Table 2. Sensitivity of various cool season grasses to soil EC levels. Soil salinity levels are greatly influenced by EC of irrigation water. Adapted from Harivandi et al (1992).

Sensitivity	Turfgrass Species	EC at which symptoms may appear
Sensitive	annual bluegrass, colonial bentgrass, Kentucky bluegrass, rough bluegrass, velvet bentgrass	3 dS m^{-1}
Moderately sensitive	creeping bentgrass, fine fescues	3 – 6 dS m^{-1}
Moderately tolerant	perennial ryegrass, tall fescue	6 – 10 dS m^{-1}

Table 3. Sodium hazard guidelines of irrigation water according to Richards (1954). Adapted from Carrow et al. (2001).

Sodium Hazard	Comments	Sodium Adsorption Ratio of Water (SAR)
Low	Can be used to irrigate almost all soils without structure deterioration.	< 10
Medium	Permeability hazard on fine-textured soils with high CEC. Best used on soils with good drainage.	10 - 18
High	Structure deterioration and infiltration reduced on most soils. Intensive management required.	18 - 26
Very High	Generally unacceptable for irrigation.	> 26

extract. If you want to avoid the lab fee and two-week turnaround time, a handheld soil EC meter can be used. Soil EC varies with soil moisture content, so it's best to measure soil EC at field moisture capacity. Guidelines for the tolerance of several grass species to soil salinity levels are shown in Table 2. More detailed instructions about operation are included in the user manuals. Water EC probes start around $100 and cost around $400 for a dual soil/water probe.

Sodium Hazard

Another potential problem with using poor quality water for irrigation is sodium hazard. When sodium ions are high relative to calcium and magnesium, clay aggregates will disperse into individual clay particles leading to a reduction in pore size and a greatly reduced infiltration rate. In addition, soil aeration is decreased and the soil becomes more sensitive to traffic. Sodium-affected soils are difficult to reclaim, because substantial leaching is required but prevented by the chemically-altered soil structure. The sodium adsorption ratio (SAR) is a measure of the potential for irrigation water to lead to poor soil structure caused by excess sodium. The SAR is normally calculated by the water testing laboratory and listed on the report. Table 3 shows classifications of SAR for irrigation waters. These classifications were developed for soils with appreciable clay content, and therefore they overestimate the potential for water to cause problem in sand root zones. Sand root zones have very low clay contents, and therefore any sodium-induced dispersion will have a small effect on pore space distribution and soil structure.

The average SAR for the 63 sampled waters was 0.8, nowhere near a value that would be cause for concern. Additionally, the greatest SAR value found was 4.2. While these findings indicate that sodium hazard is not a universal concern in Wisconsin. In fact, the fear of sodium hazard has resulted in tons and tons of un-warranted applications of calcium to golf courses across the US. Calcium is indiscriminately marketed as a nutrient that improves drainage and soil structure among other things. However, this claim turns out to only be true for fine-textured soils with appreciable amounts of sodium - conditions that are rare in Wisconsin. Unfortunately, field testing of sodium hazard is not possible. Soil and water samples must be sent in for laboratory testing.

Conclusions

Salt problems have been rare in Wisconsin due to adequate rainfall and high quality irrigation water. However, poor quality water sources can be found in the state, and future use of effluent water will increase the incidence of salt problems. Management of salt problems involves basically the over-application of water to leach salts out of the root zone. On sand-based systems, large amounts of water can be applied at one time to alleviate the problem. For soils with lower infiltration rates, irrigation must be applied gradually by

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applying amounts slightly greater than ET. Because of the potentially negative agronomic consequences of applying excess water, it is best to be sure salt issues exist. Vigilant testing and monitoring of soil and water are key to a superintendent's success in potentially salt-affected areas. Know what's in your water and know how it may change during the season. Most times the water quality is poorest when you need it most.

