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UPDATE

Homeowner Fertilizer Practices And Turf Quality Management

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Homeowners, like golf course superintendents, use many management techniques to improve turf quality including fertilizing, mowing, core aerification, vertical mowing, irrigation, pesticides and top dressing applications. Turf quality is important to homeowners. Creason and Runge, in their survey "Use of Lawn Chemicals in the Twin Cities," stated that 93% of Twin Cities homeowners believe that having a nice lawn is either very important or somewhat important,[1] The survey also found that 90% of their neighbors believe that having a nice looking lawn is either important or somewhat important. Many studies have attempted to gain an understanding of turf management by surveying homeowners by telephone or mail. Many of these surveys will often make claims and accusations that homeowners are over applying lawn chemicals and are therefore contributing to surface and ground water pollution. However, these surveys have not taken into account the complex nature of applying nutrients to control turf quality. In order for turf maintenance to be properly assessed, specific factors, like soil nutrient levels, that cannot be assessed by phone or questionnaire must be considered.

One of the largest impacts a homeowner or superintendent can make to turf quality is through fertilizer applications. Homeowners and turf managers must consider not only the amount of fertilizer to purchase, but also the fertilizer carrier and the application rate and time. Homeowners often overlook fertilizer recommendations made by turfgrass specialists and soil testing which is usually inherent in the training of most golf course managers. Soil testing has also become an important tool for turf growers, especially with regards to phosphorous, since recent research has indicated that applying phosphorous to turf and soils high in phosphorous results in run-off, contributing to the eutrophication of area surface waters and decreasing water quality.[2]

In addition to making conclusions about environmental impact, interesting comparisons could be made between the home turf and golf course turf manager. Homeowners do not have specialized equipment, nutrients and chemicals at their disposal or the pressure to produce high quality turf that is under great stress and wear. The types, intensity and frequency of homeowner turf maintenance practices have not been directly observed, like those of golf courses. To evaluate the impacts on maintaining a quality lawn in an efficient and environmentally safe manner, objective analysis of turf needs, soil fertility and homeowner practices needs to be completed. This evaluation could lead to more valid comparisons between golf course and homeowner turf management.

Table 1. Fertilizer Application Times

# of Homeowners	Time	# of Applications
7	April-June	1
	July-August	1
	Sept.-October	1
1	April-June	1
	July-August	2
8	April-June	1
	July-August	1
2	April-June	2
2	April-June	1
	Sept.-October	1
1	April-June	1

In the summer of 1993, the University of Minnesota Soil Science Department, partially sponsored by a grant from the Minnesota Center for Urban and Regional Affairs, studied 21 Minneapolis-St. Paul suburban lawns containing Kentucky Bluegrass, Creeping Red Fescue and Perennial Ryegrass. Lawn soils had a loamy sand texture, containing 78% sand, 13% silt and 9% clay. Soil physical properties, and soil nitrate, phosphorous and potassium levels were obtained. The fertilizer bags were collected after homeowner application; fertilizer spreaders were calibrated and application dates were recorded. Grass samples were collected 10 days after the fertilizer spreaders were calibrated, and application dates were recorded. Grass samples were collected 10 days after the fertilizer application to determine the plant's response to fertilization. Turf quality was measured on a scale from zero to five. A lawn with a quality of zero was considered bare soil. A lawn with a rating of five was a dark green, weed-free turf with uniform texture and high density. Ratings were obtained on July 7, August 18 and October 1, 1993. Statistical correlation was used to determine the level and appropriateness of homeowner fertilization which allowed insight into the parameters that control turf quality.

Homeowner Fertilzer Practices

The nitrogen carrier used by homeowners was predominantly urea. Other carriers included nitrates, ammonia and slow release sulfur coated urea. Homeowners applied an annual average of 2.04 pounds of nitrogren per 1000 ft^2. (Figure 1). Homeowners followed the recommended number of bags and fertilizer spreader settings; however,

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frequently, through the purchase of low nitrogen fertilizer grades, the nitrogen amount applied was too low to meet recommendations. Related to nitrogen fertilzation, 15 of the 21 homeowners left their clippings. These lawns had higher nitrate levels than those who collected their clippings (See Figure 2). Although most homeowners did receive nitrogen from these clippings, it must be stressed that the underapplication of nitrogen on home lawns may result in lower turf qualty and the potential for decrease in turf health.[3]

It is recommended that fall and late fall fertilizations take place.[4] Homeowners applied fertilizer during the periods April-June, July-August or September-October. The most common time that homeowners applied fertilizer was the April-June period. Homeowners did not make two fertilizer applications in the fall. Of the 21 homeowners, nine applied nitrogen in the September-October period. Table 1 shows fertilizer application times.

