Late Season Nitrogen Fertility on Putting Greens

The Wisconsin Survey

By Dan Lloyd, *Graduate Student, Department of Soil Science, University of Wisconsin - Madison*

Many of you may remember filling out a survey regarding your fall N fertility practices for your putting greens. The survey was distributed both at the symposium last November and also online via Noernet. With fall around the corner, it seems like an appropriate time to relay the trends compiled from the 42 responses from Wisconsin superintendents. For those *Grass Roots* historians among us, you may recall the inspiration for this survey. Robert J. Erdahl conducted a similar survey and published the results in the May/June 1989 edition of *The Grass Roots*, providing an interesting glimpse of the management practices of that time. While Mr. Erdahl's survey covered nearly every aspect of putting green management, this 18-year follow-up focuses on putting green N fertility with emphasis on late season and dormant applications.

Table 1 shows the annual averages and ranges of N fertilizer applied to putting greens in 1989 and 2007. There appears to be a small increase (0.6 lbs N/M) in the total amount of N being applied from 1989 to the present, although both averages are inline with what one would find in the textbook or UW-Extension recommendation (2.5-3 lbs/M). Perhaps more intriguing is the wide range of N application rates exhibited in both surveys. Applications ranged from 1 to 7 lbs/M in 1989 and 1.5 to 6 lbs/M in 2007.

Figure 1 shows the average monthly application rates between September and November. Once again, averages are similar to current recommendations for fall-applied N, but the ranges are drastic. Some superintendents are applying little or no N fertilizer after September 1st and others apply over three lbs N/M. The anticipated date of final fertilizer application ranged from Labor Day into the New Year.

Fall fertilization can be sorted into two categories. The first is what we will call late-season fertilization, which Dr. Wayne Kussow defined in a *Grass Roots* soils report (Sept/Oct, 1987) as the time of the year when mean air temperatures linger around 50° F or less; during this time shoot growth tapers off but roots are still active (generally around mid-October in lower Wisconsin). The second category of fall fertilization is categorized as dormant fertilization. In a different *Grass Roots* article (Nov/Dec, 1994), Dr. Kussow differentiates these two categories of fall fertilization based on when the plant will absorb the applied N. Dr. Kussow distinguished fertilization as dormant if plant uptake has ceased and the fertilizer will not be taken

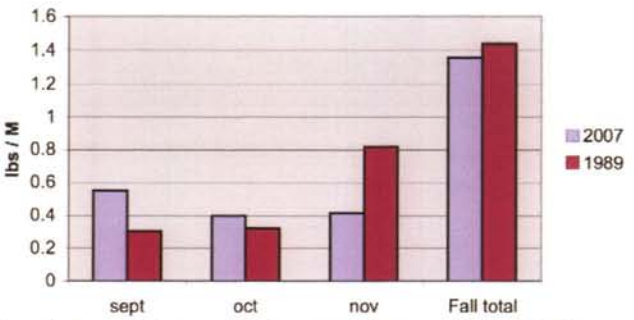

Figure 1. Average N rates and timings compared between 1989 and 2007 surveys. 1989 late season N totals averaged 60% of annual N applied, 2007 late season N applied accounted for 44% of annual N applied.

Table 1. Annual N rates applied to putting greens in 1989 and 2007. Results based on 25 responses in 1989 and 41 responses in 2007.

Annual N (lbs/M)	1989(%)	2007 (%)
1.0 - 2.0	36%	17%
2.5 - 3.0	40%	49%
3.5 - 4.0	8%	14%
4.5 - 5.0	4%	15%
> 5.5	*12%	4%
Average annual N	2.49	3.1

* Data points in 1989 with asterisk indicate < 2yr old putting greens

up until the following spring. For the purposes of this article however, I will classify any fertilizer applications after November 1 as dormant. Figure 2 indicates that 20% fewer superintendents are making dormant fertilizer applications today compared to 1989.

The fertilizer products used for the late-season treatments are listed in Table 2. There was considerable diversity among fertilizers, although most products are variations of an ammoniacal or urea-based product having an analysis of approximately 18-3-18. Andersons Contec DG was the most frequently used product in the fall of 2007. The dormant fertilizer used most often was overwhelmingly Milorganite, which was usually applied at the rate of 1 lb N/M in mid-November. Only 10% of 2007 respondents indicated that a predominantly quick release fertilizer was used for a dormant application. Figure 2 displays the percentage of superintendents using biosolids vs. other fertilizers for their dormant applications in 1989 and 2007.

The survey also asked about the dominant factors that influence fall fertilization timing. Responses included "weather, aerification, growth, snow cover, irrigation blow out, budget, and seat of my pants". When asked about rationale behind late-season fertility, superintendents cited carbohydrate storage, root growth, recovery from aerification, and recovery from summer stress as primary motivation for their chosen application timings and rates. Specifically in response to dormant fertilization, the main reasons for applications included protecting crowns from ice formation and kick starting growth and green up in the spring.

