such as drainage ditches, streams, and ponds and indicate topographic features such as steep grades, hills, and low areas. Because water moves downhill, this information will help you understand where the water and nutrients will likely end up. Include on this map all pertinent soil texture information.

Identify the species of turfgrass growing in the turf stand. If you know the types of turfgrass in your field, and understand its requirements, your nutrient management plan will have a better chance for success. Information about the nutrient requirements for your specific turfgrass is available through your local cooperative extension service. Be sure to document the health and conditions of your turf stand because this information will help you evaluate the effectiveness of your plan.

Soil sampling and testing is the next step in this process. A basic chemical soil test can quantify the levels of available phosphorus, potassium, and micronutrients. The chemical test will also determine the soil pH, cation exchange capacity and base cation saturation. This information provides insight into how efficiently your soil stores and makes available nutrients that the turf needs.

All of the information is critical for calculating what soil amendments and nutrients are needed (if any) as well as the amounts. Often the soil lab will make lime and fertilizer recommendations including rates and timing based on the information that you provide them when you request the test.

A separate test for soluble salts can indicate if excess fertilizer or potentially damaging levels of salts are present in the soil. This is helpful for selecting appropriate treatments using soil amendments to move the excess levels out of the root zone. Other tests include testing your irrigation water to check pH and detect the presence of soluble salts, bicarbonates and minerals. Plant tissue testing is another way of measuring nutrient levels within the plant. Tissue tests will help you spot excess or deficient nutrient levels in the soil.

Testing for soil physical properties including percentages of sand, silt, clay as well as percent of organic matter can be useful to assist in determining how well the soil will hold on to nutrients. Sandy soils that drain well often do not hold moisture or nutrients very long. Soils with higher percentages of clay and organic matter have more moisture and nutrient holding capacity. Use this information to indicate where the different soil textures are on your soil map. Your soil-testing laboratory will instruct you in how you should take samples, the number of samples to take per acre as well as the depth at which you should take them.

Customizing your plan

Once you have collected and documented the information on what you have and what you need, you are ready to customize your site-specific nutrient management plan. For example, a low maintenance ballfield in a schoolyard will have a much different plan than a professional stadium field. This is where nutrient management becomes an art.

Consider the nutrient tools available. As sports field managers, we are fortunate to have a wide variety of fertilizer options depending upon our management needs. Simply put, fertilizers can be grouped into two categories: quick release and controlled or slow release. This distinction is important because it relates to plant response and longevity in the rootzone. Each category may be derived from natural sources or synthetic processes. Quick release and slow release fertilizers commonly refer to the nitrogen source used, although it can also include phosphorus and potassium sources.

Quick release fertilizers are water soluble, inexpensive per pound and provide rapid plant response. Because of their solubility, they tend to leach out of the root zone easily and can cause foliar burn. These materials can provide desirable results when used at low rates with frequent applications. By combining these fertilizer components together in different proportions it is possible to create a variety of complete water soluble fertilizer formulations.

Controlled release fertilizers include products formulated for slow release nitrogen characteristics. The release rates vary between the different products. Controlled release fertilizers usually cost more per pound for the nutrient. The turf response, color, and growth are slower than water-soluble fertilizer. The advantage is that more material can be

applied with less foliar burn, so fewer applications are needed. Common examples of controlled release sources include: coated fertilizers, where the particles are coated in a permeable "jacket" and the nutrients diffuse out of the "jacket" at a controlled rate.

Natural organic products derived from animal and vegetable byproducts are low in nutrients, but can be applied in large volume with very low risk of foliar burn. Synthetic organics such as Isobutyraldehyde Diurea (IBDU 31-0-0) and Urea Formaldehyde (UF 38-0-0) and Methylene Ureas are widely used and all are a source of slow release nitrogen. The release rates of all of these materials are dependent upon fertilizer particle size, temperature, moisture and soil microbial activity.

For many sports field managers, cost seems to be the limiting factor when choosing a nutrient source. By understanding the costs involved with making a fertilizer application, as well the longevity of the nutrients in the soil after the application, products with a higher cost per pound may be a better value and deliver more consistent results.

