SOIL FERTILITY AND FERTILIZERS

The backbone of any good turf care is a well-designed fertility program. All lawns need fertilizer applications to produce density and color. Here are some factors to consider.

by Bill Bedrossian, Servicemaster MLP

The turf condition that Americans try to develop is not a natural system. Natural turfgrass stands are mixtures of plants including weeds. These plants are both unattractive and may not cover the soil from year to year. The density of plant population is also unnatural. We are trying to develop a turfstand with many times the normal plant population. The ideal lawn is dense and uniform in both color and texture. It is only through good nutrition of the turf plant that we enable it to outcompete the constant encroachment of weeds.

The only reliable method of determining the fertilizer needs of a lawn is through a soil test to reveal the soil's native fertility. The test will pinpoint potential problems you could not be aware of.

The nutrient requirement for good turfgrass growth is usually much less than the soil's total nutrient content. However, much of the nutrient supply is stored in the soil's mineral and organic matter fraction. In order for a soil nutrient to be available to the plant root, it has to be in solution.

Proper soil aeration is also necessary for roots to take up the fertilizer nutrients.

Nutrient uptake

Since fertilizers are one of the main expenses in a lawn care program, it is important to understand the factors influencing uptake to maximize the response. The depth and extent of rooting affects how well the plant picks up nutrients. Well-developed root systems are in contact with more soil solution and have greater surface area to absorb nutrents.

PH is a second factor affecting nutrient uptake. As the pH values move

Bill Bedrossian received his bachelor's degree in plant sciences from Havorford College. He currently manages more than 31,000 acres of turf at ServicMaster MLP as director of grounds management.

out of the 6 to 7 range, plant nutrients become insoluble compounds. Since the roots only absorb nutrients in solution, those insoluble materials are not available to the roots. A good example is that phosphorous, in either an acid or alkaline soil, becomes an insoluble compound in the soil after being applied as a fertilizer.

Essential nutrients

An element is essential if a deficiency of the element makes it impossible for the plant to complete its life cycle. The deficiency can only be corrected by that element The following table lists the essentlal elements, their symbols and the source.

Nitrogen

Nitrogen is used in turfgrass fertilization in greater amounts than any other element. It has a greater impact on the turfgrass plant than any other element and is a constituent in every living cell and part of the chlorophyll molecule that determines the green color of the leaf. Nitrogen results in a darker green color and improves the overall quality of the plant unless applied in excessive amounts.

Nitrogen applications accelerate growth of shoots, rhizomes and roots. However, excessive rates inhibit root and rhizome growth. Excessive shoot growth at very high rates will deplete carbohydrate reserves for the rest of the plant. This leads to the death of the root system.

The nitrogen level directly relates to color and shoot density. As levels decrease, color lightens, and shoot density decreases.

Nitrogen nutrition also influences disease severity. High nitrogen levels increase the severity of brown patch, Fusarium blight, leaf spot and Ophiobolus patch. At low levels of nitrogen nutrition, dollar spot, red thread, powdery mildew and rust increase in severity.

Resistance of cold, heat, and drought stress can be modified by the nitrogen nutrition level. Very low or excessive rates will have a negatlve effect. High levels of nitrogen enhance wilting by decreasing root mass and increasing the leaf tissue's succulence.

Late fall fertilization with nitrogen has a dramatic effect on root growth. No other period in the year produces the same root response.

Even though the turf plant is surrounded by tons of atmospheric nitrogen (air is 78% N_2), this form cannot be used by plants. The most common form used by plants which the roots can absorb is the nitrate ion (NO_3^-).

Urea is the most common form of nitrogen used to fertilize turfgrass. If heavy rainfall occurs, it may be washed through the soil or leached. If soil aeration is poor, the anaerobic (no oxygen) bacteria will convert the nitrates to gaseous nitrogen. In both of these processes, leaching and denitrification, nitrogen is lost from the soil.

The last possible fate is immobilization back into the soil organic matter. Some groups of bacteria need nitrates as part of their nutrition. As bacteria die with nitrates in their bodies, we say the nitrates are immobilized but not lost from the soil.

