley focused his investigations belowground.*

Over the course of multiple investigations, Randy Kane had found that soilborne fungi were capable parasites of roots. Smiley and Kane found that *Magnaporthe poae* (originally misnamed *Phialophora*) could breach the inner stele of roots and invade vascular tissue, and that it caused summer patch of Kentucky bluegrass. Xylem vessels that move water and nutrients were impaired by fungal infection. Compromised, the roots then rot. Aboveground the root disease appears as dead patches. At the time this idea generated controversy. However, the long-term outcome has been a whole-plant approach to solving turfgrass problems. The pathogens weren't actually 'new,' but they were as yet unstudied in a relatively new field called Turfgrass Pathology. In 1985, the field was only two decades old. The first comprehensive textbook of its kind, *Diseases of Turfgrass*, by Dr. Houston Couch, had first hit bookshelves in 1962.

Photo credit: D. Wehner

Figure 1: Bacterial wilt of a green killing the creeping bentgrass variety Toronto/C-15.

The Idea

A trained turfgrass diagnostician was placed in Chicago in many ways owes itself to a relatively rare bacterial pathogen we now call *Xanthomonas translucens*. The story begins sometime in the 1930s, when an improved creeping bentgrass variety designated C-15 was born. By the 1970s, C-15 or 'Toronto' had become a popular choice for newly renovated golf greens in Chicago

The Family Doctor

Carl Hopphan remembers meeting Paul Butler in a room filled with some of the region's best turfgrass experts. It was at Butler National Golf Course, located in the west Chicago suburb of Oakbrook. Paul wanted answers. In 1980, the greens at Butler had died mysteriously just two weeks prior to the PGA Western Open. Among those attending the Oakbrook meeting were two highly regarded turfgrass pathologists; Dr. Houston Couch from Virginia, and Dr. Joe Vargas from Michigan.

Later, Carl would attend another meeting where the phrase 'Family Doctor' was introduced in regard to Chicago's golf courses. A small contingent of Chicago superintendents along with University of Illinois professors were invited to attend a CDGA board meeting at Oak Park County Club. Carl admits the group never really knew what would happen. "Some on the CDGA Board of Directors were skeptical it

(continued on page 15)

was even needed. Many hurdles existed. It had never been done before." It took about fifteen minutes for the closed-door decision. Carl remembers, "When told, we were actually somewhat surprised. At the time we really didn't realize what the position would grow to mean. Today it represents a feather in the cap of the CDGA." Nevertheless, this unique position was initially funded for only one year. An annual review would determine if the 'Family Doctor' should stay.

The initial proposal the CDGA agreed to fund was written by Dr. Hank Wilkinson. Originally, it was conceived as a position within Hank's University of Illinois program. "Randy was hired to give Chicago a rapid response expert for golf pathology and other aspects of golf. I was his director on paper." Later, the Chicago-based position would be reclassified to the U of I Extension, and then to CDGA entirely. Dr. Randy Kane became the Family Doctor. He was largely self-sufficient and worked from a small lab he outfitted at an Oakbrook office complex, where the CDGA headquarters existed from the 1980s until 2001. His 'on call' hours were generally March through December. His patients were golf courses and their greens. His research plots were on select golf courses throughout the District.

Varieties to Improved Greens

Chicagoland has always been innovative with respect to golf course management. This included the rapid adoption of improvements, such as using an improved creeping bentgrass variety for a better playing surface. In the 1930s, the first improvement of bentgrass began under a joint project by the USGA and USDA. Dense, finely textured turfgrass that could withstand low mowing heights were selected.

The idea was based on early observations that superior-looking creeping bentgrasses could be found in patches across a green. We see the same phenomenon today and each superior patch likely originates from a single seed at establishment. Given frequent low mowing and time, the spreading stoloniferous bentgrass forms a patch possessing superior visual quality. In a way, the superintendent is an unknowing geneticist. Using cultural practices, he has produced a superior bentgrass clone for greens.

Photo credit: D. Settle

Figure 2: The 2003 NTEP fairway/tee bentgrass test located at Sunshine Course in Lemont, IL during July, 2006.

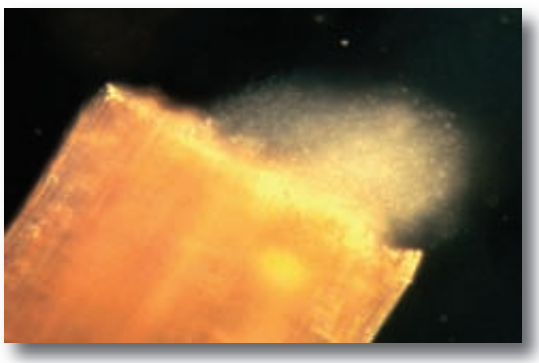

Photo credit: N. Mitkowski

Figure 3: Xanthomonas translucens bacteria streaming in a cloud from a cut leaf blade.

