Slow-release nitrogen granules.

Understanding Sports Turf Nutrition

Nitrates and phosphates are words you hear more often today, not just from fertilizer salesmen, but from a growing number of people concerned about water quality in this country. While environmental concern over fertilizers applied to turfgrass is almost completely unjustified, there are other important reasons for sports turf managers and golf course superintendents to have a good understanding of the fertilizers on the market today.

Yet, like an athlete, sports turf requires a special diet. Both must exert tremendous energy to achieve goals set for them, recover from injury, and remain durable. Special attention to nutrition is essential to their performance.

"A plant doesn't care where nutrients come from," says Jim Mello, president of Nice-N-Green Plant Foods, Romeoville, IL. "The main consideration is whether these nutrients are available when needed without harming the plant. The type of fertilizer you buy needs to fit into your maintenance program and budget, and that goes beyond a simple comparison of the price of products."

Today's turf manager has a much broader selection of fertilizer products to choose from than he did just ten years ago. For decades, the choice was simple—natural organic fertilizers for slow-release and synthetic products for quick-release. Nearly all products were granular, applied with spreaders. If the color or vigor of turf began to fade, the solution was to apply more.

Now there are quick- and slow-release fertilizers in both dry and liquid formulations. In most cases they can be spread or sprayed onto the turf in combination with other chemicals. Different nutrient sources can be mixed to stimulate growth for a period ranging from two weeks to four months. Slow-release fertilizers allow a larger amount of nitrogen to be applied at one time without "burning" or overfeeding the turf. They also regulate the release of nutrients to reduce loss caused by leaching, runoff, or evaporation.

Research over the past 25 years has increased our understanding of turfgrass nutrition. Not only do we have a clearer picture of what the plant requires and when, we also have a greater insight into the effects of soil texture, moisture and chemistry on availability. Now researchers are looking more closely at the fate of fertilizers in the soil. All this information is of value to you whether you are responsible for a golf course, athletic field, park, school, or resort.

Any discussion of fertilizers begins with nitrogen. But experience has shown that equal consideration of all macro- and micronutrients is needed to have adequate control over our fertilization programs. By knowing your choices, you can use a combination of fertilizer products to meet the high standards and use placed upon natural sports surfaces today.

A complete fertilizer with micronutrients.

The most basic principle in fertilization is that plants absorb nutrients after they have broken down and been dissolved in water.

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Until this happens, fertilizers are of no immediate benefit to the plant. Anything disrupting this process reduces their effectiveness. For example, root absorption of nutrients is hampered by soils that are either too wet or too dry. Soils that are compacted, too alkaline or too acid also harm fertilizer performance.

Some nutrients can also be absorbed through the leaves. Foliar absorption can occur when the appropriate form of the fertilizer is applied to turf with water or when a dry product comes in contact with moisture on the surface of the leaves. For this reason, soluble, quick-release fertilizers should be applied at low, safe rates or to dry turf.

The most soluble and fastest acting nitrogen sources currently on the market include urea, ammonium nitrate and ammonium sulfate. Urea is actually a man-made organic fertilizer, but it acts more like inorganic products with its high solubility and rapid breakdown to nitrate or ammonia, the forms plants can absorb. Ammonium nitrate and ammonium sulfate are called synthetic inorganics. All three of these nitrogen sources are subject to loss through leaching and volatilization and must be used with caution to avoid burning the turf.

"You have to be careful with soluble fertilizers, especially during hot weather," warns Dr. Paul Sartoretto, techical advisor

Soluble fertilizer packaged in dry form.

for Cleary Chemical in Somerset, NJ. "But the turf manager wants the quick response they provide. Most slow-release products contain some portion of soluble nitrogen for this reason."

Manufacturers have taken two different tacks to extend the nitrogen release period of soluble fertilizers. The first is to coat products such as urea with sulfur or plastic. The urea escapes through holes or cracks in the coating and enters the soil solution over a period of time, often two months or longer. O. M. Scotts, Lesco, and CIL pioneered sulfur-coated ureas. Sierra Chemical makes plastic-coated products.

The other tactic used to control release of nitrogen is to react urea with other chemicals to make part of the urea insoluble. Instead of a coating, strong chemical bonds tie up the urea until they are broken down over time by microorganisms or soil moisture.