One final note: I have spoken with superintendents who irrigate with high quality water but still notice a significant visual response the day following a large leaching or flushing event. I suspect the response is not a result of salt leaching, but more likely can be attributed to the alleviation of moisture stress and an increase in population of soil microbes, which tend to dislike dry conditions. The increase in microbe population will result in an increase in available nitrogen shortly after the soil is re-wetted. The same green-up can likely be achieved with irrigation amounts much smaller than a traditional flushing event. Additionally, heavy irrigation cycles on sand root zones may need to be followed with a potassium application, as a recent study found a 22% decrease in available potassium following the application of 5.5 inches of irrigation over 22 hours (Hathaway et al., 2007).

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Legends of Brandybrook Hosts 2007 Super/Pro Tourney

By Jim VanHerwynen, *Golf Course Superintendent, South Hills Golf and Country Club*

On May 30, 2007 the annual Superintendent/Pro Tournament or simply the "Super/Pro" was held at The Legends At Brandybrook in Wales, WI. Unfortunately for me, I could not make the event because my partner, PGA Professional, Don DuChateau had elbow surgery weeks earlier. We do plan to attend next year when Northern Bay, near the Wisconsin Dells, has committed to hosting on Wednesday May 28, 2008.

Talking with Chris Hoel, Tournament Director for the Wisconsin Section PGA, I can elaborate on the day's event. The host club, with Jack Gaudion PGA Professional/Managing Partner along with golf course superintendent Jake Renner, provided another fabulous event with a superbly conditioned golf course and first class accommodations. On behalf of the WGCSA we would like to thank vendors: Tiziani Golf Car Company including Dennis Tiziani, Darrin DiChristopher, Steve Fisher and Jim Yost; Ashworth represented by Mike Warren and Aaron Buesing, and Steve Syrjala representing the Prestwick Golf Group. Not only did Ashworth donate GCSAA logo golf shirts they and the other supporting vendors contributed to bring the purse to an amazing $3,800.00. The event drew 92 players and the winners are as follows. Division 1 went to Charlie Brown and John Feiner both from Johnson Park Golf Course. Division 2 was won by Curt Smits and Dave Busse of Rock River CC. Congratulations to both winning teams and thank you to all who attended.

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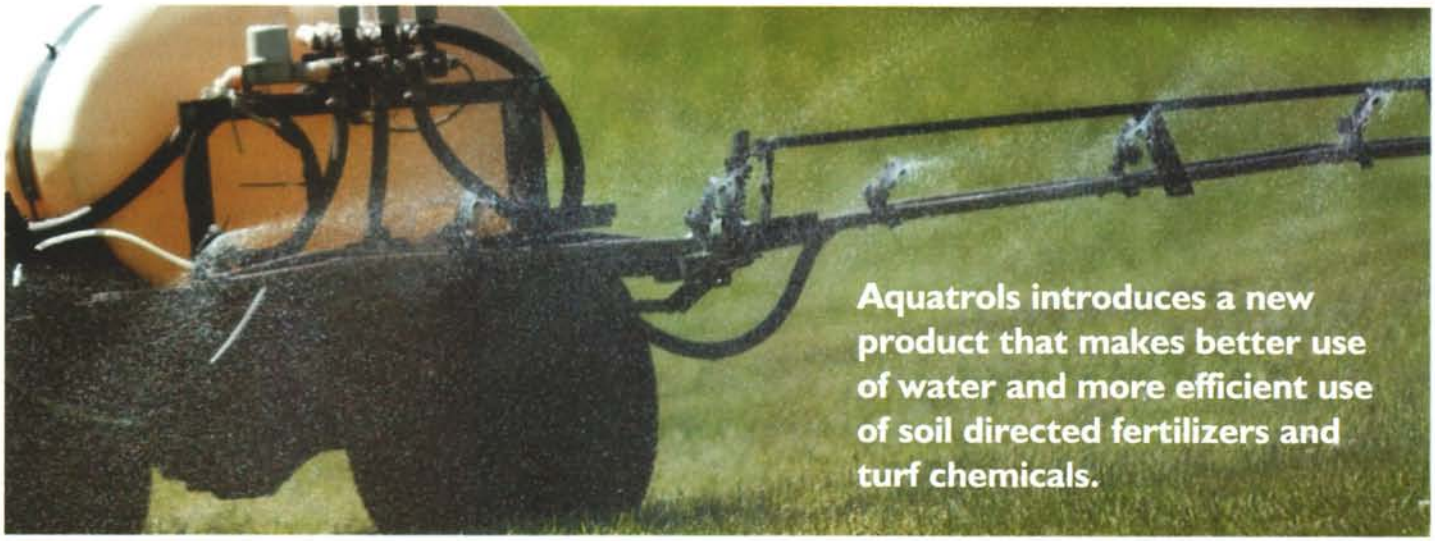

