intervals resulted in the most phytotoxicity. Considerably less injury was obtained when the low rate (10 g ai/A) was applied at 7 day intervals. Less injury probably occurred when the application intervals were spread out because the bentgrass was able to metabolize and detoxify the active ingredient prior to the next application and/or develop new growth which essentially diluted the product in the plant.

Bentgrass quality ratings were taken to help determine the best timing of application (Table 6). In July and August treatment 2 provided the best turf quality out of the 6 treatments. The increased quality in treatment 2 was largely due to the control of dollar spot.

CONCLUSION

The objective of this study was to evaluate multiple applications of Velocity SG for control of annual bluegrass on bentgrass fairways. The SG formulation worked quite well to control *P. annua* as well as dollar spot disease. Treatment 2, which was 6 applications of 10 g ai/A on a 7 day interval, provided the best overall *Poa annua* control with minimal bentgrass injury and the longest-term dollar spot control. Treatment 1 also performed well suggesting that splitting the total rate up into 6 applications at low rates provides better control of *Poa annua* than making 2 applications at higher rates. Treatment 5, which was 2 applications of 30 g ai/A on a 14 day interval also provided good control of *Poa annua* showing that making the applications of the high rate at longer intervals improves efficacy.

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Table 5. Phytotoxicity of Velocity herbicide applied to bentgrass fairway turf beginng 8 June 2006, Verona, WI.

Treatment	Jun 11	Jun 16	Jun 23	Jun 29	Jul 5	Jul 11	Jul 26	Aug 8
1	1.5 a	4.0 a	4.0 a	2.3 a	1.0 b	1.0	1.0	1.0
2	1.5 a	2.5 b	1.0 c	1.5 b	1.5 a	1.0	1.0	1.0
3	2.3 a	3.8 a	1.5 c	1.3 b	1.0 b	1.0	1.0	1.0
4	1.5 a	3.0 ab	2.3 b	1.3 b	1.0 b	1.0	1.0	1.0
5	1.8 a	3.0 ab	1.0 c	2.8 a	1.0 b	1.0	1.0	1.0
6	1.3 a	1.0 c	1.0 c	1.0 b	1.0 b	1.0	1.0	1.0
LSD (0.05)	ns	1.1	0.7	0.6	0.4	ns	ns	ns

Means followed by the same on letter within columns are not significantly different at $P \leq 0.05$. (Scale: 1-9, 1 = no phytotoxicity, 9 = totally dead, 3 = unacceptable.)

Table 6. Quality of creeping bentgrass fairway turf treated with Velocity herbicide, Verona, WI, 2006.

Treatment	July 5	July 26	Aug 8	Sep 9
1	6.9 a	5.5 b	4.9 bc	6.5 a
2	7.0 a	6.5 a	5.9 a	6.4 a
3	6.1 b	5.3 bc	5.3 b	6.3 a
4	7.0 a	4.8 c	4.6 c	6.3 a
5	7.0 a	5.3 bc	5.0 bc	6.4 a
6	5.9 b	4.9 bc	4.9 bc	6.5 a
LSD (0.05)	0.4	0.7	0.6	ns

Means followed by the same on letter within columns are not significantly different at $P \leq 0.05$. (Scale: 1-9, 1 = dead turf, 9 = perfect turf quality, 6 = acceptable turf quality)

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NR 151 Update: 'Tis the Season for Soil Testing

By Dr. Doug Soldat, *Department of Soil Science, University of Wisconsin - Madison*

Another busy summer is well underway, and NR 151 is probably only a faint whisper in the back of your mind. However, obtaining soil analyses this season will prevent that whisper from developing into a headache by next March when nutrient management plans will be required by NR 151. Soil test results are the foundation for a nutrient management plan and the purpose of this article is to discuss the requirements of NR 151 and the DNR technical standard as they pertain to soil testing.

