



Evaluating Newer Alternative Topdressing Materials (Angular Sands) for their Effects on the Playability of Putting Greens

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Introduction

Frequent sand topdressing is a common cultural management practice in routine golf course maintenance. Regular sand topdressing helps to ensure a smooth green surface and this enhances playability. Regular sand topdressing also prevents excessive thatch and organic matter accumulation. Traditionally, subangular sand is used for topdressing sand. More recently, superintendents have begun using angular sands with a coarser particle size (similar to bunker sand) for regular topdressing to improve surface characteristics of putting greens. Also, biochar, an organic matter alternative is being used in topdressing sand as well as root zone mixes. Scientific research is needed to validate the effects of newer alternative topdressing materials.

Objectives

- Evaluate creeping bentgrass growth and surface characteristics of a putting green surface given subangular versus angular topdressing sand.
- Evaluate turf health with and without biochar in topdressing sand.

Materials and Methods

Field Research using a Randomized Complete Block Design

- A ‘Pure Distinction’ creeping bentgrass putting green at the Bob Berry Sunshine Course in Lemont, IL.
- Five treatments were replicated four times.
- Individual plot Size: 10 ft x 10 ft.

Topdressing sand: Calcareous sands composed of calcium carbonate (CaCO₃).

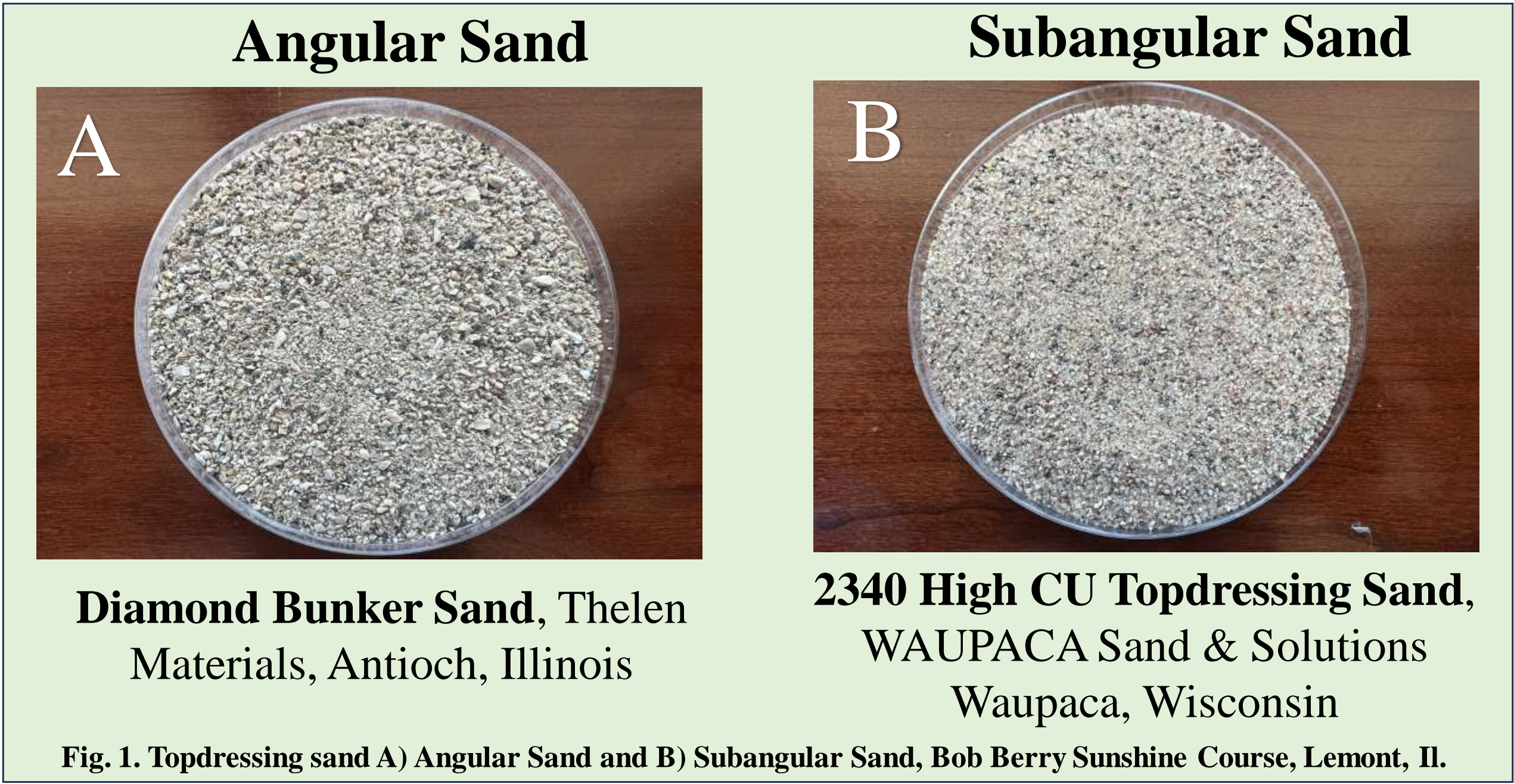


Table 1. Treatment list and description, Bob Berry Sunshine Course, Lemont, IL.

No.	Treatments	Application Rate (per 1000 sq ft)	Interval	Application Total = 10
1	Untreated	-----	-----	-----
2	Angular Sand	1.5 cubic feet sand	14 day	May 23 - Oct 3
3	Angular Sand + Biochar	1.5 cubic feet sand + 10 % biochar (w/w)	14 day	May 23 - Oct 3
4	Subangular Sand	1.5 cubic feet sand)	14 day	May 23 - Oct 3
5	Subangular Sand + Biochar	1.5 cubic feet sand + 10 % biochar (w/w)	14 day	May 23 - Oct 3

Treatment Details