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Safety of Velocity™ on Kentucky Bluegrass Cultivars Maintained at Fairway Height

By Dr. John Stier, *University of Wisconsin-Madison, Department of Horticulture*

Each year I receive many calls about controlling annual bluegrass (*Poa annua* L.) in turf. It appears to be one of the more "successful" weeds as some biotypes compete well with creeping bentgrass at putting green height and other biotypes compete well with bentgrass and Kentucky bluegrass at fairway heights. Ethofumesate is labeled for selective, post-emergent control in Kentucky bluegrass (*Poa pratensis* L.) though its efficacy is inconsistent and typically requires multiple applications in fall and spring. Cultural and biological controls are generally impractical or ineffective once a site is infested with *P. annua*. For the past few years we have been conducting trials and reporting data on the efficacy of a relatively new herbicide, Velocity™ (bispyribac-sodium), to remove annual bluegrass from creeping bentgrass fairway turf (Stier, 2004; Koeritz and Stier, 2006). Velocity™ is currently labeled for use on creeping bentgrass and perennial ryegrass species. Missing from the label is inclusion of Kentucky bluegrass, which is important given the large percentage of bluegrass fairways in Wisconsin and other northern states.

Product labels often evolve over time for various reasons. Some changes are prompted by regulations, others by formulation changes or additional active ingredients. Many times, however, labels change because new information is made available. Our goal was to evaluate the potential phytotoxicity on Kentucky bluegrass cultivars in case a label change to include Kentucky bluegrass might be appropriate.

MATERIALS AND METHODS

Over 170 varieties of Kentucky bluegrass in the 2000 National Turfgrass Evaluation Program (NTEP) were assessed for tolerance to Velocity in Wisconsin

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during summer 2005. We maintained the turf throughout the study as a fairway by mowing at one-half inch height three times weekly and returned the clippings. The soil type was a Troxel silt loam with pH 7.2. Turf was fertilized each spring, late summer and late autumn with 1 lb N per 1000 ft^2 each time using a combination of slow and fast-release fertilizers. Irrigation was provided twice weekly to replace 100% estimated evapotranspiration during the growing season. Apart from one broadleaf herbicide application the year following establishment, no other pesticides were used.

The NTEP plots, measuring 5 ft x 5 ft, were planted in autumn 2000 as a randomized block with three replications. Velocity™ 17.6 SG was applied to one-half of each plot as a strip-plot treatment on 17 June 2005 with a second application 14 days later at a rate of 30 grams active ingredient per acre (less than 6 oz of product per acre). Applications were made with a CO_2-powered backpack sprayer using 8004 flat fan nozzles and a carrier volume of 2 gal water per 1000 ft^2. We rated phytotoxicity on a 1 to 9 scale, with 9=no injury and 1=100% dead turf, at 3, 7, 14, 21, 28, 42, and 56 days after treatment (DAT). Since many of the plots were heavily infested with either *P. annua* or creeping bentgrass, only those varieties which maintained 70% or better desirable turf cover by autumn 2005 (in untreated portions) were used for statistical analysis.

