Native-Soil Field Management

by Dan Bergstrom

We continue to hear of new technologies for sand-based athletic field management: sub-surface heating systems, sand stabilization systems, remote-control irrigation, GPS tracking, and the list goes on. However, 80-percent of all sports turf managers still maintain native-soil fields.

Native-soil field management poses many challenges. Some of the biggest problems begin with a lack of adequate internal drainage.


University of Kentucky football field.
Courtesy: Dan Bergstrom

Drainage

Drainage on native-soil fields is a major concern. The silt and clay particles that make up the largest fraction of native-soil composition are smaller than sand. The open pore spaces between these particles are smaller than those between sand particles as well.

Smaller particles and pore sizes translate to lower infiltration and percolation rates, and native-soil fields need to be crowned or sloped to allow heavy rain to run off the surface. Standard slopes tend to be between 0.5 and 2.0 percent.

Crowns on football fields can run the center of the field, or they can have a 'hipped roof' design. In the latter situation, the ends of the field fall toward the end zones.

Baseball field crowns should start at the pitcher's mound, and should slope out in all directions. Outfield areas should fall away from the infield at a rate of 1.0 percent.

Soccer fields usually have less of a crown; 0.5 percent is standard. A more pronounced slope threatens to interfere with play in the corners of the field, but sometimes it is necessary when heavier soils are involved.

The debate over drain lines in native-soil fields continues. The technique places two- to three-inch diameter drain lines at 15- to 20-foot intervals either perpendicular to the field's crown or in a herringbone pattern.

One of the biggest misconceptions about drain lines is that after they are installed, the native soil is used as backfill around the drains. Backfilling with the native soil will not help drainage problems, since water cannot percolate to the drain pipes any faster than it could on any other area of the field. Additionally, backfilled silts and clays can quickly accumulate in the drain pipes and render the system useless.

Drain lines need to be covered with uniformly sized gravel. The trench should then be backfilled to the top with sand that is tested to percolate water at a rate of at least five inches per hour. It's also a good idea to line the sides and bottom of the trench with a geotextile fabric to keep the native soils from finding their way into the drain line.

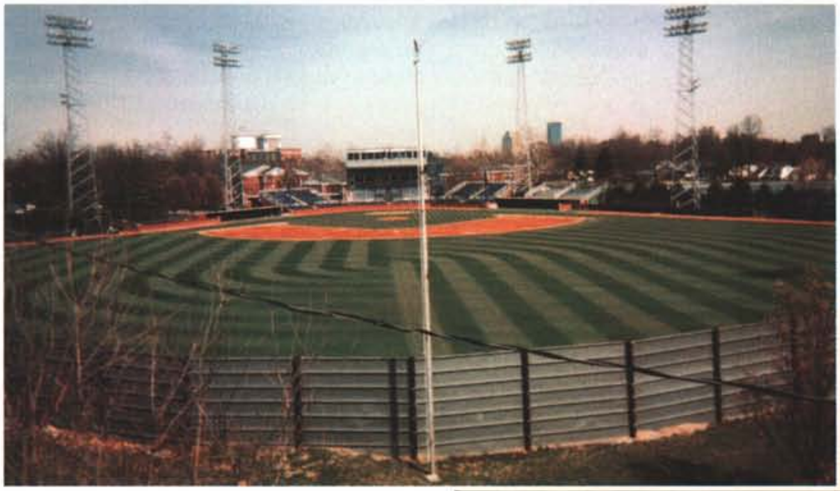
Another misconception about drain lines is that it is acceptable to sod over the top of the sand backfill. This defeats their purpose. The soil in the sod layer will not percolate at the same high rate as the sand below, and the line will effectively be capped.

On bermudagrass fields, instead of capping the lines with sod, allow the bermuda to spread and grow over the sand-filled trench. Cool-season grasses should be seeded into the trench, or you can use washed sod to cover the lines.

Even when sand-filled drain lines are properly constructed, they have a tendency to get desiccated during periods of extended dry weather. Fields that are irrigated regularly have few problems, but turf can struggle in sand drain lines on fields that are seldom irrigated.

Aerification

Aerification is the most important cultural practice for maintaining a field's infiltration rate.



University of Kentucky baseball diamond. *Courtesy: Dan Bergstrom*

Native-soil fields are subject to compaction much sooner than their sand-based counterparts because of the size of the particles and pore spaces that make up the soil.

Pore spaces allow water and oxygen to infiltrate the soil to reach turf roots. Aerification loosens the soil enough to allow trapped carbon dioxide to escape the root zone, while opening pore space for oxygen and water to diffuse into the root system.

