

Research *You Can Use*

In Search of the Silver Bullet

The influence of microbial and organic-based products on putting green performance.

BY FRANK S. ROSSI

Turfgrass research is a burgeoning scientific discipline and is investigating the most important challenges facing golf course superintendents. A growing number of scientists are interested in the basic aspects of heat stress, winter injury, lethal diseases, and soil nutrient management. Often, the science has implications that might elude the practical golf turf industry.

Science does not always take a direct path from A to B. In every scientific endeavor there is a question to be asked and answered through trial and error. The challenge for today's "want the answer now" world is patience. Not every study has a practical application, but often it is a piece of a more complex puzzle.

The fact is, we know precious little about the dynamic nature of the golf ecosystem. Much of our current thinking is derived from practical problem solving research (e.g., product evaluation studies). Getting to the underlying biological mechanism is tedious, expensive, and time consuming. As a result, long-term needs are sacrificed for solving immediate problems.

As the scientist strives to understand, the superintendent seeks to solve. Superintendents function in a "what did you do for me today?" environment created by overzealous golfers and owners. Pressure for perfection in turf under severe conditions breeds desperation. There is no time to understand the problem; superintendents need solutions and they seek a silver bullet.

Ironically, turfgrass product manufacturers claim to have the solutions. I am regularly baffled by testimonials



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from superintendents and well-meaning sales staff who try to explain how certain products solve problems.

Of course, it is entirely reasonable that some products can solve specific problems. Pesticides are developed to control specific pests, and certain fertilizers may provide a more desirable response for a specific turf and soil type. In every case, however, they provide only short-term solutions. In doing so, they can distract superintendents from long-term thinking.

Golf turf managers are regularly inundated with a variety of microbial- or organic-based products that are touted as providing enhanced performance, i.e., more roots, less disease, stress tolerance, improved quality, etc. In some cases the manufacturer provides inde-

pendent research data taken out of context to position a product as filling an important niche. However, upon closer examination of these products, it appears that small amounts of nutritional supplements included in the formulation produce a visual response that can be provided with a less expensive nutritional source. In addition, manufacturers have been reluctant to fund meaningful research that compares their products against other similar products and traditional nutrient sources.

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METHODOLOGY

Products from a variety of companies were compared to traditional liquid and granular nutrient management programs in a completely randomized experiment with three replications. Treatments were applied to a mixed stand of creeping bentgrass (Penn G-2) and annual bluegrass growing on a sand-based green (pH 7.8) constructed to California specifications and subjected to 30,000 rounds of simulated non-metal spike traffic.

Applications commenced on June 10, 2003. Liquid sprays were applied weekly on Wednesdays, and granular and drench treatments were applied on Fridays throughout the season. A CO₂ backpack sprayer fitted with TeeJet XR8015 nozzles was calibrated to deliver 2 gallons of water per 1,000 square feet.

Plot maintenance included mowing seven days a week at 0.100 inch with a grooved roller. The green was irrigated to 80% ET on an as-needed basis to avoid localized dry spots. Straight sand topdressing was applied every three weeks.

Products were sampled and analyzed by the Cornell University Analytical Laboratory according to Infant Formula protocol as published in the Official Methods of Analysis of the Association of Official Analytical Chemists (1990: 1106-1107).

Data were collected for quality, shoot density, rooting, clipping production, tissue nutrient content, and ball roll distance. In addition, disease incidence and insect activity were monitored.

RESULTS: PRODUCT ANALYSIS

Processing products for analysis with the ICP instrument is orders of magni-

tude more sensitive than would be required for standard product labeling required by law. As a result, we have found significantly more nutrients in many cases than what is reported by manufacturers. However, with this process we are not able to assess the level of available nutrients or additional chelating agents such as amino acids, humates, etc.



When using any product it is important to assess the impact of fertilizer in the product and its subsequent impact of turf visual quality. These two treatment plots show how different nitrogen and iron levels contained in the treatments altered turfgrass quality.

The product analysis results reveal the variety and levels of nutrients found in the products. The nitrogen (N) levels are mostly consistent with those reported by manufacturers; however, there are substantial differences among levels we report and current labels. That is to say, what they report on the label is not consistent with the amounts of nutrients found in our analysis.