IBDU (Par-Ex) is made from one process. It is broken down slowly by water. Ureaform, manufactured in a slightly different way, is broken down by microorganisms in the soil. These organisms require heat and moisture to do their job. During periods of drought or low temperature, the release of nitrogen from ureaform slows. However, ureaform can be combined with water without breaking down. This has enabled fertilizer manufacturers to develop sprayable formulations of ureaform. A few examples are Blue Chip Nitroform (Nor-Am), Formolene (Georgia Pacific and Nice-N-Green), Fluf (Cleary), N-Sure (Triazone Corp.), and Coron (Coron Corporation).

Both coated products and reaction products enable the turf manager to apply a high rate of nitrogen to turf at one time with relative safety. Furthermore, the insoluble portion is not prone to leaching or volatilization.

Slow release of nitrogen is also available from natural organic fertilizers, such as Milorganite. The primary difference between the synthetic organic products and

natural organic ones is the percentage of nitrogen related to volume. Activated sewage sludge may be five or six percent nitrogen, while ureaform products can contain nearly 40 percent. Higher concentrations also simplify shipping, storage, and application.

All nitrogen fertilizers eventually break down to nitrate. In this form they have the potential to be carried into the soil by water, either from irrigation or rainfall. The potential for leaching is greatest in high-sand soils and lowest in clay or loam soils. Still, there is no evidence to support a charge that greens or fields containing a high proportion of sand are prone to significant nitrate leaching.

Dr. Martin Petrovic, turf specialist at Cornell University in Ithaca, NY, recently recommended the following strategy for protecting groundwater from nitrate contamination. First, apply light rates of nitrogen or use slow-release sources. Avoid fertilizing when turf is naturally slow-growing, especially in cool weather.

Irrigation systems should be capable of accurately applying only the amount of water needed by the turf to reduce the chance of leaching. Petrovic suggests reducing the size of "heavily managed" areas, planting low-maintenance grasses where practical, and amending soils to retain nitrogen. In cases where nitrates from fertilizers are found in drainage water, the water should be recycled through the irrigation system. It's important to note that a certain amount of nitrate is typically found in natural water sources.

Phosphate is the other contaminant occasionally linked to fertilizers. However, in turf applications, phosphorus is so immobile that core aeration is frequently recommended to get this important nutrient deeper into the root zone where it is needed. In some instances, phosphorus is so tied up by clay and minerals such as iron and aluminum that not enough is available for uptake by the roots. Phosphorus deficiency is also common in soils with either high alkalinity or high acidity.

Many soils are rich in phosphorus, but sometimes it's just not available. Plants absorb this nutrient when it is broken down into oxide ions. The phosphorus source must placed on the surface for seeding and incorporated into the root zone for established turf.

Superphosphate and treble superphosphate are frequently used during establishment. The oxide content of treble superphosphate is considerably higher than standard superphosphate, making it more practical for fertilizer mixes.

Both products reduce the acidity of soils and can increase problems in alkaline situations. For this reason, fertilizer manufacturers treat superphosphate with ammonia to create monoammonium and diammonium phosphates. These products have an acidifying effect on soils and can also serve as an added source of nitrogen. Turf managers with acid soil conditions should use the superphosphates or calcium metaphosphate, a product with a high oxide content that also decreases acidity.

There is no evidence that greens or fields containing a high proportion of sand are prone to significant nitrate leaching.

Unlike phosphorus, potassium is soluble in water and will leach. Frequent use of nitrogen sources containing ammonia will also reduce the amount of available potassium in the soil. For these reasons, potassium levels need to be restored on a regular basis, especially for turf receiving heavy wear.

Two things to look for in potassium carriers are the amount of chlorine and nitrogen they contain. Chlorine increases the salt index and burn potential of the fertilizer.

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Muriate of potash (potassium chloride) is almost 50 percent chlorine. Potassium sulfate contains very little chlorine but has an acidifying effect on soils due to its sulfur content. Sulfate of potash (potassium magnesium sulfate) also has a low salt index, will acidify soils slightly, and is a good source of magnesium, one of the frequently overlooked macronutrients.

Potassium nitrate is incorporated in fertilizer mixes, since it contributes both potassium and nitrogen. It also has a low salt index and does not have an acidifying effect on soils. However, it is considered a fire hazard and repeated use can cause a breakdown in soil structure.

Nitrogen, phosphorus and potassium are the "big three" in turfgrass fertilizers. When they are all incorporated into a fertilizer that product can be called complete. Early complete fertilizers were mixtures of individual granular products. Keeping the mix uniform during shipping, storage and application was a problem.

