Sports Turf Nutrition
A Special Diet For High

Ground-driven rotary spreader.

Statisticians keep records on some strange yet important facts. For example, people spend more than a third of their life sleeping, more than a fourth of it working or commuting to work, and nearly a tenth of it eating. With all that time invested we should concentrate on making the most of it.

If these same statisticians evaluated the daily routine of sports turf managers, they would no doubt find a large portion of their day is spent on the basics of mowing, fertilization and irrigation. There are other, more exciting aspects of the job that draw their attention away from the basics, but the best sports turf managers remain vigilant to their skill in the basics.

To the novice, fertilization seems simple, yet it is the most complicated of the basic management practices for sports turf. Fertilization provides the diet of the turfgrass plant. A poor diet results in weak turf incapable of recovery from the wear inflicted upon it by sports. A rich diet results in lush turf that is vulnerable to diseases and insects, requires more mowing than necessary, and favors foliage growth at the expense of important root growth.

PTO-powered pendulum spreader.

The sports turf manager must determine the amounts of important nutrients needed by high-use turf and the rates at which they need to be replenished. These amounts will typically be different than amounts considered adequate for utility or lawn turf. Turf under stress utilizes nutrients differently than turf in a standard lawn situation. Without a special diet, sports turf is unable to recuperate and will deteriorate with repeated field use.

The amount of nutrients required by sports turf is greatly influenced by the condition of the soil. As mentioned in the article in the September issue by Eliot Roberts and Fred Grau titled *The Living Soil*, clay and humus particles in the soil serve as storage and exchange sites for nutrients. The amount of clay and humus in the soil will affect the amount of fertilizer that needs to be applied during the growing season. Greens, tees and some athletic fields are constructed largely of sand to improve drainage and prevent compaction. These areas typically require more frequent applications of nutrients than clay/loam soils.

The acidity or alkalinity of the soil can also impact fertilizer rates. The measurement used to describe soil acidity/alkalinity is pH. Even though sufficient levels of nutrients may be present in the soil, they may not be fully available to the turfgrass roots when the pH is below 5.5 or above 7. Sports turf soils should be amended to be within this range so the full benefit of fertilizer is obtained. It should also be noted that acidity or alkalinity can hamper the decomposition of thatch and organic matter in the soil.

To lower the pH in alkaline soils or sites irrigated with alkaline water, apply sulfur in the fall or spring after aeration. Fertilizers containing sulfur can also be used in a maintenance program to slowly reduce the pH of alkaline soils. Some of these are ammonium sulfate, sulfur-coated urea, potassium sulfate, sulfate of potash and ferrous sulfate.

The pH of acid soils can be raised by applying lime or dolomitic limestone to the turf in the spring or fall after aeration. Fertilizers containing sulfur should be avoided on turf with acid soil conditions. Correcting soil pH problems may take a series of applications of soil conditioners.

Soil testing is the first step to achieving

Traffic Areas

a balanced turf diet. Every sports turf manager should have a soil probe in his vehicle to pull plugs for soil testing. Pull three or four plugs from each critical turf site and mix them together in an envelope. The soils lab can provide envelopes for this purpose. A two week wait from the time you send the samples to the lab until you receive the results is typical so send in the samples a few weeks before you intend to fertilize.

A $40 investment in soil testing can save hundreds of dollars in fertilizer or pesticides during the year. The test results should provide soil pH, soil type, organic matter content, and levels of all major and minor nutrients. An additional test that provides the sports turf manager with valuable information is a percolation test. This test rates the soil on how well water drains through it. Most soils labs provide recommendations for correcting soil and nutrient deficiencies. By repeating these tests periodically and recording all fertilizer applications as they are made, you will have a good handle on turf nutrition.

These tests help you select the right amounts and combinations of nitrogen (N), phosphorus (P) and potassium (K) and other nutrients for your fertilizer program. However, it is up to the sports turf manager to select from a wide variety of sources for each of these nutrients. He can purchase each of the primary nutrients separately or buy "complete" fertilizers that have been premixed or formulated to contain nitrogen, phosphorus and potassium. Dry, premixed fertilizers are less expensive than formulated products. The dry components are carefully mixed together by the manufacturer, but the individual components may not remain perfectly mixed when applied with rotary spreaders. The heavier particles in these fertilizers can be thrown farther than the lighter particles by the spreading mechanism.