NR 151 states that fertilizers should be applied based on "appropriate" soil tests. According to the DNR technical standard (download a copy at www.turf.wisc.edu) "appropriate" means a Bray or Mehlich-3 soil test for areas that are managed differently. At a minimum, this could mean three samples, one sample to represent greens, tees, and fairways. However, this approach is not recommended for two reasons. First, soil types can differ greatly across a property, and different soils may have different levels of available nutrients even if nutrient applications have been uniform for a number of years. Second, soil phosphorus (P) levels are related to the prior land use of the site. For example, soil P levels on a fairway that was once a farm field will likely have a greater soil P level than an adjoining fairway cut out of forested land. Combining soil samples from these two areas could lead to a relatively meaningless average, reminding me of the old joke about the statistician who drowned while attempting to cross a river with an average depth of three feet. When developing a fertility program based on soil test results it's best to gather as much information as possible. In my opinion, it is a good idea to obtain one sample from each green, tee complex, and fairway on the course; particularly if this is your

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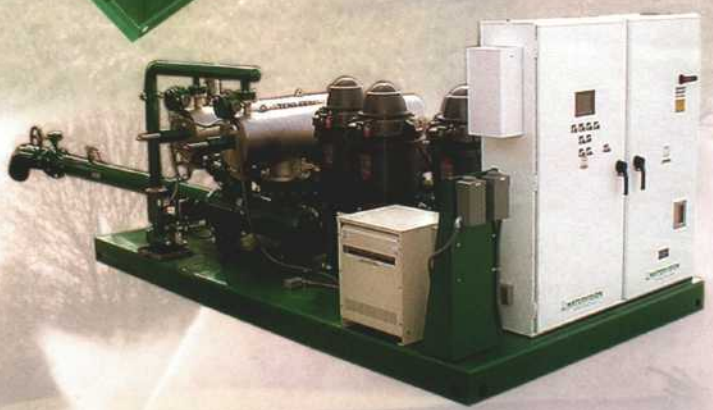

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first time sampling. For future sampling, or if you have extensive soil test results from the past, you could combine areas that have similar soil P levels.

Sampling technique makes a big difference

After deciding how many different areas to test, the next step is pulling the sample. As mundane as this task sounds, proper sampling is more important than most people think. For example, soil P levels are greatly influenced by the depth of the sample. A two inch deep soil sample is likely to contain double to triple the amount of available P than a six inch sample. Hence, it is important to maintain a constant sampling depth. But what depth should you choose? The interpretation of whether available P is low, optimal, or high is based on research that examined hundreds of paired turfgrass tissue and soil samples. Those research soil samples were obtained to a four inch depth for greens and tees, and six inch depth for higher cut areas such as lawns and fairways. Therefore, your samples should be taken to those same depths, so they can be directly compared to the research data. Furthermore, these soil testing depths were chosen because they are representative of the average root zone depth over the course of the growing season. Soil sampling is an often overlooked step in the soil testing process. For consistent and accurate results, follow these steps:

1. Take at least ten cores per sample regardless of size of the area
2. Sample to four inch depth for greens and tees
3. Sample to six inch depth for fairways and other higher cut turf areas
4. Mix the cores well in a clean plastic bucket, as soil testing laboratories usually do not mix samples very well
5. Place two cups of the mixed soil in an appropriately labeled bag

A soil test interpretation is only as good as the data supporting it

Several different soil nutrient extractants exist; examples include the Bray, Mehlich-1, Mehlich-3, Morgan, and Olsen extractants. For the results of a soil test to be meaningful, the relationship between the soil P level and a crop response must be known. The process of gathering information on how crops respond to different soil nutrient levels is called calibration. Figure 1 shows the relationship between Olsen soil P and turfgrass quality of a USGA putting green with a pH of 7.7 in Utah. From this information we can conclude that Olsen soil P level should be kept above 5 mg/kg (or 5 ppm). Below this level, a decrease in turfgrass quality is evident. Although 5 ppm Olsen soil P is sufficient for this particular calcareous sand green, the same may not hold true for different soil types. Unfortunately, very few soil tests have been properly calibrated due to the large amount of work involved.

