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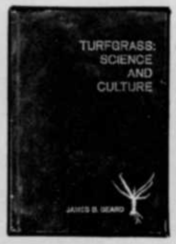

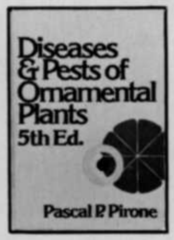

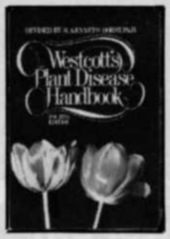

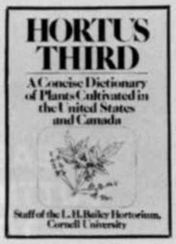

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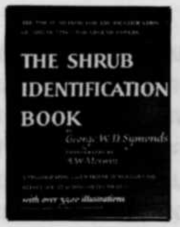

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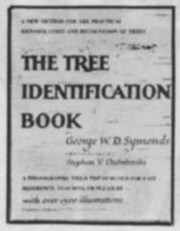

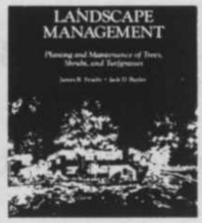

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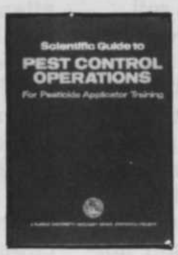

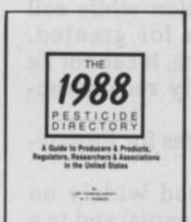

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Circle No. 136 on Reader Inquiry Card

MANAGE YOUR TURF, MANAGE YOUR SOIL

Although the turf is what you see, you might have to get to the root of your problems through the soil.

by Paul E. Rieke, Ph.D., Michigan State University

Most of our efforts in turf management are based on how the above-ground portion of the plant responds to the practices followed or different stresses. The stems and leaves provide the beauty and functional aspects of a quality turf.

While deserved attention has been given to the above-ground portion of the turf, what happens in the soil is receiving greater attention as well. Soil provides water, nutrients and air to the plant roots. Soil also serves as the medium for rooting.

A healthy soil is a very complex system involving physical, chemical and biological systems. Each of these systems is complex in its own right, but they each interact on the others, as well as with the plant tissue above ground.

Sod place on this compacted clay loam subsoil develops its own growing medium—thatch.

Physical soil management

Texture and structure are soil's primary physical components.

Soil texture tells us about the amounts of sand, silt and clay in the soil which affect water holding capacity, drainage, aeration, space for roots and susceptibility to compaction.

Structure is a general term referring to the way the soil particles are put together. The traditional "ideal" soil consists of 50 percent solids, 25 percent small (or micro) pores for water holding capacity and 25 percent large (or macro) pores for drainage, aeration and easy rooting.

These numbers assume a loam soil with excellent structure. Such conditions seldom exist under turf conditions, especially on intensely-trafficked sites. So frequently the turf manager must maintain the turf on poor quality soils and/or where traffic results in compaction.

Compacted soils lose their larger pores, reducing drainage, aeration and rooting. Recent research by Robert Carrow, Ph.D., and co-workers proves that compacted soil conditions result in more roots in the surface soil but fewer roots deeper in the soil.

This clearly reduces the reservoir from which the plant can extract water. The turf is thus more susceptible to stresses—especially moisture stress. Sandy soils have a high percentage of larger pores but hold less water than finer textured soils.

The rapid drainage and good aeration conditions in a sandy soil normally permit use of a turf area soon after rainfall or irrigation. For this and other reasons, the preferred soils for high traffic areas are high sand content mixes.

While a soil-based mix (such as the USGA mix) is considered most desirable by this author, it is sometimes difficult to find adequate amounts of quality topsoil to use in the mix. The ultimate mix is often variable due to poor mixing techniques.

For this reason, many architects and construction firms prefer to use sand/peat mixes containing no soil. While this provides an easier approach to construction, management will be more difficult. More careful attention must be given to water and fertilizer rate and frequency. It is more difficult to overseed successfully on high sand soils. The playing surface can be very hard on sands, especially when the soil is dry.

The soil mix selected for a given site should be planned carefully. Then that plan should be followed closely. Often we find great attention is given to seed selection while soil conditions are taken for granted. Once the soil is in place, it cannot be changed without costly reconstruction efforts.

There are alternatives for improving a poor soil.

Top dressing is used widely on greens (golf, bowling, tennis) and to a limited degree on athletic fields. Careful attention must be given to select-

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ing proper top dressing material, appropriate timing and rate.

Do everything possible to prevent the development of layers in the soil. Differing layers can result in a perched water table and limitations on rooting, drainage and aeration. Detrimental effects of layers could occur short-term but usually will not be too evident until several years later.

Another alternative for improving compacted soils is cultivation, to till or loosen the soil without seriously affecting the turf surface. Loosening the soil provides improved infiltration, drainage, aeration (exchange of gases between the soil and the atmosphere) and rooting.

