BY JOHN STIER, PH.D.

VELVET TOUCH

Researchers consider velvet bentgrass as an alternative to creeping bentgrass, evaluating whether it can provide high-quality golf turf and reduce the need for fertilizer, water and fungicide inputs.

Most of us take for granted the creeping bentgrass (*Agrostis stolonifera* L.) turf used for putting greens. Daily irrigation and routine disease control practices are just an accepted fact of management costs. But creeping bentgrass only has been used commonly on putting greens for about 50 years. Can there be another, lower maintenance alternative? The turfgrass research program at the University of Wisconsin-Madison has been developing approaches towards lower cost, more sustainable golf courses since the early 1990s, and the potential looks good. We're particularly interested in addressing fungicide, nutrient and water issues.

Superintendents are constantly dealing with new restrictions on fungicide use. Mercury-based fungicides met their end a couple of decades ago. More recently, restrictions have been placed on the more common, lower cost fungicides such as PCNB, chlorothalonil and iprodione. PCNB will likely be phased out in the next two to three years, eliminating arguably the most cost-effective means for controlling snow mold disease.

Golf courses of the future will need to be maintained with less reliance on fungicides. The most practical way to reduce fungicide requirements is to use grasses that are inherently resistant to diseases.

Fertilizer use on golf courses also is becoming a contentious issue. The large and sudden increase in nitrogen costs in 2008 had superintendents asking me when was the single best time to fertilize, as they could only afford a single application for the year. Bans, or at least restrictions, on nitrogen use are likely to occur, beginning in the Northeast as the Environmental Protection Agency seeks to reduce nitrogen fertilization of golf courses. States such as Minnesota and Wisconsin have already severely restricted phosphorus fertilizer applications to turf.

Water restrictions are the up-and-coming bane of golf course management in many areas of the country and are no longer restricted to the South. It's becoming an accepted fact that many golf courses may have to cut back their use of potable water due

'L-93' creeping bentgrass (left) had coarser leaf texture and lower turf density than 'Vesper' velvet bentgrass (right) when maintained as putting greens in Madison, Wis.

ERIC KOERITZ

to other public demands. Last year the state of Wisconsin began requiring golf courses to submit information on their water use. This is likely the first step towards limiting ground and surface water withdrawals for irrigation – and Wisconsin is considered a water-rich state.

One of the most insidious and least-recognized challenges to the golf course industry is the development of invasive species rules at both state and federal levels. Virtually all turfgrass species commonly used on golf courses are on one or more invasive species lists. Creeping bentgrass, for example, is listed by The Nature Conservancy as a prime example of an invasive species (http://wiki.bugwood.org/Invasipedia).

Some states (e.g., Massachusetts and Wisconsin) are beginning to pass bans on the sale and transport of plants deemed invasive. Publicly-funded sites (e.g., municipal golf courses) tend to be the first areas to respond to actual and impending regulations, eventually followed by private industry.

HISTORY OF VELVET BENTGRASS

Velvet bentgrass (*Agrostis canina* L.) is native to North America, though it was also likely introduced about 100 years ago in bentgrass seed mixtures known as South German bentgrass (Brilman, 2003). Its leaves are extremely fine-textured, producing a dense, uniform turf well-suited for putting greens. During the first half of the 20th century, it was deemed a better putting green surface than creeping bentgrass (Monteith and Welton, 1932). Problems with seed supply, coupled with the advent of seeded types of creeping bentgrass and good marketing in the 1950s, motivated golf courses to begin using creeping bentgrass.

In the 1960s, Dr. Skogley developed the first new velvet bentgrass in nearly 30 years. Named 'Kingston,' it struggled to gain acceptance because its light green color caused managers to over-fertilize it, leading to excessive thatch development (Brilman and Meyer, 2000).

Other breeders, notably Dr. Leah Brilman of Seed Research of Oregon and Dr. Bridget Ruemmele of the University of Rhode Island, began developing new velvet bentgrass cultivars in the 1990s. In the past 10 years several cultivars have been released by various companies, including 'SR7200,' 'Vesper,' 'Legendary,' and 'Greenwich'.

