Battling Compaction

Aeration provides an effective defense against damaging compaction. Courtesy: File photo.

by Steve and Suz Trusty

You'll increase the odds of winning your battles against sports field compaction by understanding its causes and effects, by assessing your fields' reactions to it, by examining your options among the arsenal of weapons against it, and by matching your methods of attack with your fields' needs.

Back to the basics

Review this basic demonstration from Soils 101. Start with two small, dry sponges. Imagine each sponge is one of your fields. The solid portion of the sponge represents the clay, silt and sand components of your soil profiles. The open spaces represent the pores available for air or water.

Squeeze one of the sponges in your hand to the maximum compression your strength allows. The sponge becomes smaller as compression forces air from the pore space. This is what compaction does to your fields.

Release the sponge, allowing air to infiltrate the pore space and return the sponge to its original size and shape. You've just seen the results of aeration.

Now, get two small bowls, a cup half-full of water, and an assistant. Hold the first sponge over one of the bowls and squeeze it again. Have your assistant pour the water over the compressed sponge. You'll notice that only a small amount of the water will soak into (infiltrate) the sponge. Because limited pore space is available, the majority of the water will run off into the bowl.

Continue to squeeze the sponge. Have your helper refill the cup to its half-way point. Place the second, fully expanded dry sponge in a small bowl and pour the water over it. Because more pore space is available, more water will infiltrate this sponge, and very little water will run off.

Have your assistant quickly pick up the moist sponge. Pour the excess water back into the cup, and place the sponge back in the bowl. Leave the sponge in the bowl for a minute or two while you continue to compress the first sponge in your hand.

Now examine the sponges. Both will show water movement (percolation) down into the sponge from the point of entry (infiltration point). However, because more pore space is available in the second (uncompacted) sponge, the percolation rate will be greater than that of the first (compacted) sponge.

Obviously, compaction in your fields is a bit more complex, but the basic principles are the same. Compacted soil profiles "squeeze out" the pore space needed for the air, water and nutrients necessary to support turf growth and survival.

Understanding your fields

Field soil profiles vary greatly from facility to facility, among the various fields of multi-field facilities, and even within individual fields. To develop an effective compaction management program, you must first define each individual field's soil profile and understand how that soil profile reacts to the stress of use and to maintenance practices.

You'll remember from Soils 101 that the three primary soil components - sand, silt and clay - vary greatly in size. Remember those boxes of basketballs [sand], baseballs [silt] and marbles [clay] in the particle size demonstration? There are ever fine, medium and coarse size variations among the different components.

The smaller silt and clay particles fit together tightly and leave fewer pore spaces between particles. The larger sand particles fit together loosely and allow more pore spaces between particles.

Both clay and silt are defined as plastic components, while sand is non-plastic. Physics defines plastic components as those capable of continuous and permanent change of shape in any direction without breaking apart. Plasticity causes clay and silt to change shape and squeeze together under the pressure of compression. Non-plastic sand retains its shape during compression and retains its greater pore space.

When silt, clay and sand are mixed in the soil profile, smaller particles move into the pore spaces between larger particles. Thus, it takes a high proportion of the right type of sand to significantly increase available pore space and improve field compaction resistance.

Sports field soil profiles may also contain such materials as organic amendments, diatomaceous earth, calcined clay, synthetic fabrics, synthetic fibers, rubber or other granules and industrial bi-products. With organic materials, physical properties tend to be unstable, and they can cause the physical properties of the soil profile to change.

Assessing the problem

When you understand the physical components of each of your fields, the next step is to monitor each field's reaction to your current maintenance program. You'll need to note variable factors such as regional weather patterns and the use schedule of each field. It's also important to factor-in the specific characteristics of each field's location, including shade and sun patterns, wind patterns, and lack of air movement.

Compaction may be a problem over an entire field, or it can be confined primarily to high use segments. It's time to take action when it adversely affects turf growth, water infiltration, percolation or drainage, or when it creates a hard surface unsuitable for athletic activity.

While it is the most disruptive of the aeration practices, core aeration opens up the greatest amount of pore space and has the longest lasting effect.
Courtesy: Trusty & Assoc.

Comparing your options

"Core" aeration removes plugs of turf and soil from your fields. Aeration depths of three to four inches are common, and the number of passes over an area determines the number of cores pulled. While it is the most disruptive of the aeration practices, core aeration opens the greatest amount of pore space and has the longest lasting effect.

Different equipment options allow you to choose the pattern of coring and the spacing between cores. You can also customize diameter and depth of cut through equipment choice. Quality equipment will deliver consistent spacing and depth, and will cause minimal surface scuffing.

Core aeration is often combined with topdressing of material that matches the existing soil profile and improves compaction resistance. In addition, removed cores may be broken up on the soil surface and dragged across the field to be recycled.

Solid tine or "spike" aeration pokes holes rather than pulling cores. As in the case of core aeration, a range of equipment offers choices in the diameter and length of the tines and in the spacing of the holes. Spiking gives less soil surface disruption, but delivers less compaction relief than does core aeration.

Deep tine, or "shatter" aeration reaches further into the soil profile (often 8 to 10 inches or more). It's used to break through barriers of compaction or layering that stem from long-term aeration to a specific depth and layers of varying materials within the soil profile.

Verticutting blades slice through turf into the upper layer of soil to open narrow slits of pore space. The technique provides less pore space than coring or spiking, and the degree of surface disruption varies with the condition of the turf and its root depth.

High pressure water injection is another form of aeration. Depending on the equipment used, depth of soil penetration can vary from one inch to as much as eight to 10 inches or more. The units often offer multiple variations for spacing the injections. Pores obtained through water injection tend to be quite small, but multiple passes can be made with the equipment to fully aerate the field.

Removed cores may be broken up on the soil surface, and the material can be dragged across the field. Courtesy: Trusty & Assoc.

With any of these methods, the timing of aeration is critical to turf performance. Actively growing turf recovers more quickly than turf that is in a state of dormancy.

Matching methods to needs

Each of the mentioned aeration methods has its place in sports turf maintenance. Method selection for a particular field must be based on multiple factors: the condition of the individual field, the season of the year and anticipated weather conditions, field use schedules, the availability of equipment, and budgetary and labor constraints. An individual field may even require the use of multiple aeration methods to reach its optimum potential.

As is the case with most aspects of field maintenance, the sports turf manager must communicate with field users and user groups to make an aeration program effective. By limiting excessive turf wear and restricting field use in potentially damaging situations, it's possible to attack compaction before it occurs. ❑

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