# Fertilizing High-Traffic Turf

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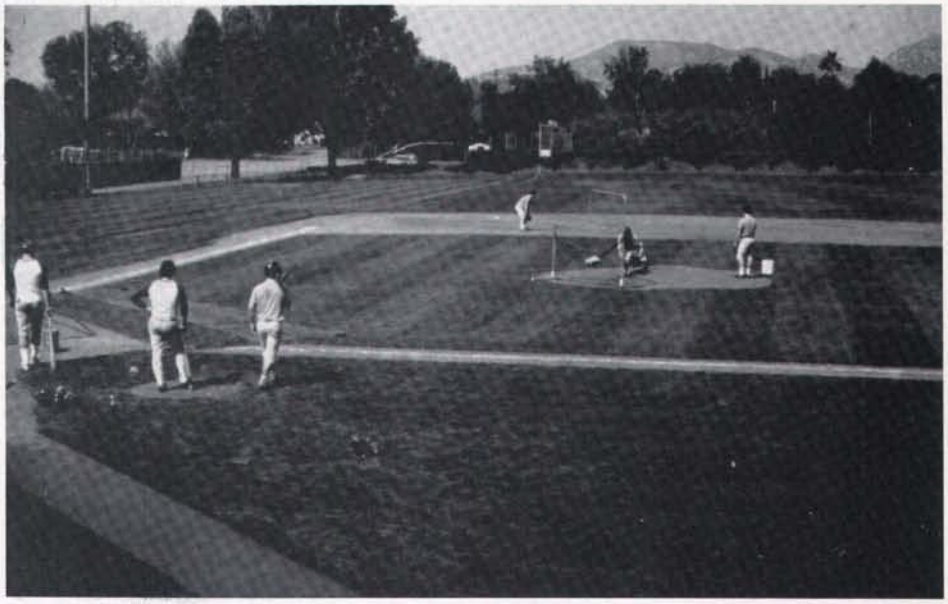
Sports fields are stomped on, kicked, scuffed, dug out, and otherwise generally and thoroughly beat up. More often than not, through all of this, the field still has turfgrass on it.

Well-managed turfgrass sports fields are safe, durable, and aesthetically attractive, but they are not low maintenance. Turfgrass under the pressures of high traffic should be sustained at their optimum vigor. Correct fertilization of the turf is a key factor in that process.



Sports fields can have a dark uniform color with the correct application of fertilizer.

**Fertilizers**—When selecting fertilizers for use on sports turf, consider the turfgrass species, the nutrients needed, the effect of the nutrients on the plant, the nutrient sources available, the characteristics of different nutrient sources, time of year, and the requirements and limitations of the facility (budget, manpower, equipment, events schedule, and maintenance schedule).

There is not a particularly wide range of grasses grown as sports turf. In the Sunbelt it is pretty well limited to cultivars of one warm-season grass, bermudagrass, plus various cool-season species that might be winter overseeded. In the North, three cool-season species are used alone or in mixtures: Kentucky bluegrass, tall fescue, and perennial ryegrass.

Nitrogen (N), phosphorus (P), and potassium (K) are the primary nutrient elements used in large quantities by plants. Fertilizer labels contain the nutrient analysis indicated by the percent by weight of N-P-K in the package.

As a fertilizer, phosphorus is referred to as phosphate and shown as the chemical notation P2O5. Potassium as a fertilizer is known as potash and is shown by the chemical notation K2O. For simplicity we will use P and K, meaning P2O5 and K2O. Nitrogen is designated as N in fertilizer analysis.

*Nitrogen* is a major ingredient of the plant. As a component of chlorophyll, nitrogen deficiency first shows up as a yellowing of the turf. The deficiency is corrected by the application of nitrogen as a turf fertilizer. Nitrogen fertilizer sources are separated into three groups: inorganic, natural organic, and synthetic organic.

*Inorganic nitrogen* fertilizers produce quick plant response, are not very sensitive to temperature, and are low in cost per unit of nitrogen. However, they are highly soluble in water, so the response doesn't last much longer than four weeks.