Phosphorus

Phosphorous is an essential element found in every living cell. It is necessary for energy transfer in each cell. It is extremely important to establish new seedlings. Since it is very immobile in the soil, it accumulates near the surface.

Outside the 6.5 to 7.5 pH range, phosphorous ions become insoluble and unavailable to the plant.

Potassium is unique compared to the other major elements. It does not

continued on page 48

Granular fertilizers remain the most popular type of nitrogen source in the landscape market. Liquid fertilizers, which are sprayed on the grass, are second.

Table 1

ESSENTIAL MINERAL ELEMENTS FOR TURFGRASS

Quantity Usage	Element	Chemical Symbol	Source
Macro	Nitrogen Phosphorus Potassium Sulfur Calcium Magnesium	N P K S Ca Mg	Soil
Minor	Iron Manganese Boron Copper Zinc Molybdenum Chlorine	Fe Mn B Cu Zn Mo Cl	
Macro	Carbon Hydrogen Oxygen	C H O	Carbon Dioxide Water Water
Macro Acronym	C HOPKINS	CaFe Mg	

become a part of the cell. However, large quantities are needed to ensure the development of the plant.

Turfgrasses do not show the dramatic visual response to potassium that they do to nitrogen. Unless there is a great deficiency in the soil, you will not see color, density, or growth changes with potassium applications. However, potassium will have a positive effect on root growth, wear tolerance, ability to withstand environmental stress and disease resistance.

Fertilizers

All fertilizers, whether liquid or granular, require labeling mandated by state agencies. It is a legal requirement to state on fertilizer labels:

- The percent of each element; always in the same order, N/P/K (nitrogen/phosphorous/potassium (ie: 18-5-9 means that the bag contains 18% nitrogen, 5% phosphorous and 9% potassium).
- Under the nitrogen is a list of nitrogen carriers and their portion of the total nitrogen.
- The primary nutrient list describes the basic fertilizer materials used to make the fertilizer.
- The net weight stated at the bottom tells you the total weight of the fertilizer. This weight, multiplied by the percentage of each element, equals the weight of each element in the bag (i.e., .18 × 50 lb. = 9 lb. of N in the bag).
- Potential acidity statement tells you that the fertilizer, when applied to the soil, has an acid-forming reaction. In some areas, calcium carbonate (lime) is applied to neutralize the acid effect caused by fertilizer on the soil surface.

With proper balance of water soluble and water insoluble nitrogen, you can achieve a quick green-up from the WSN and then a sustained color and growth from the WIN.

Complete fertilizers

Fertilizers containing all three elements, N-P-K, are called complete fertilizers. Incomplete fertilizers have one or more of the elements missing, such as 20-0-5. Straight goods fertilizers are one material like urea, 46-0-0. The question often asked is, "Why don't the percent numbers add up to 100?" These fertilizer materials are compounds instead of pure elements. For example, urea is a compound made of nitrogen, carbon and oxygen. The pure element is either unstable or maybe a form which is useless to the plant.

If excessive amounts or improper fertilizers are applied to the turf, you burn the grass. When fertilizer dissolves, it forms a salty solution which, if saltier than the solution inside the plants, will actually draw the water out of the plant. This dried, brown condition is actually a desiccation of water. If severe, the grass dies. However, burns normally are temporary and recover.

The higher the salt index, the greater the potential to damage the turf. The selection of materials is based partially on these salt indexes to give you a high degree of safety.

Carriers

Nitrogen sources can be broken down into water soluble and water insoluble materials. The water soluble materials (WSN) are generally inexpensive, fast-acting and have a high burn potential. Water insoluble nitrogen (WIN) is more expensive, longer-lasting and has a low burn potential.

With proper balance of WSN and WIN, you can achieve a quick green-up from the WSN, then a sustained color and growth from the WIN.

These combinations give you a high degree of safety from turf burns at a good price. Urea is the most common nitrogen carrier used as a water soluble source on turfgrasses.

Urea—Urea is used as a quick-releasing water soluble nitrogen source in many fertilizer applications. Although not in an available form as applied, it is quickly converted to NO_3^- in warm soils.