Velvet bentgrass has the capacity to provide high-quality golf turf with reduced reliance on water and chemical inputs. In fairway situations, velvet bentgrass has been shown to use less water than creeping bentgrass (DaCosta and Huang, 2006a). Velvet bentgrass has better drought tolerance than other bentgrass species, perhaps partly because it uses more of its energy for root production, which allows it to extract water better from the soil (DaCosta and Huang, 2006b).

The fine leaf texture of velvet bentgrass may lead some people to think it's less traffic tolerant than creeping bentgrass, and so won't hold up under typical putting green traffic. Scientists at Rutgers University, though, proved otherwise. They planted two cultivars of velvet bentgrass and 13 creeping bentgrasses, then tested them under four levels of traffic (Cashel et al., 2005). The two velvet bentgrass cultivars, Vesper and SR7200, maintained excellent turf over the three-year test. The velvet bentgrasses always had better turf quality than the

Velvet bentgrass greens had the same level of green speed as creeping bentgrasses, regardless of mowing heights, while providing an even denser turf.

JOHN STIER

creeping bentgrasses, as good or better turf density, and essentially no annual bluegrass (*Poa annua* L.). Greens seeded to creeping bentgrasses had 5 to 15 percent annual bluegrass at the end of three years.

Annual bluegrass infests almost all mature putting greens. Many biotypes look and grow differently than bentgrass, which reduces the quality of the putting green and can affect ball roll. Annual bluegrass also requires more water and chemicals than bentgrasses to keep it in green during the summer. Golf course superintendents will occasionally overseed greens with bentgrass to reduce the amount of annual bluegrass, but it doesn't always work. One study showed that planting SR7200 velvet bentgrass into a turf of 100 percent annual bluegrass resulted in as much as two-thirds of the green being converted to velvet bentgrass, one and a half to seven times better than creeping bentgrass cultivars (Henry et al., 2005). The ability to maintain velvet bentgrass on a putting green instead of annual bluegrass will reduce a golf course's input costs.

WISCONSIN RESEARCH

Textbooks state that velvet bentgrass is adapted only to New England and perhaps the Pacific Northwest. However, no studies conducted outside of these areas have been published, and the extent to which velvet bentgrasses were ever planted outside of these areas is unknown.

The few scientific studies of velvet bentgrass all have been conducted on acidic soils (pH < 7.0); consequently, conclusions have been reached that an acidic soil pH is needed to grow velvet bentgrass. Part of the reason for conducting turf research, though, is to test assumptions and find new uses for plants. Given that about one-third of U.S. golf courses are in the Midwest, with soil pH often above 7.0, we've been evaluating velvet bentgrasses in one way or another for nearly 10 years.

One of our first trials was a test of shade tolerance. Velvet bentgrass has been touted as more shade tolerant than creeping bentgrass, but no data have been published to support the claim. We partnered with golf course superintendent Scott San at Greenwood Hills Country Club in Wausau, Wis., to compare SR7200 velvet bentgrass to Penncross in the shade. Those plots were planted in the early 2000s and maintained at tee height. SR7200 maintained much better turf cover and quality than Penncross over a two-year period.

We have since constructed two putting greens at the O.J. Noer Turfgrass Research and Educational Facility in Madison, Wis., for further shade research. We're comparing newer cultivars of each species, Vesper velvet bentgrass and Tyee creeping bentgrass, both of which have received high scores in cultivar trials (NTEP, 2008; Cashel et al., 2005). The greens were planted in summer 2008 and are being maintained under 80 percent shade. Three levels of N fertilizer (1, 2 and 4 pounds per 1,000 square feet per year), with and without the plant growth regulator trinexapac-ethyl, are being tested.

The ability to maintain velvet bentgrass on a green instead of annual bluegrass will reduce input costs.