Potassium (K), iron (Fe), and calcium (Ca) tend to be exceedingly high in many products, and this most likely relates to the reported benefits these nutrients are thought to afford for color and stress tolerance. Of particular concern are several products with very high levels of sodium. Several of these products are produced from ocean-derived materials such as seaweed and fish waste.

TURF QUALITY CORRELATION

Turf quality ratings were excellent (>7.0) for most treatments, except for the Organic Gem product. In general, turf quality ratings were correlated to nitrogen rates. Pearson correlation coefficients were as high as 90% when turf quality was analyzed against nitrogen rates.

Interestingly, there were some products that did provide a high level of turf quality that were not entirely correlated with nitrogen rates, specifically the Plant Food programs and the Advanced Microbial Solutions (AMS) product Super Bio Life in combination with the standard fertility treatment. The AMS treatment in combination with standard fertility was consistently above the standard fertility treatments alone.

The Emerald Isle program did not always provide the highest turf quality ratings, but were rarely different from the standard fertility program. This was significant in that the nutrient levels applied to the turf were a fraction of those provided for other programs.

It is likely that the high iron levels in the Plant Food products resulted in significantly higher quality ratings than other products. However, there were several programs with high iron levels, such as Griggs Brothers products, that were not rated as high as the Plant Food products.

The 2003 growing season in Ithaca, N.Y., was warm and wet. Temperatures were slightly above normal for the season, and rainfall was well above (≥ 8 inches) normal. Oddly, there were no significant pest outbreaks, and it is

worth noting that every treatment did provide turf quality acceptable to the most discriminating clients.

GROWTH RESPONSE

An ideal product would produce high turf quality (color, density, and uniformity) with minimal clipping production and adequate root growth. Growth

responses were similar to turf quality ratings in that they were well correlated with nitrogen rates.

However, there were some instances where clipping production was almost twice the amount of the standard fertility (data not shown). In contrast, there were some treatments with high levels of nitrogen that did not result in significant growth surges. This might be related to the timing of clipping collection that was performed when treatments may have been in a down cycle. The standard fertility treatment pro-

duced a relatively consistent growth rate throughout the season, while programs from Helena Chemical and Floratine fluctuated over the season.

In contrast to clipping production, rooting did not appear to be influenced by nitrogen rate. In fact, there were little significant differences except for the increased rooting in response to Trichoderma applications and low rooting levels from the Organic Gem product. Few products produced any significant rooting below 6 cm, and there were no significant differences among the products at these depths.

TISSUE NUTRIENT CONTENT

Tissue nutrient levels fluctuated significantly throughout the season, making interpretation very difficult (data not

shown). In general, tissue nitrogen and iron levels were consistent with application amounts. However, this was not always consistent with turf quality ratings.

There were several dates when potassium levels were significantly different and consistent with potassium application rates. This was true for phosphorus and manganese, but sur-



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prisingly not significant on any date for calcium. This could be related to the calcareous nature of the growing medium and demonstrates further that if a nutrient is available in adequate amounts, supplying additional nutrients does not increase tissue levels.

The most consistent and concerning response evident was the high sodium (Na) levels found in the tissue following product application. This was consistent for the ocean-derived products, notably Emerald Isle, Organic Gem, and Floratine.

BALL ROLL

An important functional performance measure is ball roll as measured by a Stimpmeter. Data presented to this point regarding turf quality and clip-

ping weights might be expected to produce an effect on ball roll. However, there were no significant differences among treatments for ball roll on the four dates in 2003.

It is possible that with the number of variables involved in ball roll, any potential differences were not discernable. The close mowing height (0.100 inch) conducted daily during the season

produced ball roll distances greater than 10.5 feet. It is significant that some treatments with large clipping weights did not result in reduced ball roll distances.

SUMMARY

It is hard to draw significant conclusions from one year's data, yet some important trends have emerged. It appears that nitrogen exerts a dominating effect on turf quality and growth. The products contain a variety of nutrients, most of which do not appear

to be absorbed in significant amounts by the plant except for N, Fe, K, and Na.

