WTA Summer Field Day Has Something for Everyone

By Tom Schwab, O.J. Noer Turfgrass Research and Education Facility, University of Wisconsin-Madison

The crowd shows the value in attendance at the WTA Summer Field Day!

The WTA Summer Field Day will be here before you know it. The date is set for Tuesday, July 21, 2009. This is a wonderful day for you to visit the University and see all the turfgrass research being conducted at the OJ Noer Facility. There are over 80 studies being conducted this summer and 16 of those studies will be showcased during the morning research tour. The talks on the tour describe new research designed to help managers from sports turf, golf course management, sod production, lawn care, and general turf maintenance. Several of those talks are named here while others are still being decided on.

WTA Summer Field Day Research Tour Talks

1. Establishment timing of seed mixtures for sports turf
2. Fertilizer types and rates for velvet bentgrass greens
3. Putting green management in the shade
4. *Certainty* herbicide for maintaining a pure stand of Kentucky bluegrass
5. Best timing and rates for fall applied N on putting greens
6. When to re-apply *Primo*?
7. Subsurface drip irrigation for lawns
8. Dollar spot forecasting
9. Early-season timing for dollar spot
10. Combining dollar spot and snow mold chemical control

In the afternoon, there will be more education available during the lawn care workshop. This workshop was introduced during the 2008 field day to resounding acclaim and will be continued for 2009. This session will show techniques for identifying turfgrass species, weeds, diseases, and insects as well as explain fertilizer and pesticide calibration. Though the program is still being finalized, new interactive talks and demonstrations will likely be added that deal with Emerald Ash Borer, water conservation and management, and pesticide safety. The workshop is not included in the field day registration price and requires an additional fee. Attendees from last year commented that it was well worth the additional cost. Space is limited, and attendees will be accepted on a first come, first serve basis to provide for a unique interactive experience.

More education will be available during the afternoon trade show. Learn about all the latest supplies, services, and equipment available to the turf industry from helpful vendors willing to answer questions about all their latest products. Several equipment vendors allow test drives of their products so you can compare between brands.

Look for the Field Day registration to arrive in your mailbox in early June. Summer Field Day is a great way to learn the latest research coming from the UW-Madison, compare the newest commercial offerings from the trade show, visit with colleagues over a great lunch, and to possibly participate in the new lawn care workshop. You will surely leave field day with new ideas to put into practice back home. Call Audra Anderson at 608-845-6536 if you have any questions or have suggestions of subjects you'd like to see addressed during field day. The field day brochure can also be found online at www.wisconsinturfgrassassociation.org.

Effluent Water: A Potential Irrigation Source in Wisconsin?

By Brad DeBels, *Recipient of Terry and Kathleen Kurth Wisconsin Distinguished Graduate Fellowship, Department of Soil Science, University of Wisconsin-Madison*

The importance of preserving potable water for the future has never been more evident than the present. Growing populations are extracting large amounts of surface and groundwater for municipal and domestic use. High water demand during times of drought often leave municipal water supplies depleted resulting in water use restrictions to conserve water. Irrigation accounts for approximately 80% of total water use in the United States. For turfgrass managers irrigation restrictions directly affect their livelihood. New technology and alternative water supplies must be considered in making irrigation more environmentally friendly.

Irrigation technology has improved application efficiency while research and education has provided turf managers with improved ways to determine irrigation needs and scheduling through monitoring soil moisture and evapotranspiration. Throughout the United States golf courses are also turning to effluent water as an irrigation source. Effluent water is water that has undergone one cycle of use and treated to Congress and EPA standards. More than 37% of golf courses in the Southwest and 24% in the Southeast use effluent water. The Midwest region hasn't yet utilized this resource to the degree of other regions, as only 3% of golf courses irrigate with effluent water (Throssell, 2009). Many possible explanations exist for this phenomenon.

