Deep Cultivation:
When and Why

By Gil Landry

With the development of effective cultivation programs to relieve surface soil problems, interest has naturally shifted to programs that improve conditions deeper in the soil profile. Equipment that can penetrate six to 16 inches include the Aerway Slicer, Deep-Drill Aerofier, Hydroject, Turf Conditioner, and Verti-Drain. Research conducted by Bob Carrow at the University of Georgia and Paul Rieke at Michigan State University, and supported by the equipment industry, has led the way to developing these deep cultivation programs.

Riding aerator with hollow tines at work. Photo courtesy Ransomes America Corporation.

SPRING PRODUCT SHOWCASE

The steps in formulating a program include identifying the problem, choosing the method(s) for correcting the problem, deciding on the correct timing and frequency of cultivation, and evaluating the results.

Identifying the Problem

The most common detrimental conditions on sports fields is the presence of fine-textured soils or soils with significant silt and/or clay. Such soils are sometimes referred to as "heavy soils" because they are difficult to till.

Common soil problems that can be relieved by cultivation include:

1. Poor water movement (drainage), air exchange and rooting.
2. Soil layers (i.e., clay or sand layer) that reduce water and air movement and rooting.
3. High salt levels, particularly in sodium soils.
4. Subsurface soil compaction.
5. A high water table formed by a compacted layer.

Poor drainage caused by low surface areas should be corrected at the surface rather than by deep cultivation.

Identifying the problem can be difficult and requires accurate evaluation of surface and subsurface conditions using a soil probe or shovel. Look at the soil texture and soil color, note rooting patterns and the soil resistance when probing or digging. Abrupt changes in soil texture or color, poor root development, rooting patterns inconsistent with normal growth, strong resistance to probing or digging — all are indicators of compaction problems. If no apparent soil physical problems are present, perhaps soil fertility/chemistry should be tested.

Once the problem is identified, the most effective method for correction must be determined. Cultivation may not be the answer. Perhaps improved drainage or soil modification is necessary. Maybe better traffic and irrigation control will be sufficient. In most cases, a combination of these practices is needed.

Methods of Attack

When choosing a cultivation method consider the following:

1. *How much surface damage will occur?* The more severe the damage, the more important active turf growth is to reduce turf recovery time. The more disruptive the procedure, the less often the practice will be used.
2. *How long will the effects last?* The longer the benefits last, the more turf damage can be tolerated.
3. *How deep in the soil is the problem?* Be sure the cultivation reaches the problem area.
4. *Is soil-loosening important?* Soil loosening occurs from vibratory or lifting actions such as those produced by the Verti-Drain, Aera-Vator, Shatter-core, Aerway, and Yeager-Twose Turf Conditioner.
5. *Will topdressing be used to fill holes or is subsurface incorporation needed?* In most cases, once holes are made, the longer they remain open to the surface, the longer lasting the effect. Once a hole is sealed, even if only at the surface, the benefits of air and water movement significantly, if not totally, eliminated by sealing. Topdressing with a porous material keeps the holes open. If topdressing is prohibitive, more frequent cultivation will be needed to overcome surface sealing.

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Subsurface incorporation of less heavy soils (sandy) alters the soil profile, makes it less susceptible to compaction. Such procedures can be costly, time-consuming, and disruptive. They should only be undertaken as scheduling and budget permit.

6. *Will soil be brought to the surface?* The ideal situation would normally be to use hollow tines or spoons that remove soil and cause less compaction around and below the tine than do solid tines.

Any tool used to penetrate the soil will cause some compaction. The question should be whether it relieves more compaction than it causes. Also, cultivating with different types of equipment and to different depths should minimize any compaction from cultivation.

Generally, an effective cultivation program will use a number of methods, and the timing will differ with the equipment chosen. Logically, it seems that combining normal depth cultivation with deep cultivation will provide both surface and subsurface cultivation.

Cultivation timing and frequency are generally influenced most by the damage caused and turf recovery time. But other factors to consider include soils moisture needs, turf rooting patterns, turf conditions, pests and stress problems.

The most common soil moisture problem is having enough moisture present to allow satisfactory penetration. Soils that are too dry resist penetration, limit effectiveness of procedures and put excessive stress on equipment.

Cultivation methods that cause loosening work best when soil moisture is just below field capacity. This generally means one day after normal irrigation or rainfall. If the soil is too moist, no loosening (vibration) will occur. Soil moisture closer to field capacity is best for practices that penetrate with minimal loosening like vertically operated tines.

Evaluating cultivation response can be difficult because of the more indirect effects that result and because multiple treatments may be needed to obtain a significant response. Regardless, effective cultivation should result in improved infiltration/percolation, looser and more penetrable soil, fewer dry and/or wet areas, better rooting and reduced turf stress. Leaving an untreated area can help evaluate cultivation effects.

Although evaluation may be difficult, it is important to monitor a program through the year, and from year to year. Since wet soils compact more quickly, rainfall in relation to field use will require program adjustments.

As previously mentioned, there are a host of deep cultivation machines on the market. However, many of the more sophisticated units are quite expensive. Bringing in an outside contractor for deep cultivation procedures is a viable option.

Deep cultivation programs should provide a natural progression for sports turf managers to use more innovative approaches for developing and maintaining high-quality facilities. ❑

Editor's note: As Extension Turfgrass Specialist with the University of Georgia, Dr. Gil Landry provides leadership in the development of statewide educational program in turfgrass management. He is the president of the national Sports Turf Managers Association.