Incorporating Cultivation Practices and Products to Reduce Salinity Parameters from Poor Quality Irrigation Water on Golf Course Fairways

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The second year of field research was completed in October 2016 with minor lab work remaining. The research was initiated at both Rawls Golf Course and Meadowbrook in June 2016 applying cultivation treatments and products to the same strip-split plot randomized complete block design that was established in 2015 (Table 1; Images 1 and 2). Last fall and winter provided leaching rainfalls and some heavy snow storms early that facilitated movement of salts deeper into the rootzone. However, the summer months were extremely dry, which increased reliance on supplemental irrigation to maintain adequate playing conditions at both locations. The injury from cultivation and time to full recovery at each golf course was the primary factor for statistical differences in percent green cover, spectral analyses (Fig. 1), and soil moisture content as observed in 2015. Core-aerified plots had significantly less green cover, color, and moisture than sliced or control treatment strips at both locations initially, but the recovery process was lengthened at the Rawls Golf Course (Fig. 1). Soil texture analysis was conducted on samples from each course, and the Rawls Golf Course location contains 5% greater clay content than soil from Meadowbrook on average. Hence, the additional clay content keeps the soil from being as pliable to encompass the voids left from cultural practices applied.

There is limited evidence that the salinity levels reached in this region with our high ET demand and water quality results in significant above ground effects on the turf. It is rare to see wide spread areas of bare ground with saline or sodic soils as I have observed from other regions around Texas with heavier clay soils. Our typical sandy clay loam type soils and variability in water quality may not result in high salinity/sodicity levels to see above ground effects; however, increased soil EC levels have been documented in irrigated areas on golf courses in this region. The increased irrigation demand and limited leaching type rainfall events this year were thought to make great conditions to separate salinity levels based on soil electrical conductivity (EC). The primary differences in soil EC observed were from Meadowbrook Golf Club where significant differences in products were observed at the August and October soil sampling dates (no differences in June) (Fig. 2). Similar to 2015, granular products (gypsum and Verde-Cal G) significantly increased measured EC level in both months. This increase in EC level was observed for many products as the untreated control treatments remained in the lowest group. Both golf courses exhibited significant differences in soil pH in October following the full season of applications (Fig. 3). We are currently scanning all soil with the PXRF gun to determine potential correlations with large chemical elements and salinity measurements, and we will do further water quality analysis from both locations to estimate the greatest salinity hazard at each course (saline vs sodic or both).

Summary bullet points

- Increased clay content (5% greater) at Rawls Course significantly increased recovery time from cultivation practices, especially core aerification, which resulted in poor above ground characteristics.
- Relative soil moisture at 1.5 inch (3.8 cm) depth was significantly reduced throughout the summer 2015 and 2016 at Meadowbrook with core aerification.
- Core aerification decreased ratio vegetation index (RVI) throughout summer at Rawls Course, but cultivated practices provided significantly better RVI at Meadowbrook late in the summer.
- The granular gypsum and verde-cal G applications reduced soil pH in October at both golf courses with Meadowbrook maintaining significantly lower pH than other treatments.
- The same granular treatments (gypsum and verde-cal G) significantly increased soil EC levels at Meadowbrook in August and October, but no significant differences were observed at Rawls Golf Course in 2016.

Tables, Figures, and Images

Trt #	Product trt	Rate/1,000 ft^2	Application timing
1	Untreated control	None	None
2	Kelly's gypsum	10 lbs	Applied once a month
3	ACA 2994	8 fl oz	Applied once per two months
4	ACA 2786	4.5 fl oz	Every two weeks
5	ACA 1900 ACA 2786	8 fl oz 4.5 fl oz	Initial application and 6 wks after Two aps two weeks apart between ACA 1900
6	Oars PS	5 fl oz	Applied once a month
7	Vertical G	12 lbs	Applied once a month
8	Oars PS Vertical G	5 fl oz 12 lbs	Applied once a month with liquid applied over the top of granular
9	DG Gypsum	12 lbs	Applied once a month
10	Cal-Pull	6 fl oz	Applied once a month

Table 1. Products and rates applied to three replicates of each cultivation treatment [non-cultivated, AerWay Slicer, and core-cultivated (3/4 inch diam. tine on 2 inch spacing)]. Initial applications were made on 10 June 2016 with subsequent applications made on manufacture recommendation.

Image 1. Fairway at Meadowbrook following cultivation practices on 10 June 2016.

Image 2. Application of dry granular products to appropriate treatments at Rawls Golf Course.

