Evaluating sand-capping depth and subsoil influence on fairway performance, irrigation requirements and drought resistance

B. Wherley, K. McInnes, W. Dyer, C. Reynolds, and J. Thomas- Texas A&M University

Sand-capping of golf course areas has gained popularity in recent years, especially on golf course fairways. Fairways represent one of the largest areas of irrigated turf on golf courses, and management of these areas can become especially difficult where fine textured native soils become degraded due to high sodium levels in irrigation water leading to loss of soil structure and permeability. Common problems arising in these scenarios include excessive fairway wetness, slow drainage, poor aeration, and severe compaction of highly trafficked areas; all of which result in poor quality turf. While no USGA recommendations currently exist for specific depths or particle size distribution of capping sands, less than optimal depths of sand are often used to reduce the cost of renovation. The ideal placement depth ultimately depends on physical properties of the sand, environmental conditions, and providing a balance of water- to air-filled porosity for optimal growing conditions. Preliminary testing of the capping sand used in this project indicated equal air to water filled porosity was achieved at 22 cm water tension (Fig. 1).

The objectives of this research are to 1) evaluate 'Tifway' bermudagrass (*Cynodon dactylon* (L.) Pers. x *Cynodon transvaalensis* Burtt-Davy) fairway performance and rooting characteristics as influenced by four initial capping depths (0= topdressed only, 5 cm, 10 cm, and 20 cm) atop two subsoils (clay loam and sandy loam), 2) determine how sand-capping by subsoil combinations influence root zone soil moisture and irrigation frequency requirements, and 3) monitor development of subsoil sodicity (SAR) and electrical conductivity and as a function of sand-capping by subsoil by irrigation treatments.

Plots were sprigged late summer 2014. Plots with shallower capping depths achieved full cover more rapidly than plots with deeper capping, however all plots reached full establishment by May 2015 (Fig. 2). Irrigation-frequency treatments of 1 and 2 events weekly were imposed beginning June 2015, with all plots receiving irrigation amounts of 60% of reference evapotranspiration. Despite a very dry 2015 summer, no significant differences in quality or percent green cover occurred between the 1 and 2 day per week irrigation frequency, regardless of sand-capping depth. A significant effect of capping depth on percent green cover occurred within plots having sandy loam subsoil, but not within plots with clay loam subsoils (Fig. 3). Sodium adsorption ratio (SAR) of fairway subsoils (upper 10 cm) increased sharply within the initial 12 months of the study, due to high Na concentration (~270 ppm) of irrigation water, but the rate of increase was delayed by sand-capping (Fig. 4). Assessment of thatch development and rooting profiles (root biomass and root length density) within the sand cap by subsoil treatments is currently underway. Preliminary observations indicate root development into subsoils has not been impeded, regardless of capping depth. Data on temporal dynamics of water movement within and through sand-cap treatments following summer irrigation/rain events have also been collected and are being analyzed. In the final year of the study, a 60-day drought will be imposed on all plots, with recovery under irrigation evaluated.

Summary Points

- While construction of a 20-cm deep sand cap would provide equal air to water filled porosity with this sand if it were placed above a capillary barrier such as in a green, this study will evaluate the impacts of capping depths on substrates that wick water.

- Bermudagrass sprig establishment time was increased as capping depth increased during the establishment period, however, all plots reached full establishment by May 2015 after being sprigged in late summer 2014.

- Despite a very dry 2015 summer, no significant differences in turf quality or percent green cover due to irrigation frequencies of 1 and 2 times per week (at 60% of reference evapotranspiration) were observed, regardless of sand capping depth.

- SAR is rapidly approaching sodic (SAR ≥ 13) conditions in both sandy loam and clay subsoils, however, this increase has been delayed by sand-capping.

- This study may lend insight into how recommendations for the physical properties of capping sands may differ from those currently used for USGA putting greens.

