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Evaluating Sand-Capping Depth and Subsoil Influence on Fairway Performance, Irrigation Requirements and Drought Resistance

B. Wherley, K. McInnes, and W. Dyer
Texas A&M University Department of Soil & Crop Science

A sand-capping research facility was constructed in College Station, TX in summer 2014. Establishment rates of Tifway bermudagrass in plots were inversely proportional to capping depth. While 0, 5, and 10 cm capping depth plots reached full establishment by the end of the 2014 season, 20 cm capping depths did not achieve full establishment until May 2015. This was due largely to differences in surface soil moisture between treatments, which progressively decreased with increasing capping depth.

Over the subsequent two years, turf performance, irrigation requirements, and water and salt dynamics have been closely monitored in relation to capping depths (0, 5, 10, and 20 cm) and subsoil textural treatments (Clay Loam vs. Sandy Loam). Interestingly, irrigation requirements were not found to differ between different capping depths, as plots irrigated 1x weekly generally maintained similar turf cover and quality to plots irrigated 2x weekly (both receiving 60% x reference evapotranspiration). However, overall turf quality and percent green cover was slightly decreased with increasing capping depth both years of the study (Figure 1). Averaging across both 2015 and 2016 seasons, the 0 cm capping depth (topdressed at a rate of 2.5 cm annually) supported ~90% overall green cover; both 5 and 10 cm capping depths supported ~80% overall green cover; and the 20 cm capping depth supported only ~70% overall green cover. Unlike 0, 5, and 10 cm capping treatments, the 20 cm capping depth also exhibited slightly delayed recovery following occasional verticutting and developed hydrophobicity near the thatch surface in year 2. Based on the findings from the establishment year and 2015/2016 seasons, the 5 and 10 cm capping depths seemed to provide better overall Turf Quality and Cover relative to the 20 cm capping depth, however, it is unknown whether these differences will persist long term as root zone organic matter accumulates.

During the 2017 season, a 60-day dry-down period was imposed, with all irrigation to the study terminated to allow for drought stress to be imposed on plots. Given the reduced amount of subsoil root development observed within deeper sand-capping treatments and potential for elevated irrigation water Na (275 ppm) to cause sealing off of subsoil, the dry-down provided an opportunity to observe drought resistance and recovery responses related to sand-capping x subsoil construction. The dry-down was imposed June 10 and continued until August 8, during which evaporative demand was high (reference ET ranged from 0.2 to 0.26"/day) and only 3 appreciable rain events occurred (Table 1; Figures 2 and 3). Soil volumetric water content, as measured by in-ground time domain reflectometry probes buried at the 5 and 15 cm depths in 20 cm capping depth plots, showed a brief spike occurring after these rain events, but was extremely low (3-5%) within the sand-cap for the duration of the dry-down. All treatment plots began the dry-down at ~80-85% green cover on June 13, but gradually declined over the course of the 60-day period to green cover levels of only ~17-24% (Clay Loam) and ~17-27% (Sandy Loam) by July 31. Following resumption of irrigation to plots on August 8, all

treatments exhibited rapid bounce back, achieving nearly full recovery levels (~80% green cover) by September 28.

Summary Points

- During establishment year (2014) and initial two growing seasons (2015/2016), the shallower (0, 5 and 10 cm) capping depths supported more rapid establishment, improved turf quality, higher percent green cover, and higher surface moisture relative to the 20 cm capping depths.
- Irrigation of 1x weekly and 2x weekly (each at 60% x ET_o) provided similar levels of turf quality and cover during the 2015/2016 seasons.
- A 60-day dry-down was imposed during the 2017 summer in order to evaluate sand-cap x subsoil treatment effects on drought resistance, recovery, and/or survival.
- By the end of the dry-down, all sand-cap x subsoil treatments had declined from ~80-85% to ~20-25% green cover levels, but rapidly rebounded back to near-full cover levels (~80%+) following resumption of irrigation in early August.