The Seed Problem

In the early 1900s only two sources of creeping bentgrass seed existed: Seaside and South German. Unfortunately, the seeded greens lacked uniformity once established. Each green eventually wound up looking like a patch-work of color, density, and texture. It is called segregation. Quilt-like, the greens were heterogeneous and of diverse genetic material. Those seed sources are very different from today's highly refined varieties. For example, the variety Seaside, for unknown reasons, contained a majority of plants that lacked vigor at green height. Seaside was difficult to maintain. Its seed originated from creeping bentgrass swards indigenous to coastal regions of Washington and Oregon.

Understanding South German is even more complicated. Prior to World War II, 'South German' actually meant a seed mixture of many cool-season turfgrasses native to Europe. 'South German' seed was harvested from a natural field of good quality in what is now Austria. Thankfully, this grab-bag of seed contained bentgrasses (creeping, colonial, and velvet). Once in the Midwest, creeping bentgrass or *Agrostis stolonifera*, was best adapted since it out-survived or out-competed all other *Agrostis* spp.

The Early Solution

There was a simple solution; quit using heterogeneous seed and introduce a new vegetative variety propagated of creeping bent. Establishment would utilize the spreading aboveground plant part, the stolon. After culling numerous selections, twelve were deemed good enough by the USGA. The ultimate green, one of uniform quality, might just exist. But first, the twelve needed to pass one final test. They would be grown at multiple locations across the U.S., using a unique test plot design. Each would owe its genetics to a single plant seed of either Seaside or South German. A variety would be a genetic clone from a single mother plant.

The final USGA evaluation occurred at only a few US golf course locations. Each variety was established as a wedge within a pie-shaped circle. The best variety or varieties would become apparent given 'real world' conditions. It seemed to work. Julius Albaugh, a Chicago superintendent, wrote of his experience "…for thirty-four years we had some of the most uniform, true, fast, and beautiful greens in the Midwest." He recalled that in 1943 they began propagating stolons of Toronto from the USGA study to make a separate nursery at his course in Wilmette, Illinois – Westmorland Country Club. Its experimental name was C-15. Of the pie- shaped wedges that radiated from the test green center, Toronto was deemed best. That same year, Westmoreland's number nine green would become the first Toronto green in the Midwest. Over a period of 10 years the remaining 17 greens were converted to Toronto. It had a spillover effect and Toronto become popular in Chicago – in the name of golf.

What did Toronto creeping bentgrass look like? A 1968 USGA Green Section Record report by Alexander Radko tells us. "Toronto/C-15 – thin-bladed, tight and upright growth; forms a true putting surface; exhibits a tendency towards reduced summer vigor; best in spring and fall." Dan Dinelli of North

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Shore Country Club remembers Toronto as, "A wonderful grass, fairly tight. A wide leaf by today's standards, but it performed well and proved hardy…" A growing group of private Chicago clubs began to intensively manage Toronto on their greens. At the time, 3/16 inch was the standard height of cut. Sand topdressing did not yet exist.

Other vegetative-clone varieties from the USGA test were also adopted for golf greens. Popular varieties would include; Arlington/C-1, Congressional/C-19, Cohansey/C-7, and Washington/C-50.

Toronto use ended abruptly in 1981. Toronto would be remembered by its experimental name and for a disease in Chicago. The disease would initially be called 'the C-15 problem' or 'C-15 decline', though Cohansey and another vegetative selection named Nimisilla were also somewhat vulnerable. The rapid fall of Toronto dovetailed with other events. Putting green management changed around 1980 and resulted in higher levels of midsummer plant stress. Possibly it was the advent of light frequent sand dressing and a new potential for wounding. Maybe it was the adoption of lower mowing heights that neared 5/32 inch. Whatever the precipitating event, Toronto was suddenly highly susceptible to a previously unknown disease.

