TURFGRASS FERTILITY BASICS

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Fertilization of turfgrass sites is just one of the many things that influence how a turf performs. For a high quality, stress tolerant turf the major factors are: 1) Good soil conditions (texture, structure, drainage); 2) Using grasses well adapted to the site and use conditions; 3) Good management practices (mowing, fertilization, irrigation, pest management, thatch control, treatment for compaction); and 4) Reasonable use of the turf. Although fertilization is just one of these factors, proper fertilization is essential for maintenance of cool season grasses.

To develop a sound fertilization program one must first understand the growth cycle of cool season grasses and how fertilization, particularly with nitrogen, affects the plant physiologically. Understanding how the plant generates, stores, and utilizes carbohydrates helps understand why it responds to different conditions. While all nutrients are important for good turf, management of nitrogen (N) and potassium (K) have the greatest influence on plant health. A healthy turf is much easier to manage.

Nitrogen management has many important impacts on turf. Among these are: 1) color; 2) top growth; 3) density – competition with weedy species and recuperative potential after turf has thinned; 4) wear tolerance; 5) level of carbohydrate reserves; 6) root growth, rhizome and/or stolon growth; 7) susceptibility to diseases; 8) thatch; and 9) susceptibility to stress conditions (extremes of temperature, moisture, traffic, shade).

We have also learned much about how potassium plays significant roles in plant health, including influence on: 1) top growth; 2) root growth; 3) carbohydrate synthesis in the plant; 4) cell size and cell wall thickness; 5) how water is stored in the plant; 6) turgor pressure; and 7) control of stomatal openings and wilting tendency. The bottom line is that adequate K is necessary for a healthy, stress tolerant turf.

Turfgrass growth stages can be grouped into several categories during the typical year: early spring, late spring, summer, fall, and late fall. During **early spring** (April through early May, depending on the year) the typical growth curve begins with the grass breaking dormancy as air temperatures warm. This early growth utilizes carbohydrates stored the previous fall. For this reason, fertilization in the fall is a very important part of a good fertility program. Continued increases in air temperatures result in increasing soil temperatures. With spring rains, growth increases rapidly. Heavy rates of N in the early spring contribute to rapid growth, resulting in increased frequency of mowing. This growth enhances turf density, improving competition with weeds, but it does drain carbohydrates from the plant. Once the leaf is cut off, that portion of the plant's carbohydrates are lost. This could cause the plant to be more susceptible to environmental stress during the summer. Susceptibility to diseases can increase or decrease, depending on the disease. Clearly, use of N during the early spring has a major effect on how the turf responds the rest of the year.

If a late fall fertilization was applied, it may not be necessary to use any N in early spring, depending on turf conditions. If N is needed, only modest rates should be used at this time. Don't cause the need for extra mowing and loss of carbohydrates unless a significant increase in turf density is required. N rates could be anywhere from none to ¼ to ½ lb. per 1,000 sq. ft. if an early spring preemergence weed control is needed. For seriously thinned turf, up to 1 lb. N may be needed.

The second period for fertilization time is **late spring** (late May to mid-June). Some N is normally needed during this period. Use modest rates like ½ to ¾ lb. N, but do not exceed 1.0 lb N. Vary the rate depending on turf and weather conditions. If higher N rates are accompanied by extensive periods of warm, rainy weather, excessive growth could occur. For this reason, use of more moderate N rates is better for healthy turf.

Use of N in the **summer** (late June through August) should have the goal of maintaining modest color and growth with the attitude of holding turf quality, especially when irrigation is not available. When a turf is properly irrigated it may be possible to maintain uniform turf color and quality with less N than when one is dependent only on rainfall. Proper use of N also is necessary for successfully following an integrated disease management program. If extensive drouth conditions occur, hold off on N until rains resume at which time some N will be helpful to improve turf density. Generally, ¼ to ½ lb. N per month should be adequate during summer.

Perhaps the most important time for N fertilization is in the **fall** (September). Nitrogen applied at this time provides an increase in turf density after summer stress and enhances accumulation of carbohydrates. Typical N rates are ½ to 1 lb. per 1,000 sq. ft.

About the time top growth ceases in **late fall** is another important period to consider N fertilization. While low temperatures result in limited top growth, the soil is still warm and root growth continues. Leaves are green and capable of photosynthesis. Most of the carbohydrates generated by the plant are stored in crown, root, and rhizome or stolon tissues. This is the plant's mechanism for preparing for next year. Timing of N applications may vary depending on location (north to south, and proximity to the Great Lakes) and the year. In mid-Michigan this typically occurs about Nov. 1, but can vary by year. Appropriate rates vary widely from as little as ½ to 1.0 lb. There could be some increase in snow mold disease with late fall N applications, but general grounds turfs usually recover quickly in the spring. Some heavily worn football and soccer fields could benefit from higher rates of N, but environmental fate of N suggests it is better to apply lower rates more frequently to reduce the risk of loss of N to the environment.