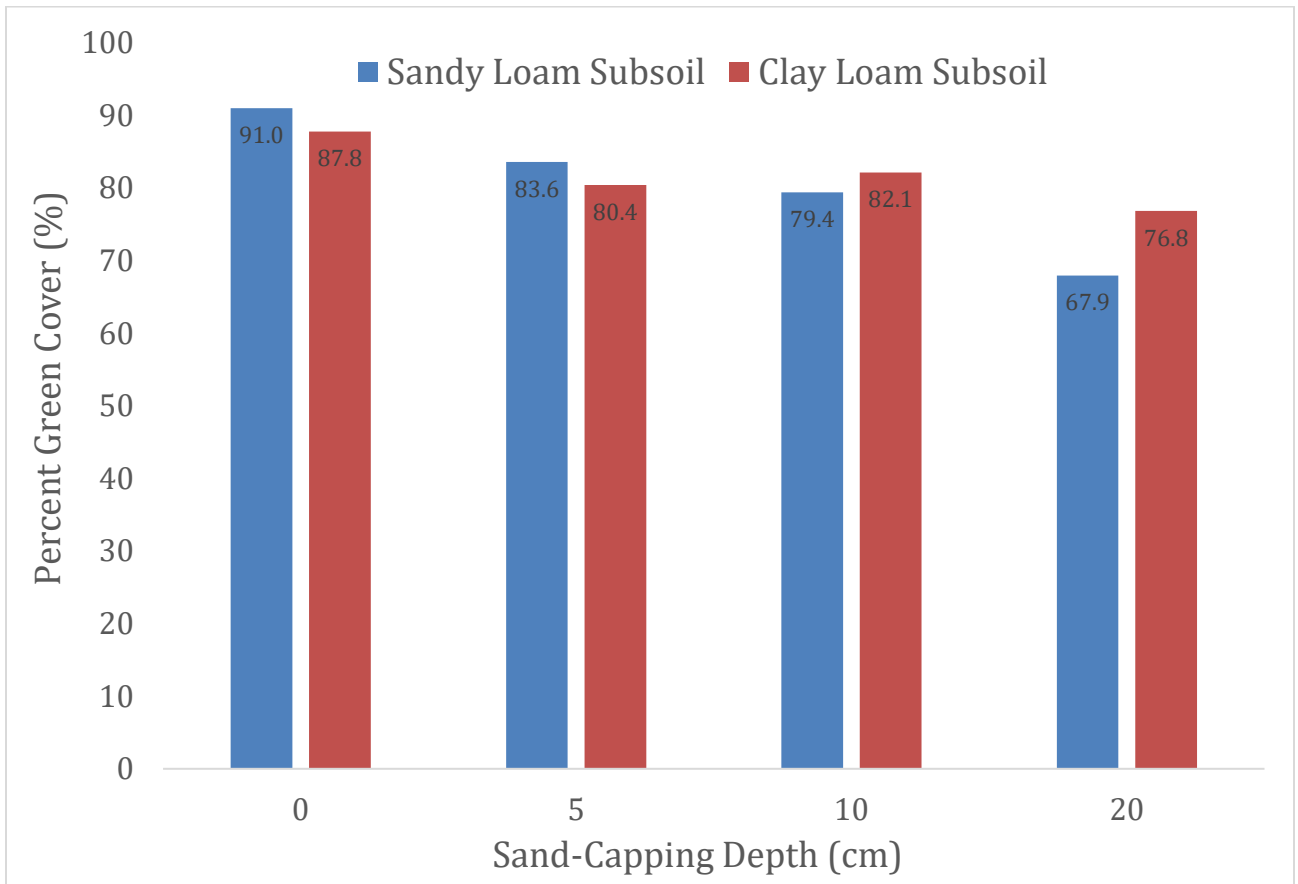


Figure 1. Two-year average Percent Green Cover of fairway plots as affected by Sand-Capping depth and subsoil texture. Measurements were obtained every two weeks during the study. Data are averaged across 1x and 2x per week irrigation frequency treatments for the 2015 and 2016 seasons.