Homeowner phosphorous and potassium rates were compared to the recommended rates determined by soil testing (Figure 1). The University of Minnesota Soil Testing Laboratory determined that phosphorous levels on *all* turfgrass sites in this study were very high. It was recommended by the soil test and the lab that *no* phosphorous be applied. This study also tested the native soils of these sites. These native unaltered soils were also high in phosphorous. It can be inferred that many of the soils in the Twin Cities region may be high in phosphorous and do not require additional phosphorous fertilizer for turf grass growth.

Soil test recommendation for phosphorous was 0.0 pounds per 1000ft^2; homeowners applied 0.59 pounds of phosphorous per 1000ft^2. The phosphorous that homeowners are applying, in the carrier form of phosphoric acid, is not being utilized in the plant. Plant tissue levels showed little response tot he phosphorous fertilizer applied, implying that the turf is receiving phosphorous from the soil. This additional phosphorous, since it is not being utilized by the plant, may be susceptible to run-off, contributing to the eutrophication of area water. Although most sites showed an increase in growth and dark green color after nitrogen applications, there were no changes in turf quality on sites that applied less or more than average phosphorous.

Potassium, a nutrient important for turf health that helps the plant during times of stress, drought or increased precipitation should have been applied at higher rates during this season. This is especially true of the 1993 summer, when the Twin Cities received precipitation higher than the 30-year average, and much of the Midwest experienced flooding. Soil tests recommended that potassium be applied at a rate of 1.0 pounds per 1000ft^2; however, homeowners applied only 0.87 pounds potassium per 1000ft^2. Considering the unusual wet summer and the soil test, homeowners underapplied potassium, which may have impacts on future turf quality, health and growth.

A project concurrent to this study was completed by Research Exploration for Teachers participant Leanne Merila. She surveyed homeowners purchasing fertilizers in area stores, lumber yards and nurseries. It was determined that nitrogen grades for spring fertilizers were 25% in the spring and 18% in the fall. Phosphorous amounts increased from 44.1% in the fall to 9.2% in the spring, and potassium increased from 6.1% to 8.4%. Fertilzers were purchased based on product sale price, friend recommendation and favorable product history. Homeowners did not use soil testing or other recommendations as tools to select fertilzer grades.

Factors that Contribute to Homeowner Turf Quality

Maintenance practices, soil type and turf quality were compared and correlated with one another and turf ratings to determine what parameters control turf quality. The lawns in this study were divided into high and low quality lawns, and comparisons between these sites were made. The sandy loam textures of high quality sites were ideal for turf. Soil nitrate levels and plant nitrogen concentrations were higher on high turf quality sites. Turf density was higher on higher quality sites. The number of weeds were 50% to 75% lower on high quality sites.

Homeowners on high quality sites applied more fertilizer annually than those on low quality sites. Although nitro-

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gen applications remained lower than recommended, homeowners with higher quality turf applied more nitrogen, phosphorous and potassium. The study determined through multiple regression analysis that the parameters contributing significantly to turf quality were total annual and nitrogen fertilzer applied, turf soil nitrate, and plant nitrogen content. Turf density and weed count, obvious parameters to the turf quality rater, contributed to the definition of turf quality also, but it was the intent of this study to find other, less obvious parameters that contributed to turf quality.

Conclusions

Unlike surveys that have attempted to determine the impact lawn maintenance practices have on the environment or turf growth, this study directly observed how homeowners control their turf quality. It found homeowners can influence turfgrass growth by adding soil and plant nutrients. This is seen in returning clippings that break down to return nutrients to the turf and when plants showed responses to applied nitrogen and potassium. Other practices assessed were compared to the recommendations made by turfgrass specialists and by soil tests, and it was concluded that homeowners are not following recommendations (Figure 1). The intent of recommendations, printed in many extension service bulletins, is to guide homeowners, as well as golf courses, to develop a healthy and high quality turf. It may be necessary to develop programs that educate homeowners in accessing and interpreting soil testing and turf practice recommendations. This finding is also supported by research completed in Pennsylvania that stated that extension agencies and soil testing laboratories need to increase the awareness of soil testing before fertilzing turf. Agencies may need to start by educating garden centers since they are an important source of information for may residents.[5] This is especially true in light of the fact that homeowners applied fertilizer in the spring when it should have been applied in the fall and underapplied nitrogen and potassium, and over applied phosphorous. Following recommendations, as it relates to the carrier, rates and times of fertilizer applications, can result in a higher quality and healthier turf.

