Soil Amendment Considerations for *Sand-Based Root Zones*

by Joe Betulius and Larry Lennert

If we think of a sand-based athletic field rootzone as a reservoir for the water, nutrients and oxygen needed by turfgrass plants, it's easy to see why the quality of turfgrass grown in pure sand rootzones commonly is poor. Although properly sized sands can provide a rootzone that drains rapidly and remains well oxygenated even after significant traffic is applied, adequate amounts of water and nutrients are often lacking.

Traditional Amendment Choices

To improve water and nutrient retention, various organic materials have traditionally been used as amendments in high sand content rootzone mixes. Peats are the most commonly used organic materials for amending sands, although other materials such as composts and rice hulls are also being utilized today.

The physical properties of organic amendments can best be described as highly variable. As an example, the organic matter and fiber content of two sphagnum peats, a reed-sedge peat, a compost and a muck peat soil were determined to range from 40 to 96 percent and 7 to 54 percent, respectively. In fact, golf green or sports field failure can often be blamed on the poor quality of the organic amendment used in a rootzone mix.

In addition, the physical properties of organic amendments begin to change soon after they are added to a rootzone mix due to decomposition of the organic matter. This negatively influences the performance of sand/peat mixes by causing infiltration rates to decline over time.

Newer Amendment Options

Although these amendments are not really "new," the use of several types of internally porous inorganic amendments (IPIAs) for both construction and maintenance of athletic fields with sand-based root zones has become much more common in recent years. These materials are gaining popularity because they have the ability to retain additional water and nutrients for turfgrass use, without undergoing the undesirable physical and chemical changes that occur to organic amendments.

The most frequently used classes of IPIAs include naturally occurring zeolites, nutrient-loaded zeolites, non kiln-fired diatomaceous earths (DE), kiln-fired DE and kiln-fired, clay-based porous ceramics. Although all of these materials are IPIAs, their physical and chemical properties vary greatly, and their particle size distributions can differ substantially. The combination of all of these product characteristics significantly affects the performance of rootzones amended with these materials.

Organic Amendment Effects on Soil's Physical Properties

Adding organic amendments to sand increases the water retention of the mix in two ways. The organic matter contained in organic amendments has its own internal porosity, which holds water. Additionally, small particles of organic matter partially fill the spaces between larger sand particles. This effectively increases the amount of small, water holding capillary pores, while reducing the amount of larger, non-capillary drainage pores in sand/organic amendment mixes. Infiltration rates of sand/organic amendment mixes decline further over time as organic amendments break down, reinforcing the need for routine aerification, core removal and topdressing.

Building a Bigger Reservoir

Similar to the organic matter contained in organic amendments, inorganic amendments contain internal pores. The amount of internal porosity and the size of the pores varies from product to product, and largely determines the water retention and release characteristics of each IPIA. However, unlike organic amendments, the particle size distribution of many IPIA products is equal to or greater than particle size distribution of sands used for athletic field rootzone mixes. The particle size of certain IPIAs are similar to sand, and adding these IPIAs to sand can increase water retention without reducing the amount of larger, non-capillary, drainage pores.

Conversely, the use of IPIAs with very small particle sizes may be detrimental. In one study, a zeolite with a particle size distribution much smaller than the sand it was added to significantly reduced both non-capillary porosity and infiltration rates of the sand/zeolite mix, versus the pure sand. This demonstrates the importance of determining the particle size distribution of IPIAs and the sand prior to designing a sand/IPIA root zone mix, and testing the physical performance of the mix prior to use.

By amending properly-sized sands with the proper IPIA, it is possible to create rootzones that hold adequate amounts of water for turfgrass use, yet drain more rapidly than the sand itself. This seems to be a very desirable combination of physical properties for sand-based root zones to possess prior to turfgrass establishment, since infiltration rates of athletic fields rapidly decline with age. In essence, it is possible to build a bigger rootzone reservoir for water and oxygen by using IPIAs to amend sands alone, or in combination with organic amendments.

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