Field Day Highlight: Managing Sand-Based Athletic Fields

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Turfgrasses subjected to traffic are generally assessed by their ability to resist wear and recuperate. Because athletic fields receive an abundance of traffic, maintaining quality turf stands has always been a challenge. Root zone selection and developing sound management practices are two important components to maintaining quality athletic fields. Specifically, constructing a sand-based athletic field and properly implementing the primary cultural practices of irrigation, mowing, fertilization and cultivation will help maintain the most consistent turfgrass playing surface.

STA FIELD DAY

Coverage from September 23, 2010.

Generally, the root zone of an athletic field is either native soil or sand-based. Native soil root zones high in silt plus clay provide exceptional soil strength (soil stability); however, traffic from play often causes poor drainage and soil compaction to occur. In contrast, sand-based root zones provide smooth and uniform playing surfaces that resist compaction and have adequate drainage. However, sand-based root zones typically have low nutrient and water holding capacities. In addition, sands lack cohesion which can cause stability problems. Variables to control stability problems associated with sand-based root zones include: particle size distribution, average particle size, particle shape, soil density and soil amendments.

A well-graded root zone in which there is a significant distribution among sand particle sizes is preferred for sand-based athletic fields. Research by Dr. Jason Henderson (Asst. Professor, University of Connecticut) as a graduate student at Michigan State University determined that a sand-based root zone with 10% silt plus clay will provide both soil stability and adequate drainage for athletic fields. The sand content root zone near maximum density will retain macro pore space (air-filled pores) for rapid drainage, and the addition of about 10% silt plus clay will provide the soil stability and the increase in nutrient and water holding capacity. Unfortunately, the high costs and quality of available native soil to mix with the sand root zone can often limit blending the two.

Above. Sand channel after the drill and fill, Shields Watkins Field, Neyland Stadium, Knoxville, TN.

In contrast to athletic fields, the United States Golf Association specifications for putting green construction limit the amount of silt plus clay percentages (not more than 5 and 3%, respectively) that can be used in order to provide the desired infiltration (drainage) rates. In addition, very fine sand cannot be more than 5%, and the very fine sand and silt plus clay cannot be over 10% of the total root zone mix. Because the expectations for the use of an athletic field playing surface are extremely different than those for a putting green surface, it makes sense that Dr. Henderson's research recommends slightly higher percentages of silt plus clay. Higher silt plus clay percentages reduce soil infiltration rates, but provide firmer and more stable playing surfaces.

In addition to building a sand-based athletic field, properly implementing the primary cultural practices of irrigation, mowing, fertilization and cultivation will help maintain the most consistent turfgrass playing surface. Typically, sand-based athletic fields require more frequent irrigation compared to a native soil athletic field. This is because of the low water holding capacity.

Turfgrass water requirements vary depending on the time of year and weather conditions. Actively growing turfgrasses will generally require about 1 to 1.5 inches of water per week. The water used by a turfgrass plant is predominantly absorbed by the roots from the soil and can be supplied via natural rainfall events and supplemental irrigation. The amount of water that needs to be applied by supplemental irrigation will depend on how much water is available in the soil and how much the turfgrass demands. For example, irrigation applications will be more frequent during sunny days with high temperatures, low humidity and high winds than during cloudy days where humidity levels are high and temperatures are cool.

Thus, any factor that contributes to the turf transpiring more (using more water) and the soil losing moisture via evaporation would warrant increased irrigation scheduling. Therefore, it would not be accurate to suggest irrigation once, twice or three times per week because weather patterns change frequently. Instead, irrigation requirements should be monitored daily for turf watering needs.

Soil nutrient tests should be conducted regularly and subsequent fertilizer applications should be done for any nutrient deficiencies that occur. Nitrogen fertility for sand-based root zones should be more light (low N) and frequent if using water soluble nitrogen fertilizers because of the low nutrient holding capacity. Using slow release nitrogen fertilizers such as poly coated urea can reduce application frequencies and allow for increased nitrogen rates.

Mowing should be done regularly enough to not exceed the one third rule. This rule states that no more than one third of the leaf material should be removed at any mowing. Optimal mowing heights for cool-season athletic fields (Kentucky bluegrass and perennial ryegrass) are between 1 to 2.5 inches and 0.75 to 1.25 inches for warm-season athletic fields (bermudagrass and zoysiagrass). In addition, regular mower maintenance including reel or blade sharpening will assure the highest quality of cut.

Turfgrass vigor increases with the proper implementation of irrigation, fertility and mowing practices; therefore, as turfgrass vigor increases, irrigation, fertility and mowing requirements also increase. Sand-based athletic fields typically do not become compacted; however, layering problems as a result of organic matter accumulation often occur over time. Regular cultivation practices of aerification and topdressing are required to dilute organic matter accumulation and potential layering problems that build up. Whether it is Kentucky bluegrass for a cool-season athletic field or bermudagrass for a warm-season athletic field, organic matter accumulation as a result of decomposing roots, rhizomes and/or stolons, and clippings contribute to an increase in organic matter at or near the root zone surface that can over time impede infiltration rates.

This problem is especially pronounced on overseeded bermudagrass athletic fields in the transition zone and southern climates where turfgrass growth from both cool and warm-season turf occurs 10 to 12 months of the year. For example, Shields Watkins Field at Neyland Stadium in Knoxville, TN was constructed with a sand-based root zone that had 0.5% organic matter by weight. Over a ten year period, even with regular core aerification and sand topdressing, a 4 to 6% organic matter layer by weight formed in the top 5 inches of the 12 inch root zone.

For Bob Campbell, University of Tennessee Athletic Field Manager, the increase in organic matter was not high enough to significantly cause drainage problems, but infiltration rates decreased from the original rates. Because Shield Watkins Field is an overseeded athletic field, organic matter accumulation for the two turf species being used accumulates for ten months of the year. Compounding the problem is the fact that core aerification is only being done during the early summer and regular sand topdressing amounts and frequencies are limited due to the fall football season. Since the organic matter accumulation occurred over a 5" depth, conventional core aerification cannot penetrate deep enough to break up the layering profile, but coupled with sand topdressing the percent organic matter accumulation is diluted.

In order to address the layering issue, Campbell used deep tine drill and fill to create a series of channels backfilled with the original sand blend for water infiltration (see photo on adjacent page). The increase in organic matter was not necessarily a major problem, but it was an issue that needed to be dealt with in regards to water infiltration. Conversely, the increase in organic matter by weight over time has helped increase the nutrient holding and water holding capacities of the root zone.

With the ever increasing demand and use for athletic fields, the effects of wear as a result of traffic continue to be a challenge for maintaining quality sports fields. However, proper root zone selection and implementing sound management practices (irrigation, mowing, fertility and cultivation) will help provide more consistent, quality athletic fields.

Editors Note: Under Canadian conditions where bermudagrass is not grown, such a high buildup of thatch would not occur.