Regardless of the nutrient sources you select, good cultural management implements your nutrient management plan. For example, turfgrass needs water for growth, good health, and vigor. Irrigation management complements your nutrient management plan. Begin by conducting an irrigation audit and inspection of your irrigation system to determine how well it functions. The audit will show you how uniform the water is being distributed so that you can make repairs or improvements. The process includes measuring how much water volume is being supplied by the system in a given period of time.

The audit will also help you schedule water usage by calculating how much water your soil can hold, the amount of water the turf needs, and how much is lost through evapotranspiration. To avoid leaching, puddles and runoff, make sure that the amount of irrigation being delivered is less than the rate at which water infiltrates and percolates through the soil.

The soil texture of your field figures prominently in your plan particularly in relationship to your irrigation methods. For example, sandy soils receiving frequent irrigation might be prone to nitrates leaching past the rootzone. In another example, heavier textured soils such as a silt or clay loam could erode during a thunderstorm losing phosphorus bound to the soil particles.

The idea is to keep the nutrients where we want them so they can be used efficiently by the turf, and not lose them in the groundwater, streams and ocean. Whether you have an irrigation system or rely solely on rainfall, the form and frequency of your nutrient applications has an impact on the effectiveness of your nutrient management plan.

Aeration enhances nutrient management by increasing the amount of pore space in the rootzone for air and water. This process increases

Continued on page 14

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water infiltration into the soil and helps reduce runoff. Aeration facilitates root uptake by the turf and creates a more habitable environment for the soil organisms.

Cool and warm season turfgrasses each have periods of growth and dormancy. Plan your nutrient program around the nutritional requirements of your turf stand and optimum growth periods for your particular species. A cool season turfgrass best management practice is to overseed with improved cultivars. You can select cultivars with genetic characteristics such as darker color and better disease resistance that require fewer nutrient inputs and add biodiversity to your turf stand. Lists of improved cultivars suitable for your geographic area are available from the National Turfgrass Evaluation Program (NTEP) on the web at www.ntep.org .

Mowing is the most common cultural practice that occurs on sports fields at all levels. Follow the best management practices for mowing with sharp blades at an acceptable mowing height that is specific for the turf species, following the 1/3 mowing height rule. The question of whether or not you will leave clippings will factor into your nutrient management program, as the clippings when left return a residual amount of nitrogen, phosphorus and potassium to the soil to be broken down by microorganisms and used by the turf.

Nutrient management is about good stewardship and working smarter. When our mission is to produce safe, playable, and attractive sports fields, it helps to deliver great results. It is good for us individually and as an industry to do our part to help our environment become healthier through careful planning and responsible actions. ■

Don Savard, CSFM, CGM is also a Delaware Certified Nutrient Consultant and manages the athletic facilities and grounds at the Salesianum School in Wilmington.

Common quick release water soluble fertilizers

Urea	45-0-0
Ammonium nitrate	34-0-0
Ammonium sulfate	18-0-0
Monoammonium phosphate	12-61-0
Diammonium phosphate	18-46-0
Superphosphate	0-20-0
Triple superphosphate	0-48-0
Muriate of potash	0-0-60
Sulfate of potash	0-0-50

John Mascaro's Photo Quiz

Can you identify this sports turf problem?

Problem: Brown spots on soccer field
Turfgrass Area: Soccer Field
Location: South Portland, Maine
Grass Variety: Kentucky Bluegrass

Answer to John Mascaro's Photo Quiz on Page 51

John Mascaro is President of Turf-Tec International

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The Organic and Humic Acid Qualities of APEX-10

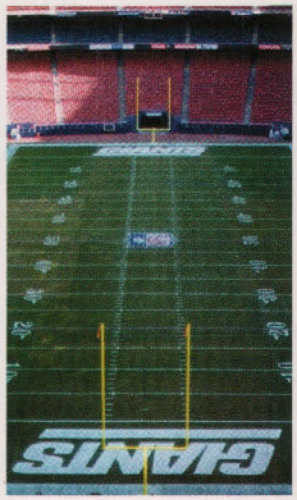
APEX-10 is a Peat Humic Substance (PHS) and is one of a class of natural materials called "Fossil Humic Substances" that were examined by professional engineer H.A. Hartung. Through his work he was able to recover fossil humic substances made from lignite, leonardite, and peat, finding that PHS recovered from highly humified North American Peat was invariably more active.