When I developed this survey, I thought it would be interesting to see how late season nitrogen management has changed over the past 18 years. As it turns out, not much has changed. The largest change is in dormant fertility practices, as a smaller percentage of superintendents are applying N after November 1st, which can be assumed to be from a similar sized reduction in biosolid applications. The other finding in this survey that was also apparent in 1989 is the wide range of annual N rates. These results highlight the variability of N requirements among golf courses. Superintendents are dealing with countless variables such as age of the greens, shade, precipitation, root zone type, species composition, and many other factors that make each microclimate of a golf course unique, not to mention budget, player demands, and rounds per year. The wide range of these surveys brings me to re-evaluate the validity of the one-size fits all N recommendations that have been the standard for so long.

As an example of how current recommendations can improve, let's look at corn. Current corn fertility recommendations are outlined in detail in a 70 page UW extension nutrient application guidelines publication (A2809) that takes into account details such as soil texture, organic matter, site history, N source, and pH. Site-specific details are important for maximizing efficiency both economically and environmentally. Obviously corn production is a different situation from turf management, because the goal in

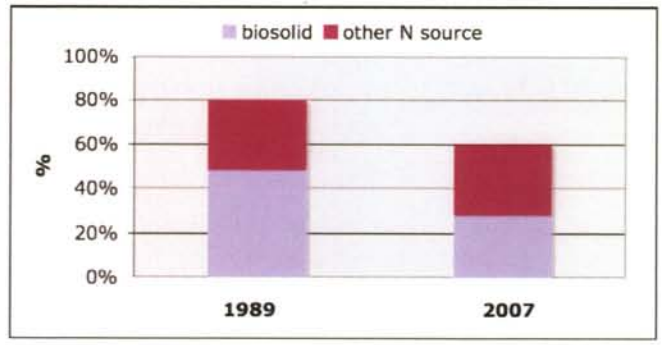

Figure 2. Percentage of surveyed superintendents that made a dormant fertilizer application in 2007 compared to 1989. Dormant application sources are shown separated into biosolid and non-biosolid categories.

Table 2. Fertilizer types applied on putting greens by surveyed Wisconsin superintendents during the fall. Products listed are reproduced directly from survey answers.

Products applied in September and October	Number of Respondents	Products applied in November	Number of Respondents
IBDU (21-3-16)	4	Milorganite (6-2-0)	5
Ammonium sulfate	1	Lesco w/ biosolids (18-2-18)	1
Andersons Contec DG	10	Nature Safe (10-2-8)	1
Signature (19-0-19)	1	Isotek 19-3-19 w/ IBDU	1
Urea	3	Prosource (21-0-21)	1
Methylene urea	2	Andersons 20-0-20	2
Prosource (21-0-21)	1	Urea	2
Sulfur-coated urea	3	Ammonium sulfate	1
LESCO 18-0-18 ELITE	4	IBDU 10-18-22	1
Spring Valley (21-3-12)	5	Spring Valley	1
Potassium Nitrate	1		
Plant Marvel (28-8-18)	1		
Growth fluid fert (15-2-15)	1		
UMAXX	2		
Plant Food (12-3-12)	1		
Country Club NX (21-3-21)	1		
Reinders Pro (EcGrow)	1		
Nature Safe	1		

corn production is to realize maximum profits by identifying the optimal ratio between N fertility rate and yield based on prices of grain, fertilizer and fuel. However, turf managers also seek the optimal balance between turf quality and management costs. Fertilizer prices have skyrocketed recently in response to soaring fuel costs and an increase in demand driven by ethanol production. USDA agricultural statistics show that fertilizer prices have tripled in the last five years, including a 135% increase in the last six months (Dec. 2007 - May 2008). In addition to the significant economic incentive for maximizing fertilizer efficiency, DNR's recently enacted NR151 highlights another trend in the form of fertility management accountability. In response to these economic and environmental motivations, fertility recommendations will continue to evolve.

While we in the turf industry do not have nearly as much research to draw upon when as corn producers, research is currently under way in the UW-Madison Soil Science department evaluating N uptake in cool temperatures for different grasses grown in sand and silt loam root zones. One anticipated outcome of this research is more specific late-season N recommendations for maximizing the efficiency of N use.

Golf course superintendents remain a highly-educated group and have always been receptive to changes. In the 1989 *Grass Roots* edition containing Mr. Erdahl's survey two other articles caught my eye. The first was an article written by Rob Shultz which advocated equal golfing rights for women, the second was a piece written by Dennis Thorp encouraging superintendents to learn to use tools like computers and a new concept called "an electronic bulletin board" which we now know as the Internet. This article titled "Electric Dreams" went on to say that if a company could figure out a way to run irrigation from a computer they would make a lot of money. Today, many take computerized irrigation, the Internet, email, and on-demand weather information for granted and consider them an invaluable tools of the trade. Women are now enjoying equal stature as men on golf courses (excluding Augusta) and in some clubs even outnumber the men in the membership. Fall N fertility programs on the other hand haven't considerably changed over the last two decades. New environmental regulations have been passed while prices and golfer expectations have increased dramatically. And though that phrase is beginning to sound worn out to my ears, it is clear that these trends will continue, and it is increasingly important to make effective decisions to enhance our agronomic impact while minimizing costs and protecting environmental quality. As we always have, our dynamic industry will continue to adapt and evolve, while current and future research will attempt to assist these efforts.