There were no meaningful differences for rooting or ball roll. It is possible that the lack of significant environmental stress does not allow for subtle differences to be detected. This was evident by the overall lack of pest pressure noted on the plots.

The study is expected to continue for two more seasons, and that might allow for more significant trends to emerge.

IMPLICATIONS

I understand the impulse to seek the silver bullet. Often, superintendents address a problem on the golf course with at least one hand tied behind their

backs. Superintendents know that golfers will not accept a disruptive long-term solution. They cannot always rebuild a green, regrass a fairway, or remove unneeded trees and underbrush.

I am often asked to speak at meetings of club managers, golf professionals, and avid golfers. I admit that I do “dummy down” my talks. Golfer expectations are pushing the limits of biology. There are no simple solutions to the challenges we face as an industry, so we must work together.

Not all my scientific colleagues share my opinion. Some scientists feel that if we simplify the information, golfers will think there are simple solutions. Others recognize that a tsunami of data frustrates golfers and complicates superintendents’ efforts to communicate with members and management. It is critical for superintendents to work with scientists in developing a concise message for golfers.

At the same time, golf course superintendents need to spend more time learning basic science. Most superintendents come through college programs that stress the technical aspects of golf turf management but not the science. We need superintendents who understand basic soil chemistry.

The challenges we face as an industry require serious people thinking broadly for solutions. The answers are not simple and require all the interested parties to work together. If one partner is more interested in selling than helping, the whole industry loses.

When Greg Norman signed on to the GCSAA’s Environmental Institute for Golf, I became hopeful that he would be a strong advocate for superintendents. Support from recognized and respected figures is critical to creating the demand for long-term solutions to managing championship turf on a daily basis.

Scientists must conduct research that seeks meaningful answers, not just short-term problem solving, and they must communicate the information concisely. Manufacturers need to recognize and discuss the limitations as well as the benefits of their products. Superintendents must look beyond immediate problems and end their search for the silver bullet.

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Table 1
The Influence of Microbial and Organic-Based Products on Putting Green Performance
Root depth after treatment with a variety of microbial and organic-based products

Trt #	Treatment	Depth (cm) on July 22				Depth (cm) on October 30			
		0-3	3-6	> 6	Total	0-3	3-6	> 6	Total
1	Standard	1.4	0.5	0.1	2.0	1.6	0.6	0.2	2.4
2	Standard plus EcoGuard	1.4	0.4	0.1	1.9	1.6	0.5	0.2	2.2
3	Standard plus Trichoderma	1.6	0.6	0.2	2.4	1.8	0.7	0.3	2.9
4	Helena Chemical	1.4	0.4	0.1	1.9	1.6	0.5	0.2	2.2
5	Plant Food I	1.3	0.4	0.1	1.8	1.5	0.5	0.2	2.1
6	Plant Food II	1.5	0.3	0.2	2.0	1.7	0.4	0.3	2.4
7	Standard plus Nutramax	1.3	0.3	0.1	1.7	1.5	0.4	0.2	2.0
8	Half-rate Standard plus Nutramax	1.2	0.2	0.0	1.4	1.4	0.2	0.0	1.6
9	Griggs I	1.2	0.3	0.1	1.6	1.4	0.4	0.2	1.9
10	Griggs II	1.4	0.4	0.0	1.8	1.6	0.5	0.0	2.1
11	Emerald Isle I	1.5	0.4	0.1	2.0	1.7	0.5	0.2	2.4
12	Emerald Isle II	1.3	0.3	0.0	1.6	1.5	0.4	0.0	1.8
13	Sustane plus BioGK	1.6	0.5	0.0	2.1	1.8	0.6	0.0	2.4
14	Standard plus SuperBioLife	1.6	0.5	0.2	2.3	1.8	0.6	0.3	2.7
15	Organic Gem	1.1	0.3	0.0	1.4	1.3	0.4	0.0	1.6
16	Standard plus Floratine	1.5	0.5	0.1	2.1	1.7	0.6	0.2	2.5
	LSD (0.05)	0.3	0.2	NS	0.6	0.3	0.2	NS	0.4