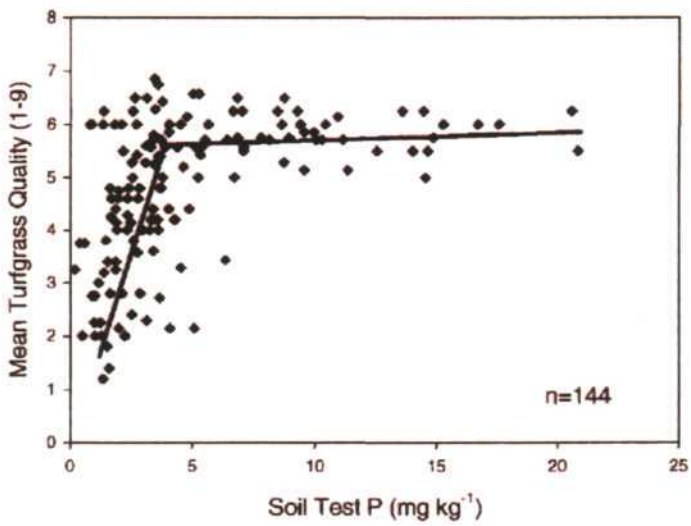

Figure 1. Turfgrass quality of a USGA putting green (pH = 7.7) is affected by Olsen soil P level. Below 5 mg/kg P (also 5 ppm P), putting green quality declined. Above 5 ppm no increase in quality was observed. Figure from Johnson et al. (2003)

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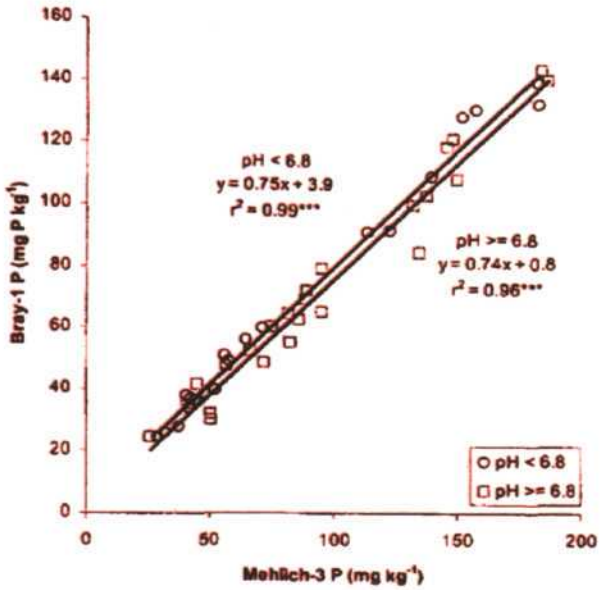

Figure 2. Relationship between soil P extracted by Mehlich-3 and Bray tests for soils with pH 5.3 - 6.7 (circles) or pH 6.8 - 7.9 (squares). Figure from Ketterings and Flock (2005).

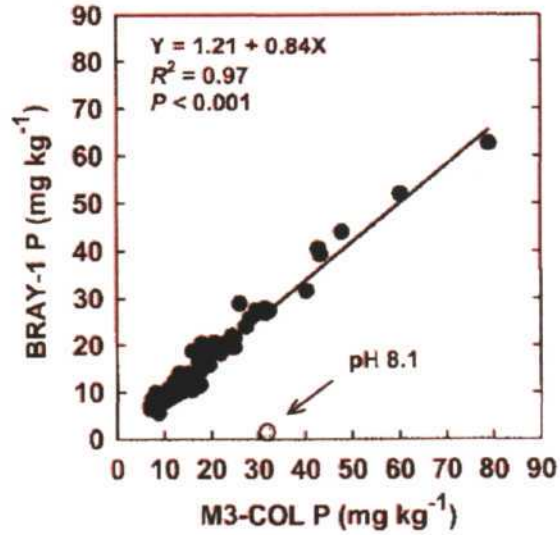

Figure 3. Relationship between soil P extracted by Mehlich-3 (M3-COL) and Bray-1 P. The white circle shows that Bray-1 P was underestimated for the soil with a pH of 8.1. However, the Bray test did not underestimate soil P level for soils with pH less than 8.1. Figure from Mallarino (2005).

However, fortunately for turfgrass managers in Wisconsin, Dr. Kussow calibrated the Bray and the Mehlich-3 soil tests for turfgrass grown in Wisconsin on both native soil and sand-based root zones. Chances are some of the data was collected from your golf course. For more information on how the new interpretations were developed see Kussow and Houlihan's article in *The Grass Roots* (2006). Because of the large amount of information supporting the interpretations of the Bray and Mehlich-3 tests, the DNR technical standard recommends their use for preparing a nutrient management plan.