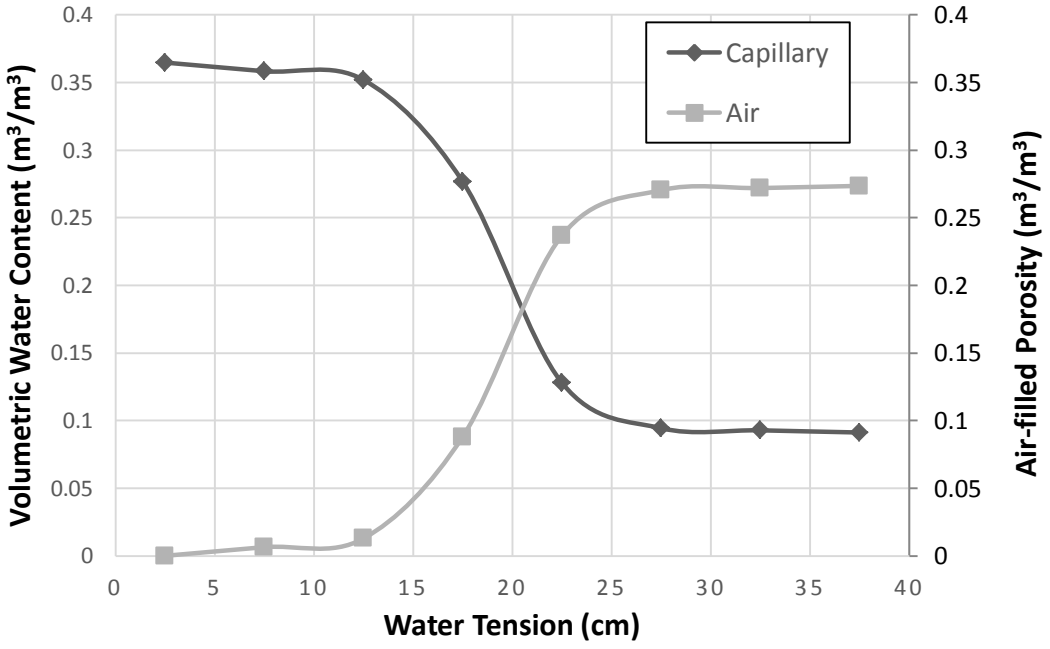

Figure 1. Volumetric water content and air/water filled porosity of the capping sand as a function of water tension (cm).

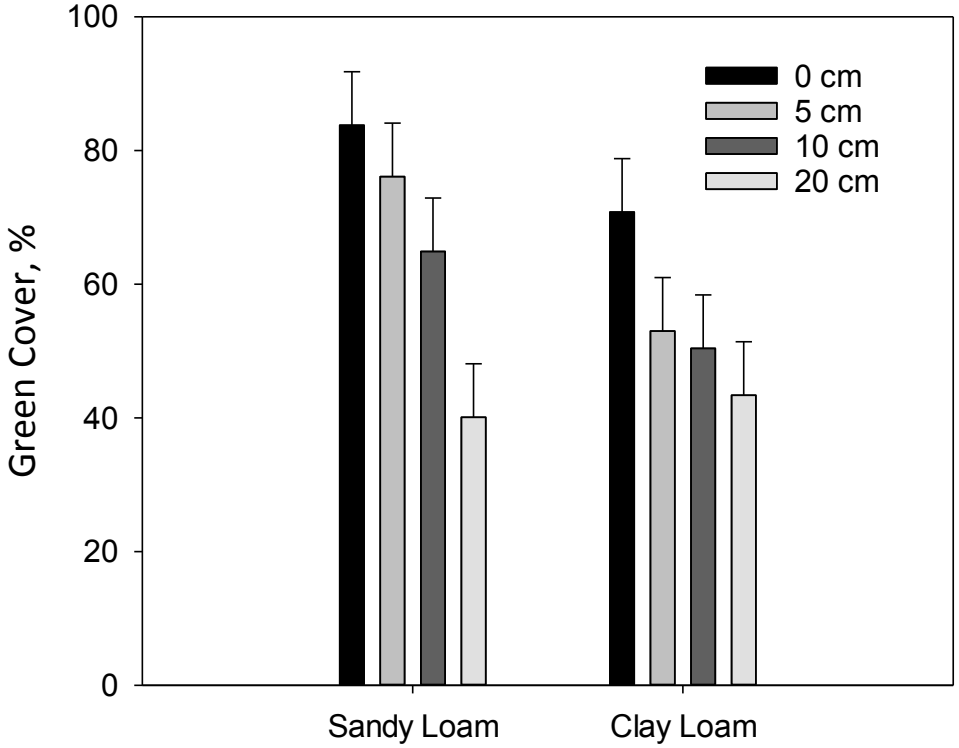

Figure 2. Green cover of fairway plots 8 weeks following sprig establishment as influenced by sand-capping depth on sandy loam or clay loam subsoils (November 2014). All plots reached full coverage by May 2015.

