Poultry Compost as an Amendment for Establishing Creeping Bentgrass in a Sand-Based Rootzone

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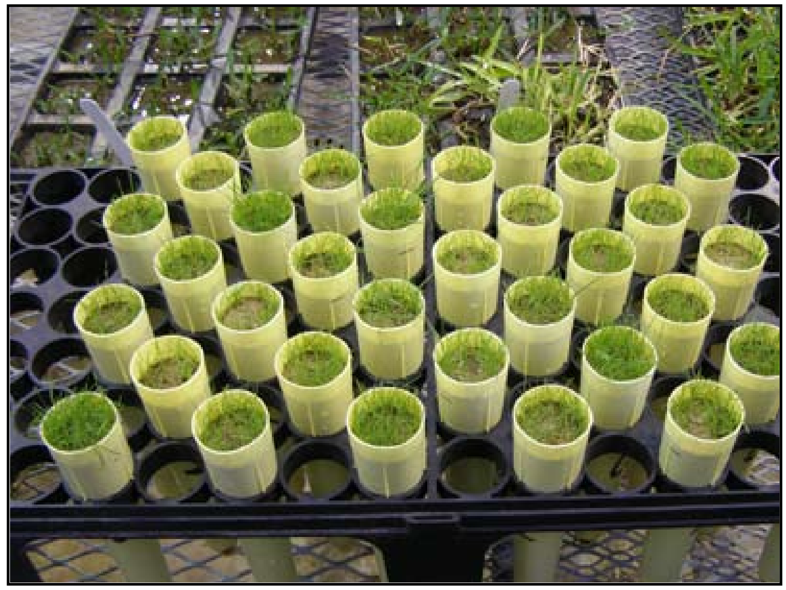

Photo by Josh Summerford

Creeping bentgrass establishment in sand rootzones amended with various ratios of poultry compost or reed sedge peat.

Summary. Establishing creeping bentgrass on sand-based putting green rootzones is a challenge due to the poor water and nutrient retention of the rootzone. Identifying locally available rootzone amendments to improve rootzone physical properties and enhance establishment would be beneficial. The objective of this study was to compare locally available poultry compost to peat and an unamended sand when establishing creeping bentgrass in sand-based rootzone. The compost treatment resulted in increased turf coverage and darker green turf color during establishment compared to the peat and unamended sand. Locally available compost shows promise as a sand-based rootzone amendment to enhance turf establishment.

Abbreviations: DAS, days after seeding; DGCI, dark green color index

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Putting green construction is one of the most crucial aspects of golf course construction as putting greens are the most vital area of a golf course and have the biggest impact on its success. For decades, the most accepted methods of putting green construction have called for the use of high sand content rootzones. Sand is the best material available for rootzone construction due to physical characteristics that enable it to resist compaction, maintain good aeration, and drain quickly. Although sand has many positive traits that make it a good rootzone material for putting greens, it does have deficiencies such as poor water and nutrient retention.

To compensate for these deficiencies, sand is commonly amended with materials to improve the physical and nutritional properties of the rootzone. The goal of rootzone amendments is to improve the relationship between the plant and the rootzone, thus improving growing conditions and minimizing management problems (Waddington, 1992). The most commonly used amendment is peat, an organic material with high water-holding capacity and some nutritional value. Peat fulfills the objectives of rootzone amendments by increasing water and nutrient-holding capacity, as well as reducing bulk density to improve the plant–rootzone interaction. In past research, peat amended rootzones have been shown to improve germination and establishment compared to 100% sand based rootzones, which is likely due to the increased water and nutrient retention provided by the addition of peat (Bigelow et al., 2001).

Another organic amendment that has shown promise in sand-based rootzones is compost (Carey and Gunn, 1998). Carey and Gunn (1998) showed that an 80:20 (v/v) blend of sand to compost significantly improved germination and establishment rates of bentgrass compared to the same ratio of sand and peat. This study also showed significantly faster growth rate of shoots and roots as well as significantly higher water-holding capacity on the sand-compost blend compared to the sand-peat blend. The increased growth rates are likely attributed to the nutrient content of the compost, with more nutrients being readily available compared to the peat. An advantage of compost over peat is that it is more locally available throughout many regions of the world, including Arkansas. In addition, studies are consistently demonstrating that compost can enhance disease suppression in many soils.

This study compared two ratios (90:10 and 80:20 (v/v)) of locally available poultry compost and peat-amended sand rootzones as well as a non-amended sand rootzone for creeping bentgrass establishment and turf color. The objective of this research was to determine which amendment and ratio provides the fastest establishment and darkest turf color.