The available water supply in the Midwest region has currently kept water costs relatively low, from less than \$1.75/1000 gallons to free-of-charge. Often effluent water may also be free, but utilizing it doesn't come without an initial and hidden costs. In areas that haven't been retrofitted with modern infrastructure to transport and store effluent water, initially high expenses will be incurred to install these systems. Turfgrass managers will have to adjust management practices to account for a less pure water supply, which will alter soil and plant properties. Research is being conducted to determine the possible impacts effluent water will have on soil and turf properties, but has primarily taken place in regions with limited rainfall. Wisconsin receives nearly 30 in/yr, which may play a significant role in minimizing negative impacts.

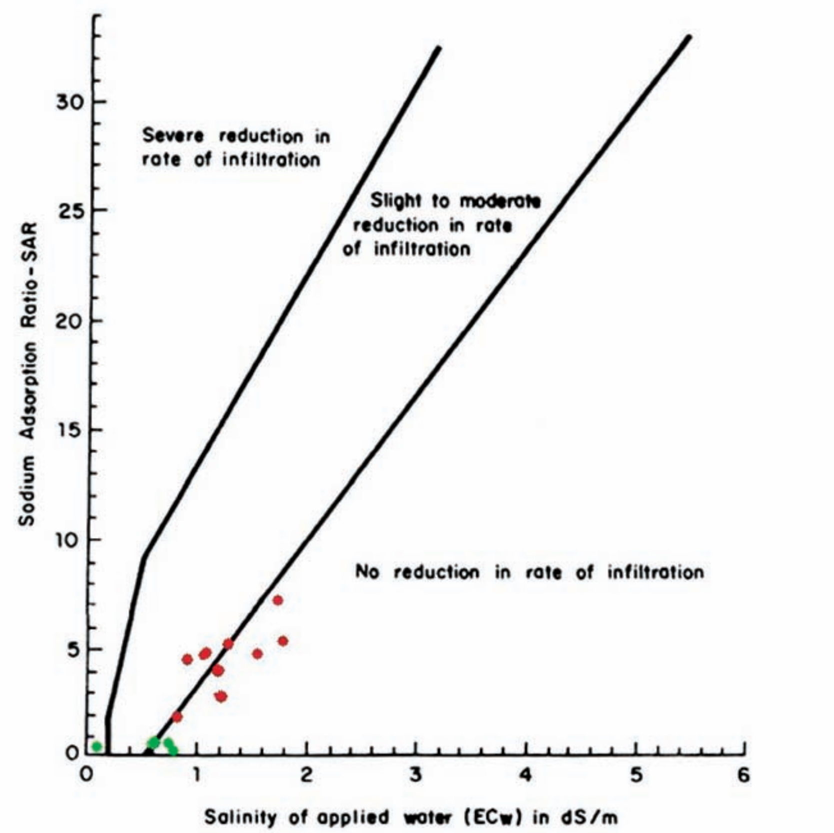

Figure 1. Predicted effect of EC_w and SAR on soil infiltration from Wisconsin water samples (each dot represents one water sample) (red=effluent water) (green=well water samples). Figure adapted from Ayers and Westcot (1985).

Each wastewater treatment plant's (WWTP) effluent water can vary significantly depending on degree of treatment and amount of industrial land use. In February 2009 a survey of nine WWTPs throughout the state was conducted to evaluate the average quality of effluent water and its potential use as irrigation water for turfgrass in Wisconsin. The treatment facilities chosen represent a range of city sizes and locations throughout the state. The survey

Table 1. Wastewater Treatment Plant Effluent Water EC and SAR (red dots in Figure 1)

Location	E.C. (ds/m)	SAR	Infiltration Hazard based on SAR and EC
WWTP #1	1.83	7.15	**
WWTP #2	0.91	2.17	*
WWTP #3	1.28	5.37	*
WWTP #4	1.79	5.38	*
WWTP #5	1.21	2.78	*
WWTP #6	1.16	4.83	*
WWTP #7	1.24	3.88	*
WWTP #8	0.91	4.36	**
WWTP #9	1.63	4.42	*
Average	**1.33**	**4.48**	*

