

Common Sense Cultivation

by Dr. Tony Koski

Do you analyze why you perform certain turf management practices, how often you perform them and what you want to accomplish in performing them? Common sense cultivation requires careful consideration of each of these factors.

Cultivation procedures—coring, drilling, slicing, spiking, grooving, water injection—can be employed for any number of reasons. The reason for (and method of) cultivating should be determined on the basis of what problem one is trying to correct. Problems that may be corrected, at least in part, by well thought-out cultivation include:

- Surface compaction
- Subsurface compaction

- Subsurface layering
- Standing water
- Low infiltration/percolation rates
- Isolated dry spots
- Organic matter accumulation/thatch management
- Presence of high levels of soluble salts and/or sodium

Compacted and Layered Soils

Compaction reduces the rate of water infiltration and percolation and air movement within the root zone. But one must determine how deeply the compaction zone extends into the soil. To complicate things, layering can similarly impede water and air movement. To develop a successful cultivation strategy, it is essential to determine exactly where the problem lies.

Cup cutters, soil probes and shovels can be used to look for signs of root zone trouble. The careful extraction of an intact soil core or profile can reveal the presence of layers or compaction zones. Take a few cores and determine how deeply roots are penetrating. Rooting may stop at the interface between two different layers, and the layers may be visually apparent. Layers may be composed of soils of different textures, or may be due to accumulation of organic matter. They may have different colors, or may retain moisture differently.

Compaction is not as easy to visually detect from a core. Less compacted soil may separate or shear off of a plug or profile. Rooting depth may be very shallow, as roots will not grow where there is a lack of oxygen. Compaction doesn't always occur near the surface of the soil, as it most commonly does. Compaction deeper in the root zone may have occurred during construction, where soil was compacted but then only cultivated to a shallow depth prior to seeding or sodding. Deeper compaction may result from years of core cultivation (hollow- or solid-tine) to the same depth, developing a compaction layer just below the penetration depth of the tines.

Some soil testing labs that specialize in turf soils offer the testing of intact soil profiles. By close examination and testing of sample profiles they are able to suggest reasons for poor turf performance and recommend management tools for solving those soil problems.

Wet Soils

Constantly wet soil may be indicative of poor internal drainage, which could be caused by compaction or layering (which can perch a water table). Of course, heavy clay soils always may appear to hold water, even if they are not compacted or layered. Cultivation can relieve compaction and mitigate the effects of layering, but will not necessarily "fix" a heavy soil. Replacement of a "heavy"

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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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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 tech-

niques 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-tine 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.

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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

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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

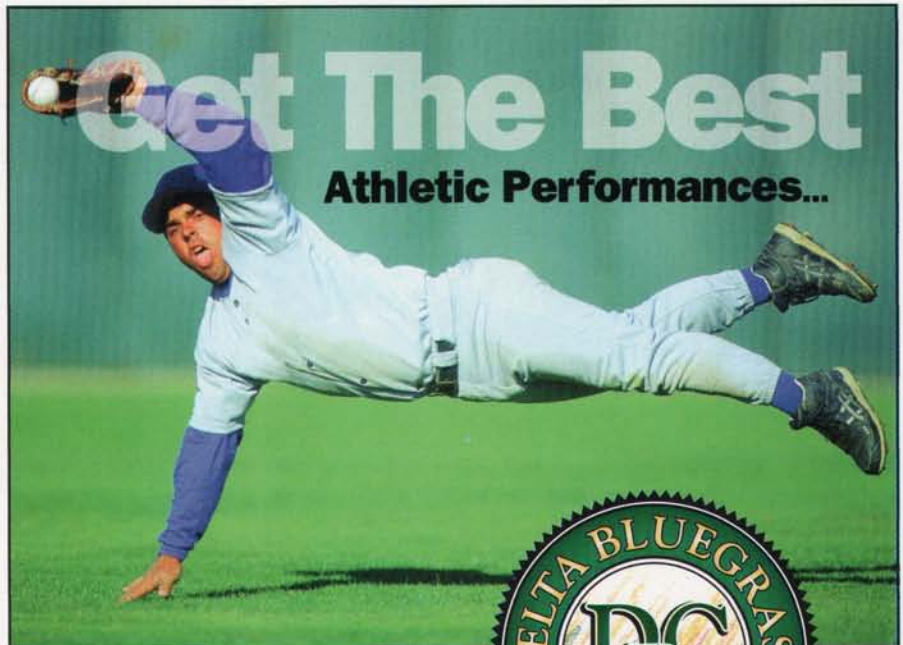
Most cultivation methods achieve maximum effectiveness when performed at or near field capacity, which is generally reached by irrigating deeply one to two days prior to cultivation. These methods would include "conventional" vertical core cultivation, cultivation with drum-type equipment, equipment 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?



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