Bray or Mehlich-3?

Now that we have established that the Bray and the Mehlich-3 are the most reliable soil tests for turfgrass areas in Wisconsin, the next question is which one is right for your course. The Mehlich-3 test is relatively new test that is gaining in popularity nationwide. It has been shown to work very well across a wide range of soil types and pH levels, and in addition to available phosphorus and potassium, micronutrient levels can also be provided. For this reason, many golf course superintendents prefer the Mehlich-3. Downsides to the Mehlich-3 are usually a higher cost related to the more expensive analytical equipment required for analysis, and the fact that the micronutrient levels are of questionable utility due to the very limited research data available for interpreting them.

The Bray test has been around for a long time and is widely used in the Midwestern states. It works very well on acid soils; however, at high pH levels the test can underestimate available P. For most Wisconsin soils this is not likely to be a concern. Figure 2 shows that the relationship between Bray and Mehlich-3 is very similar for soils with low pH (5.3 - 6.7) and high pH soils (6.8 - 7.9). Figure 3 shows a similar relationship as shown in Figure 2, except for one data point where the soil pH was 8.1 and the Bray soil test underestimated the soil P level. *Notice that the Bray underestimation would result in a recommendation for P fertilizer, and therefore using the Bray test for high pH soils will result in a conservative error (if any).*

Aside from these minor differences, it makes little difference which test you choose. The most important factor in selecting a soil test method is whether or not the interpretations of the soil test results are based on turfgrass response.

Which Soil Testing Lab?

Unlike the rules for agricultural nutrient management plans, turfgrass soil samples **do not** need to be analyzed by a soil testing lab with certification from the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP). However, using one of these laboratories ensures soil test results and recommendations will be generated through analytical procedures approved by the University of Wisconsin with consistent results. Laboratories must continually perform with a certain level of success to remain certified.

Shown on page 19 is a list of soil testing laboratories certified as of October 2006 by the Wisconsin DATCP. As of press time, the UW Soil & Forage Lab and Dairyland Laboratories are the only DATCP certified labs that do not offer the Mehlich-3 test. Prices for these labs are similar with a basic Bray or Mehlich-3 test costing around $7. Secondary and micronutrients

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are usually provided for an additional fee. This spring, the UW Soil and Plant Analysis laboratory introduced a special rate for turfgrass nutrient management plans. For $7, a Bray soil test (P, K, pH, and OM) is provided. The normal professionally managed golf sample is run using the Mehlich-3 and costs $20/sample. This package gives secondary and micronutrient soil levels, as well as an estimated CEC. Most soil testing laboratories offer similar packages.

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Golf Courses Are Not Killing Us

*By **Rob Schultz**, Golf Writer, The Capital Times*

It's a rite of spring.

The grass turns green, leaves grow on trees, flowers bloom ... and some obtuse nitwit screams that golf courses are killing us all.

Or, at least golf courses are killing the superintendents who tend to them, or the children who live near them, or those cute baby robins who nest in trees located within 500 blocks of one of them.

True story: A woman walked out of her home and immediately sneezed. Later, she learned a nearby golf course was spraying a fungicide that day. So she automatically assumed that the fungicide made her sneeze and was somehow killing her and her children. She called city officials and demanded that they tell the golf course employees to stop spraying "that poison."

What she didn't know was that her neighbor was in his garage using heavy-duty turpentine to clean old paint brushes when she walked outside that day. It didn't matter to her. She figured that it had to be bad for the environment if golf courses sprayed fungicide so she joined an interest group to get the process stopped.

That's the kind of nut-cake logic that makes me want to get my wedge out and ... and ... well, I'm not going to sink to the level of those whack-jobs who think golf courses need to radically change to save us all.

What got my blood pressure rising was Rob Zaleski's thorough and well-written article in Monday's Capital Times about pesticide use on golf courses. He mentioned that a Madison physician named Gary Giorgi was trying to convince Madison parks officials to turn Glenway golf course into a pesticide-free golf course.

"I mean, what are the priorities of the city course? Shouldn't its focus be the health of those who play there?" Giorgi asked.