Best practices: fertilizer programs

By Cale A. Bigelow, PhD

Cool-season grasses like Kentucky bluegrass, perennial ryegrass, turf-type tall fescue and to a certain extent, cold-hardy bermudagrass cultivars, grow best during the spring and fall and generally remain green year round.

Bermudagrass by contrast is a warm-season grass that grows best during the summer, turns straw brown following the first hard frost and remains dormant during the winter months. For this reason bermudagrass is sometimes overseeded with ryegrass to extend the use period, sustain favorable surface playing conditions, improve aesthetic appearance, and to a lesser extent provide some protection against traffic.

Regardless of the species being grown, the overall goal for any athletic field manager is to provide a consistently dense, attractive, and safe turf for athletic competitions. The two major cultural practices that you have the most control are mowing and fertilization. Most fields will respond favorably to regular mowing, at least twice per week, during the growing season. Regular mowing provides a smooth, even surface and increases stand density due to enhanced tillering.

Above: the exact fertilizer needs for individual turf areas and species will vary by site.

Cool-season fertilization

Turfgrasses require 16 essential macro and microelements to maintain proper health. Simply because a nutrient is classified as a macronutrient, do not assume that this nutrient is more important than a micronutrient. Macronutrients are simply required by the plant in greater amounts. For micronutrients like iron or manganese, very small deficiencies can result in poor turf color and slow growth. Whenever the topic of fertilization arises the discussion usually revolves around three major plant nutrients: nitrogen (N), phosphorous (P) and potassium (K), which are contained in a complete fertilizer. In reality, however, most fertilizer programs are constructed around an annual N requirement because N is the most abundant nutrient in the plant tissue, normally 3-5% by dry weight and elicits the strongest growth and greening response. Generally, the higher the tissue N content, the more green the leaves appear. Turf with a high leaf tissue N content will require more N to sustain that level and greenness. The major questions with respect to N applications are often, how much and when should you apply fertilizer?

For cool-season grasses the most beneficial time to apply N is during the fall months. Therefore, the bulk (50-75%) of the annual N needs should be applied using several applications, the first occurring in late summer (e.g., first week of Sept.) and continuing at least once or twice more through the autumn months. Some of the reported benefits of this practice are that you extend the greening period later into the fall, spring green-up occurs as much as one month sooner, it stimulates tillering and rhizome activity which increase stand density and reduces weed pressure and most importantly increases root growth. Furthermore, N applications during this period generally do not result in unwanted growth surges like they would if N heavy N levels are applied in the spring.

One of the most important N applications for facilities with a limited fertilizer budget is the late fall N fertilization. This is an application of a readily soluble N source like urea or ammonium sulfate that is applied just prior to winter dormancy when the turf is still green but very little shoot growth is occurring. In many regions this occurs sometime between Nov. 1 and Dec. 1.

Although fall fertilization is generally positive one possible negative is the potential for increased winter disease injury. The main disease associated with this practice is Microdochium patch, also referred to as pink snow mold. It is most severe in succulent turf going into winter. Although this disease sometimes occurs it can be cured with fungicide applications and the benefits of fall fertilization strongly outweigh this potential negative. In fact, turf properly fortified in the fall generally has fewer spring and summer disease problems

The remaining 25-50% of annual N needs should be applied during the growing season and during periods of intense use, generally middle to late spring (mid-May-early July). These N applications help maintain greenness and promote plant vigor. If possible, little to no N should be applied during the peak summer months to minimize disease incidence and prevent possible damage where turf may be under heat and/or drought stress.

When subjected to intense traffic and wear though, mowing alone is not enough to maintain stand density. You need regular fertilization. To maintain a high quality, dense turf requires multiple nitrogen (N) fertilizer applications applied throughout the year. These periodic N applications maximize and maintain green color, shoot density and result in consistent controlled shoot growth. Apply more frequently, and at lighter (1/2 lb. of N per 1000 ft2) rates, which help them monitor turf health and enhance nutrient recovery, especially in heavily trafficked areas. Additionally, this practice allows you to minimize unwanted growth surges and unnecessary mowing.

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The exact fertilizer needs for individual turf areas and species will vary by site, prevailing weather conditions, and intensity of use. In any given growing season a fertilization program may need to be adjusted to apply slightly more or less nutrients depending on the following factors:

Desired appearance. A dark green, vigorous turf will require more fertilizer than a thin, lighter colored turf. We often forget that as fertilizer applications increase to maintain green color, so do mowing and irrigation requirements. Choosing naturally dark green turfgrass species and cultivars may be one solution for reducing nutrient applications while ensuring a dark green turf.