Manufacturers also formulate fertilizers to combine all the nutrients onto particles of a "carrier," such as ground corn cobs, clay or perlite. This eliminates inconsistencies when the products are applied and provides the same proportion of nutrients evenly to the turf. Both mixed and formulated dry fertilizers should be watered into the soil soon after application.

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Gravity feed drop spreader.

Ground-driven boom sprayer.

Engine-powered boom sprayer on truckster.

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Application uniformity is also high when fertilizers are applied as liquids. Nutrients that are in liquid form, soluble in water or that can be suspended in water are available. As long as these materials are compatible with others in the same tank, they provide very even distribution to the turf area.

In all cases, spreaders and sprayers should be checked and recalibrated before applying fertilizers to make sure distribution of the granules or sprays is equal across the width of the swath. One method of avoiding potential problems with gaps or overlaps is to apply a half rate of the material in two directions. A colorant can be added to liquid fertilizers for visible proof of skips and overlapping. Use the same spreader or sprayer to apply fertilizers to an important turf area to avoid inconsistencies caused by differences in the equipment.

Fertilizers, whether they are mixed or formulated, complete or incomplete, liquid or dry may contain a wide variety of nutrient sources. The sports turf manager needs to know how these different nutrient sources will affect his turf.

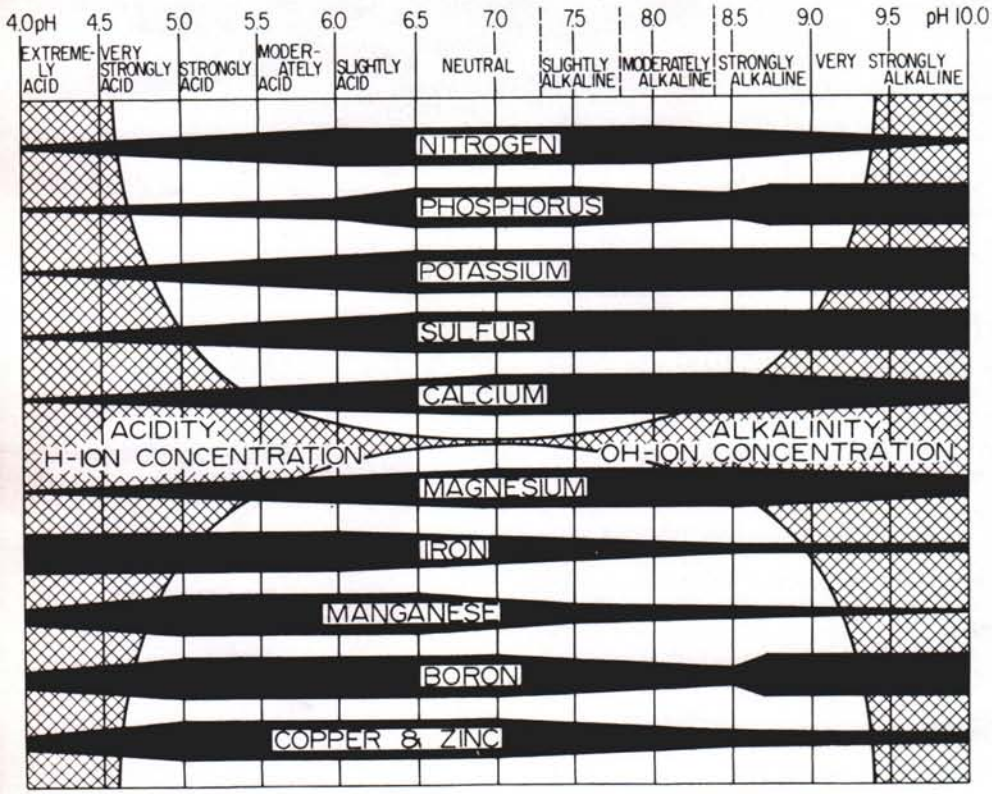
The most important component is nitrogen. Each nitrogen source has its own burn potential and rate at which it releases nitrogen. Commercially produced organic fertilizers, such as CompGro and Milorganite, contain a low percentage of nitrogen and release it slowly as they break down. Their burn potential is extremely low. However, it takes larger amounts of these products to provide the same amount of nitrogen as other sources.

Urea, ammonium sulfate, ammonium nitrate and potassium nitrate are synthetic (man-made) sources of nitrogen. They are also the most economical sources of nitrogen for turf. However, these synthetics contain much greater percentages of nitrogen than organic sources, release it much faster and have higher burn potentials. The sports turf manager should check his application equipment and rates carefully when using these products.

