Cultivation for Surface Problems

by Dr. Robert Carrow

When preparing fields for play, sports turf managers must keep athletes' needs in mind. Safety and playability sit atop the list of maintenance objectives. With these goals in mind, it's important to maintain surface characteristics that athletes desire.

Firm, stable athletic surfaces provide good footing to prevent injury and facilitate play. The turf must not be too hard or too soft. It must be resilient enough to withstand intense athletic competition, cushioning falls while resisting compaction.

Surface uniformity ensures that athletes, and not field conditions, decide the outcome of play. An even surface with a dense stand of turfgrass prevents irregular ball rolls and bounces, and it gives all of the athletes equal footing.

Wear tolerance is essential to maintaining surface uniformity, particularly in high-traffic areas. A deep root system helps by resisting divots and tears. A persistent turf that will last throughout extended seasons requires strength and resilience both at the surface and in the root zone.

Cultivation basics

Surface characteristics depend on turfgrass variety, drainage contouring, and soil physical conditions. Since switching turfgrasses and improving field drainage can require extensive renovation and reconstruction, manipulating soil physical conditions provides a more practical means of improvement.

Soil physical conditions in the top three inches of the root zone can influence field characteristics dramatically. Surface cultivation can help maintain adequate physical conditions, and it can help address problems when they arise.

Cultivation can create macropores at your soil surface (pores greater than 0.12 millimeters in diameter). These enhance water infiltration and percolation, and they promote oxygen and carbon dioxide exchange between the soil and the air. Macropores also aid the soil by becoming root channels.

Cultivation also loosens your surface soil to soften the field. On fine-textured sites, the soil may be naturally hard, or it can become hard with compaction. Even coarse-textured soils exhibit surface hardness when the soil lacks organic matter or features wide particle-size distribution.

Finally, cultivation provides a means to add amendments to the soil. It opens the surface so amendments can be integrated into holes or injected directly into the turf.

Problem identification

When weighing the benefits of surface cultivation, you must first assess the primary problem you're addressing. It's important to establish whether or not the problem lies in the top three inches of your root zone.

For example, an excessively wet surface can stem from several possible causes. The natural water table may be high, particularly in prolonged wet weather. A layer below your benchmark three-inch depth may be causing a perched water table and impeding drainage. Higher-ele-

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vated adjacent grounds may be directing runoff or seepage onto the field. Insufficient surface drainage, especially "pot-hole" depressions, may be collecting extra surface water.

Surface cultivation may help alleviate some of these problems, but other approaches will be more beneficial. Field problems that require cultivation include the following:

• **Layers in the root zone's top three inches.** Fine-textured fields that are high in silt and clay can exhibit layers if the zone is compacted at the surface; if it's a sodic-affected zone; if algae lies at the surface; if a layer of different texture or composition appears in the zone, especially if the interface is distinct; if excess clay or silt is causing low infiltration, even without compaction; and if a naturally occurring caliche layer forms from high-carbonate irrigation water.

Coarse-textured sand fields can develop layers of organic matter or fine-textured layers from sod, topdressing, or water and wind deposition. Layers can also form if there is algae at the surface, or if the zone is sodic induced or calcite affected.

Courtesy: Bannerman

All of these layering situations restrict water movement and gas exchange. Most also limit rooting by increasing soil strength.

• **Hard sands.** Some sand athletic fields develop hard surfaces due to low organic matter content or wide particle size distribution. Such sands are susceptible to compaction, and cultivation can help loosen the soil temporarily.

• **Hydrophobic sands.** Water-repellent sands can cause localized dry spot (LDS) in the surface one to four inches of high-sand soils. Cultivation alone will not correct the problem, but it will help fight the condition when combined with a wetting agent application. Some high-pressure water injection units will inject wetting agents directly into the soil surface.

It's important to note that all LDS situations are not caused by hydrophobic conditions. Some apparent LDS can result from poor irrigation coverage or from shallow root systems or soils.

• **Sloped areas that cause excess runoff.** Surface cultivation can improve water infiltration on sloped sites where excess runoff results in droughted turf. At times, a semi-hydrophobic thatch on a sloped

area magnifies the problem. In such cases, add a wetting agent to your cultivation program.

• **Material injection.** At times surface cultivations can be conducted specifically to inject chemicals or physical amendments into the soil. Soil injections include insecticides, nematocides, fertilizers, wetting agents, sand, and sand substitutes.

Practical guidelines

Unsuccessful cultivation programs most often result from improper problem identification or from selecting the wrong cultivation technique. Unfortunately, no single piece of equipment can solve all soil physical problems.

Turf managers must understand the benefits and limitations of each type of cultivation technique. Turfgrass cultivation equipment manufacturers also have to do their part by promoting products based on the types of problems they can resolve.

Cultivation frequency should be carefully determined. Some problems can be permanently eliminated with one or two cultivation operations, while other problems reoccur. A layer of surface compaction can reform repeatedly under continuous traffic. Cultivation frequency should be adjusted to compensate.

If more than one problem requires cultivation, develop a program that addresses each problem. Carefully time each cultivation operation within your program according to soil moisture levels, turfgrass condition, and climatic conditions. All of these conditions must be favorable for turf to recover from the temporary injury cultivation inflicts.

Finally, periodically evaluate the effectiveness of your program. Record the effects of each operation, and ask whether your objectives are being accomplished. Benefits may include improved infiltration and percolation, better root growth, enhanced turf quality and growth, and elimination of black layer.

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