* No Restriction on Use, ** Slight to Moderate Restriction on Use, *** Severe Restriction on Use based on infiltration hazard according to Ayers and Westcot (1985).

primarily focused on possible negative impacts of salinity and infiltration hazard as well as the benefits of nutrients contained in the effluent water. Salinity is the accumulation of salts in the soil measured by electrical conductivity (EC - dS/m). Salts accumulate in the soil and potentially cause plant water deficits slowing plant growth. Infiltration hazard refers to the rate at which water can infiltrate the soil; the hazard is estimated based on E.C. and the Sodium Adsorption Ratio (SAR). Elevated SAR and low E.C. can result in soil dispersion and aggregate swelling which reduces soil water infiltration and hydraulic conductivity.

Table 2. Well Water from Golf Courses EC and SAR (green dots in Figure 1)

Location	E.C. (ds m^{-1})	Sodium Adsorption Ratio (SAR)	Infiltration Hazard based on SAR and EC
Madison	0.54	0.08	**
Janesville	0.77	0.18	*
La Crosse	0.72	0.44	*
Eau Claire	0.11	0.24	***
Average	**0.54**	**0.24**	**

* No Restriction on Use, ** Slight to Moderate Restriction on Use, *** Severe Restriction on Use based on infiltration hazard according to Ayers and Westcott (1985).

Table 3. Primary nutrient content in Wisconsin effluent water.

Location	N (ppm)	P (ppm)	K (ppm)
WWTP #1	12.51	0	15.03
WWTP #2	34.01	12.79	11.08
WWTP #3	24.06	1.45	15.35
WWTP #4	12.92	0.37	14.98
WWTP #5	0.3	0.01	11.65
WWTP #6	0.98	17.69	12.05
WWTP #7	9.76	0	9.52
WWTP #8	16.18	4.84	13.16
WWTP #9	18.0	0.44	9.62
Average	**14.3**	**4.2**	**12.5**

The effluent water surveyed in Wisconsin had ECw values between 0.91 and 1.83 dS/m while SAR values range between 2.17 to 7.15 (Table 1). These values are clearly greater than potable water supplies typical of golf courses across Wisconsin (Table 2). Irrigation water E.C. below 0.7 ds/m has no restrictions and E.C. values above 3.0 ds/m can have severe restrictions on use and have negative impacts on turfgrass growth. Effluent water E.C. is several times higher than that of potable water supplies found in Wisconsin, but most are not near the threshold level of 3.0 ds/m.

Managing SAR levels is relatively straightforward and is accomplished by the application of calcium (Ca^{2+}) to soil or by adding Ca^{2+} to the irrigation source. Managing salinity in arid regions requires applying irrigation in excess of crop demand which leads to leaching of salts out of the root zone. However, the consistent rainfall in the Midwest likely provides enough precipitation for adequate leaching. Because most research is predominantly performed in the southern U.S., this hypothesis has yet to be thoroughly tested. If true, adapting to effluent water use would be easier in the Midwest by decreasing the need for actively managing salt accumulation.

One potential economic and agronomic advantage of using effluent is the considerable amount of primary nutrients (N-P-K) contained in most effluent water offer economic and agronomic advantages. The presence of nutrients in irrigation water can reduce the cost of additional fertilizer inputs and facilitate turf growth. The surveyed Wisconsin WWTP effluent water samples contained an average of 14.3, 4.2 and 12.5 ppm N, P and K respectively (Table 3), although variability among WWTPs was great. The average N content accounts for nearly 1 lb N/1000 ft2 per acre foot of applied water. In some cases this may account for a substantial portion of the entire N fertilizer budget. As fertilizers costs and labor needed to apply fertilizers rise, the nutrient content and ease of application in effluent water will become even more valuable.