The most commonly used inorganic nitrogen fertilizers are ammonium nitrate, ammonium sulfate, and calcium nitrate. Ammonium is taken up by the roots, but most of it is absorbed by soil particles. Soil microbes convert it into the nitrate form, release it from the soil particles and make it available again. Cool temperatures slow the soil microbes, making the ammonium less available to the plant. Nitrate, also easily absorbed by the roots, is not sensitive to temperatures.

Ammonium sulfate (21-0-0) in addition to nitrogen in the ammonium form contains 24 percent sulfur. Because sulfur reacts to acidify soil, this fertilizer is recommended for use on alkaline soils.

Calcium nitrate (15-0-0) is a good cool weather turf fertilizer, but it absorbs moisture easily causing it to cake in the bag. Therefore, it should be stored in airtight containers.

*Natural organic nitrogen* turf fertilizers are derived mostly from animal wastes (manure and sewage sludge). These materials typically are not soluble. The plant growth response is slow and they are only effective for four to eight months.

The low nitrogen analysis (two to 15 percent) of natural organics makes their cost per unit of N higher than the inorganics. Even though they are expensive N sources, many turf managers use natural organics due to the presence of a number of other nutrients. Since soil microbes break down the natural organics to release the nitrogen, effectiveness is poor in cool weather.

Activated sewage sludge is the primary natural organic nitrogen fertilizer used routinely on turf. Activated sewage sludge, produced from treated, processed sewage, contains four to seven percent N. Manures are occasionally applied as a preplant fertilizer for turfgrass establishment, but the high soluble salt content can be undesirable.

*Synthetic organic nitrogen* fertilizers are primarily urea and urea-based compounds, both soluble (quick-release) and slow-release. Soluble synthetic organic fertiizers give quick turf growth response that may last four to six weeks.

Soluble urea (45-0-0) is by far the most popular soluble sythetic organic nitrogen source for use on turf. The prills are convenient to apply dry through a spreader, or can be dissolved in a sprayer tank for liquid application. The very high N content means that less total quantity must be handled compared to other fertilizers.

Besides leaching as rapidly as a soluble fertilizer, a large percentage of N is lost to volatilization in warm weather, which happens when the ammonium in the urea turns to free ammonia and evaporates. Cool-season use of urea minimizes volatilization.

Slow-release insoluble synthetic organic nitrogen fertilizers have little turf burn risk, and plant growth response is slow. They release N over an extended period, making plant growth more consistent and reducing the number of applications. However, the slow-release materials are more expensive than other sources.

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Slow-release N fertilizers are made by either combining urea with other compounds to produce water-insoluble materials, or coating a readily soluble N source. The most commonly used water-insoluble urea compounds for turf are ureaformaldehyde (UF) and isobutylidene diurea (IBDU).

UF (38-0-0) fertilizer is packaged with about 25 percent N in the soluble form to provide a quick turf response. Nitrogen is released from the insoluble fractions of UF through microbial breakdown and is dependent upon temperature. It isn't very effective when temperatures fall below 50 degrees F.

The rate of N release from UF is controlled by the size of particles and the fertilizer chemistry. A smaller particle size increases the number of particles, thus increasing the surface area of the fertilizer that is exposed to microbial activity.

IBDU (31-0-0) releases N as the particles slowly dissolve in soil moisture. Since release is not influenced by microbial breakdown or temperatures, IBDU is good for cool season use. Like UF, the rate of N release depends on the size of the particle. Turf response may take as long as four weeks, but can last as long as 16 weeks. Turf managers, often anxious for a quick response, sometimes add soluble N to IBDU for immediate impact.

Slow-release sulfur-coated urea (SCU) is produced by spraying molten sulfur onto granules of urea. The rate of N release from SCU is determined by the thickness of the sulfur coating and the particle size. The N analysis varies, but 32-0-0 is a common formulation, and sulfur (12 to 22 percent) is available to the plant.

Response to common turf formulations of SCU lasts eight to ten weeks. SCU usually provides a better initial growth response than other slow-release fertilizers, and the cool season activity of SCU is acceptable. It is the least expensive slow-release synthetic organic fertilizer per unit of N.

Resin-coated materials are produced by coating urea, or other compounds, with a water-permeable plastic resin. These products usually are 26 to 34 percent N. The permeability of the coating is sensitive to temperature. Lower temperatures slow N release by causing the resin to contract, so resin-coated fertilizers are primarily for warm season use.

