FERTILIZING UNIRRIGATED TURFS

Paul E. Rieke
Crop and Soil Sciences
Michigan State University

When planning a fertilization program for any turf there are a number of things to take into consideration. One of the most important is the quality of turf desired for the site. Another is the availability of irrigation. With irrigation, a fairly uniform growth pattern can be maintained through the season although somewhat higher growth can be expected in spring and fall. Growth patterns for unirrigated turfs will vary significantly, depending on rainfall patterns as would be expected.

To understand how the plant responds to moisture stress it helps to review the growth curve of cool season grasses in our part of the country. When the soil begins to warm in the spring and with spring rains the grass breaks dormancy and growth resumes using carbohydrates stored the previous fall. As the days become longer and the soil continues to warm these grasses respond with rapid growth. Commonly, maximum growth occurs in May and June. As temperatures increase during summer when moisture stress is usually the greatest, growth slows. If there is significant moisture stress the plant may go dormant. With the resumption of rainfall, growth recovers in late summer and fall resulting in another growth surge that typically is smaller than the spring growth period. As temperatures cool during fall and late fall, growth subsides and the plant gradually returns to dormancy when the ground freezes.

During years of adequate summer rainfall there is very little difference in growth of grass, whether irrigation is available or not. Typically, for cool season grasses there is at least one period of dormancy during most summers in northern climates. Usually there are sufficient levels of residual carbohydrates to regenerate growth in the fall.

An exception occurred during the spring and summer of 1988 when typical spring growth took place followed by little rainfall from mid-April through late July. Most turfs without irrigation simply went dormant and gradually recovered during late summer with there was adequate rainfall. Limited rainfall during July and early August was inadequate for resumption of growth but was adequate for germination of crabgrass. High temperatures permitted rapid growth and maturity of the crabgrass, resulting in the highest populations of crabgrass in memory in Michigan. That pool of crabgrass seed was still evident in 1999.

Another observation from 1988 was that some lawns suffered serious thinning of the turf. It appeared that most of these were fertilized at least once, sometimes twice by the middle of May when the drought was becoming evident. Some of these lawns were irrigated to maintain growth through early to mid-June. At that point home owners decided to quit watering because of cost. These lawns seemed to be the most susceptible to loss of grass and required renovation the next fall. If this was not done there was significant encroachment of weeds, both broadleaf and grassy. One suggestion for this loss of turf is that the carbohydrate levels in the grass were depleted by the rapid growth caused by liberal spring fertilization and irrigation, followed by abruptly shutting off the water. There were not enough carbohydrates in the turf to regenerate adequate numbers of plants for good turf density.

In past studies we have observed that Kentucky bluegrass was irrigated, somewhat less N was needed to attain the same general quality of turf when the turf was unirrigated. Irrigation helped maintain a good turf density, providing greater competition with weeds. However, we have also seen that higher N rates resulting in greater susceptibility to wilt during summer moisture stress conditions. One must balance these and other factors when planning a fertilization program.

Planning a Fertilization Program

When designing a fertilization program for any turf there are several factors to consider. Among these are: 1) species and cultivar of grass; 2) soil texture (sand versus loams); 3) availability of irrigation; 4) soil tests, tissue tests; 5) environmental conditions (shade, slope, etc); 6) condition of the turf; 7) budget (for labor, mowing, equipment); 8) other management practices (management of weeds, diseases, insect problems); 9) use of the site (traffic); and 10) quality of turf desired.

When these factors have been evaluated the steps in planning a program are: 1) determine relative

annual N needs; 2) set the approximate dates and rates of N needed by the turf; 3) determine needs for P, K, and other nutrients; 4) select appropriate fertilizers, considering associated factors (price, ease of application); 5) plan the program; and 6) make adjustments as needed during the year based on weather, disease, etc.

Annual N needs. This could vary from as low as 1 lb. N per 1000 sq. ft. annually for fine fescue turfs in the shade to perhaps as high as 4.5 lbs. for other turfs in the open sun. Under shade conditions (deciduous trees) all the N is best applied during fall about the time leaf fall occurs and in late fall. Spring and summer applications should be avoided as this timing would encourage top growth and depletion of carbohydrate levels in the turf just at time when light for photosynthesis is most limiting. Nitrogen (1 lb. or more) applied in spring can result in rapid loss of grass under intense shade conditions.

Once fine fescues are well established in the open sun 2 lbs. N per year are usually adequate to hold reasonable turf density. Some fine fescues under open sun conditions have not performed well when not irrigated. The cause is unclear, but appears to have disease like symptoms.

