

## **WinterTurf and Nutrient Management Research Update**

Dr. Kevin W. Frank, Payton Perkinson, and Eric Galbraith  
Michigan State University

### **Long-term nitrogen leaching**

Since the summer of 1998 leachate samples have been collected from the monolith lysimeters at the HTRC and analyzed for nitrate-nitrogen. July 2023 marked 25 years of consecutive leachate collection and 33 years since turfgrass was established on the lysimeters. The high N rate of 5 lb. N/1000 ft.<sup>2</sup>/yr was applied in 1998 and concluded following the 2002 season. High levels of NO<sub>3</sub>-N leaching were measured from the high N rate from 1998-2002. In 2003 the high N rate was reduced from 5 to 4 N/1000 ft.<sup>2</sup>/yr, and subsequently leachate NO<sub>3</sub>-N concentrations declined over an approximately 15-year period. After 15 years of treating the high N rate at 4 lb. N/1000 ft.<sup>2</sup>/yr, in 2018 we reverted to applying urea at 5 lb. N/1000 ft.<sup>2</sup>/yr split over 5 applications to two of the lysimeters to determine if the high N rate would once again result in high nitrate-nitrogen concentrations in leachate. The application dates were May 1, June 1, July 1, Aug. 1, and Sept. 1. The remaining two lysimeters were treated with urea at 2 lb. N/1000 ft.<sup>2</sup>/yr split over two applications on May 1 and Sept. 1. The turf was mowed at 3 in. and clippings returned to the plots. Lysimeter percolate was collected regularly, volume measured, and a sub sample collected for NO<sub>3</sub>-N, NH<sub>4</sub>-N, and phosphorus (orthophosphate) analysis.

Leachate was collected from January through December in 2023. The mean NO<sub>3</sub>-N concentration in leachate for the low and high N rates was 0.8 and 4.1 ppm, respectively. Mean leachate concentration for the low N rate was basically unchanged from 2022 to 2023, 0.9 and 0.8 ppm, respectively. Mean leachate concentration for the high N rate increased from 1 to 6 ppm from 2018 to 2022 and then moderately decreased from 2022 to 2023, 5.7 to 4.1 ppm, respectively. After 6 years of the 5 lb. N rate, NO<sub>3</sub>-N concentration in leachate has increased from 1 ppm in 2018 to 4.1 ppm in 2023.

This research will continue to measure nitrogen leaching in a continually managed turfgrass system and provide insight into the effect of fertilizer rates on nitrogen leaching from mature turfgrass stands.

### **Key Points**

1. After six years of the high N rate, 5 lb. N/1000 ft.<sup>2</sup>/yr, mean annual nitrate-nitrogen concentrations have increased from 1.1 to a high of 5.7 ppm in 2022.
2. Dormant season leaching continues to be a point of concern for the high N rate application.



Photo: Lysimeters used for measuring nutrient leaching at the Hancock Turfgrass Research Center.

## **WinterTurf Research Projects**

### **Reestablishment on a bare soil putting green**

In the spring of 2022 reestablishment seeding research was conducted at MSU, University of Minnesota, University of Wisconsin, and Iowa State University. On three consecutive weeks in the spring of 2022, four creeping bentgrass cultivars and Two-Putt annual bluegrass were seeded into an existing putting green that was killed with glyphosate the previous fall. The bentgrass cultivars were Penncross, Declaration, Pure Distinction and A4. Previous seed germination research at the University of Minnesota found that some bentgrasses displayed high germination rates at low temperatures while others performed poorly.

We had poor germination and establishment across all locations in 2022. In addition to unfavorable temperatures that are often typical of establishing following winterkill, we had considerable amounts of creeping bentgrass survive and reemerge following the glyphosate applications. To eliminate the confounding factor of bentgrass not being completely killed by glyphosate applications, the turf was stripped from a green in the fall of 2022 so that in the spring of 2023 seed could be applied directly to bare soil.