These quick-release fertilizers can be compared to sugar. Sugar breaks down quickly in water and provides the person who consumes it with a short burst of energy. Quick-release fertilizers give turf a fast burst of growth and color and last just a few days. They provide no long term benefit to the plant.

Chemists developed two basic ways to slow down the release rate of synthetic nitrogen fertilizers. The first was to chemically bond nitrogen to other elements through a reaction process. Ureaformaldehyde (Nitroform) and isobutylidene diurea (IBDU, Par-Ex) are synthetic fertilizers that release nitrogen over many weeks. Even though they contain a relatively high percentage of nitrogen, their slow release rate gives them a very low burn potential.

Ureaform is really a group of compounds created simultaneously by reacting urea with formaldehyde under controlled conditions. These products release nitrogen as microbes in the soil break them down. Changes in microorganism activity will alter the rate of release. Low soil temperature reduces microbial activity and slows the release of nitrogen.



The availability of fertilizer nutrients in the soil can be changed by soil pH. Chart courtesy: American Society of Agronomy.

By changing the conditions under which urea and formaldehyde are reacted, slightly different fertilizers are produced. A number of these are categorized as methylol ureas or methylene ureas. These slow-release fertilizers also contain a certain portion or their nitrogen in the form of urea.

IBDU is created by reacting urea with isobutyraldehyde. Water in the soil slowly decomposes the IBDU releasing the urea contained in it. The two things that influence the rate of breakdown of IBDU are the size of the particle and the amount of moisture in the soil. Small particles break down faster. Nitrogen release will be slowed by dry soils.

Slow-release fertilizer can be applied less frequently while still providing the turf with sufficient nutrients.

The second method of slowing down the nitrogen release rate of synthetic fertilizers is by coating them. The most economical method of coating to date involves sulfur. Through a process that coats urea droplets with widely varying thicknesses of sulfur, fertilizer manufacturers are able to control the amount of nitrogen escaping through cracks and imperfections in the coating. It takes weeks for all the nitrogen to escape from sulfur coated urea. Lesco Inc., Scotts, and CIL have SCU plants.

A more expensive coating process utilizes plastic. The advantage of a plastic coating is a more predictable rate of release through precise pores in the plastic. The coating can also be much thinner and contain a number of different quick-release fertilizers, including urea, ammonium nitrate and ammonium phosphate. The rate of nitrogen release from plastic coated fertilizers increases with temperature. Manufacturers are continuing their research on plastic-coated fertilizers in order to produce a low cost version in the near future. Sierra Chemical's Osmocote is a plastic coated fertilizer. Estech and Scotts also have products under development in this category.

Slow release nitrogen sources have three primary advantages. The most obvious is the extended amount of time they release nitrogen into the soil. By utilizing slow-release fertilizers, the turf manager can apply fertilizers less frequently while still providing the necessary nutritional benefits to the turf. Finally, the slow rate of release greatly reduces the chance of fertilizer burn.

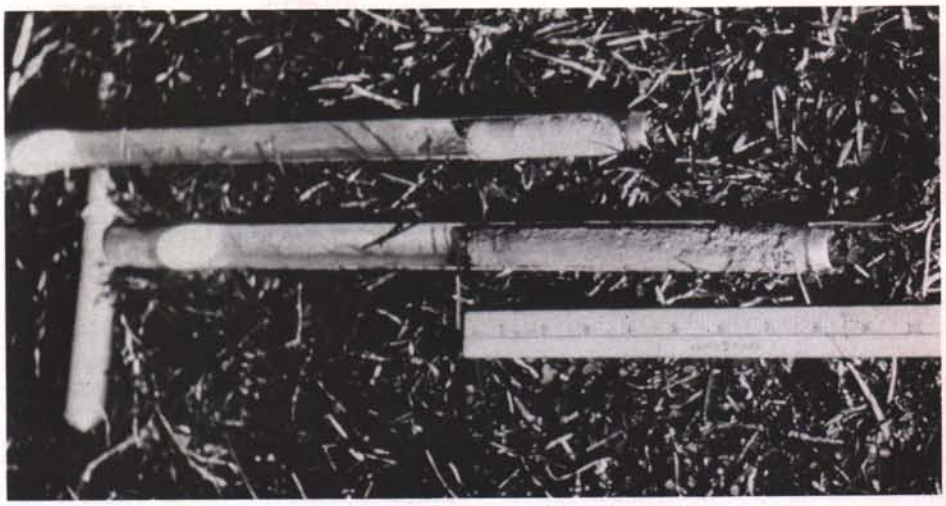
While fertilizers containing slow-release nitrogen cost more for the amount of nitrogen delivered, they reduce the risk of fertilizer burn and provide a nutrient base for