Urea formaldehyde—This is a nitrogen compound made by combining urea and formaldehyde to form various length compounds. The longer chain compounds take much longer to break down to NO_3^-. These materials are insoluble in water and require soil bacteria to break them down to NO_3^-. They will not break down in cold weather because the bacteria are not active then. Urea formaldehyde

Frankly my dear... I'll take grass

Both artificial turf and natural grass have advantages for the baseball player, but 90% of today's players don't prefer one to the other, says Hall of Fame outfielder **Billy Williams**. Grass, however, is more likely to sustain a career.
'We always say that artificial turf takes two or three years off a player's career," said Williams at the third annual Midwest Sports Turf Institute in Glen Ellyn, Ill. The first to go are a player's knees, says Williams, victims of continuous pounding on a hard surface.

He also reminded groundskeepers that "A good ground crew can mean the difference between a home team winning an extra five or six ballgames a year."

Match your turf with your sport

When planning to put grass down on your football, soccer, or baseball field, the most important characteristics to look at are a cultivar's growth and recovery rate, traffic and compaction tolerance, disease resistance and cultural intensity level, says Tom Voigt, assistant horticulturist at the University of Illinois, Urbana. Here's how Voigt sees each through the eyes of a groundskeeper in the Midwest:

Kentucky bluegrass has a good recovery rate, medium traffic tolerance (which can be improved by combining it with perennial ryegrass), medium to high compaction tolerance, medium disease resistance and a medium cultural intensity level.

Perennial ryegrass has a slow recovery rate but good traffic and compaction tolerance. "The newer varieties can be mowed lower and have improved disease resistance and cold/heat tolerance compared to the older varieties," says Voigt.

Tall fescue, despite a poor recovery rate, has good traffic and compaction tolerance, high disease resistance and medium cultural intensity and germination rate. A mix of 90% tall fescue and 10% Kentucky bluegrass may lead to one variety dominating the other. Voigt suggests mixing Tall fescues with a less aggressive bluegrass such as Bronco.

Creeping red fescues have a low traffic/compaction tolerance and disease resistance level. "I don't think fine fescues are going to play a big role in sports turf in the Midwest," concluded Voigt.

Creeping bentgrass, the "Rolls Royce" of the bentgrasses, recovers well but has poor traffic and compaction tolerance and low disease resistance. "This is a grass that you have to constantly work with to be successful."

breaks down over a period of three years on a schedule of 60% the first year, 30% the second year and 10% the third year. Urea formaldehyde can be finely ground to a powder to be sprayed as a suspension.

IBDU—Isobutylidine diurea is a slightly soluble nitrogen compound available in a coarse and fine granular form. It is a slightly soluble material releasing a little nitrogen each time it is exposed to water. As long as water is not freezing, it releases nitrogen independent of temperature. All of its nitrogen will be released the year of application.

SCU—Sulfur-coated urea (SCU) is not a truly water insoluble nitrogen source, but it is considered a controlled-release material. Water soluble urea is sprayed with molten sulfur and then sealed with wax. Since these coatings vary in thickness and imperfections, the coatings gradually break down over a 12- to 14-week period. This materlal is only applied as a granular fertilizer.

Turfgrasses do not show the dramatic visual response to potassium that they do to nitrogen.

Potassium carriers—Muriate of potash (KCI) and sulfate of potash (K_2SO_4) are the two most commonly-used sources of potassium (K). Muriate is much cheaper, but it has almost double the salt index of K_2SO_4. In sprayed materials where salt index is critical, the sulfate form is preferred. Often, high soil pH makes K_2SO_4 the preferred potassium source in a quality fertilizer.

Application

Application equipment is designed to apply granular fertilizers, liquids and suspensions. Insoluble fertilizers can be ground to a powder and sprayed as a suspension.

Sprayed fertilizer does not have to be strictly fast-acting. Since insoluble, slow-acting fertilizers can be suspended in solution, then can be applied by spraying.

Water soluble urea can be applied as a granular material or sprayed. The difference in quality between liquid or granular fertilizers is not how they are applied but what's in them.

Becoming familiar with the variety of ingredients available in a fertilizer will help you buy wisely and make the most effective use of your fertilizer dollar. **LM**