There are several options when it comes to aerifying native-soil fields. Hollow coring times vary in diameter from 1/2 inch to one inch, and they vary in depth from one inch to 18 inches. Solid tines vary from 1/4 inch to 1 inch in diameter, and the range of depths offered is similar to that of hollow tines. Slicing tines open a narrow slit in the surface to depths ranging from 1/2 inch to 7 inches.

How does an athletic field manager know when to use which tine?

• **Coring tines** alleviate soil compaction most effectively. Pulling cores and dragging them back into the field produces highly productive results.

Holes opened by hollow tines allow water and oxygen to reach turf roots. The turf usually responds immediately with growth.

Hole spacing is an important factor with this type of aerification. With a 3/4-inch hollow tine, use 30 holes per square foot as your benchmark. More holes translates to more compaction relief, and over-aerifying a field is nearly impossible. Aerifying four to six times per year is not unreasonable by any means.

Unfortunately, core aerification

creates the most severe surface disruption of the different techniques. The procedure requires a field to be taken out of use for at least a couple of days. Crews need enough time to effectively aerify, drag in the cores, and irrigate the turf to ready the field for play. Also, soil moisture must be near field capacity before aerating, so the tines can effectively penetrate the soil to remove uniform cores.

- **Solid-tine aerification** allows turf managers to aerate more frequently, since the procedure produces less surface disruption. Turf areas in soccer goal mouths, in front of the pitcher's mound on a baseball field, and between the hash marks on a football field can benefit greatly from weekly 1/4-inch solid-tine aeration.

Solid tines larger than 1/4 inch in diameter open turf to allow water and air infiltration, but the process compresses displaced soil downward and to the sides. This actually increases soil compaction around newly created aerification holes. Repeated solid-tine aerification with larger-diameter tines can create a hardpan at the aerating depth.

- **Slicing tines** can have the same effect as solid-tines on heavy-wear areas. They can also stimulate turf growth by cutting turf rhizomes and stolons.
- **Deep solid-tine aeration** can alleviate hardpan with little surface disruption by opening the soil profile to depths ranging from four to 18 inches.

Deep hollow-tine aeration is generally not recommended on native-soil athletic fields. Pulling cores from deeper than four inches usually brings poorer-quality soil to the surface, and defeats the purpose of the original soil modification effort.

No matter which aerification technique you choose, be sure to vary the depths of the tines over the growing season to avoid forming a hardpan layer.

Topdressing

A common fallacy of native-soil athletic field management is that topdressing with sand will improve soil structure and drainage. Most soil fields have high concentrations of silt and clay. Adding sand to this mix will only decrease a field's percolation and make it harder.

Consider the ingredients used in concrete: sand, silt, and clay mixed with water! Over time (10 to 30 years), topdressing will gradually build up sand concentration in the soil and improve the field in the long run. However, in the short term, adding sand actually makes a native-soil field worse. The sand fraction of the soil must reach 60 to 70 percent in the top three to four inches before topdressing with sand will help drainage and infiltration characteristics.

There is a better way to modify a problem native-soil field with sand. Harvest the cores after a hollow-tine aerification. Then topdress with enough sand to completely fill the holes.

This method allows water to better infiltrate the aeration holes. Over time, much more of the problem native soil can be replaced with sand, as opposed to simply being mixed with the sand.

This method is not without its

drawbacks. Depending on the size of the field and the diameter and number of holes, up to 60 tons of sand could be needed to completely fill the holes.

Topdressing this much sand at one time can be prohibitive, and it can produce a sand layer on top of the soil if the sand is not properly dragged into the holes. A sand layer on top of native soil leaves turf susceptible to divoting and shearing-type injuries, because the sand layer can slide off the top of the soil layer under athletes' cleats.

Diatomaceous earth or calcined clay products are often a good alternative. These materials increase pore space within the soil profile if worked into the soil during aerification. Of course, these options are considerably more expensive than topdressing with sand.

Aeration cores make the best topdressing for native-soil fields. When you drag cores back into the field, most of the soil will fall back into the holes, but some of it will topdress the turf in the process.

Take a physical soil test of each of your fields. This will reveal the respective fractions of sand, silt, clay, and loam. If you're going to initiate a regular, heavy topdressing program, your mix should closely approximate the test results.

Even with a proper crown, good aerification and topdressing strategies, and properly constructed drainage, there are times when a field is simply too wet to allow play after rain. When play threatens to severely damage and compact the soil, field managers must work with the coaches to relocate field activities. Wisely using a field every day is as important to the life expectancy of a native-soil field as construction considerations.

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