Materials and Methods

This experiment was conducted from 30 October through 7 December 2009 in a greenhouse on the University of Arkansas, Fayetteville campus. All rootzone blends were made using sand meeting USGA greens construction guidelines (USGA 2004). Compost was supplied by Soil-Smart Professional Organics (Ag Natural, LLC, Colcord, Okla.) and had an N-P-K analysis of 1-3-1. Two rootzone blends were made for both compost and peat. The ratios were 90:10 and 80:20 (v/v) and were blended in bulk then added to cone-tainers. The cone-tainers measured 1.5 inch in diameter and 8.25 inch long and were filled to 0.5 inch from the rim. Each rootzone blend was replicated six times. Creeping bentgrass (*Agrostis stolonifera* cv. Providence) was seeded into each cone-tainer at a rate of 1 lb/1000 ft^2. Each cone-tainer was also fertilized with an organic fertilizer (6-2-0) at a rate of 1 lb N/1000 ft^2, then topdressed with 2 g sand to ensure good seed to soil contact. Following seeding, irrigation was applied 3 times daily until germination, once daily for the week following germination, and 4 times weekly for the remainder of the trial. Digital images were taken twice weekly to evaluate for percent green turf cover and dark green color. Dark green color was measured by a dark green color index (DGCI) value resulting from digital image analysis (Karcher and Richardson, 2003). Plots were maintained at a 0.5 inch height of cut with a mowing frequency of 3 times per week. In early December, the turf appeared chlorotic and the growth rate had slowed, so urea fertilizer was applied on 2 December at a rate of 0.5 lb N/1000 ft^2 to encourage complete establishment.

Results and Discussion

Throughout the duration of this trial, rootzone sand amended with peat at either ratio never produced significantly different percent green turf cover or dark green color compared to the 100% sand rootzone. This is likely due to water not being a limiting factor in this study, and therefore the abundance of irrigation compensated for the lower water holding capacity of the 100% sand rootzone.

Green turfgrass coverage. The rootzones amended with compost did however demonstrate improved green turf coverage and dark green color values (Figs. 1 and 2). From the second evaluation date, at 13 days after seeding (DAS), through 45 DAS the 80:20 compost blend produced higher turfgrass coverage than both peat blends as well as the 100% sand rootzone. By 25 DAS the 80:20 compost blend produced greater green turfgrass coverage than all other blends and the 100% sand rootzone and continued to do so until 41 DAS. From 31 DAS to 45 DAS, the 90:10 blend of compost and sand had greater green turfgrass coverage than both peat blends and the 100% sand rootzone.

Dark green color. From the first evaluation date at 11 DAS through 41 DAS, the 80:20 sand to compost blend had higher DGCI values than either peat blend as well as the 100% sand rootzone. At 11 DAS and 31 DAS, the 80:20 sand-compost blend had higher DGCI values than the 90:10 sand-compost blend. The 90:10 sand to compost blend had significantly higher DGCI values than the 100% sand rootzone on the first evaluation date, but was not different than the sand and peat blends and the 100% sand rootzone for the next six evaluation dates. At 38 DAS, the 90:10 sand-compost blends had higher DGCI values compared to both sand-peat blends. By 45 DAS, there were no differences in DGCI (data not shown).

Conclusions

Based on the data from this research, the 80:20 ratio of compost to sand provided significantly faster establishment rates compared to either ratio of peat and the non-amended rootzone. The 90:10 ratio of compost to sand provided better establishment than the peat and non-amended rootzones by the final three evaluation dates; however, establishment was still significantly lower than the 80:20 compost to sand blend. Since water was applied judiciously in this trial, the enhanced establishment with the compost treatments was likely a nutrient effect, although this was not evaluated in this experiment. Future work should evaluate the water-holding capacity of compost versus peat. These results suggest that locally available compost may be a viable option for amending sand-based putting green rootzones to enhance creeping bentgrass establishment.