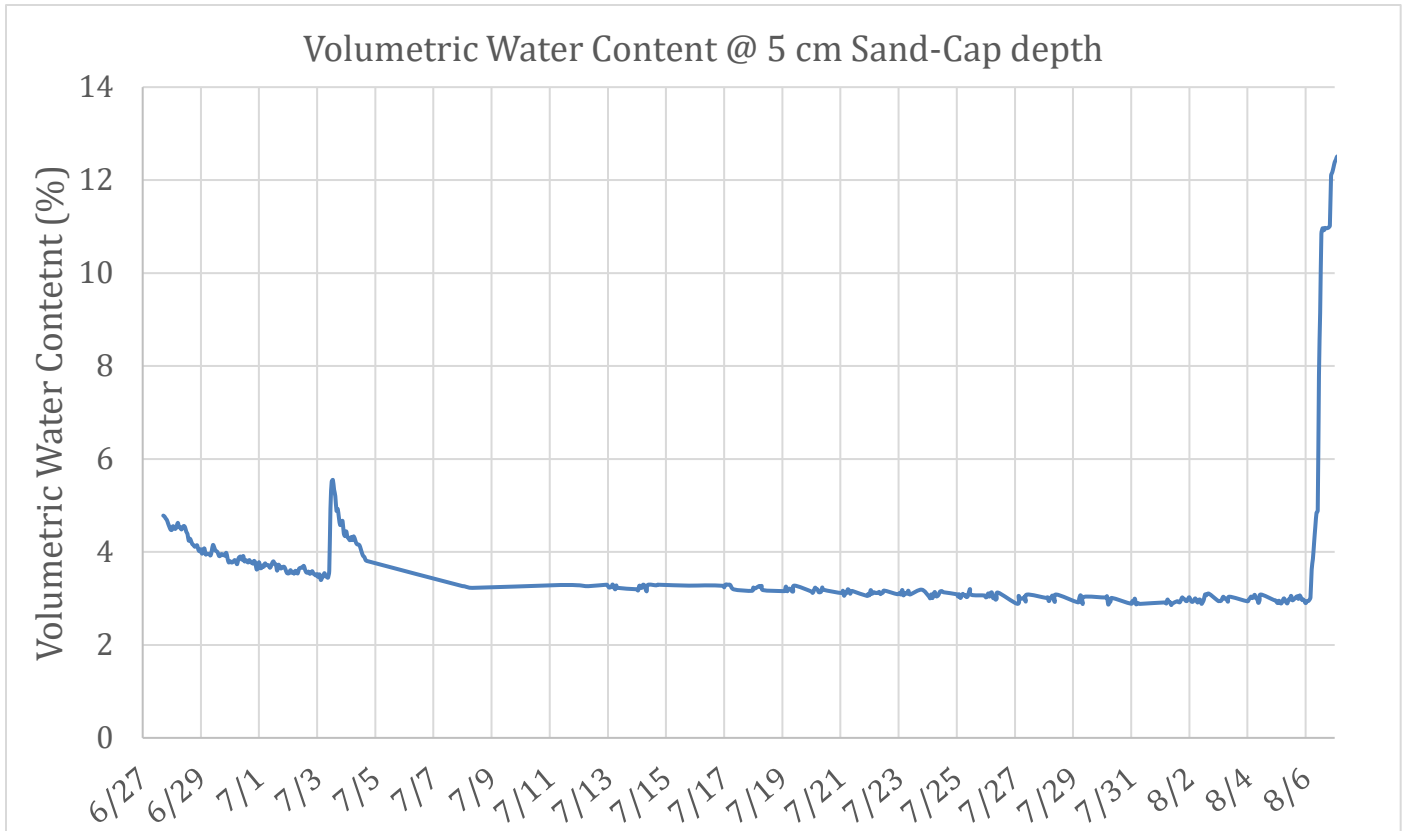


Figure 2. Soil Volumetric Water Content at the 5 cm depth within the 20 cm Sand-cap atop Clay Loam Subsoil during the 10 June- 8 Aug 2017 60-day dry-down period. Data shown are for 27-Jun through 8 Aug. No rainfall occurred from 10 June to 24 June. A 1.0" rainfall occurred 25 June. A 0.2" rainfall event occurred on 4 July. A 1.9" rainfall occurred on August 7.