To utilize effluent water, contracts will often be necessary between supplier (WWTP) and user to ensure that treatment facilities don't become inundated with water supplies in times of low demand. This may force users to irrigate beyond plant requirements or require increased water storage capacities. Winter months in much of the Midwest don't require turfgrass irrigation and can pose a serious use and/or storage issue. Each regions situation possesses its own unique issues and appropriate agreements between suppliers and users will be necessary. This may prove to be the biggest obstacle to widespread adoption of effluent water for golf course irrigation. However because water is continually used and disposed, effluent water is virtually the only source of water that has a guaranteed supply. As demand increases, potable water becomes more costly, infrastructure is built and research is conducted, the use of recycled wastewater will become a core resource for irrigation even in the Midwest. Effluent water shouldn't be considered a waste, but a valuable asset in conserving potable water supplies and sustaining healthy turf growth for the future.

References:

Ayers, R.S. and D.W. Westcot. 1985. Water quality for agriculture. FAO irrigation and drainage paper No. 29. Food and Agriculture Organization of the United Nation, Rome.

Throssell, C. S., Lyman, G. T., Johnson, M. E., Stacey, G. A. and Brown, C. D. 2009. Golf course environmental profile measures water use, source, cost, quality, and management and conservation strategies. Online. Applied Turfgrass Science doi: 10.1094/ATS-2009-0129-01-RS.

BIOSTIMULANTS - YES OR NO?

By Wayne R. Kussow, *Emeritus Professor of Soil Science, University of Wisconsin-Madison*

INTRODUCTION

Biostimulant - what a glorious name. In the broadest sense, it's anything that promotes the growth, development or general health of a living organism, be it plant or animal. This is much too broad a definition for us to work with here. We're only concerned with turfgrass and "non-traditional" substances and materials. This excludes the traditionally applied products such as fertilizers, pesticides, water, and even plant growth regulators. Traditional products have a long history of use and their value has been proven through many years of research.

This more restricted definition of biostimulants implies a couple of things. The first is that they are not "stand alone" products. They are "add-ons" to the traditional irrigation, fertilization, growth regulation and pest control practices adhered to in turfgrass management. This is why biostimulants are generally touted as products that overcome stresses in turfgrass from which conventional products or cultural practices do not provide relief. This is an interesting claim in light of the fact that turfgrass researchers have yet to develop a simple and convenient method for measuring stress in turfgrass. When I once pointed this out in a telephone conversation, the call was abruptly ended with the statement, "Young man, all turfgrass is under stress".

The classification of biostimulants as "non-traditional" products also implies limited scientific evidence of their efficacy, particularly under field conditions. Behind virtually every biostimulant is some research supporting the claim one or more of the constituents in the product can influence plant growth. The problem is the conditions under which much of this research was conducted. A good case in point is humic acids. Add them to plants growing in nutrient solutions or pure quartz sand totally devoid of humic acid chances pretty good that and you will see some type of response. But grow the plants in soil and there is no response to additions of humic acids. Why? All soils inherently contain humic acids. They result from microbial decomposition of organic matter.

No one has been able to identify a humic acid "deficient" soil. In fact, there is no standard method for measuring the humic acid content of soil. Lack of humic acid deficiency in even sand-based putting greens is evidenced by research such as that recently conducted by Utah State University researchers. They applied four humic acid products and one fulvic acid product to putting greens on four golf courses. The purpose was to test claims that the products reduce turfgrass water requirements and the need for fertilizer P. The data gathered refuted both claims.

RESEARCH

Through the years I've field tested many different biostimulants, the majority of which contained humic acid along with numerous other materials such as fulvic acid, plant extracts, amino acids, proteins, seaweed extracts and small quantities of secondary and micronutrients. Sometimes their composition is a closely guarded secret. A former colleague once asked about the active ingredients in a biostimulant he was being asked to test. The response was, "Only God knows and he's not talking".

I examined biostumulant influences on bentgrass establishment, putting green quality, thatch development and even the claim that application of humic acid containing fertilizers improves soil health that translates into healthier turfgrass. The results of my research are summarized in tables 1, 2, 3, and 4. You can wade through the description of each trial if you wish or just go to the bottom entry labeled "Net responses". I arrived at them by first totaling the numbers of positive *and* negative responses in each trial and calculating them as a percentage of all measurements taken. I then subtracted negative from positive percent responses to get the net responses expressed as percent of all measurements in the trial.