- Sand was uniformly applied on individual plots using a Scotts Turf Builder 22 inch W Drop Push Spreader (Scotts Miracle Gro, Marysville, OH).
- Biochar was uniformly spread by hand before topdressing sand was applied.



Data Collection:

- Visual Turf Quality: 1 to 9 scale, 9 = best and 6 = minimum acceptable quality
- Normalized Difference Vegetation Index: GreenSeeker handheld sensor, (Trimble Inc. Westminster, CO).
- Ball Roll (ft): USGA stimpmeter
- Surface Firmness (in.): TruFirm, (Spectrum Technologies, Aurora, IL).
- Shear Strength (Nm): Shear strength tester, (Turf-Tech International, FL).
- Root Length (in.): Maximum root length using 0.5-inch diameter soil sampler
- Thatch Depth (in.): Thatch depth using 0.5-inch diameter soil sampler
- Matt Layer Depth (in.): Measured a 0.5-inch diameter soil sample
- Root Feeding Nematodes (nematodes per 100 g soil): Modified sucrose flotation technique with centrifugation



Figure 3. Aerial view of experimental area after topdressing sand application on Aug 12, 2024. Green 1, Bob Berry Sunshine Course, Lemont, IL.

Statistical Analysis

- Statistical analysis conducted for all data by date within each year (ARM statistical software, GDM Solutions, Inc.)
- Area Under the Progress Curve (AUPC) used to summarize data across one year. Estimated by the trapezoidal integration method (Madden et al., 2007).

ANOVA TABLE

Source	23-May	12-Jun	25-Jun	11-Jul	25-Jul	7-Aug	22-Aug	5-Sep	16-Sep	1-Oct	16-Oct	AUDPC
VQ	NS	NS	NS	NS	NS	*	NS	NS	NS	NS	NS	NS
NDVI	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Firmness	NS	NS	NS	NS	NS	NS	*	*	NS	NS	*	**
Shear Strength	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	*	NS
Moisture	NS	NS	NS	NS	NS	NS	NS	NS	NS	*	NS	NS
Ball Roll	NS	-	NS	-	NS	-	NS	-	NS	-	NS	NS
Root Length	NS	-	-	-	-	-	-	-	-	-	NS	-
Thatch Depth	NS	-	-	-	-	-	-	-	-	-	***	-
Matt Layer Depth	NS	-	-	-	-	-	-	-	-	-	*	-

Table 2: Summary ANOVA table for evaluated parameters. NS = not statistically significant, * = significant at 0.05 level of probability (or p value of 0.05), ** = significant at p value of 0.01, and *** = significant at p value of 0.001. AUPC = Area Under Progress Curve. Dash = data not collected