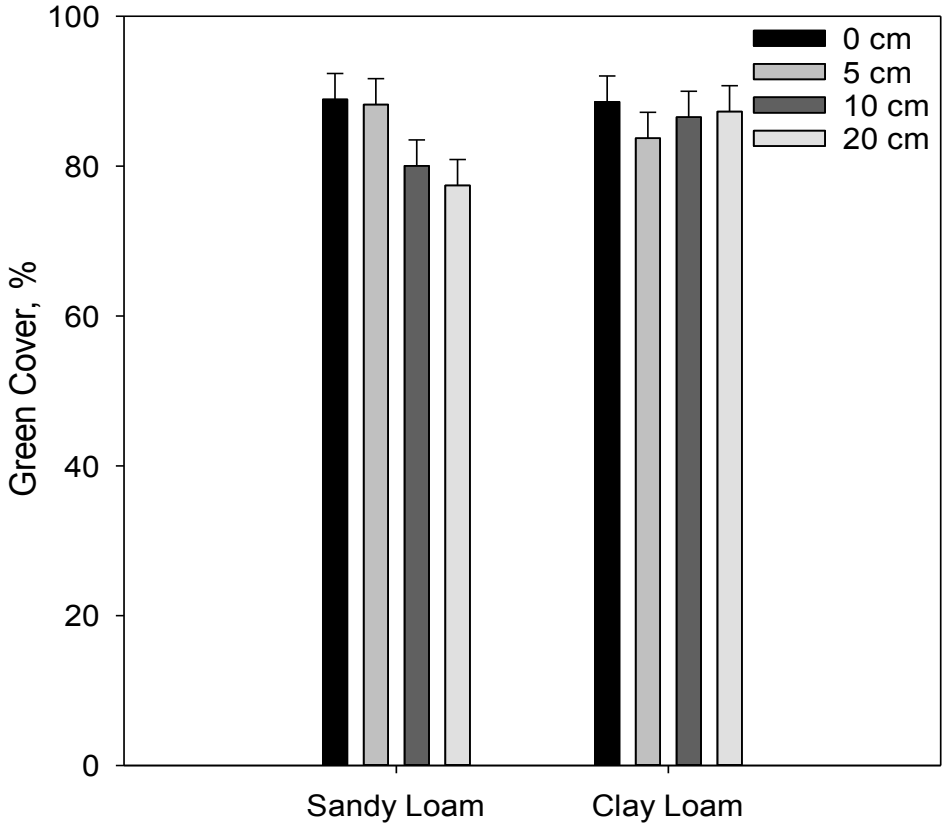

Figure 3. Mean percent green cover of sand-capping treatment plots on clay and sandy loam subsoils over the 2015 season. Means are pooled across irrigation treatments. Error bars denote LSD (0.05).

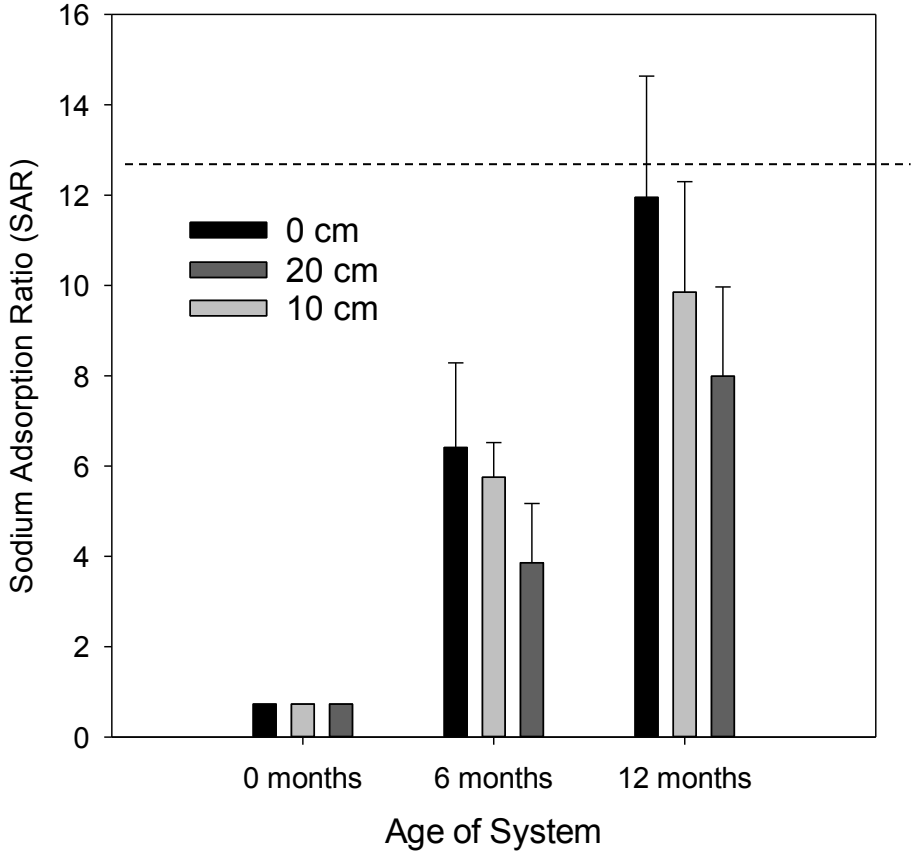

Figure 4. Increase over time in sodium adsorption ratio (SAR) of the sandy loam subsoil beneath the 0, 10, and 20 cm capping depths (0, 6 and 12 months into the study). Dotted line represents SAR level indicative of sodic soil. Error bars denote standard error.

Figure 5. Image of the sand-capping research fairway study at Texas A&M University Turf Field Laboratory taken during July 2015, just after topdressing of the 0 cm plots.

Figure 6. Construction of sand-capping treatments during summer of 2014.