the turf. Many sports turf managers apply fertilizers that contain half or more of the nitrogen in slow-release form. Supplemental applications of quick-release nitrogen can be made to help turf recover from the wear and tear of sports as well as damage from insects and diseases.

While potassium may be listed third in fertilizer analysis ratios, it is second only to nitrogen in importance for established turf. All parts of the turfgrass plant contain potassium. It is vital for nearly all biological reactions taking place within the plant. Without adequate levels of potassium, the health and recuperative potential of sports turf is severely reduced.

Potassium is linked to improving the winter hardiness, drought tolerance and disease resistance of turf. You could call it the vitamin C of the turfgrass plant. It is essential for proper storage of carbohydrates in turfgrass roots and the overall health of the root system. Without a healthy root system sports turf will not provide a reliable, long-lasting surface.

Due to the utilization of this nutrient by the turf and its movement through heavily irrigated, high sand content soils frequently found in sports turf, potassium levels in the soil need to be replenished regularly. In fact, this may be the element you should watch most closely in soil testing. Potassium deficiency is recognizable as stunted growth, discoloration and rolling of leaf tips and yellowing of older leaves. It is not uncommon to apply a half pound of potassium for each pound of nitrogen.



Every sports turf manager should have a core sampler in their vehicle.

The two primary sources of potassium in fertilizer are potassium chloride and potassium sulfate. Some caution is advised when making separate applications of potassium chloride since it has approximately the same burn potential as urea. Potassium sulfate has a lower burn potential and also provides a slight acidifying effect on alkaline soils. Its use on problem acid soils is not advised.

Potassium nitrate is more expensive than the previous two products and also has a burn potential about the same as urea. Monopotassium phosphate has a very low burn potential but is priced higher than all other potassium sources.

Phosphorus is important to young turf and overseeded turf areas. It contributes to proper root development in seedlings as well as the overall growth of the turfgrass plant. It is important to turf like the calcium in milk is important in the diet of newborns and children. Seedlings in a phosphorus deficient soil will have a red cast instead of bright green.

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Phosphorus does not move through soils as rapidly as nitrogen or potassium. However, much of it is tied up chemically in the soil, especially in soils outside a pH range of 5.5 to 7.5. By correcting soil acidity or alkalinity, existing phosphorus in the soil will become available. Minerals and organic matter in the soil also provide a natural sourse of phosphorus but at a very slow rate. For these reasons, soil tests are designed to measure orthophoshpate, the form of phosphorus most readily available to the plant.

Most phosphorus sources have a relatively low burn potential and can be applied separately with relative safety. Superphosphates are the most commonly applied source of phosphorus for dry applications. The amount of available phosphorus ranges from 20 percent to 50 percent for triple superphosphate. Monoammoinium phosphate and diammonium phosphate are frequently used for liquid fertilization. Monoammonium phosphosphate is recommended for use on alkaline soils. Excessive applications of phosphorus, especially on alkaline soils, should be avoided when possible since they can tie up iron and make this important micronutrient unavailable to the turfgrass plant.

Iron is the micronutrient of chief concern to sports turf managers. Sandy soils, alkaline soils and waterlogged soils frequently lack sufficient levels of iron. Turf has a sickly yellow appearance termed chlorosis when levels of iron are inadequate. Turf specialists recommend application of chelated iron to correct deficiencies. This iron source is less likely to cause injury to turf than salt forms such as iron sulfate and ferrous ammonium sulfate and remains available to turf for a longer period of time. They are, however, more expensive.

Iron deficiencies can sometimes be solved by correcting alkaline soil conditions or by improving drainage.

Iron deficiencies can sometimes be solved by applying sulfur to correct akaline soil conditions or by improving drainage. Excessive applications of iron can turn turf almost black. However, light applications are being used by some sports turf managers to achieve a darker green shade for turf without using additional nitrogen. In severe cases, applications of iron may be needed every few weeks until the problem is corrected.