RESULTS AND DISCUSSION

About half of the 173 varieties in the NTEP provided 50% or better Kentucky bluegrass cover by June 2005, though only 55 maintained 70% or better cover. Most injury did not start to show itself until 14 days or more after application, with the worst injury seen about 28 days after application (Table 1). Discoloration started as a slightly lighter shade of green which was only noticeable when compared against the untreated half of each plot. By day 28, though, most cultivars had significant portions of the leaves or entire plants discolored a straw-yellow color. Some notable exceptions like Chateau, Alpine, Coventry and Lily had minimal discoloration and returned to full color within two months of application. Several other cultivars such as Courtyard, Alexa, and Blue Velvet also returned to full color and quality. Otherwise, a wide range of recovery was seen in the two months following Velocity™ application, from full to partial to no recovery. For example, Princeton 105, an old cultivar known for traffic tolerance, was essentially killed by Velocity. Most cultivars made at least a partial recovery within two months with 32 cultivars having acceptable recovery, with a lighter green tint being the only noticeable effect of Velocity.

We coordinated our trial with Dr. Brian Horgan at the University of Minnesota who applied Velocity to

	Days after first application		
Cultivar	**14**	**28**	**56**
Courtyard	8.0	4.7	9.0
Alexa	8.0	5.0	9.0
Blue Velvet	8.0	5.3	9.0
Excursion	8.0	6.0	9.0
Liberator	8.0	5.0	9.0
Chateau	8.0	7.0	8.7
Impact	8.0	6.0	8.7
Tsunami	8.3	5.6	8.7
Alpine	8.0	7.3	8.3
Ginney	8.0	5.0	8.3
Awesome	8.0	5.3	8.3
Nu Destiny	8.0	5.3	8.3
Beyond	8.0	5.0	8.3
Midnight	8.3	6.7	8.0
Nu Glade	8.0	5.3	8.0
Barrister	8.0	5.0	8.0
Rugby II	8.0	5.0	8.0
Serene	8.3	6.3	8.0
Moonshine	8.0	5.7	8.0
Coventry	8.0	7.0	7.7
Blue-tastic	8.0	6.3	7.7
Rambo	8.0	5.7	7.7
Lily	8.0	7.0	7.3
Brooklawn	8.0	5.3	7.3
Chicago II	8.0	4.0	7.3
Diva	8.3	4.7	7.0
Blackstone	7.7	6.0	7.0
Award	7.7	3.7	7.0
Arcadia	8.0	3.7	6.7
Royce	7.3	4.3	6.3
Chelsea	8.0	5.3	6.0
Brilliant	8.0	4.0	6.0
Blue Knight	8.0	4.3	5.7
Shamrock	8.0	4.3	5.3
Limousine	7.7	4.7	5.3
Skye	6.7	3.0	5.3
Baron	7.0	3.3	5.0
Hallmark	8.0	3.7	5.0
Voyager II	8.0	3.7	5.0
Delight	8.0	3.3	4.7
Unique	8.0	4.0	4.7
Bedazzled	8.0	4.0	4.3
Wildwood	8.0	3.3	4.3
Mallard	7.3	3.3	4.3
Arrow	7.7	3.0	4.3
Valor	8.0	3.0	4.0
Washington	6.0	2.3	3.7
North Star	7.3	2.0	3.7
Monte Carlo	7.0	3.3	3.3
Langara	7.7	3.0	3.0
Julius	5.0	1.7	2.7
Royale	7.7	2.3	2.3
Avalanche	6.0	1.7	1.7
Champagne	6.7	1.7	1.7
Princeton 105	5.3	1.3	1.0
Tukey's HSD (0.05)	2.6	2.9	4.4

Table 1. Kentucky bluegrass ground cover and sensitivity to bispyribac-sodium (Velocity™) when maintained at 0.5 inch mowing height after four years in Madison, WI. Cultivars listed all maintained 70% or better turf cover by autumn 2005. Bispyribac-sodium was applied at 30 grams active ingredient per acre on 17 June and 2 July 2005. Phytotoxicity was rated on a 1 to 9 scale with 9 = no injury, 6 = acceptable fairway turf, and 1 = 100% dead foliage.

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