A primary focus of our turf research program is to develop low input sustainable golf courses. We recently finished a project designed to determine the suitability of velvet bentgrass as a putting green turf with low fertilizer rates on a high pH (7.5) sand root zone. Vesper and SR7200 velvet bentgrasses were planted next to Penncross and L-93 creeping bentgrasses in 2004. We tested three mowing heights, 0.1, 0.156 and 0.25 inches, and two N rates, 1 and 3 pounds per 1,000 square feet per year. Normally, we irrigate putting greens on sand root zones every day, with enough water to replace water used by the plants the preceding day [i.e., 100 percent evapotranspiration (ET)]. Due to the lower water use of velvet bentgrass, and the need to conduct research in advance of probable water restrictions, we only replaced 75 percent of the daily water use.

We found that 1 pound of N per 1,000 square feet on an annual basis was simply insufficient to provide acceptable quality putting green turf of any cultivar on the sand-based root zone (Koeritz and Stier, *In press*). At 3 pounds of N per 1,000 square feet, Vesper velvet bentgrass was the only cultivar that produced acceptable quality turf. The turf quality of Vesper was best at the lowest mowing height of 0.1 inch, which is currently the benchmark of many high-end golf courses. Vesper produced twice the shoot density of creeping bentgrasses (~ 18,000 to 28,000 shoots per square foot compared to ~9,000 to 14,000 shoots of creeping bentgrass). Denser turf not only produces a better looking turf but one that is more resistant to weeds such as annual bluegrass and chickweed. One of the potential drawbacks to a dense turf can be loss of green speed. In our study, we tested green speed every two weeks for two years, and found no difference among cultivars. Both velvet bentgrasses, particularly Vesper, had much less dollar spot disease than the creeping bentgrasses. At 0.1 inch height of cut, for example, Vesper had only 5 percent of the amount of disease seen in Penncross and only 10 percent of the disease seen in L-93. Such extraordinary disease resistance can allow for much lower fungicide costs as the need for application is decreased.

Another trial, started in 2007, is helping us to determine if the acidity of fertilizers affects the quality of velvet bentgrass, as suggested by observations more than 70 years ago (Monteith and Welton, 1939). We planted Vesper velvet bentgrass on both a silt loam soil and a USGA sand-based root zone and have been using fertilizers representing a wide range of acidity. The pH of both soil types is about 7.5, which is considered basic, not acidic (7.0 is neutral). During the first year, we found the more acidic fertilizers sometimes produced better turf quality on the sand root zone. In the second year, however, we did not find that acidity was important. We are continuing the study through 2009 as sometimes climatic differences between years can change results, along with age of the turf. One positive result so far is that, once estab-

lished, velvet bentgrass on the soil green is able to produce high-quality turf with only 1 pound of N per 1,000 square feet. This is considered a very low N rate, and could be quite useful for golf courses seeking to reduce their fertilizer inputs.

We're extending our research into the use of velvet bentgrass for low maintenance, sustainable golf course fairways. We're planting monostands of velvet bentgrass, creeping bentgrass, fine fescues, Kentucky bluegrass and a mixture of velvet bentgrass and fine fescues. Turf will be irrigated to replace only 40 percent of water use during the summer, far lower than what is normally used to maintain creeping bentgrass or Kentucky bluegrass. All turf treatments will receive low and high N rates, with and without fungicide applications. We'll be monitoring turf quality, disease and soil moisture. We anticipate that the velvet bentgrass and fine fescue turfs will perform much better than the creeping bentgrass and Kentucky bluegrass turfs. The treatment we're particularly interested in is the mixture of velvet bentgrass and fine fescues, as they both appear capable of providing good turf with few inputs, yet have different growth habits. So far it appears that velvet bentgrass can reduce the need for fertilizer, water and fungicide inputs, especially on soil-based root zones. **GCI**

John Stier, Ph.D., is a professor and chair of the Department of Horticulture at the University of Wisconsin-Madison.