To further prove this theory, 80 different studies conducted with 80 different peat samples from three continents were used to measure the time it takes to lower the pH in soil, not falling farther but falling faster. The samples were mixed with finely divided sulfur at the rate of 1000 parts per million and PHS was added to the soil mixture at the rate of 0.2 PPM.

All 80 tests results found that PHS reduced the time it takes for thiobacters to convert elemental sulfur to sulfuric acid, lowering the pH of soil in 7 days rather than 21 days, an act regarded as true stimulation. As always in the case in science, solving one problem uncovers another and now the question was, How could PHS stimulate thiobacters when thiobacters do not metabolize PHS?

Scientists and researchers from around the world reviewed this discovery and their response was the same: In complex populations such as exist in soil, there is always some form within that population that can start the metabolic chain, followed by a succession of enzymes and metabolites formed as PHS is consumed.

This article is sponsored by Nature's Wonder. To see an online demonstration, visit http://oners.hotims.com/14481-420



The biological process of converting organic matter from peat into humic substances is the key to the success of PHS. It is both the completely decomposed organic matter and the humic acid that it is readily soluble and available to the biomass surrounding the plant's root system, and the 100% solubility of the humic acid that is plant available.

Many of the country's leading universities have studied and analyzed the PHS of APEX-10 and have found it in every instance to be the single most active. Manhattan College found PHS to have a higher adsorption rate of metals in water. The New Jersey Institute of Technology found the solids in PHS are 88.7% Volatile Organic Matter, 100% soluble, and available to the soil biomass. Virginia Tech University found that 100% of the humic acid in PHS is soluble and plant-available. The Soil Foodweb found PHS increased soil biomass from 77% to more than 3000% and increased nitrogen retention in soil by more than 500%. Rutgers University found PHS increases turf grow-in from seed by a margin of 61%.

Research has shown that APEX-10 increases better turf when grown under adequate or deficient soil moisture in trials. A number of previous research reports have shown the humic acids in APEX-10 increase rooting due to auxin-like activities and have convincingly shown to improve chlorophyll content and root growth.

Given the application of adequate amounts of a complete fertilizer, and the added effect of APEX-10 treatments, results have proven APEX-10 increase plants root systems when compared to humic acids made from leonardite and lignite.

When sports turf managers consider their biggest limiting factor for a newly sodded or seeded sand-based field is to provide a playable surface, the added effect APEX-10 provides brings a completely new approach to the industry.

The single most common problem faced by many athletic field managers is the need to achieve a functional playing surface soon after sodding or seeding. Apex-10 and its volatile organic matter along with its humic acid qualities have shown repeatedly to improve rooting and tensile strength during turf establishment and the management of mature turf. ■

All photos above feature sod that was grown with APEX-10.

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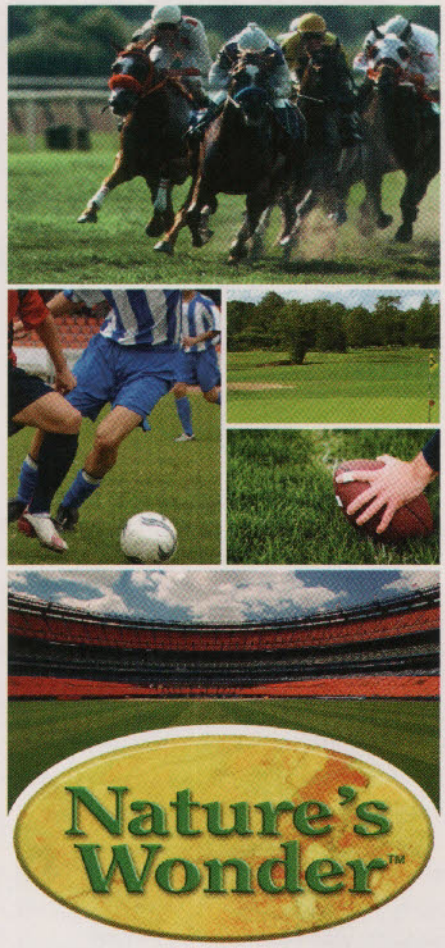