Logic says that the chances of seeing positive responses to humic acid applications are highest when putting green humic acid contents are at their lowest levels. This is during bentgrass establishment on newly constructed putting greens. In the trials I conducted the putting green organic matter levels were around 0.2 % and concentrations of soluble humic acid were in the range of 40 to 50 *micrograms* per kilogram of soil. As shown in table 1, the net responses of bentgrass during establishment to biweekly applications of humic acids or 67 kg/ha of humate were either 0 or a miniscule 0.1 percent positive response rate. This was not surprising. At the recommended application rates of 0.09 to 0.23 lb humic acid/M there were no significant changes in soil humic acid concentrations.

Over 5 seasons of bi-weekly applications of numerous biostimulants to sand and pushup putting greens the net responses were insignificant -0.2 and -0.3 percents, respectively (Table 2). In the third trial conducted on an established putting green there was an 18 % net positive response rate. This has to be clarified. These positive responses were temporary increases in soil enzyme levels seen within a week of application of soluble carbohydrates, plant extracts or amino acids. None of these temporary elevations in soil enzyme levels had any detectable influence on putting green quality or clipping production and nutrient content.

The results of three investigations of biostimulant effects on thatch control in a putting green, a bentgrass fairway and a lawn speak for themselves (Table 3). There were no significant responses, positive or negative, among

Table 1. Biostimulant influences on bentgrass establishment.

Experiment variables/outcomes	SR 1020 from seed	A-2/G-6 washed sod
Biostimulants tested	3 humic acids seaweed extract	6 humic acids 1 humate
Measurements	Stand density root weights	Stand density and quality chloropyll index roots and tillers soil humic acid
Experiment duration	63 days	134 days
Number of measurements	42	234
Number of positive responses	0	3
Number of negative responses	0	0
Percent positive responses	0	0.1
Percent negative responses	0	0
Net responses - percent	0	0.1

Table 2. Biostimulant influences on putting green quality.

	Type of putting green		
Experiment variables/outcomes	Sand	Pushup	Sand
Biostimulants tested	7 alone and in combination. Humic acids, carbohydrates, amino acids, proteins, micronutrients.		5 with different compositions - humic acids, sugars, bacteria, plant extracts
Measurements	Turfgrass color, quality, chlorophyll index, clipping weight and nutrient contents roots and tillers disease severity		Turfgrass color, quality, clipping weight and nutrient content, 4 soil enzymes, soil bacteria diversity
Experiment duration	5 seasons		2 seasons
Number of measurements	540 to 2214/season		808
Number of positive responses	0 to 9/yr	0 to 18/yr	143
Number of negative responses	4 to 25/yr	1 to 9/yr	0
Percent positive responses	5.1	0.8	18
Percent negative responses	5.3	1.1	0
Net responses - percent	-0.2	-0.3	18

Table 3. Biostimulant influences on thatch in turfgrass.

Experiment variables/outcomes	Putting green	Bent fairway	Lawn
Biostimulants tested	4 humic acids + bacteria	3 humic acids, 3 rates	3 humic acids + bacteria, sugars
Measurements	Turfgrass color, thatch, infiltration rates	Turfgrass color, quality. Thatch thickness	Turfgrass color, thatch thickness, infiltration rates
Experiment duration	163 days	188 days	163 days
Number of measurements	576	624	420
Number of positive responses	0	0	0
Number of negative responses	0	0	0
Percent positive responses	0	0	0
Percent negative responses	0	0	0
Net responses - percent	0	0	0

* For contrasts between the synthetic and organic fertilizers.

1,620 measurements in these trials. I attribute this to the fact most biostimulants for thatch control have been formulated on the premise that thatch accumulates when turfgrass production of plant tissues exceeds the capacity of microorganisms to decompose the material. This naturally leads to the assumption that adding food for the decomposers or more microorganisms will lead to more rapidly breakdown of the thatch. My research and that of many others offers proof that this is not a valid assumption. It is well established that lignin, which is difficult for microorganisms to decompose, accumulates in thatch. This fact prompted my telephone call to a chemist at the U.S. Forest Products Lab in Madison who was researching microbial breakdown of wood lignin. He'd found that fungi are the primary decomposers of lignin, but that they do so only when starved for nitrogen. Perhaps one of you can find a way to starve fungi in thatch for nitrogen *and* grow acceptable quality turfgrass.