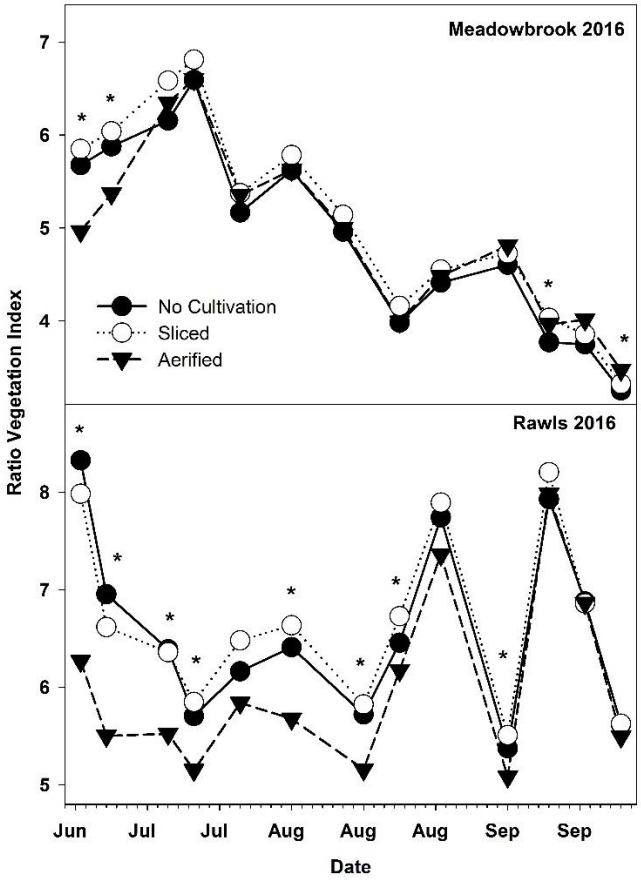

Figure 1. Ratio vegetation index (RVI) from Meadowbrook Golf Course (GC) and Rawls GC in 2016. Asterisks are placed above rating dates that were significantly different. Core aerified treatments had poorer RVI on every rating date at Rawls GC with differences, but cultivated treatments at Meadowbrook were better than control treatments late in the summer.

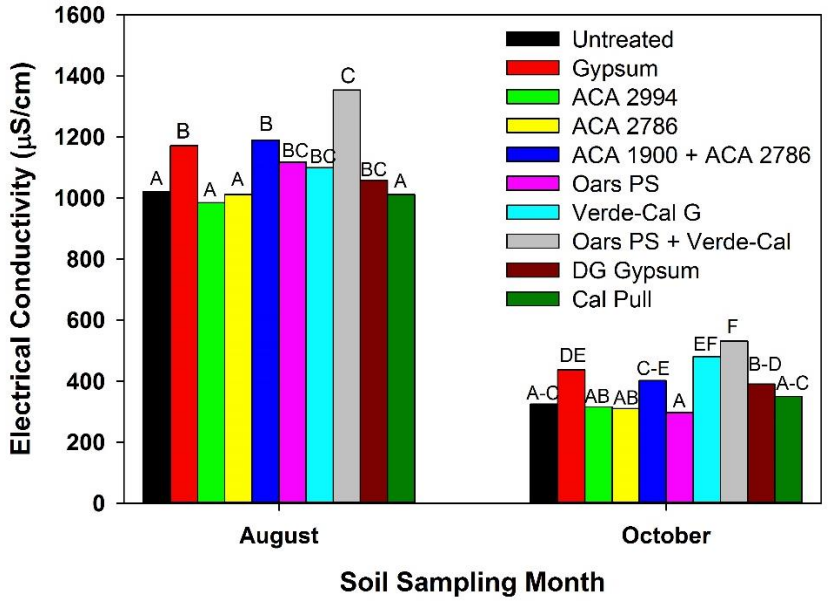

Figure 2. Soil electrical conductivity from August and October samples collected at Meadowbrook Golf Club. Bars sharing the same letter within sampling dates are statistically similar at $\alpha = 0.05$.

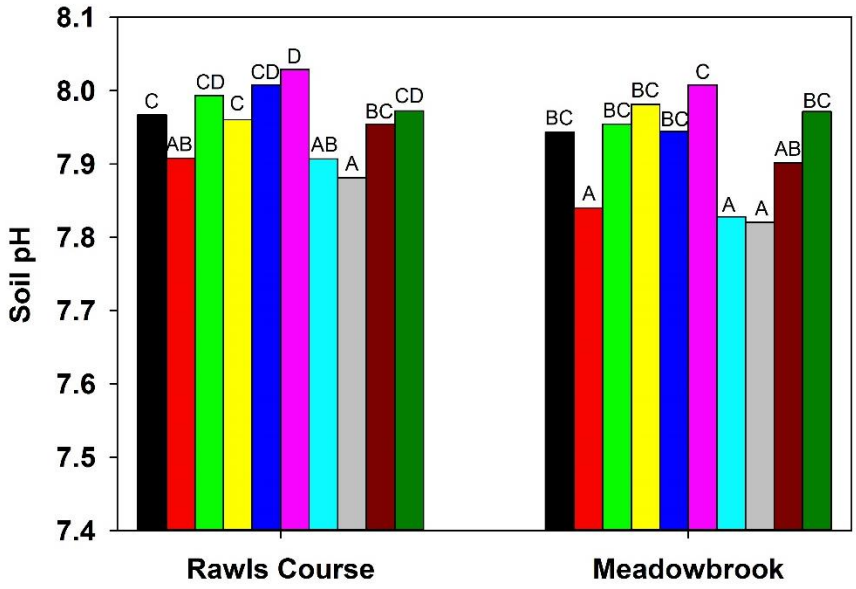

Figure 3. Soil pH from October soil samples from both Rawls Golf Course (GC) and Meadowbrook GC in 2016. Bars within a golf course sharing the same letter are statistically similar at $\alpha = 0.05$.