This study also raised the question about the need for phosphorous fertilizers. It may be environmentally beneficial that fertilizer products with no phosphorous be marketed in this region, since soil tests have not recommended phosphorous. Further studies that measure the response from phosphorous fertilzer applications to turf with high soil phosphorous needs to be completed. With the recent research about the impacts of phosphorous on area water quality, it may be necessary to make changes in how phosphorous is applied. If homeowners begin to follow fertilzer recommendations, fertilzers may need to be made available at the appropriate times during the turf's growth cycle and in fertilzer grades that can meet the soil and the turf's need. It was shown that high nitrogen fertilizers were made

Figure 1. **Comparison between Recommended Nutrient Rates and Rates Applied by Homeowners.** It should be noted that the Phosphorous recommendation was 0.0 lbs.1000 ft².

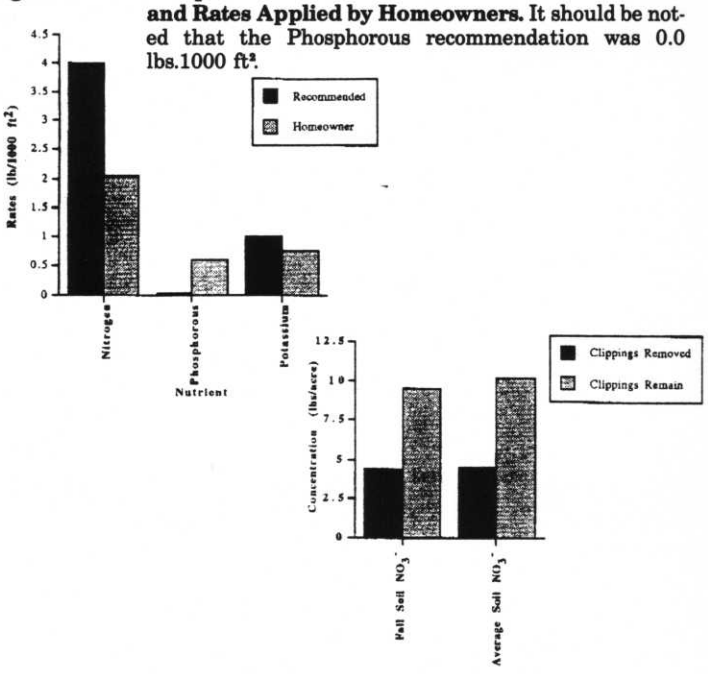

Figure 2. **Soil Nitrate Levels in Homeowner Lawns that Leave Clippings Remain and those that Collect Clippings.** A fall comparison was made to show the differences in nitrate after one season. Average combines nitrate levels in spring and fall.

available in the spring and lower nitrogen grades in the fall. This does not allow the homeowner to purchase fertilizers to meet the turf's needs. It also showed that phosphorous was a nutrient in all fertilizers sold. The adherence to recommendations may lead to significant changes in how fertilizer is marketed.

By defining the parameters that control turf quality, this research has introduced more opportunities to study the factors that control homeowner turf quality. We determined that fertilizer amounts, soil nitrate, plant nitrogen concentration, as well as verdure and weed count contribute to homeowner turf quality. This study will aid researchers in the future to develop efficient and environmentally safe ways to show homeowners how they can manipulate the parameters that control turf quality.

[1] Creason, J.R. and Runge, C.F. Use of Lawn Chemicals in the Twin Cities. Public Report Series #7.

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[3] Mugaas, R.J. 1991. Turfgrass Management. Minnesota Extension Service Bulletin. AG-BU-5726-E. University of Minnesota.

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[5] Pennsylvania Turfgrass Council and Pennsylvania Department of Agriculture. 1989. Pennsylvania Turfgrass Survey. Pennsylvania Agricultural Statistics Service, Harrisburg, PA.

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