Cultivation also brings soil to the surface so it may be worked back into the thatch, theoretically providing a better medium for microorganism activity and thatch control. On golf greens, cores are often removed before top dressing. This permits a gradual change in soil conditions.

Some factors to evaluate in your cultivation program include spacing of aeration holes, depth of holes, type of tine or spoon, type of aerifier action, amount of soil brought to the surface, speed of unit and cost.

Be sure the unit you are using is doing what you want. Many turf sites do not need cultivation, while others may require very aggressive treatment.

A compacted soil cannot be corrected in a single treatment. Cultivation should be viewed as a long range program. Turf managers should sell the program on that basis whether for home lawns, grounds, athletic fields or golf courses.

Other helpful practices in high-traffic areas include changing traffic patterns, restricting traffic when soils are wet, using paving blocks or alternate surfaces, planting wear-tolerant grass species, using adequate potash, and mowing the grass at a higher height if feasible.

Irrigation/wetting agents

Another facet of soil management is irrigation. The turf manager must know the basics of irrigation:

1. How deep are the roots which are effective in water uptake?

2. What is the available water holding capacity of the soil? (Using 1 and 2 above he can then determine how much water is available in the root zone.)

3. How much water is lost by evapotranspiration each day?

4. What are the "indicator" spots where moisture stress will show first?

The last factor could be affected by soil variability, slope exposure, irrigation system design, wind effects, traffic, disease and other factors which could affect rooting or water movement in the plant.

Wetting agents can be a very helpful tool in soil water management.

For example, if susceptibility to hydrophobic soil conditions occurs, wetting agents can help re-wet the dry soil. Cultivation and careful watering practices can also help to deal with these localized dry spots.

Since wetting agents vary widely in composition, be sure to check whether the wetting agent you are using is effective for the objective you have in mind.

Some wetting agents are more likely to cause phytotoxicity than others. Our recommendation is to water the turf lightly, apply wetting agent and water with at least $1/4$ inch of water. This should reduce the potential for injury. Use special care when using wetting agents during hot weather conditions.

Chemical soil management

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Soil properties which are considered chemical in nature are pH control, available nutrients, cation exchange capacity and soluble salts and sodium. Control of soil pH is frequently overemphasized. But pH adjustment must be done with care.

Generally, raising pH by liming is relatively simple. Ground limestone is safe to use on turf. In most cases, dolomitic limestone is preferred because of its magnesium content, but soil should be tested to be sure. Hydrated lime, which can cause phytotoxicity, should be used carefully.

Gradually the lime, placed on the surface where it neutralizes soil acids, is dissolved and moves lower into the soil. In fine textured soil, this process can take two years or more to have any impact on pH more than three inches below the surface.

Nitrogen fertilization is a major soil management practice on turf. Knowledge of the growth patterns, physiology, susceptibility to diseases and environmental stresses are necessary for its wise use.

Additionally, as an industry we must use proper carriers, rates and timing of nitrogen to prevent nitrate leaching at levels which could pollute groundwater. The February issue of LANDSCAPE MANAGEMENT provided good coverage on N fertilization.

It is best to use soil tests for phosphorus needs. This is especially wise for turfs along lakes and streams which could experience algal bloom problems with enough phosphorus pollution. Following soil test recommendations for phosphorus should prevent pollution when it is used.

Potash has become the "newly-found" nutrient in turf management, based on reports of improved tolerance (wear, moisture stress, rooting and disease pressure) when high K levels are applied.

While there are many good reasons to use K, remember that nutrient balance is still essential. Most turf specialists would not exceed a 1:1 ratio of N to K_2O on an annual basis. This depends on the annual N rate, however. Some golf course superintendents in the north are using less than 2 lbs. N/1000 sq.ft. annually, especially on sandy greens. Under such conditions, one would surely want to be using 4 lbs. K_2O or more annually.

Be careful to keep a balance between potassium and magnesium. Test the soil to be sure the rates between these two nutrients is not more than 4:1 or 5:1 (Mg:K_2O) on sandy soils. And on sandy soils we need to "spoon feed" potash, since there is limited cation exchange capacity to hold the K ions in the soil.

Other nutrients used on turf include sulfur, iron and other micronutrients. The response to these nutrients will vary with turf and soil conditions. The turf manager should be familiar with local conditions dictating the need for these nutrients. Managing turf soils when soluble salts (saline) or high sodium (sodic) conditions exist requires evaluation of both physical and chemical soil factors.

The importance of irrigation water quality and volume, drainage and—in the case of excess sodium—the use of gypsum, must be understood to deal with these problems. Wise use of soil tests is essential for proper management of saline and sodic soils.

Biological soil management

Biological soil components include the activities of both desirable and undesirable organisms. The decomposition of soil organic matter and release of nutrients and other materials to help maintain good soil structure are desirable.