Results and Discussion

Visual Quality – 2024

- No differences except on Aug 7. (Fig. 4A)
- Angular sand + biochar had higher visual quality than subangular sand and untreated. (Table 2)
- Compared to untreated, all sand topdressing treatments appeared visually greener on Oct 16. (Fig. 4 and 5)

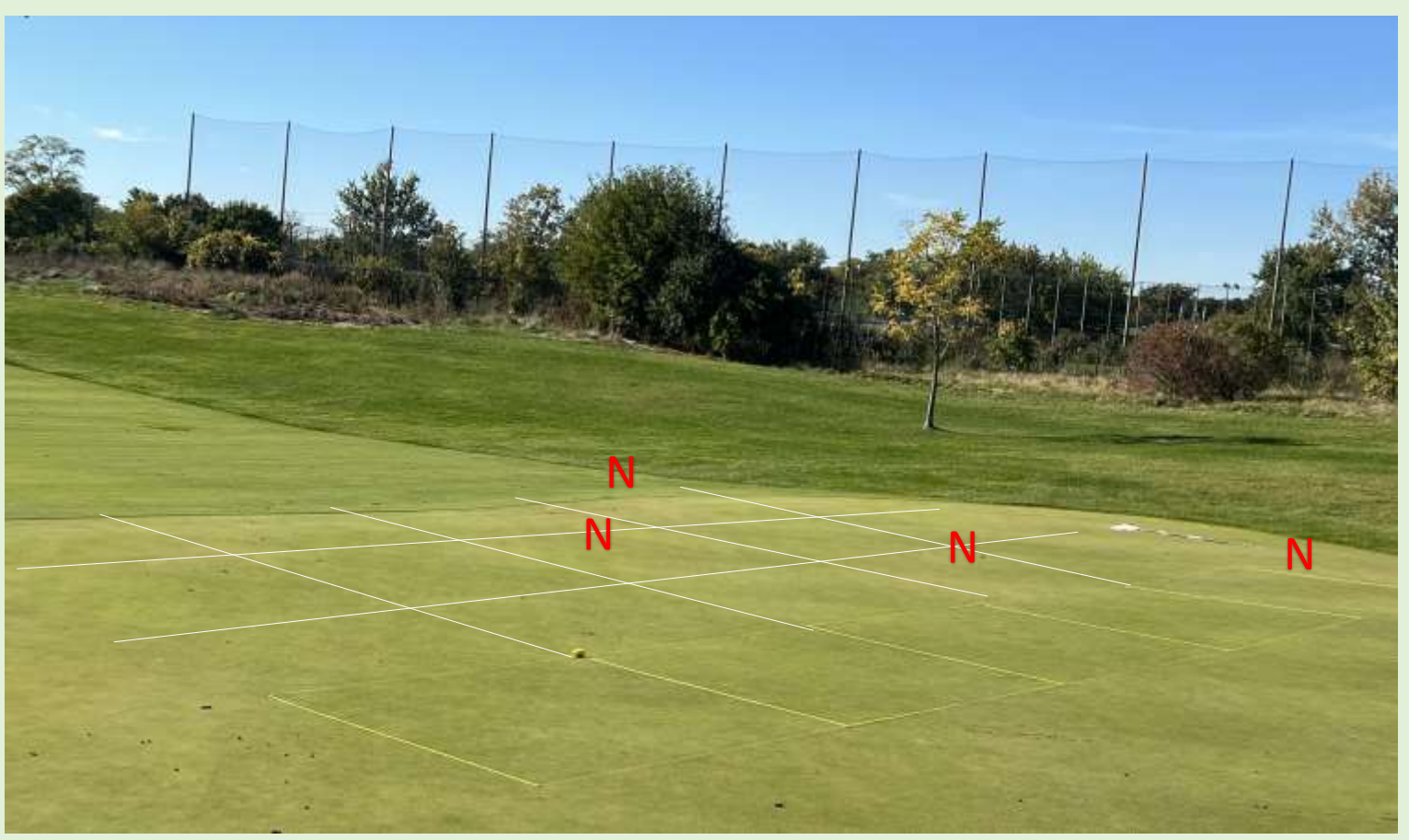


Figure 5. Aerial image of the experimental area showing enhancement of green color of sand applied plots compared to untreated plots (N) on Oct 16, 2024. Bob Berry Sunshine Course, Lemont, IL.

