Quantifying Performance Benefits of the pHairway® Program

A Michigan State University Study

July, 2003

Executive Summary

March, 2004

A study performed at

The Wyndgate – 2003

by

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Typing the words “acid injection” into the basic search of the Turfgrass Information File yields 15 articles. None of these articles are based on research results, but rather are based on scientific principles of soil and water and are testimonial in nature. Certainly, many differing opinions exist on the subject and acid injection remains controversial.

During the summer and early fall of 2003, the first scientifically valid research was performed with pHairway and a Prime Turf injection system at The Wyndgate, a golf course in Rochester Hills, MI. The front nine greens, tees, fairways, and roughs received pHairway-treated irrigation water, while the back nine received untreated irrigation water and were utilized as a check.

Data collection included irrigation water nutrient analysis, soil chemical tests, nutrient tests of turfgrass tissue, and soil tests for physical properties (e.g. infiltration, bulk density, and total porosity).

Results

Soil chemical tests were obtained from the fairways and greens at the depths of 0-1” and 1-3” below the soil surface on 6-13-03 and 10-2-03 (Tables 1-8). Though many claim that acid injection into an irrigation system can change the pH of the soil, simple mathematical calculations indicate that changing the soil pH in this manner is unlikely. Results from the soil chemical tests indicate no significant differences in soil pH (which remained approximately 7.8) from the areas irrigated with pHairway-treated irrigation water compared to the areas irrigated with the non-treated water.

Clippings for plant tissue nutrient analysis were obtained from the greens, fairways, and roughs on three occasions during the year. However, it seems apparent from the results that most clippings taken from the greens and fairways were erroneous, a common problem on tightly mowed turf. When tissue nutrient “results show excessive amounts of Fe and Al, no doubt” the samples were contaminated” with soil, fertilizer, and/or pesticide residue. In general, “tissue concentrations of Fe are usually within 100 to 500 ppm” (Carrow, et al. 2001). Most of the Fe tissue concentration results from the greens and fairways were many times the anticipated range and for this reason green and fairway samples that yielded far higher concentrations of Fe, with the exception of the October 2, 2003 greens data, are not included in this report.

Fortunately, clippings collected on all three dates from the Kentucky bluegrass roughs (higher mowing height with less fertilizer and pesticide applications) were not contaminated. In Tables 10 and 11, the percentage and ppm (parts per million) of nutrients in the Kentucky bluegrass roughs from June 13, 2003 are reported.

The results of the nutrient concentrations from the Kentucky bluegrass rough samples make this research particularly interesting. Further advancement of this aspect of turfgrass science will continue via a continuing study performed under tighter control conditions during the summer of 2004.

Significant findings are summarized below.

Treated vs. Untreated

"In Tables 12 and 13, the percentage and ppm of nutrients in the Kentucky bluegrass roughs from July 24, 2003 are reported. The roughs receiving the pHairway treatment resulted in significant increases in nutrient concentrations of nitrogen, phosphorous, potassium, magnesium, sulfur, zinc, and copper. Some scientists speculate it is not necessary to change the pH of the entire soil profile to enhance nutrient uptake, but it is only necessary to change the pH in the rhizosphere for a short period of time to enhance nutrient uptake. These results add credence to that speculation."

Significant Data Summary

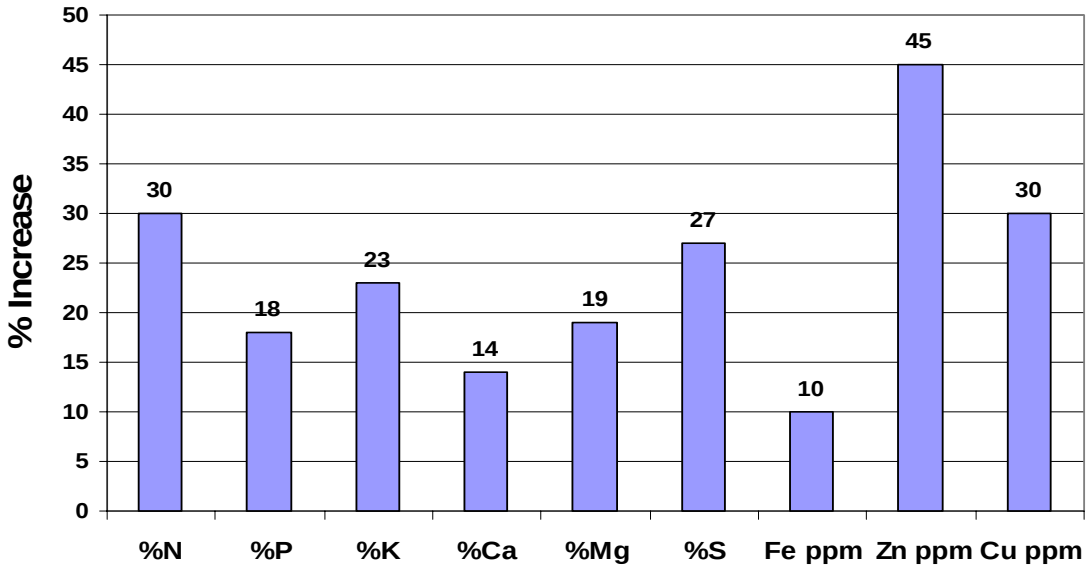
Table 12

Percentage of nutrients in the Kentucky bluegrass leaf tissue from golf course rough at the Wyndgate golf course in Rochester Hills, MI July 24, 2003.							
Treatment	**%N**	**%P**	**%K**	**%Ca**	**%Mg**	**%Na**	**%S**
Acid-Injection	**4.3**	**0.39**	**3.19**	**0.49**	**0.25**	**0.04**	**0.37**
Check Irrigation	**3.3**	**0.33**	**2.60**	**0.43**	**0.21**	**0.03**	**0.29**

Table 13

PPM of nutrients in the Kentucky bluegrass leaf tissue from golf course rough at the Wyndgate golf course in Rochester Hills, MI July 24, 2003.					
Treatment	**Fe**	**Zn**	**Mn**	**Cu**	**B**
Acid-Injection	**241**	**35**	**34**	**13**	**5**
Check Irrigation	**219**	**24**	**35**	**10**	**5**

Increases in pHairway Treated Turf - Tissues Sample Data



Double Checking Results

After treatment was terminated, additional testing was conducted to confirm the impact of treatment noted when the treatment was being used. In Tables 14 and 15, the nutrient concentrations in the Kentucky bluegrass roughs from October 2, 2003 (after treatment termination) are reported. Once treatment was stopped, there was no significant difference in nutrient concentrations in the Kentucky bluegrass tissue between those roughs that had been receiving the pHairway treatment and those that didn't. This is highly reliable indication that the treatment did in fact increase nutrient uptake during periods of use.

Table 14

Percentage of nutrient in the Kentucky bluegrass leaf tissue from golf course rough at the Wyndgate golf course in Rochester Hills, MI October 2, 2003.							
Treatment	**%N**	**%P**	**%K**	**%Ca**	**%Mg**	**%Na**	**%S**
Acid-Injection	4.96	0.378	3.22	0.461	0.217	0.022	0.343
Check Irrigation	4.73	0.387	3.02	0.430	0.205	0.030	0.321
Probability	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	

Table 15

PPM of nutrients in the Kentucky bluegrass leaf tissue from golf course rough at the Wyndgate golf course in Rochester Hills, MI October 2, 2003.						
Treatment	**Fe**	**Zn**	**Mn**	**Cu**	**B**	**Al**
Acid-Injection	496	36	45	14	5	237
Check Irrigation	463	32	48	12	5	231
Probability	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**