Thatch decomposition is accom-

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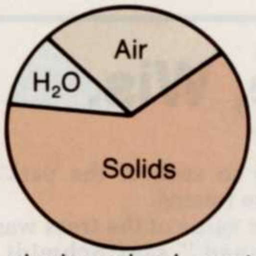
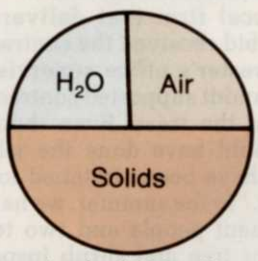
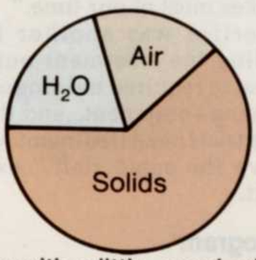


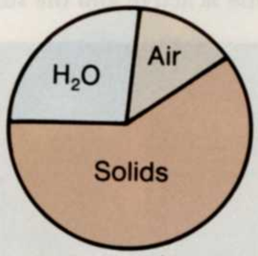
single grained sand



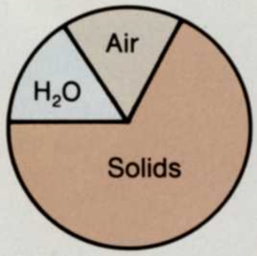
typical "ideal" loam soil with good structure



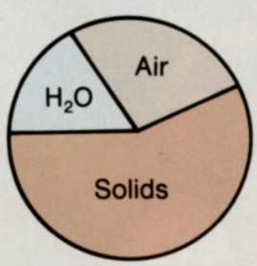
loam with a little sand added



compacted loam



wide particle size range sand



loam with enough sand added to permit bridging of sand particles

plished by a range of soil organisms from large, like earthworms, to the smallest bacteria.

Another desirable activity of soil organisms is their ability to biologically break down certain pesticide residues. This helps prevent accumulation of pesticides. This would be undesirable, however, if the pesticide's residual activity is shortened enough to make its use impractical.

Other detrimental activities are caused by pathogens, insects and nematodes. Some of these may be active on the grass above the soil, while others are primarily active in the soil. Knowledge of their life cycles and the effect of soil management practices on their activity will help keep the impact of these pests at a minimum. In the past, major emphasis has been placed on chemical control of most turf pests.

As this science of turf management improves, we are learning more about the impact of fertilization and watering on pest management. Coupled with predicting pest problems more

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Elm trees fight back in Eau Claire, Wis.

Tees, equally spaced along the elm's root flare, are connected with short lengths of tubing.

There's no cheer in the bright orange markers on the tall gracious American elm trees in Eau Claire, Wis. They tell a grim tale: the continued deaths of irreplaceable elms to Dutch elm disease (DED).

The numbers have been devastating since 1980: between 1,280 and 2,150 elms have been lost each year. In 1960, about 40,000 elms graced Eau Claire, according to city forester Rod Schmidt. He estimates that surviving elms number approximately 12,000. Across the northern U.S., more than half the elms have succumbed since the late 1950s, according to industry experts.

In Owen Park, an Eau Claire centerpiece, the number of elms has dwindled from approximately 200 in 1976 to approximately 100 today. In this one-of-a-kind park, the fungus' spread has been effectively halted with an intensive sanitation and fungicide treatment program.

In the past three years, the program has reduced losses to only three elms.

The whole city began experiencing extremely heavy losses with a 1980 windstorm—"a terrible disaster" Schmidt says. Fresh wounds in the elms attracted elm bark beetles which spread the fungus that causes DED. The beetles breed in elms that are weakened, dying or dead and in cut elm wood with firmly attached bark.

Clean-up after the storm took 2⁴ years. Meanwhile, losses of elms citywide skyrocketed from approximately 500 in 1980 to 1,450 in 1981.

High priorities

Control of DED in Owen Park became a priority for the Eau Claire City Council. The scenic 50-acre park covers a two-by-six-block stretch along the picturesque Chippewa River near downtown Eau Claire.

The 60-year-old, 50-foot elms shade the annual art fair, "Sawdust City Days" activities, picnickers and joggers. They form a scenic backdrop for parades, weekly band shelter concerts and film features.

"You don't see a stand of elms like that any more. Nice...leafy...mature. They make the park and community special. And we'll go the extra mile to take care of them," explains city council president Wallace Rogers.

In 1984, the city council approved the first treatment of the park's elms with Arbotect (thiabendazole) fungicide. In 1987, when the treatment needed to be repeated, cost was not a concern. The city council allocated $5,000 more than the budgeted $12,000 so each of the park's elms could be treated.

"The value of the trees was never questioned," says Schmidt. "The council just said: 'Let's do it.'"

A local firm that delivered the lowest bid received the contract. The city forester's office supervised the job. Schmidt supported contract treatment of the trees. Even though his staff could have done the job, they would have been stretched too thin, he says. "In the summer, we have four permanent people and two temporaries for tree and shrub inspections and evaluations, consultations with property owners and tree removals. That takes most of our time."

Expertise was another factor. "Handling the treatment ourselves would have required training our staff and buying equipment...and the next time the trees need treatment, we may not have the same staff," explains Schmidt.

The program

The trees were treated in July, when the beetle is active and the fungus is

Rod Schmidt, Eau Claire, Wis. city forester, checks the injection equipment pressure before injecting Arbotect into an elm.