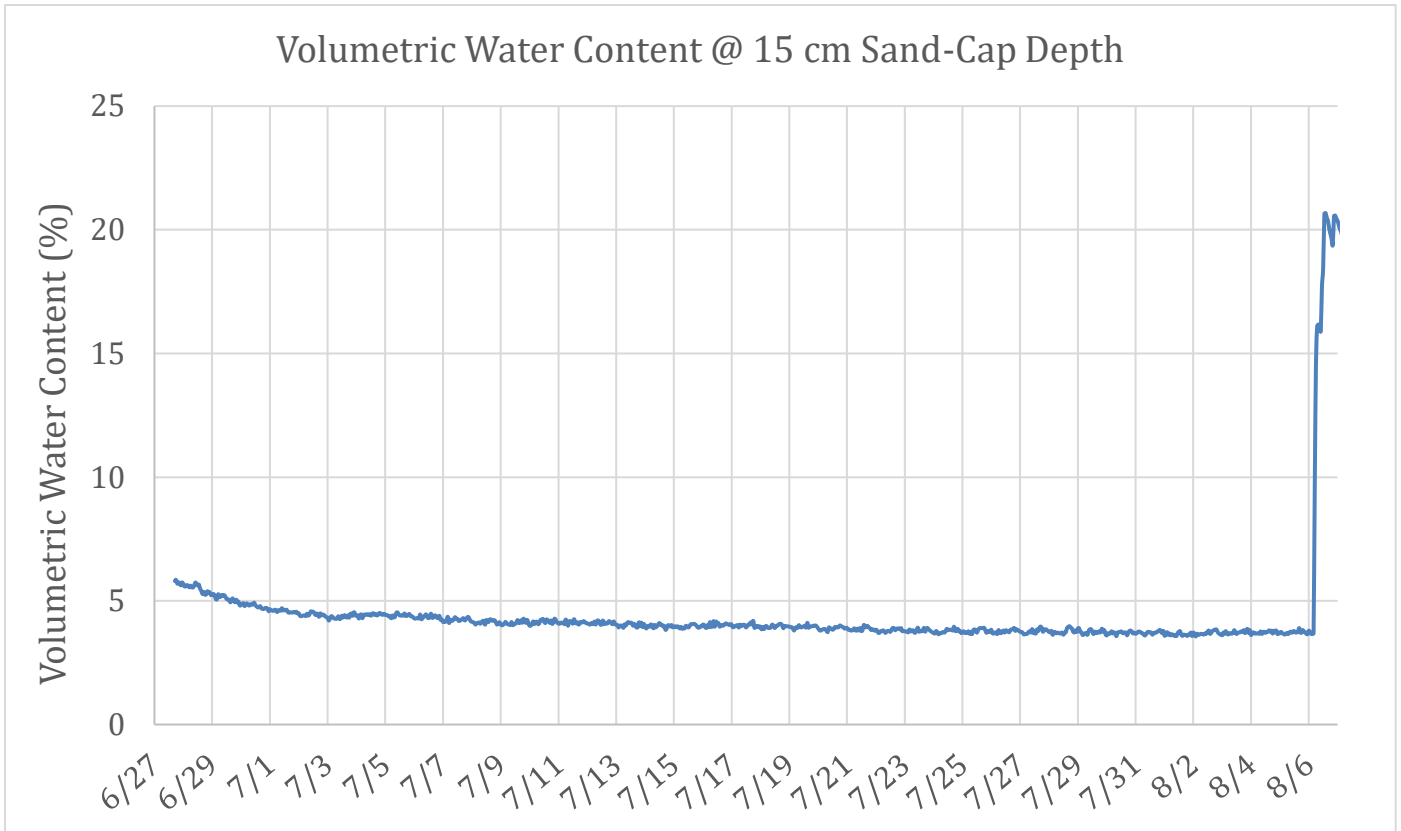


Figure 3. Soil Volumetric Water Content at the 15 cm depth within the 20 cm Sand-cap atop Clay Loam Subsoil during the 10 June- 8 Aug 2017 60-day dry-down period. Data shown are for 27-Jun through 8 Aug. No rainfall occurred from 10 June to 24 June. A 1.0” rainfall occurred 25 June. A 0.2” rainfall event occurred on 4 July. A 1.9” rainfall occurred on August 7.

Table 1. Mean Daily Reference Evapotranspiration (ET_o) and Cumulative Precipitation (inches) for the June, July, and August periods of the 2017 60-day dry-down phase. Data were obtained via an onsite weather station.

	ET _o (Inches day ⁻¹)	Precipitation (Inches)
June 10-30	0.25	1.1
July 1-31	0.26	0.4
August 1-8	0.20	1.99

Table 2. Percent Green Cover for 0 (topdressed), 5, 10, and 20 cm sand-capped fairway plots atop Clay Loam Sandy Loam subsoil during the 2017 60-day dry-down and recovery period. Dry-down period was imposed 10 June, with irrigation resumed to promote recovery on 8 August.

	Clay Loam Subsoil											
	Dry Down Phase								Recovery Phase			
	13-Jun	20-Jun	27-Jun	3-Jul	11-Jul	17-Jul	24-Jul	31-Jul	8-Aug	23-Aug	11-Sep	28-Sep