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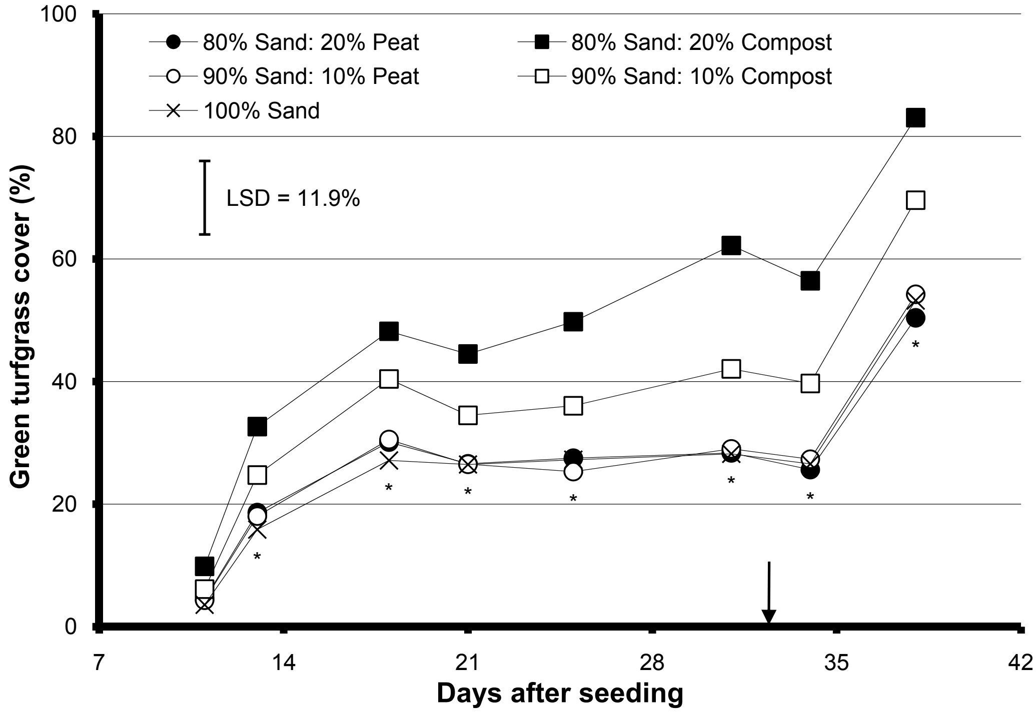

Fig. 1. Percent green turfgrass coverage as affected by rootzone blend. Error bar represents Fisher's least significant difference value (α = 0.05) for comparing rootzone blends within dates. Significant treatment differences were present on evaluation dates denoted with a "*". Arrow indicates date of nitrogen fertilizer (urea) application.

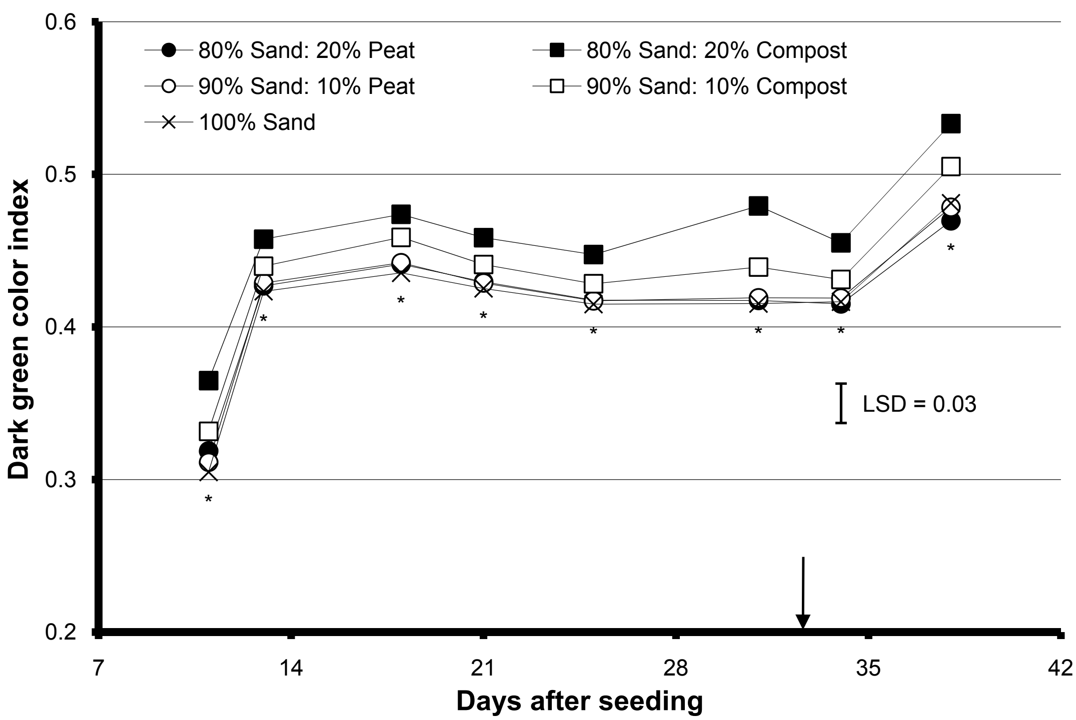

Fig. 2. Dark green color index values as affected by rootzone blend. Error bar represents Fisher's least significant difference value (α = 0.05) for comparing rootzone blends within dates. Significant treatment differences were present on evaluation dates denoted with a "*". Arrow indicates date of nitrogen fertilizer (urea) application.