soil with sand (filling aeration holes in conjunction with a sand topdressing program) can greatly improve surface and internal drainage on a heavy soil field.

Excessive Wear

Turf may perform poorly on high-use fields because soil has become compacted. Cultivation can be very useful in these situations. However, some fields are so heavily trafficked that no amount or type of cultivation alone will produce good turf. Traffic control also must become a key component of overall management programs on these fields.

The key is to determine what type of soil problem must be prevented or corrected in the specific situation. Once the problem is identified, select the appropriate cultivation technique, and be realistic. Some problems are not going to be corrected merely by cultivation, namely such problems as poor or non-existent drainage systems, improper grading, poorly designed/functioning irrigation systems or excessive field use.

Select the Best Cultivation Method

If, after considering the many options available for correcting soil properties (re-grading, drainage improvement, soil replacement/modification, irrigation improvement, traffic management), you conclude that cultivation is called for, the best method or methods must be determined. Some important questions to ask are:

How deep is the problem located? Since the depth of soil penetration varies with cultivation techniques from barely

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A common sense cultivation program incorporates the following:

IDENTIFY the soil physical problem;

SELECT the most effective cultivation technique(s);

PERFORM cultivation under proper soil moisture conditions; and

EVALUATE the effectiveness of your cultivation program annually.

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Biosstimulant Basics for Sports Turf Managers

A number of biostimulant products have been introduced in the past decade, some with claims which can seem beyond the realm of credence. Yet increasing numbers of turf managers have come to rely on these products as a standard component of their turf program.

Just what are biostimulants? And what can the sports turf manager expect from biostimulant product applications on his playing fields?

The term biostimulant has been used to describe various substances involved in turf and horticultural production. However, the definition for the term which has become generally agreed upon defines **biostimulant** as any material that is neither a fertilizer nor pesticide, but which when applied to a plant will enhance the health and growth of the plant.

A biostimulant may increase metabolism, increase chlorophyll efficiency and production, increase antioxidant production, enhance nutrient availability, speed up germination and cell development, or increase the water holding capacity of plant cells, or even the soil.

Biostimulant materials a include natural plant hormones, including cytokinins, auxins and gibberellins, as well as humic and fulvic acids, microorganisms, proteins, amino acids and vitamins.

Most currently marketed biostimulant products contain plant hormones extracted from kelp, as well as humic acids and sometimes fulvic acids. Many manufacturers also add amino acids and even vitamins.

Cytokinins extracted from kelp or kelp containing cytokinins are a popular biostimulant component. Cytokinins are produced in the roots of all plants and enable plant cell differentiation and division. Cytokinins are involved in delaying senescence and repressing apical dominance. Auxins provide similar benefits.

Cold water kelp produces anabundance of cytokinins, making it the source of choice for this important biostimulant component. Adding a product containing concentrations of cytokinins to a turf management program can enhance seed germination and seedling establishment, as well as promoting an increase in root mass when applied to established plants.

Humic acids affect the soil in a number of ways. Humic acid is characterized by a very large molecule containing a highly active charge. This charge can bond nutrient ions, preventing leaching of soil nutrients. They also increase the nutrient and water holding capacity of soils, as well as increasing the availability of micro-nutrients, phosphate and potash, providing a more effective growing environment for turf grasses.

Fulvic acids are not always included biostimulant products. Derived from humic substances, fulvic acids have been shown to be powerful chelators of organic electrolytes, transforming minerals and making them readily available for plant absorption. Fulvic acids have more internal activity in plants than humic acids. They enhance nutrient, vitamin, coenzyme, auxin, hormone and natural antibiotic availability. Fulvic acids also increase enzymes and metabolic activity, contributing significantly to healthy plant growth.

Checking root mass is the best measure of biostimulant program success.

So when and where can the sports turf manager use biostimulants to his best advantage?

Biostimulants should be considered as secondary products in a good turf management program. Proper fertility is primary, starting with soil testing and following through to assure that nutrient requirements are met. When nutrient levels are adequate, applications of biostimulants can further enhance health and vigor.

When plants are not stressed, natural hormones are produced in sufficient amounts to sustain healthy growth. However, plants are frequently under stress due to heat, drought, weak soils, disease, low mowing, excessive traffic and other less-than-optimum conditions. Under such conditions the external application of biostimulant materials can enable the plant to resist or to recuperate from excessive stress.