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brown PATCH

By David R. Spak, Ph.D.

Brown patch is the most widespread of all turfgrass diseases and can occur in both cool and warm season turfgrasses. A fungus known as Rhizoctonia solani causes brown patch. In warm season grasses, the disease is referred to as large patch. Disease symptoms vary greatly depending on environment, soil conditions, type of turfgrass, and height of cut, etc. In general, affected turf has rings or circular patches of brown, blighted grass. These turf patches range in size from a few inches to several feet in diameter. Under severely affected areas, the patches may coalesce leaving no evident pattern.

In cool season grasses, first signs of the disease include water-soaked, purplish-green patches that quickly turn to brown. Upon close inspection, cool-season grasses often have tiny, irregular tan-colored leaf spots with dark brown margins.

Warm season grasses usually do not develop leaf lesions, but instead have patches of thinned turf that occur as turf begins to break dormancy in the spring. Tip dieback and rotting of sheaths near the surface of the soil are commonly observed.

Optimal conditions

In cool season grasses, disease develops when humidity is high and night temperatures are approximately 70 degrees Fahrenheit or greater. Brown patch can develop rapidly and affect large areas in as little as 24 to 48 hours.

In warm season grasses, the disease occurs in late fall and early spring when turf is not actively growing.

Brown patch can quickly damage athletic fields and can lead to increased weed invasion during the summer. If extended periods of hot, humid weather persist, the disease is capable of killing turf, requiring costly and disruptive renovation.

Prevention tips

Sound agronomic practices, such as properly timed fertilizer applications, can help reduce the severity of brown patch. Turf that is over-fertilized, particularly with quickly available forms of nitrogen, tends to have more brown patch issues. Also, over-watering or watering at night can also increase brown patch. A properly timed fungicide application can provide effective brown patch control and greatly improve turf appearance. To get the most out of your fungicide application, apply a fungicide before the appearance of brown patch symptoms. Curative applications require high rates and are generally not as effective as properly timed preventative applications.

Brown patch in cool season turfgrasses can be controlled by monthly fungicide application treatments beginning in early summer and continuing until the onset of cooler weather in the fall. If necessary, curative applications will suppress further development of the disease.

Cultural practices to limit brown patch in turf:

- Minimize leaf wetness by irrigating in early morning.
- Avoid over-watering, particularly at night.
- Provide good drainage to both surface and subsurface areas.
- Reduce thatch.
- Maintain proper grass height.
- Remove clippings to prevent spread to other areas during mowing.

In addition, fertilizer containing slow release forms of nitrogen should be applied judiciously to maintain moderate levels turf growth. This disease is more severe under lush growth that excessive nitrogen promotes. ■

Dr. David R. Spak is Technical Development Manager - Fungicides, for Bayer Environmental Science.