The proponents of cation balancing in soil, hard core natural organic people and some manufacturers of biostimulants follow the mantra, "Feed the soil, not the plant. Healthy soils produce healthy plants". I spent three years investigating the relationship between soil and turfgrass health. In designing the study I quickly learned that soil scientists do not agree on the best way to measure soil health. It results from interacting soil physical, chemical and microbiolgical properties. Turfgrass health is likewise an elusive thing to measure. The soil and turfgrass properties I chose to measure are listed in table 4. Eleven fertilizers comprised of various types and amounts of organic materials, some amended with things like microorganisms, molasses and humate or humic acids were applied. Their influences on the measures of soil and turfgrass health were compared to those resulting from application of a 100% synthetic fertilizer.

What did I find? Over the three years there were significant fertilizer effects on fairway quality ratings. These changes in fairway quality did not appear to have been influenced by changes in soil physical or chemical properties. Rather, fairway quality was highly dependent on clipping production and this in turn on clipping N content. There was no evidence that clipping N content was influenced by changes in soil organic matter levels or microbial activity. In other words, soil organic matter decomposition did not appear to contribute a significant amount of nitrogen to the bentgrass, leaving fertilizer as the dominant source of N. Application of the synthetic fertilizer consistently resulted in higher clipping N contents, clipping yields and fairway quality ratings than did the organic or organic-based fertilizers. Therefore, when

Table 4. Biostimulant influences on soil and turfgrass health.

Experiment variables/outcomes	Bentgrass fairway
Biostimulants tested	5 natural organic fertilizers 6 organic-based fertiliers with added bacteria, yucca extracts, molasses, micro-nutrients
Measurements	Turfgrass color, quality, clipping weights and nutrient content, root mass, thatch thickness, disease ratings. 7 soil chemical, physical and biological properties
Experiment duration	3 seasons
Number of measurements	8,400
Number of positive responses	488*
Number of negative responses	1968*
Percent positive responses	5.8
Percent negative responses	23.4
Net responses - percent	-17.6

* For contrasts between the synthetic and organic fertilizers.

the contrasts were made between responses to the synthetic and the totally organic or organic-based fertilizers the overall net response to the latter group of fertilizers was a -17.6 % (Table 4).

OPINIONS

In closing, I want to express my view on claims that biostimulants overcome anti-oxidant, hormone or nutritional imbalances or deficiencies resulting when turfgrass is subjected to stress. I can't think of an instance where stress does not result in a reduction in turfgrass shoot growth rates. Reductions in shoot growth rates are accompanied by reductions in turfgrass nutrient demand and, quite likely, in anti-oxidant and hormone production that is in accord with actual plant requirements. This being the case, there is no validity to claims that stresses create the need for applications of biostimulants containing various organic compounds and small amounts of nutrients.

There may come a day when researchers develop turfgrass stress indices based on factors such as air temperature, water deficits, and soil oxygen levels and can associate these with specific physiological deficits that can be overcome through applications of biostimulants. Until that day arrives, I see no justification for spending something like $50 per gallon for a biostimulant when the chances of seeing a positive response are those observed in my research.

I expect that this article may trigger some telephone calls or emails from superintendents telling me that they applied one or more biostimulants and got excellent results. If you do, be prepared to tell me what the weather was prior to and after application and that you know the complete analysis of the product you applied. Sudden drops in air temperatures and timely rainfalls can work miracles when turfgrass is under stress. The laws regarding labels for biostimulants are very lax. I've documented cases where the labels legitimately did not disclose that the products were spiked with a small amount of water soluble nitrogen. Of course these biostimulants gave quick, short term greening responses.