Turf managers need to determine their objectives in order to determine what biostimulant components are required and when they can best be utilized in the management program.

The timing of the biostimulant application affects the results achieved. The natural growth cycle of the turf is an important consideration. Applying a biostimulant to improve the natural growth of the turf usually requires different timing than an application to solve a problem.

Applications intended to solve problems, must take into consideration the cause of the problem. If the problem is a natural stress which can be anticipated, such as summer drought or excessive heat and humidity, optimum results are obtained with applications made prior to the occurrence of the stress. Turf growing in shade, for instance, can be assisted by a biostimulant application to enhance chlorophyll production under low light conditions.

Specific cultural practices can also be augmented with biostimulant applications. Aeration, for instance, can be enhanced as can seeding, sodding and sprigging.

The use of biostimulants when seeding can provide a variety of benefits. Germination times can be reduced. Natural plant hormones also affect speed of establishment and coverage. Biostimulant applications have been shown to increase root mass for quicker sod knitdown and sprig development.

Root mass correlates with the turf's ability to resist and recover from environmental stresses. Core samples can provide the turf manager with assurance that his turf is ready to withstand the many pressures to which it is subjected during the growing season. Where good agronomic basics are in place, biostimulants can take your turf to new levels of beauty and durability.

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scratching the surface to 16 or more inches, select equipment that can penetrate to where the problem is located.

Is it important to remove soil? Soil removal may be important if you want to modify the existing root zone over time by replacing removed soil with a sand or other soil mix that will provide benefits of drainage and air exchange. Core cultivation also may be desired if the cores are simply redistributed into the turf, becoming an important (sometimes the only

available!) form of topdressing. If soil replacement or core material topdressing is not a goal, cultivation techniques that do not remove soil (deep-tine cultivation with solid tines, water-injection, vibratory plows) can accomplish much.

Will cultivation be followed by topdressing? When the goal is to modify a root zone by replacing it, over time, with a different soil, then the soil must be opened adequately to receive the topdressing soil. Topdressing can follow either hollow- or solid-time cultivation. Hopefully the topdressing soil (type, availability) has been carefully considered and an effective topdressing program (amount, frequency) has been developed to avoid the formation of layering in the turf system.

Occasional deeper cultivation can reduce or eliminate the deeper compaction layer and allow the continued use of the older cultivation method.

Will overseeding follow cultivation? The benefits of overseeding following cultivation will occur only with cultivation methods that are relatively shallow and which open the soil surface adequately enough to allow seeds to fall into soil contact.

How long will the cultivation effect last? The effects of deep-tine cultivation can last for a couple of growing seasons, so this cultivation technique—though potentially expensive—may not be required every year. Conversely, the effects of slicing may not be long-lived, but can accomplish a goal of improving short-term water infiltration. The effects of conventional hollow-tine cultivation are lengthened if the proper topdressing soil is used to fill the empty holes. When equipment must be rented or borrowed, consider how long the cultivation effect will last. It may be worth the time and effort to use an expensive piece of equipment if the results of use will be long-lived.

How much surface disruption can be tolerated? In a sports turf situation, certain cultivation techniques may be inappropriate because of the

amount of surface disruption that is caused. If traction, surface uniformity and aesthetics will be compromised before an important field event, it is best to delay cultivation (at least with that method) until a later time. Recovery time to regain field playability must be factored into the selection of the cultivation method.

How frequently must this cultivation technique be used? Certain cultivation techniques (slicing, spiking) must be used fairly frequently to realize significant benefits. Methods that loosen the soil from below (deep-tine and vibratory "plows") need not be used annually, except where severe soil problems exist. Consider equipment availability, equipment purchase vs. lease costs, availability of labor to perform certain kinds of cultivation and whether adequate windows of opportunity exist to use the desired cultivation method.

Will this cultivation technique make things any better—or any worse? If a compaction layer exists 3-4 inches deep in the soil profile, the result of long-term cultivation with the same cultivation method, then continued cultivation to the same depth will not correct the problem—and may cause it to become worse. Occasional deeper cultivation can reduce or eliminate the deeper compaction layer and allow the continued use of the older cultivation method.