Resin-coated fertilizers do not cause turf to produce a flush of growth. Instead, the initial response is a gradual increase in growth without the rapid spurts common with other fertilizers. This growth can be sustained for four to six months. Resin-coated fertilizers are the most expensive N source.

*Forcing growth*—Sports turf fields have the same normal maintenance requirements of any turfgrass sward. The unique demands of the sports field often call for forcing extraordinary growth. Frequent, high N-rate applications will cause a rapid flush of growth. Most of the response is foliage, but the roots also grow. This response is useful in peaking for a certain event or recovering from a particularly damaging event. However, forced growth creates a risk of long term problems with the turf, because the growth flush tends to deplete carbohydrate reserves and reduce later injury recovery potential.

**Phosphorus** is used to make proteins and help transfer energy within the plant. It is especially important in the development of roots, rhizomes, stolons, and tillers. The roots are vital to the sustenance of the grass plant. If there are no roots, then there is no growth. Rhizomes, stolons, and tillers are the mechanisms that established turfgrasses use to spread.

*Traffic is the most significant stress on sports fields, and potassium increases traffic tolerance.*

Two common sources for P are superphosphate (0-15-0) and triple superphosphate (0-45-0). Monoammonium phosphate (11-48-0) and ammonium phosphate-sulfate (16-20-0 plus 15 percent sulfur) are common N fertilizers that are high in phosphate.

*Injury recovery*—Turf density can be a function of the vigor and efficiency of the roots, rhizomes and tillers. Recovery from injury is most certainly a function of their vigor and efficiency. Excess P in the root zone allows the plant to utilize it.

Low solubility makes phosphorus very immobile, and repeated application causes it to accumulate in the upper soil layers. This has not been a problem and may provide excess P on demand to the plant under stress. If the sports field is being resodded, putting one of the phosphate-nitrogen fertilizers under the turf and on top of the soil or sand enhances sod knitting.

**Potassium** is involved in several plant metabolic processes, many of which are related to water use. It is highly soluble and does not stay in the root zone very long. Sports turf on sandy soils and pure sands lose K rapidly and requires applications nearly as frequently as N.

Common fertilizer sources are potassium chloride or muriate of potash (0-0-60) and potassium sulfate (0-0-50). Both are inexpensive. Often a nitrogen plus potash fertilizer product mixture is used to assure that both nutrients are available to the plant.

*Stress resistance*—Turf does not usually respond visibly to added potassium. It is the increased stress resistance that is important. Drought, heat, and cold tolerance are improved and disease resistance increased. Traffic is the most significant stress on sports fields, and potassium increases the turfgrass traffic tolerance.

**Sulfur** deficiency stunts the growth of the turf plant. Common sulfur sources are ammonium sulfate (24 percent S), potassium sulfate (18 percent S), sulfur-coated urea (12 to 22 percent S), superphosphate (12 percent S), ferrous sulfate (19 percent S), and elemental sulfur (99 percent S).

Occasional use of sulfur-containing nitrogen fertilizers (e.g. ammonium sulfate) usually takes care of the sulfur needs of sports turf. Many sports fields are built in marginal soils, including land fill, where sulfur applications may be beneficial. Sulfur fertilizers tend to lower pH due to their acid reaction in the soil and are usually preferred for alkaline soils.

**Iron** (Fe), essential for chlorophyll synthesis, is important to turf color. Turf suffering from iron deficiency is chlorotic, and does not respond to nitrogen. Iron is usually present in the soil, but has a tendency to form insoluble compounds.

Iron can be applied either as a salt or in a chelated form. Salts include ferrous sulfate (20 percent Fe) and ferrous ammonium sulfate (15 percent Fe). Chelates are chemicals that bind iron to prevent insoluble compounds from forming, while still allowing uptake by plants. Modifying the pH of alkaline soil with repeated sulfur use or an acid soil with lime can cause a turf response from released iron.

*Turf color*—As any sports turf manager knows, nitrogen is not the only way to make turf a uniform dark green. Iron is a valuable tool for providing that color.