Turfgrass species. Compared to Kentucky bluegrass and perennial ryegrass, deeper rooted species like turf-type tall fescue, and bermudagrass may perform adequately with fewer annual fertilizer applications because they are able to extract nutrients from

Kentucky bluegrass at Ross-Ade Stadium. This turf has since been replaced with the bermudagrass cultivar Patriot for the 2006 season.

greater soil depths. Currently the turf-type tall fescues are underused for higher profile stadium fields. However, on heavily used recreational fields receiving a lower level of management intensity that often includes less frequent mowing at higher (more than 2 inches) mowing heights, turf-type tall fescue may provide a fairly durable and reliable surface.

Turf maturity and existing health. Newly planted turf, both seeded and sodded, usually requires 25-50% more annual fertilizer for the first few years to encourage rapid turf coverage and deep rooting. In addition, many turf areas are established on disturbed urban soils that lack sufficient readily available nutrients. Only soil testing will determine the specific nutrient needs of a given area.

Geographic location and environment: The growing season in the upper transition zone is longer than in northern states. Therefore, slightly more annual N may be needed to sustain turf quality in Southern regions. Shaded turf will require approximately 50% less annual nitrogen than turf grown in full sun with irrigation. Shaded turf simply grows slower and should not be heavily fertilized to minimize disease incidence, improve wear tolerance, and maximize turf persistence.

Soil type. Turf grown on high sand content soils with synthetic sand-based rootzones or heavy clay soils will often require more fertilizer than turf grown on a silt loams or organic soils. Sandy soils are prone to nutrient leaching losses and many heavy clay soils sometimes bind nutrients making them available more slowly.

Weather and irrigation. Readily available soil moisture facilitates nutrient uptake and stimulates turf growth. However, frequent heavy rains or irrigation can flush soluble nutrients (e.g. nitrogen and potassium) from the soil. Thus, more frequent fertilization will be required in wet years or on irrigated sites.

Sources of nitrogen

No discussion on fertilization would be complete without at least mentioning the myriad of N sources available to turf managers. There are two broad categories: quick release or readily water soluble, and slow release or water insoluble. Most good N programs will use both sources and various quick and slow mixtures at different points during the growing season depending upon your intent.

Quick release N sources like urea or ammonium sulfate dissolve easily in the presence of water, and are capable of greening turf in a matter of hours. These N sources are relatively inexpensive but also can be short lived (a few weeks) and produce unpredictable growth flushes.

The traditional rule of thumb, for quick release N sources has been that you should never apply more than 1 lb. of N per 1000 ft2. This guideline was established long ago to minimize burn potential, avoid significant growth surges, and minimize environmental losses. With this in mind, quick release fertilizers by themselves are best used at reduced rates, applied frequently or as a smaller part of a fertilizer blend or used at times of the year when they are likely to cause little damage. When used alone at higher rates, these sources work best when applied during the last part of the growing season, just before winter dormancy.

The most commonly used slow release N sources include, sulfur coated urea (SCU), polymer coated urea (PCU), methylene ureas, and the natural organics (e.g., activated sewage sludge, manures, etc.). Slow release N sources require more than just water to release their N. Mechanisms like protective coatings and microbial decomposition control how quickly the N is released. Slow release N sources can sometimes be applied at higher rates, 2 lbs. of N per 1000 ft2 without significant risk of foliar burn or environmental losses.

Unlike quick release sources, they do not cause rapid greening but provide extended feeding, often for two to three months or more. This sometimes makes them more economical than the quick release sources because they do not need to be applied as frequently which can reduce the overall labor costs involved with fertilization. One thing to keep in mind when using the coated products on athletic fields that as those particles are subject to foot traffic or anything else that may damage the integrity of the particle coating the N release rate may be affected. If this is a concern a lower more frequent application of a quick release N source or switching to a methylene urea source may be appropriate.

For high value stadium fields or heavily used athletic fields an irrigation system is vital to ensure turf persistence. Dormant turfgrasses cannot recover from traffic stress, and unirrigated cool-season athletic fields will be especially vulnerable to accelerated wear during use in summer months.

Mowing height and clipping management. Higher mowed turf may require less frequent fertilization because the turf plant possesses a deeper more extensive root system. Where clippings are regularly removed, such as on a stadium field, 25 to 50% more annual N will be required to sustain turf quality.

Traffic and use. Fields subjected to intense use (e.g., a football practice field) will require more annual N to maintain stand density, promote growth, and recover from damage. Additionally, the skill level and size of the athletes affects fertilization strategies. Fields used by larger more skilled athletes may necessitate more annual N during the period they are using the fields.

There is no single correct way to fertilize a turf area. Many factors including turf species, growing environment, maintenance resources, available N-sources and use intensity all play a role in developing an appropriate program. While the focus of this article has been on annual N needs, don't forget the other essential nutrients.

The "don't guess, soil test" adage is certainly appropriate to reliably determine your needs. Pay attention to any existing environmental restrictions in your area regarding nutrient applications. Soils and growing conditions vary regionally and some restrictions intended to preserve and protect water quality must be observed.

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See the color retention in this Purdue study.