Soil Issues

The most important factor when growing any plant is soil. Soil provides water, nutrients, air, an anchor and support for plants, and a medium for microbe growth. Turf problems occur on soils that are excessively wet, dry, acidic, alkaline, infertile, prone to compaction, impenetrable, or full of debris. Fertile soil with a pH between 6 and 7, good drainage and available oxygen provides the best medium for turf growth.

Soil Organic Matter and Microbes

Soil has an organic matter component made up of plant, animal, and microbe residues in various stages of decomposition. Characteristics of soil organic matter include low bulk density, high cation exchange capacity (CEC), and high pH buffering capacity. Soil organic matter also improves soil structure, allows for better water movement, provides a source for nitrogen, phosphorus, sulfur and micronutrients, and acts as a medium to support microbes. In turf systems, the plant is constantly producing organic matter and can return up to four tons of organic matter per acre to the soil per year. Therefore, organic matter builds up and supports a microbe population. Microbes affect turf soil by recycling and immobilizing nutrients, decomposing organic matter and mineralizing nutrients, fixing nitrogen, protecting the plant from pests and sometimes causing plant diseases. Microbes found in the soil include bacteria, actinomycetes, fungi, protozoa, yeasts, and algae. This microbe population is influenced by moisture, temperature, available oxygen, pH, energy, and nutrients. Although there is no way to dramatically change a microbe population over the short term, ways to promote it include applying organic amendments with available carbon, providing adequate moisture, maintaining a balanced pH, maintaining soil aeration and fertility, enhancing root system volume, and limiting pesticides and plant growth regulators.

References: The information for Soil Organic Matter and Microbes was taken from “Components of an Effective Organic Fertility Program for Cool Season Sports Fields” by Mary Owen – University of Massachusetts

Soil Fertility

Nutrients in the soil can be taken up by plants, mineralized and used for growth by microorganisms, immobilized to organic matter, adsorbed onto clay and organic matter particles, transformed, or leached or volatized. Complex nutrients must be broken down by microbes, chemical reactions in the soil, or dissolved in water before they are available to plants. Once they are broken down, the plant roots can absorb the nutrients in the presence of water. Factors that affect nutrient uptake include pH, moisture, temperature, root mass and depth, and root respiration.

Adding nutrients to your soil is important for overall field health. Before making an application, it is important to test your soil for what nutrients it needs. This can be done by taking soil samples and sending them to your local university to be tested. Once that is determined, the best fertility program can be chosen. Frequency, timing, rate and type of fertilizer must all be taken into account when considering an effective fertility program.

References: The information for Soil Fertility was taken from “Components of an Effective Organic Fertility Program for Cool Season Sports Fields” by Mary Owen – University of Massachusetts

Compost

Compost is beneficial because it provides a good source of energy and low level of nutrients, increases the release of nutrients in the soil, enhances the CEC, increases microbial activity, and may suppress some pathogens. It can be used as an amendment, topdressing, or as a mix to pregerminate seed. Compost can be an effective addition to soils, but a sports turf manager must keep certain things in mind when considering its use.

A sample of the compost should always be taken to inspect and test it. It is recommended to use compost that has been thoroughly researched and tested.

Desirable compost will resemble dark topsoil with a light, crumbly structure, free of large objects such as stones or wood. For use on an athletic field, the compost should be able to pass through a 3/8 inch screen. If the compost has been properly composted and stored, it should be weed free. Fully decomposed compost should possess an "earthy" aroma.

Ideal moisture content for compost is between 30 and 50 percent. If it is too wet, it may form clumps and be difficult to spread, and if it is too dry, it may be too dusty and difficult to incorporate into the soil.

It is important for compost to have available nitrogen. Therefore, the carbon to nitrogen ratio should equal or fall below 30:1.

Composts are generally low in their total amount of nutrients and contain slow release nitrogen. Nutrients in compost are usually in complex forms and must be broken down by microbes and water before they are available to the plant. The amounts of nutrients available depend on the source of the compost. For example, animal manure typically has a higher nutrient content than yard waste. Research has found that one to two inches of compost tilled into four to six inches of soil can supply all the nutrients necessary for turf growth and development for a year.

A pH between 6.0 and 8.0 is desirable for compost. Anything outside of that range may cause damage to the turf plants.

Composts made from biosolids commonly have high metal concentrations. However, state and federal government agencies have established limits on metal concentrations for these biosolids, which limits their application.

Some compost may contain a high salt content which can damage turfgrass plants. Turfgrass species and varieties differ in their tolerance to salt, and the type of salt present in the compost influences the potential for plant injury. Cultural practices also influence salt concentrations. Compost incorporated into the soil and irrigated may leach the salts.

Composts are not completely made up of organic matter. A lab test can help determine how much of the compost is composed of organic matter.

Problems associated with compost are mushrooms and nutrient amounts. Fields amended with compost can sometimes grow mushrooms from fungi decomposing high levels of it. Compost may not always contain the amount of nutrients needed and fertilizer may be used as an additional supplement.

Information from this section can be found in the following publication from Penn State University: Using Composts to Improve Turf Performance: http://turfgrassmanagement.psu.edu/composts.cfm

Natural Organic Fertilizer

Natural organic fertilizers are byproducts or residues from agricultural or industrial processing or from mined, naturally occurring ores. Natural organic fertilizers have a complex chemical composition, and in addition to nitrogen, phosphorus and potassium, may contain minor and micronutrients. Factors influencing nutrient release are the chemical composition of the material and the environmental conditions that influence microbial activity.

Natural organics typically have a slow plant response and do not provide quick recovery or spring green up. They also have a long residual response with the best nutrient release in summer. Nutrient availability is limited in cool, dry soil. Because these materials are slow release, research has shown that a high application rate in combination with less frequent applications has the best response. These fertilizers have a low potential for burn because of the low salt index.

Some of the disadvantages associated with natural organics are their high costs per unit of nutrient as well as the inability to apply some as a liquid formulation. Examples of natural organics include, Milorganite, Sustane, and Nature Safe. However, it should be noted that cost differences may have evened out due to the increase in cost for synthetic nitrogen sources.

References: The information for this section was taken from “Components of an Effective Organic Fertility Program for Cool Season Sports Fields” by Mary Owen – University of Massachusetts

Drainage

A final point regarding soil issues is drainage. A field cannot be successful without proper drainage, and both surface and internal drainage must be taken into account. Surface drainage can be achieved with field crowns that direct water to catch basins. Internal drainage can be achieved by a rootzone made up of recommended particle sizes and an internal system such as pipe drains. For additional information about drainage, please visit the technical resources section addressing irrigation and drainage.