To solve this problem, manufacturers of complete fertilizers treated inert carriers, such as crushed corn cobs or perlite, with each nutrient. In this way, all particles had the same analysis. The same uniformity can also be achieved with coated, slow-release products. A benefit of homogeneous fertilizers is that they can also be used to carry herbicides, fungicides, or insecticides.

One limitation of dry products is that you have to accept the analysis of the fertilizers available. You can adjust the rate during application, but not the relative percentage of the components. You also have to depend on factors such as irrigation and weather to get the nutrients into the soil where the plant can utilize them.

Liquid chelated source of nutrients other than nitrogen.

This is not a problem for most sports turf managers. However, some golf course superintendents want more control. They want the ability to "spoon feed" nutrients to the turf at low rates. To do this, they require soluble products that could be applied with a sprayer or injected into the irrigation system. A number of companies today offer an assortment of soluble fertilizers for this purpose. In most cases, superintendents use solubles to supplement applications of slow-release fertilizers. They may also use solubles to give turf a slight nutrient boost when spraying for diseases or insects.

As sports turf managers strive for greater control over their swards, they are discovering the importance of other nutrients. For example, sulfur isn't just an acidifying agent, it is also a nutrient required by turf for growth. Since you may be applying sulfur already as a component of other nutrients or gypsum, additional amounts are probably unnecessary. Acid rain and organic material in the soil are sources of sulfur. If you do apply elemental sulfur, just be aware that it must be watered in immediately to avoid foliar burn.

Calcium is a major nutrient for turfgrasses as well as a factor in the utilization of potassium and magnesium. It has also been credited with reducing the loss of nitrogen to volatilization.

A calcium deficiency hampers root development and resistance to diseases such as *Pythium* and red thread. Perhaps its most important role is its beneficial effect on soil structure and chemistry.

Dolomitic limestone is the main source of calcium in turf maintenance. Since lime is needed to raise the pH of acid soils, it makes sense that calcium tends to be deficient in such soils. Sports turf managers with acid soils should use nutrients such as superphosphate that contain calcium. Those with alkaline soils can provide calcium by applying gypsum.

Magnesium is the sixth macronutrient required by turfgrasses. Plants use magnesium to make chlorophyll, so a lack of this nutrient can affect turf color. They also use magnesium to help distribute phosphorus throughout the plant. Phosphorus applied in fertilizers will be wasted if there is a deficiency of magnesium.

Problems with magnesium are seen most often on sandy, acid soils that are heavily irrigated. The problem can be solved in many cases by correcting soil pH. Supplemental magnesium is readily available from fertilizers such as sulfate of potash, superphosphate and potassium sulfate. Dolomitic limestone provides a slower release of magnesium.

Some turf managers today may question why iron is considered a micronutrient. Many find themselves applying more iron than sulfur, calcium or magnesium. They often use it to gain a deeper green color without applying more nitrogen. Stadium managers and golf course superintendents use iron to improve color before major events.

Liquid slow-release fertilizer.

The term "micro" really applies to the amount of nutrient required by the plant. Normally, turf does not need significant amounts of iron. However, golf and sports turf is not normal turf.

Iron, like most of the other micronutrients, is mainly a problem in alkaline soils. Lower the pH, and you frequently solve the problem. High pH makes the micronutrients unavailable to the plant.

Since iron is fairly soluble, it is easily leached out of soils and can be absorbed by turfgrass leaves as well as roots. The problem is keeping available iron around. Foliar applications of iron sulfate or ferrous ammonium sulfate provide a fast, short-term solution to iron deficiencies. For a longer-term solution, the iron must enter the soil in a form that releases slowly.

Some natural organic fertilizers contain slow-release iron. However, if you want to apply such iron alone the answer is chelated iron. Basically, this is iron tied up with other organic materials. As the organic material breaks down, the iron is released into the soil solution.

If soil tests indicate that your soil lacks other micronutrients, such as boron, copper, chlorine, manganese, molybdenum, or zinc, consult your extension turf specialist or manufacturer's technical representative before making any moves. They will know how to handle micronutrient problems, especially in cases of high-sand greens or athletic fields.

Some professional turf fertilizers contain trace amounts of micronutrients. Chelated forms of iron, copper, maganese and zinc are also available. Iron is relatively safe. However, the other micronutrients can build up to toxic levels if you aren't careful.

Take a close look at the labels of fertilizer products you buy to discover the nutrient sources they contain. Compare them to the characteristics above.

Only you know the special needs of your turf. Adjust your fertilization program to fit these needs. Not only will you achieve better control over your fertilization program, you will also have a better understanding of the effects of fertilizers on the environment.