Toronto/C-15 Decline

Dr. Hank Wilkinson recently recalled the devastation of 'C-15 decline.' The decline was first reported affecting Chicago golf greens sometime in the late 70s (Figure 1). "I would say that C-15 decline focused the Illinois Turf industry on the need for an expert in pathology." Hank was actually hired by the University of Illinois as a direct consequence of the C-15 problem. His early investigations indicated it was not a fungus and therefore not easily preventable. "I quickly determined it was a bacterium…"

A specific, genetic vulnerability of the C-15 clone (Toronto) was responsible. A bacterium we now know as *Xanthomonas translucens* pv. *graminis* had arrived in Chicago. A highly specific bacteria-host relationship is signified by pv., or pathovar. The pathovar *graminis* had it out for Toronto. The cloned bentgrass variety was doomed. So turfgrass scientists like Dr. Wilkinson recommended that Toronto be replaced using newer seeded varieties. At the time, Chicago's creeping bentgrass greens shifted to Penneagle, released in the 1980s.

Mystery Solved

By 1980 Toronto had slammed the door on using clones as a tool to improve bentgrass greens – a valuable lesson had been learned. In 1984, Roberts and Vargas summed it up in *Golf Course Management*'s April issue. Beginning sometime in the 1970s, Chicago had experienced an outbreak of a new turfgrass disease named bacterial wilt. Worldwide, another *Xanthomonas* species had been well studied — it was known as bacterial leaf blight of rice. Part of the mystery was that a bacterial pathogen had never been discovered affecting turfgrass until that 1980 PGA tournament in Chicago (cameras rolling). The bacterial disease began during extended cool, wet periods. A shift to warm, dry weather caused rapid wilt, then death. Frequent mowing spread the disease, and also provided the necessary wounding which the bacteria need.

The evidence was clear. During diagnostic examination by Vargas and others, opaque clouds of microscopic bacteria would stream from cut sections of infected crowns and leaves (Figure 3). By fission, the rod-shaped bacterial cells divide and quickly generate a population explosion within xylem. Histological documentation using electron microscopy showed that the bacteria and their slimy polysaccharide exudates clogged vascular elements in Toronto's leaf blades (Figure 4). Xylem are necessary for all water and nutrient transport from the rootzone to the leaves. Without xylem function, rapid death by wilt occurs.

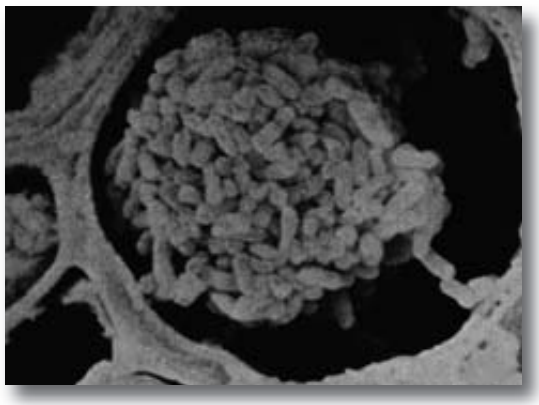

Photo credit: D. Roberts

Figure 4: Scanning electron micrograph of rod-shaped bacteria clogging the xylem of Toronto creeping bentgrass.

Photo credit: D. Settle

Figure 5: Glossy bacteria colonies isolated on sterile nutrient agar by a streaking method.

Once isolated in culture, *Xanthomonas* is recognized by its characteristic glossy yellow colonies (Figure 5). Today, natural populations of both Toronto and the bacterium *Xanthomonas translucens* pv. *graminis* are considered virtually nonexistent. The normal cascade of plant defenses by Toronto was completely overcome by a highly virulent pathovar.

The ultimate outcome of C-15 decline was a rapid development of improved seeded bentgrass varieties. The Chicago event highlighted the need for genetic variation in turfgrass. Open pollination held the answer, as long as the seeded variety did not segregate highly. For example, since 1956 a creeping bentgrass variety named Penncross had been used increasingly on greens with good results. It looked uniform visually, provided a good putting surface, and had good resistance to disease.

Today, our skepticism about new bentgrass varieties continues. It is one reason we carefully watch entries in field trials like the National Turfgrass Evaluation Program (Figure 2). NTEP tests begin every five years. Turfgrass performance data is summarized annually. Information is freely available online at www.ntep.org. In 2008, a new NTEP bentgrass trial for greens will be established across 17 states. In Illinois, bentgrass varieties will be evaluated on a Chicago golf course green where practice putting or chipping occurs. Dr. Tom Voigt will be the principle investigator. A list of entries is not yet available, but should be comparable to the 2003 test. In that variety trial, a total of 26