For homeowners who want to apply some N in the late fall, one approach to timing of N applications they find easy to remember is based on the "holiday calendar." This begins in the late fall about the time of **Halloween**. In the spring, if the turf is in good condition one can wait for the first spring application until mid to late May, before **Memorial Day**. For adequate turf, the next time is **Labor Day**. The rate of N for each of these dates could be as low as ½ lb. for low quality lawns to 1 lb. for average quality. If higher turf quality is desired, another application can be added about **July 4** at about ½ lb. N. These dates are easy to remember, but do not take into account the possible need for application of a preemergenc weed control with a fertilizer/herbicide combination product during early spring.

For a program that does not include a late fall N application, simply move the first application earlier in the spring (as in late April), follow with an early June fertilization, either no N in summer or half rate, then again in September.

When planning a fertilization program consider the species of grass. Well established fine fescues can hold acceptable turf density at 1-2 lbs. N annually, and should seldom receive as much as 3 lbs. per year. Kentucky bluegrasses can survive with as low as 2.5 lbs. N., but will often be weed infested at lower N rates. The range of 3.5 to 4.0 lbs. should provide reasonable quality turf. At rates as high as 5.0 lbs. there is increased concern for loss N to the environment. Perennial ryegrass and tall fescue turfs will typically need about the same amount of N as Kentucky bluegrass. When disease becomes a problem, N should be used to follow an effective integrated disease management program.

Sites with significant shade should receive lower N rates. When deciduous trees are present, concentrate the N application after leaf drop in fall and late fall. Make sure the leaves are promptly removed from the site so what sunlight that does penetrate through the turf can reach the turf. This will permit some photosynthesis to occur during late fall. Avoid early spring, spring, and summer N applications on heavily shaded sites.

Nitrogen carrier should also be considered. A program that uses light and more frequent applications of soluble N provides the best control over growth and potential loss to the environment. Cost of application usually makes this approach impractical on grounds. Sites that are fertilized infrequently benefit from use of a fertilizer that contains some slow release N. This will permit both short and long term response. The fertilizer should preferably contain 25-50% slow release sources with the balance from soluble sources. Coated products can also be used effectively.

What about phosphorus (P) and potash (K)? For phosphorus, soil tests provide a sound basis for P needs. The P can most easily applied as part of a complete fertilizer that contains a low level of P, depending on needs. Use of zero P fertilizers can be used on many sites where soil levels are adequate and when clippings are returned. The P is recycled to the soil where it can be reabsorbed by the roots. When clippings are removed more frequent soil testing should be used.

Soil tests also serve as a good basis for determining K needs on sandy loams and finer textured soils. But because of low cation exchange capacity, sands cannot hold much K. For this reason, on sands a ratio of about 1 part N to 1/3 part K_2O (eg., 21-X-7 or 24-X-8 where X is P_2O_5). Again, the easiest way to apply potash is with a complete fertilizer. This provides some K throughout the season.

To summarize the factors one should consider in planning a fertilization program include: 1) species and cultivar of grass; 2) soil physical properties (texture, compaction); 3) proper ratio of N to other nutrients, based on soil tests; 4) how the turf is used (intensity of use) and quality of turf desired; 5) budget (fertilizer and application cost, mowing requirements); 6) availability of irrigation; and 7) environmental concerns.

After the program is planned it can be carried out. Frequently, it may be necessary to make adjustments in the program due to unusual weather, wear, or disease conditions.

One other area that merits attention is environmental fate of nutrients. Some common sense can help prevent significant contribution of nutrients to contamination of surface and ground waters. One example is to never apply fertilizer on frozen ground or in such a manner that it reaches hard surfaces where runoff will occur. Never allow fertilizer to be thrown into surface waters. If possible, apply ¼ to ½ inch of irrigation to move the fertilizer into the thatch and soil. Use of fertilizers that have appreciable levels of slow release N can reduce the potential for leaching of nitrates, but some slow release fertilizers (low density products particularly) could be more susceptible to runoff. Use lower rates and more frequent applications of N. Calibrate equipment regularly. Use soil tests to confirm need for P. Cultivate (aerate) compacted sites to reduce potential for runoff. Use grasses that have low N requirements. Use irrigation judiciously, turning it off during rainy periods. Following these and other practices will help protect the environment and will usually be better for the turf.