Reestablishment research was conducted in 2023 at MSU, University of Minnesota, University of Wisconsin, and Iowa State University. The objective was to evaluate spring establishment rates of creeping bentgrass and annual bluegrass seeded three consecutive weeks. Seeding treatments were four creeping bentgrass cultivars ('Penncross', 'Pure Distinction', 'Declaration', 'Penn A-4'), one annual bluegrass ('Two-Putt'), and a 50/50 by weight mixture of Pure Distinction and Two-Putt. The first seeding date at each location corresponded to when soil temperature at a 2-inch depth was 40°F. After seeding each date, plots were lightly raked with a leaf rake to provide adequate seed to soil contact and starter fertilizer was applied at 1 lb. P/1000 ft.<sup>2</sup>. Overhead irrigation was applied when necessary to maintain a moist seed bed. Plots were fertilized with 0.1 lb. N/1000 ft.<sup>2</sup> at 2, 4, 6, and 8 weeks after first seedling emergence for each date. The experimental design was a split-plot design with whole plot in randomized complete block design with four replications. The whole plot was seeding timing and subplot was cultivar. Data was collected weekly using a light box to assess percent coverage. Statistical analysis was conducted separately at each location. One location showed significance in seeding timing with the earliest seeding date having a higher percent coverage than middle and late seeding timing during the first two measurement dates. Two locations showed statistical significance in cultivar, with Penncross, Penn A-4, and Pure Distinction having the highest percent coverage among cultivars and Declaration having the lowest.

### **Reestablishment on an annual bluegrass putting green**

At MSU we conducted a reestablishment trial on a native soil annual bluegrass green that was killed with glyphosate and diquat in the fall of 2022. Seeding occurred once soil temperature reached 40°F at a 2-inch depth. Seeding treatments were four creeping bentgrass cultivars ('Penncross', 'Pure Distinction', 'Declaration', 'Penn A-4'),

one annual bluegrass ('Two-Putt'), and a 50/50 by weight mixture of Pure Distinction and Two-Putt. The early seeding date had the highest percent cover for the first 6 weeks of the trial and then there were no differences among the seeding dates.

### **Fertilizer rate, timing, and leaf mulch effects on snow mold**

There are three different research trials related to snow mold that we have conducted in cooperation with Dr. Koch at the University of Wisconsin. All these trials are completing their 2<sup>nd</sup> year of research in 2024. There are two trials studying the effect of nitrogen and potassium applications on snow mold incidence on a creeping bentgrass fairway. Trial 1 is analyzing the effect of annual rate of nitrogen and potassium on snow mold incidence. Trial 2 is analyzing the effect of timing of the last application of nitrogen and potassium on snow mold incidence. In addition to measuring snow mold incidence, we are also measuring turfgrass quality and tissue nitrogen and potassium levels.

The third trial is determining the effect of leaf mulch on snow mold incidence on Kentucky bluegrass. There are six different treatments, mulched and non-mulched leaves at low, medium, and high rates. Turfgrass quality, smothering effect, and snow mold incidence are measured.

For all the snow mold research trials we did not have any snow mold occur in 2022-2023 so there were no differences among treatments. Unfortunately, it appears that we had the same result again following the winter of 2023-2024 with no snow mold occurring. The plots in Wisconsin did have snow mold in their plots the 1<sup>st</sup> year.

### **Monitoring Winter Conditions with Sensors on Michigan Golf Courses**

The MTF Founders Society funded the purchase of six winterkill sensor packages in 2020. The sensor package was developed by scientists at the University of Minnesota as part of the WinterTurf grant. Since 2020, we have been able to increase the number of sensor packages on golf courses in Michigan from the initial 6 in 2020 to 11 in 2023-2024. The objective is to be able to develop a low-cost sensor package that would allow golf course superintendents to monitor winter conditions in real time and make decisions, for example on removing ice, to prevent winterkill. The golf courses with sensor packages in 2023-2024 were: Arcadia Bluffs, CC of Lansing, Egypt Valley CC, Keweenaw Mt. Lodge Golf Course, Marquette Golf Club, Meadowbrook CC, Oak Pointe CC, Prestwick Village Golf Club, Treetops, Walloon Lake CC, and Warwick Hills CC.





Photo: Sensor system monitoring winter conditions at Prestwick Village Golf Club in 2022.





Photo: Winterkill reestablishment trial on a bare soil green in spring 2023.