Sulfur is also deficient in many soils. It is a vital component of many plant reactions as well as an acidifying agent. In addition to elemental sulfur, many fertilizers contain certain amounts of sulfur, including ammonium sulfate, potassium sulfate, superphosphate and sulfur-coated urea.

Ocassionally calcium, copper, magnesium, manganese, and molybdenum are lacking in sandy soils in certain parts of the country. Calcium and magnesium deficiencies can be corrected with dolomitic limestone. Many complete fertilizers contain small quantities of these micronutrients. Foliar-applied sources are also available for rapid correction of micronutrient deficiencies.

Due to the extensive use of sports turf, it has a higher nutrition requirement than utility or lawn turf. Bentgrass and bermudagrass used for sports require the most nitrogen during the growing season. Bentgrass fairways need almost a pound of actual nitrogen per 1,000 square feet per month during the growing season while greens often receive more. Bermudagrass greens also receive a pound or more of nitrogen per month. Hybrid bermudagrass fairways or sports fields need between 1/2 and 3/4 pound of nitrogen per month. Common bermudagrass on fairways and fields requires half as much as nitrogen as hybrid bermudagrass. Nitrogen rates may need to be adjusted upward for sand-based root

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zones and according to the amount of play on the turf.

Kentucky bluegrass requires more nitrogen than perennial ryegrass, tall fescue, St. Augustinegrass or zoysiagrass. Kentucky bluegrass on high use fields and fairways may need as much as a pound or more per month, while the other turfgrasses perform well on between half and one pound per month. Annual bluegrass also does well on soils with moderate to high fertility.

Maintenance programs with low fertilizer budgets can possibly get by with bahiagrass, centipedegrass, red fescue and possibly tall fescue. The newer, turf-type tall fescues however, require more nitrogen than the forage types such as Alta and K-31.

The higher the sand content of the root zone the more frequently fertilizers will need to be applied. A high portion of fertilizer applied to sandy root zones should be slow-release.

The manager of a cool-season turf sports field on a tight budget should make every effort to apply no less than three pounds of nitrogen per year. This can be divided into three applications, the most important being in the fall at the end of the football season. Applications in spring and late summer should also be made.

Golf course superintendents in the North should add a fourth application of fertilizer in the early spring for fairways of Kentucky bluegrass and/or perennial ryegrass. Bentgrass fairways would possibly require a fifth application. Monthly fertilization is advised for bentgrass greens during the playing season.

Managers of athletic fields of common bermudagrass, centipedegrass or bahiagrass should fertilize no less than twice per year and preferably three times. If the turf is hybrid bermudagrass, try to make four applications, but avoid late winter or early spring. If the bermudagrass is overseeded in the fall, do not fertilize for a month prior to overseeding. You want to slow the bermuda down so it will not compete with the annual or perennial ryegrass.

Golf course superintendents with hybrid bermudagrass fairways and greens should be on a monthly program from late spring to a month prior to overseeding. The fertilization program then continues for the ryegrass. Southern superintendents with bentgrass greens need to be extremely cautious about fertilizing these greens during the summer and follow a preventative disease control program.

With the extremely high use of golf courses and sports fields today, fertilizer requirements are increasing. There is no such thing as permanent, low-fertility sports turf. Poorly-fed turf will require annual renovation at a cost much higher than a properly scheduled fertilizer program. Fortunately, there are excellent slow-release fertilizers which help reduce the number of fertilizer applications. They will reduce the labor to apply fertilizers, but not the cost of the fertilizers themselves.

In a way, fertilization is like irrigation. You must first make a commitment to quality turfgrass. Once that commitment is made it has to be followed up with continuing maintenance and support. You paid for the hardware, now you have to pay for the water and keep the system performing at its designed capacity.

Realistically, to provide quality sports turf you must make a commitment to quality turfgrasses which have moderately high fertility requirements. To invest in quality sod or seed and then deny the turf the nutrients it needs to withstand sports is a complete waste. Fertilizer is not an area for budget cuts. If you have to cut the fertilizer budget, you might as well write off the field or fairway.

Finally, the home lawn expert does not understand the additional fertilizer requirements of sports turf. Utility and lawn turf have entirely different needs. Sports turf must be kept on a much more sophisticated diet than utility and lawn turf. That diet has been standard on golf courses for years, but lacking on sports fields. There is little difference between the two as far as the nutrient needs of the turf if it is to provide a permanent cover under heavy use.