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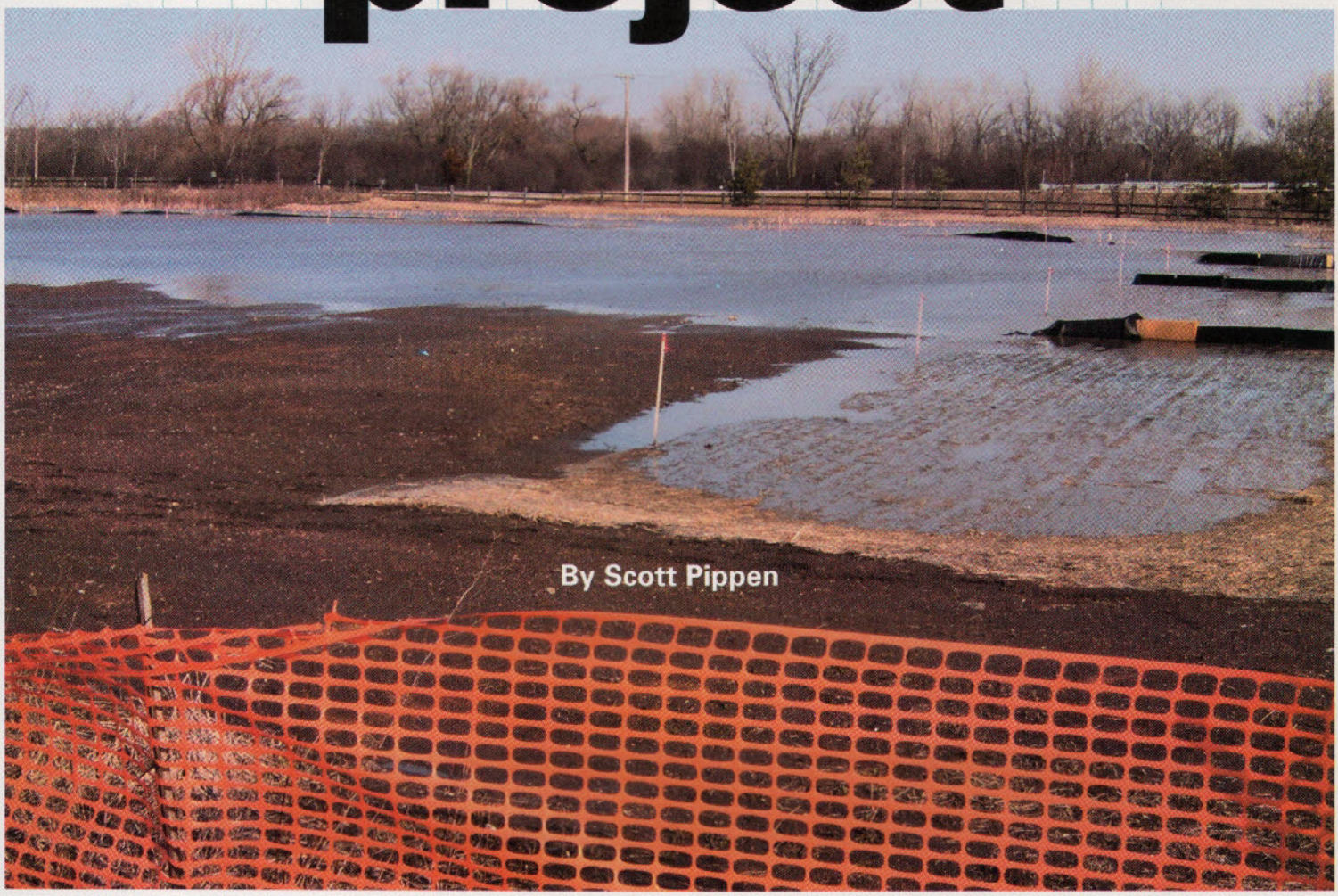
Planning a construction/renovation project



By Scott Pippen

The first step is to become educated about the basics of athletic field and park construction.

North Park is a 63.5-acre site that was purchased by the Village of Lincolnshire (IL) in the fall of 1999. The site was acquired to maintain open space in the rapidly growing Village, and to provide playing fields for the residents of the area. Before the development of this project, the Village's parks contained only two small playing fields. The schools in the area were expanding their buildings to meet the rise in their student populations, and constructing these expansions over many of the existing fields on their campuses. The local volunteer youth sports organization was having a very difficult time meeting the community's recreational sports needs with the limited facilities available to them. Thus, the $14 million North Park Project was born.

The North Park site contains 28 acres for active use, and 35 acres for passive use. The 28-