0 cm Topdressed	86.0	80.4	75.5	63.6	54.6	36.5	49.2	23.8	30.9	65.9	75.1	83.9
5 cm Sand-cap	85.4	71.6	69.6	58.2	50.7	28.1	45.4	19.8	24.4	60.0	67.6	81.8
10 cm Sand-cap	85.7	68.3	66.9	56.6	47.1	32.5	46.5	21.8	28.7	62.6	69.3	81.8
20 cm Sand-cap	84.9	65.9	63.1	47.1	28.0	23.7	31.6	16.8	20.6	46.7	62.6	80.0
LSD (0.05)	6.7	6.9	10.3	11.8	12.8	14.0	14.8	6.5	10.5	9.8	6.9	7.4

Table 3. Percent Green Cover for 0 (topdressed), 5, 10, and 20 cm sand-capped fairway plots atop Clay Loam Sandy Loam subsoil during the 2017 60-day dry-down and recovery period. Dry-down period was imposed 10 June, with irrigation resumed to promote recovery on 8 August.

	Sandy Loam Subsoil											
	Dry Down Phase								Recovery Phase			
	13-Jun	20-Jun	27-Jun	3-Jul	11-Jul	17-Jul	24-Jul	31-Jul	8-Aug	23-Aug	11-Sep	28-Sep
0 cm Topdressed	83.0	80.3	76.8	60.0	57.5	43.6	63.9	26.1	33.1	76.3	79.8	78.2
5 cm Sand-cap	78.8	74.1	72.5	59.3	54.9	41.1	57.5	26.9	36.3	74.0	75.3	78.1
10 cm Sand-cap	80.6	62.8	63.3	48.5	37.0	28.2	45.1	20.2	27.7	65.4	68.6	81.3
20 cm Sand-cap	82.5	58.2	44.5	27.2	19.0	20.1	31.7	17.3	22.1	51.8	59.0	79.2
LSD (0.05)	6.9	8.4	9.8	14.6	16.0	15.9	27.1	10.8	13.8	14.1	11.8	8.7