Cultivate at the Proper Soil Moisture

Most cultivation methods achieve maximum effectiveness when performed at or near field capacity, which is generally reached by irrigating deeply one to two days prior to cultivation. These methods would include "conventional" vertical core cultivation, cultivation with drum-type equipment, equipment using spoon-type tines, slicing and when using high-pressure water injection. Any method that uses solid tines should be performed at soil moisture levels that are drier than field capacity, which might occur (on a heavy soil) two to four days following heavy irrigation or rainfall. This would include deep-tine cultivation, shatter-core and other solid-tine methods, the use of Aerway-type equipment and sub-aerification methods (vibratory plow types of equipment). These latter methods loosen soil by shattering or vibrating, rather than by removing soil; they are most effective when soil is on the drier side.

With any cultivation method, soil that is overly dry will not allow sufficient penetration. Conversely, very wet soil is not loosened effectively or will not allow cores to be pulled. In both cases, cultivation efforts will be largely ineffective.

Evaluate Your Cultivation Program

Cultivation (and all components of the overall management program) should be evaluated annually for effectiveness. Is it accomplishing your goals? Is it cost effective? How does it impact other aspects of your turf management program? Perhaps the most important question to ask: Does my cultivation program improve the safety and playability of my sports turf surfaces?

The Green Industry's Comprehensive Website

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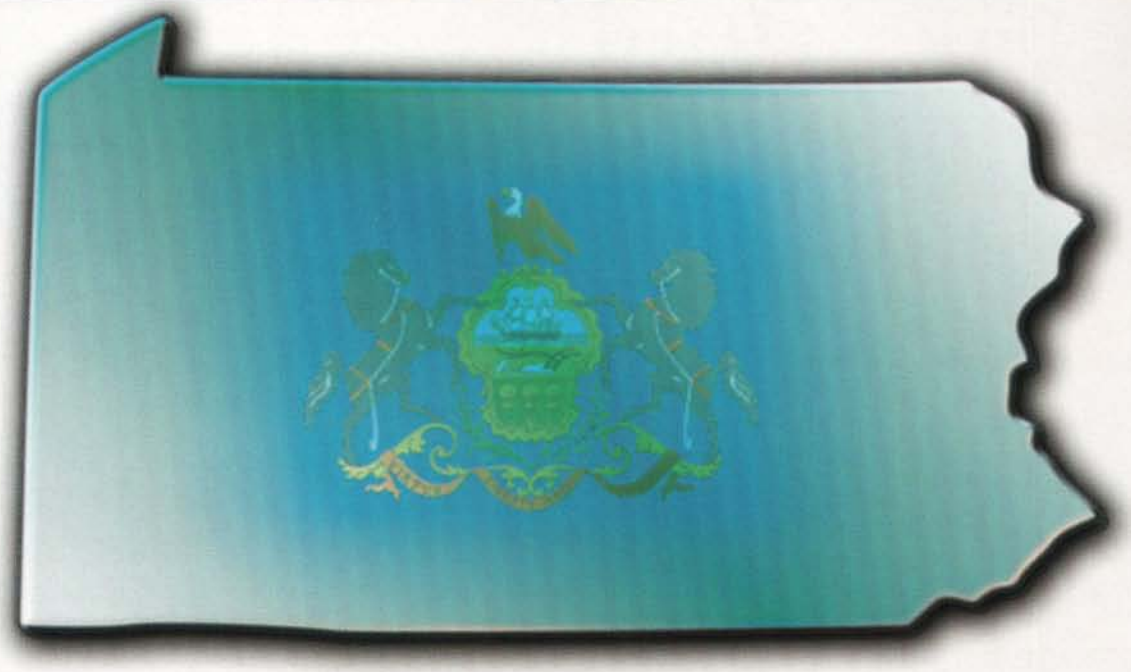

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The Sports Turf Managers Association (STMA) is an organization of professionals representing all segments of the sports turf industry. Our members work to combine the science of growing turfgrasses and the art of maintaining sports turf to produce playing fields that are both safe and aesthetically pleasing.

STMA provides members with a variety of benefits, including: educational opportunities; support for sports turf research; facilities tours; a national awards program; job hotline; access to the STMA National Conference & Exhibition; complimentary subscriptions to Sports Turf Manager and sportsTURF Magazine; and MUCH more!

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