If nitrogen is in adequate supply, an application of soluble iron (0.25 lb. Fe/1000 sq ft) such as ferrous sulfate will almost always darken the color of the turf within two to three days. Because ferrous sulfate will easily burn the turf, irrigation should follow application immediately. Application on a hot day or at a high rate will cause burn where the applicator tires scuff the turf.

The primary plant nutrient elements (N, P, and K) are seldom applied singly. When all three are in one fertilizer product, it is called a complete fertilizer.

In the fertilizer product, the nutrients are balanced in ratios to each other depending upon the local climate, soils, and grass needs. A starter or preplant fertilizer may have a ratio of about 1:2:2, which might be an analysis such as 5-10-10 or 10-20-20. The N is low, while the P and K are high to stimulate seedling development. A common maintenance ratio for complete fertilizers might be about 3:1:1, which might be an analysis such as 15-5-5.

Sports turf, regardless of species, should be fertilized with N every month of the growing season. One or two of these applications should be with a complete fertilizer with a 3:1:1 or 2:1:1 ratio. The rate is usually calculated using the percent N in the formulation.

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**Application rates**—For maintenance of sports fields with any of the grasses, nitrogen is applied at the rate of one pound per 1,000 square feet per month of growing season. If slow release nitrogen fertilizers are used, apply one pound N per 1,000 square feet/month of release period. A rate of 2.5 to 3 pounds per 1,000 square feet of product should be a minimum applicationof slow-release materials.

In the early spring, it is often possible to "jump start" bermudagrass with a one-time application of two to three pounds N per 1,000 square feet in a soluble form.

The overseed species seldom root through the thatch of the base species and draw from whatever nutrients are available in the thatch. Light, frequent N applications (0.5 pounds N/1,000 square feet monthly) may be adequate. If a vented plastic tarp is used to maintain soil temperatures, care should be exercised in the use of N fertilizers. Free ammonia released by fertilizers under a tarp will cause considerable injury to the turfgrass foliage.

Winter use of fertilizers depends upon the growth of the turf. As soil temperatures drop below 50 degrees F, bermudagrass stops needing fertilizers. For the cool season species the magic soil temperature is around 40 degrees F. When the trend of the soil temperatures is up in the spring and passes these temperatures, it is time to begin fertilization again.

On cool- and warm-season turfgrasses, phosphorus is applied at the rate of one to two pounds of P per 1,000 square feet per year. Potassium applications on sports fields can be a little heavier than on other turf. Potassium is applied at 0.5 to one pound of K per 1,000 square feet per month of growing season. On sandy soils and sands use the higher rate.

Application of N and K is possible through the irrigation system. Using liquid fertilizers and injector pumps the nutrients can be applied every time the field is irrigated. The nutrient application rate should be very dilute with the intent of putting on about one lb. of each nutrient per 1000 sq. ft. over the period of a month.

Sports turf fields require aerification to relieve compaction. There is some benefit to fertilizing immediately after aerifying. Some fertilizer will get down in the holes either as a whole particle or in solution as it dissloves in rain or irrigation water.

Turf can visibly respond to rates of iron as low as 0.1 up to 1.0 pound of Fe per 1,000 square feet within a few hours after an iron application, particularly if nitrogen is applied at the same time. Iron applied at the high rate has a very high burn risk, and it should be used only with great care—don't use it in hot weather, don't walk or drive on the sprayed area until it has been watered, and water immediately after application.

All sports turf facilities have budget limitations, but it is important that the budget not skimp on fertilizer. For the benefits it provides to a sports field, fertilizer is a low cost supply item.

For example, a sports field of 2.5 acres, which is a reasonable size for one field (football or baseball), would use less than $4,000 per year (four cents/square foot/year) for the highest application rates of the most expensive coated slow-release fertilizer. A good fertilizer program, depending upon field demands, might spend ten to 25 percent of that on fertilizer.

Scheduling fertilizer applications around events can be a major challenge. A set program for maintenance including fertilizer treatments is often impossible to keep. The sports turf manager seldom has any input into events scheduling. Events that require covering the field, such as concerts, can cause irrigation and fertilization to be postponed, or a very heavy schedule of athletic events may not leave time for field work. The sports turf manager must be flexible, decisive, and opportunistic to get the work done and to maintain a safe, attractive field.

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