Literature Cited

Brilman, L.A., and W.A. Meyer. 2000. Velvet bentgrass: Rediscovering a misunderstood turfgrass: Past mistakes have damaged an excellent species reputation. Golf Course Mgt. 68:70-75.

Brilman, L.A. 2003. Velvet bentgrass (*Agrostis canina* L.). p. 201-205. *In* M.D. Casler and R.R. Duncan (ed.) Turfgrass biology, genetics, and breeding. John Wiley and Sons, Inc., Hoboken, NJ.

Cashel, R.H., H. Samaranayake, T.J. Lawson, J.A. Honig, and J.A. Murphy. 2005. Traffic tolerance of bentgrass cultivars grown on a sand-based root zone. Int. Turfgrass Soc. Res. J. 10:531-537.

DaCosta, M., and B. Huang. 2006a. Deficit irrigation effects on water use characteristics of bentgrass species. Crop Sci. 46:1779-1786.

DaCosta, M., and B. Huang. 2006b. Changes in carbon partitioning and accumulation patterns during drought and recovery for colonial bentgrass, creeping bentgrass, and velvet bentgrass. J. Amer. Soc. Hort. Sci. 131:484-490.

Henry, G.M., S.E. Hart, and J.A. Murphy. 2005. Overseeding bentgrass species into existing stands of annual bluegrass. HortScience 40:468-470.

Koeritz, E.J., and J.C. Stier. 200X. Nitrogen rate and mowing height effects on velvet and creeping bentgrasses for low input putting greens. Crop Sci. (accepted for publication 2 March 2008).

Monteith, J., Jr., and K. Welton. 1932. Putting tests upon bentgrasses. Bulletin of the USGA Green Section 12(6):224-227.

Monteith, J., Jr., and K. Welton. 1939. Fertilizer trials on demonstration gardens. Turf Culture 1(3):214-245.

National Turfgrass Evaluation Program (NTEP). 2008. 2003 National bentgrass test-putting green, 2004-07 data-final report. www.ntep.org (verified 13 May 2009)

In one velvet bentgrass trial, fertilizing with 3 pounds of nitrogen per 1,000 square feet (right side of photo) each year provided faster spring green-up than using only 1 pounds of nitrogen per 1,000 square feet (left side of photo).

ERIC KOERITZ

IMPACT
ON THE BUSINESS

Keeper of the velvet greens

BRENT ROGERS, SUPERINTENDENT AT EAGLE'S NEST GOLF CLUB IN MAPLE, ONTARIO, SHARES HIS PERSPECTIVE ON WHAT IT'S LIKE TO MANAGE VELVET BENTGRASS GREENS. **BY MARISA PALMIERI**

How is maintaining velvet bentgrass different from other types of turf you were most familiar with?

My previous experience was with *Poa annua*, Penncross, Penlinks and Providence creeping bents, from the West Coast of Vancouver to the East Coast of Cape Breton Island, Nova Scotia. The very first head-scratching issue I had was just after seeding [in 2002]. It was the traditional seven to 10 days to germinate, and then it was like watching molasses. It took weeks for the greens to thicken up. I understood that I was dealing with a strange animal to begin with – bunch-type growth and absolutely no stoloniferous growth habits that a conventional creeping bentgrass inherently possesses – but this was absurd. [Architect] Doug Carrick would come for his site visit and pace around like an expecting father wondering if the greens ever were going to fill in; the ownership had the same puzzling look on their faces. This was the nature of the beast. Don't expect quick establishment; it's not going to happen. Because of the super fine leaf blade, velvet bentgrass has such an incredible density to it, so fine, so dense, so upright – the perfect putting surface. In fact I had a conversation with Dr. Peter Landschoot from Penn State just last year and he said, "Velvet is the finest putting green grass in the world." Unfortunately, velvet has fallen by the wayside since its trendy reintroduction back in the early 2000s.