For Kentucky bluegrass, perennial ryegrass, and tall fescue turfs, a minimum of 2 lbs. N annually is essential. Less than that results in low turf density and high susceptibility to weed encroachment, especially for Kentucky bluegrasses. These cool season grasses require enough N to achieve adequate density to compete with weedy species. In an 8-year study conducted years ago, we found unfertilized Kentucky bluegrass turf gradually changed to predominantly grassy and broadleaf weeds. By contrast when 4 lbs. N was applied annually there were only a few broadleaf weeds present that could be controlled with herbicides. There were even fewer weeds with higher N rates, but these higher rates would not be good for the turf and possibly, for the environment.

Given "typical" summer rainfall with one period of grass dormancy and assuming the objective is to maintain a reasonably good quality turf, annual N rates would need to be in the 3-4 lb. range. If dormancy extends for 6 weeks or more that number can be reduced by 0.5-1 lb. N.

Adjustments in the N program may be needed to manage diseases. For example: red thread and pink patch will be more active on grasses receiving low N rates. Dollarspot fits in that category as well. Increasing the N can help reduce severity of these diseases in some situations. Higher N may increase susceptibility to brown patch, found more commonly on perennial ryegrass and tall fescue under grounds and lawn situations. As Dr. Joe Vargas has reported, some nitrogen applied monthly from a slow release source is helpful in reducing susceptibility to necrotic ring spot on Kentucky bluegrass. About ½ lb. N per month seems best. Of course, the best-integrated pest management approach with this disease is to utilize daily irrigation as well.

Rate and Time of N application. Nitrogen applied at heavier rates in the spring cause increased growth and mowing. It can also cause depletion of carbohydrates, making the turf more susceptible to summer moisture stress. On the other hand, spring N can increase turf density reducing weed competition.

Nitrogen applied in the fall (September) can increase turf density after any loss due to summer stress and enhances carbohydrate accumulation. Late fall N, about the time growth stops (usually about the first week of November in central Michigan) has several advantages: good fall color, enhanced carbohydrate accumulation in November and early December; reasonable color in the spring; and good turf density the next spring without a major increase in spring growth. There may be some increase in susceptibility to snow mold disease, however.

The objective of a good fertilization program is to provide moderate rates of N throughout the growing season while not causing too much growth or susceptibility to stress or disease. Light and frequent applications of quick acting fertilizers works well with this approach, but this is seldom practical on unirrigated turfs. An alternative is to use a combination of slow and fast release N sources with fewer applications.

A minimum of 3 applications of N annually results in better turf than 2 applications. The alternative is to use two applications with a carrier that has 50-75% slow release N that will give up to 3 months response. Few carriers will give that length of response. For 3 applications annually, one could apply in late April, late June, and early September. If a late fall application is utilized, a program of earlyNovember, late May, and early September works well. A program that homeowners can remember is to consider fertilizing near these holidays: at Halloween, before Memorial Day, and on Labor Day.

Lawn care companies typically make 4-5 applications per year, a few may use 6 applications in unusual situations. Five applications of about .75 lb. N yields 3.75 lbs. annually, falling in the 3.5-4 lb. range. Some of the N should be from slow release sources, particularly in the summer. If the turf is thin, use the 1 lb. rate. If there is a significant period of dormancy during the summer of 6 weeks or more, one fertilization can be dropped.

It is recognized that timing of N cannot always be done at the most appropriate times. Lawn care companies for example cannot visit all clients at the best time. For this reason it is necessary to start the applications earlier in the spring than preferred. In my opinion, applying N in late February and March is too early for the grass to utilize it appropriately.

What about the ratio of N to P and K? This varies widely depending on soil conditions and management. Some lawns are growing on compacted subsoils that have little native phosphorus. Others are on native topsoils that have adequate P and K for grass growth. Sands, by nature will have less potash than finer-textured soils. If clippings are removed there is a natural "mining" of soil nutrients, requiring additional P and K. The best approach to be sure P and K are not limiting is to utilize soil testing as a part of the service provided the consumer. The cost can be passed along justified on the basis of determining actual needs and for environmental concerns with phosphorus.

Potash is seldom limiting on general grounds. Because K plays such a major role in stress tolerance, including moisture stress, it is wise to be sure K levels are adequate in the soil. Again, soil testing will provide the answer.

Many lawns will require no P and K. On the other hand, we have observed turfs that have developed deficiencies of P because only N was applied and clippings were removed. If soil tests are not available, it is best to apply a little P and K to insure they are not limiting.

Conclusion

While many factors affect the quality of turf a given fertilization program will provide, a major consideration is still what quality of turf is desired. Proper use of irrigation should provide good insurance for a high quality general turf, barring serious disease, mismanagement, or misuse of the turf. Without irrigation, the turf manager has a greater challenge to program fertilization in order to maintain a good quality turf. Following these guidelines will help plan a good program.