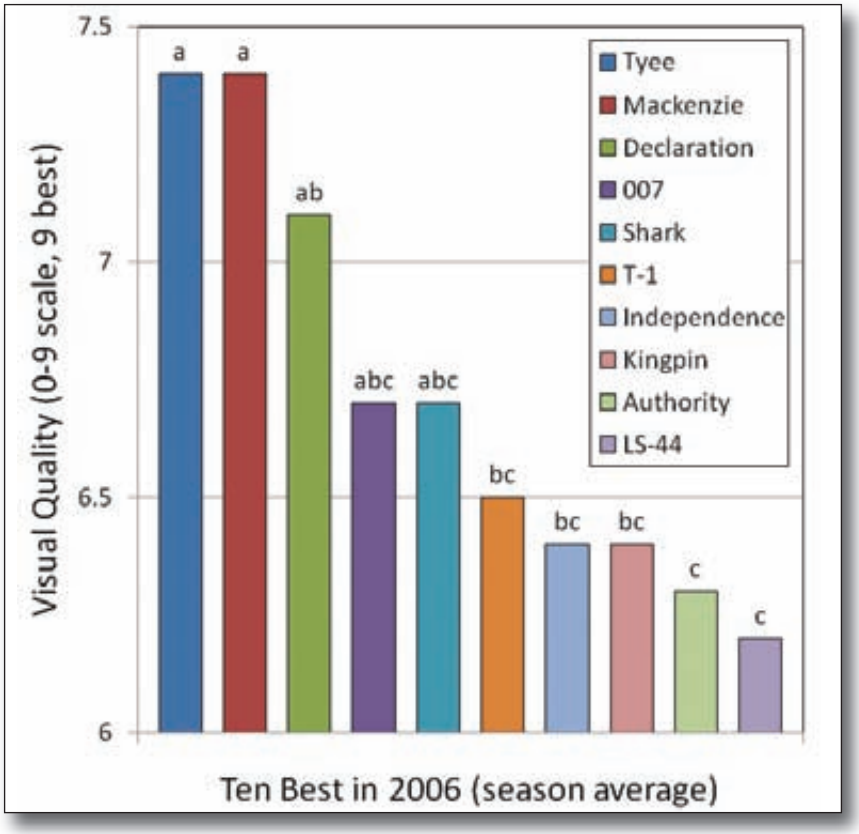

Figure 6: Average visual quality ratings of bentgrass varieties for greens during 2006 from the NTEP test in Urbana, IL.

creeping bentgrass entries were evaluated from 16 different seed companies. The bentgrass varieties tested were of two species. Twenty were creeping bentgrass (*Agrostis palustris*) and the remaining six were velvet bentgrass (*Agrostis canina*). All but three of those seeded varieties tested are now commercially available (Figure 6).

The CDGA Turfgrass Program

The C-15 event indirectly provided the impetus to establish a turfgrass scientist in Chicago. Dr. Randy Kane gained an encyclopedic knowledge of Chicago's golf courses and became a well-respected plant disease diagnostician. From his base in Oak Brook, and later Lemont, the plant pathologist faithfully served CDGA superintendents. Today, the CDGA represents 380 golf courses, with approximately 250 located in the Chicago region. Now it is my turn to assist those who manage the natural assets of a golf paradise known simply as Chicagoland.

This time my lessons are not inside Throckmorton Hall or outdoor field plots called Rocky Ford Turfgrass Research Center – Kansas State University. Nor are those lessons located in the Redding Building of a campus known simply as "Experiment Station" – University of Georgia's Griffin Campus. Today, the majority of my teachers are golf course superintendents, sometimes simply called "Sups." They and their crews have mastered the difficult art and science of intensive turfgrass management. Mostly my lessons are located at courses across Greater Chicago. Our main laboratory is outdoors and known as Sunshine Golf Course in Lemont, Illinois (Figure 7). Sunshine is cared for by Chris Painter, our superintendent. The teacher's aide is an individual we all know and respect, Mother Nature.

The dynamic attempt of the Turfgrass Program to help CDGA superintendents continues. It includes research, diagnostics, education, and new ways to communicate. Of these, diagnostics will always remain the focus and will continue to be done by traveling to see an actual site. Patterns of stress or injury are needed to understand if injury is biotic (e.g., fungal disease) or abiotic (e.g., environment or cultural practice). For 2007, 134 diagnostic visits were made in Chicago alone. Sixty percent of those occurred during July and August.

My job is pretty simple. It is about helping others through science. The long-version was penned by Randy Kane in 1985. "To help superintendents identify and control disease and other pest problems, conduct field research and product testing to determine best management practices to promote healthy turf, and to oversee CDGA educational programs related to turfgrass science." A shorter version might just as well say, "To help superintendents one tiller at a time." All that is required is membership in the CDGA – the rest is free. **-OC**

Acknowledgements

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