You have to appreciate that there are no text books; there's very little if any current literature regarding growing and maintain velvet bentgrass. It's been trial and error. It took me three years until I was getting the results I was looking for. The biggest myth perpetrated by agronomists in the past was that velvet doesn't need a lot of nitrogen and if you over fertilize velvet, it's a death sentence. In those first three years I had this in the back of my mind, but at the same time I knew the greens could be better. They still looked thin. It was an acceptable putting surface, but it was a struggle to keep them consistent. They would look good for a week, then go sideways, then look terrible, only to turn around and look great again. We had sound management practices and constant soil and tissue monitoring; again, all the soil labs and top agronomists had no benchmarks for what constituted an ideal range for nutrients in the greens. There was no established data anywhere. I was certainly frustrated, but I was not giving up. The course at the time was still getting great reviews, but that wasn't good enough. I felt almost ashamed of the greens – I had to get these greens to the next level. At times during this period I'd picture my industry colleagues enjoying their afternoons, laying back in a lounge chair, ice cold beer in hand watching their lovely creeping bentgrass become even more flawless, as I ran around my golf course sweating, frustrated and kneeling on the greens peering into the canopy of the grass. I'm sure the golfers must have thought that either I was praying to the turf gods or I had gone crazy.

In late 2005 I started to custom blend some fertilizers and slowly increase the nitrogen levels, completely ignoring the warnings that were so ingrained in my skull about over fertilizing velvet. As it turned out the velvet liked the extra nitrogen. It thrived, it became denser.

Cultural practices such as topdressing are a must with a dense turf like velvet in order to constantly dilute the thatch layer; however, that same dense canopy can make it next to impossible to work a topdressing sand into. I've had to search for sand that's fine enough to incorporate into the canopy, but yet still falls within the specifications of the root zone matrix. Verticutting is an excellent tool to utilize in conjunction with topdressing in order to open that canopy up.

What are some of the greatest challenges associated with velvet?

Where do I start? Because of its bunch-type growth and fine texture, it's extremely slow for ball marks to heal – we're talking season-long. We now incorporate mini plugs to remove the whole ball mark because we cannot sit around and wait for the recovery period. The biggest challenge is recovering from drought stress. Do not allow these greens to wilt or even approach the wilting point. The plants will not die, but all the above surface leaf tissue does and it takes two to three weeks for the plant to send up new shoots. Heaven forbid we ever host a professional event in which the tour agronomist expects us to maintain U.S. Open-style greens. They would be 100 percent brown. With mowing heights getting lower and lower and the expectations of green speed, you want to maintain them at a comfortable spot that works for both the turf and the golfer.

Has working with velvet bentgrass been what you thought it would be?

I can honestly say yes, and then some. I knew it was going to be a challenge, and trust me it has delivered its promise. If I could hit one point home through this whole conversation it's that velvet is unpredictable. Dr. Peter Landschoot is correct when he said that velvet has fallen out of fashion. I find it very ironic that all of these new generation creeping bentgrasses are being bred to have finer texture, short internodes and a dense upright growth habit – all the characteristics of velvet. If only more research and development was put into velvet bentgrass, you could have the perfect turf species in every way. In this day and age of genetic modification, anything is possible.

Would you characterize velvet bentgrass as "low maintenance?"

I would certainly not attach a label saying "low maintenance." It needs just as many inputs, a lot more topdressing and verticutting. If you had a very high-end private club with 15,000 rounds a year and a great maintenance budget, you could have some fantastic greens. I will say that we apply fewer fungicides than we would otherwise apply to a creeping bentgrass.

Do you have advice for other facilities considering velvet bentgrass?

Each course must evaluate its needs, from the type of facility, the vision of the architect and the requirements of the superintendent to maintain the level of conditioning that the clients expect. I want to make a point that all turfgrass species will respond differently to the type of root zone you have – straight sand, 80/20, 70/10/20, etc. These are my observations of the trials and tribulations that I've had here. Perhaps other superintendents in different parts of the world have achieved greater success with velvet. What surprised me was the lack of sound management data out there, even after seven years of having it. I guess that's why it went by the wayside back in the 1950s when Penncross came on the scene.