Surface Firmness – 2024

- All sand topdressing treatments were significantly firmer than the untreated on Aug 22, Sep 5, and Oct 16. (Table 2 and Fig. 6A)
- AUPC: Subangular Sand provided a firmer surface compared to angular sand and untreated. (Fig 6A)
- Overall, the least firm surface was observed on Aug 22 due to high average soil moisture content. (Fig 6A & C)

Shear Strength (Nm) – 2024

- No difference among the treatments were observed on most dates except on Oct 16. (Table 2)
- Angular sand tended to provided higher shear strength than subangular sand on a few dates, especially during summer.
- Shear strength was never below 17 Nm for any sand topdressing treatment but was observed for untreated on a few dates. (Fig. 6B)
- Sand topdressing maintained shear strength in the fall, which was different from untreated. (Fig 6B)

Ball Roll (ft) – 2024

- No difference among sand topdressing treatments were observed for ball roll on any rating date. (Table 2)
- A little increase in ball roll was observed at season end for sand applied from initial rating date.

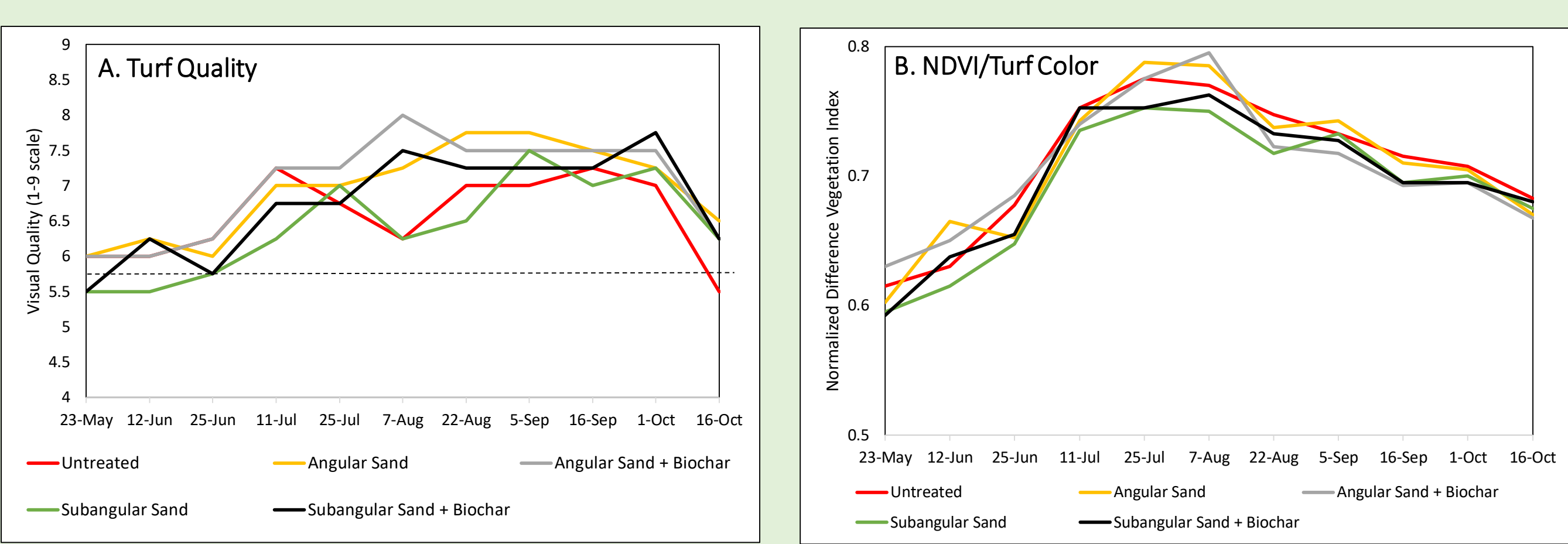


Figure 4. A) Visual Quality and B) NDVI/Reflectance of five sand topdressing treatments applied on a creeping bentgrass putting green in 2024. Different letters indicate significant differences using Area Under the Curve analysis, Fisher's LSD at P = 0.05.

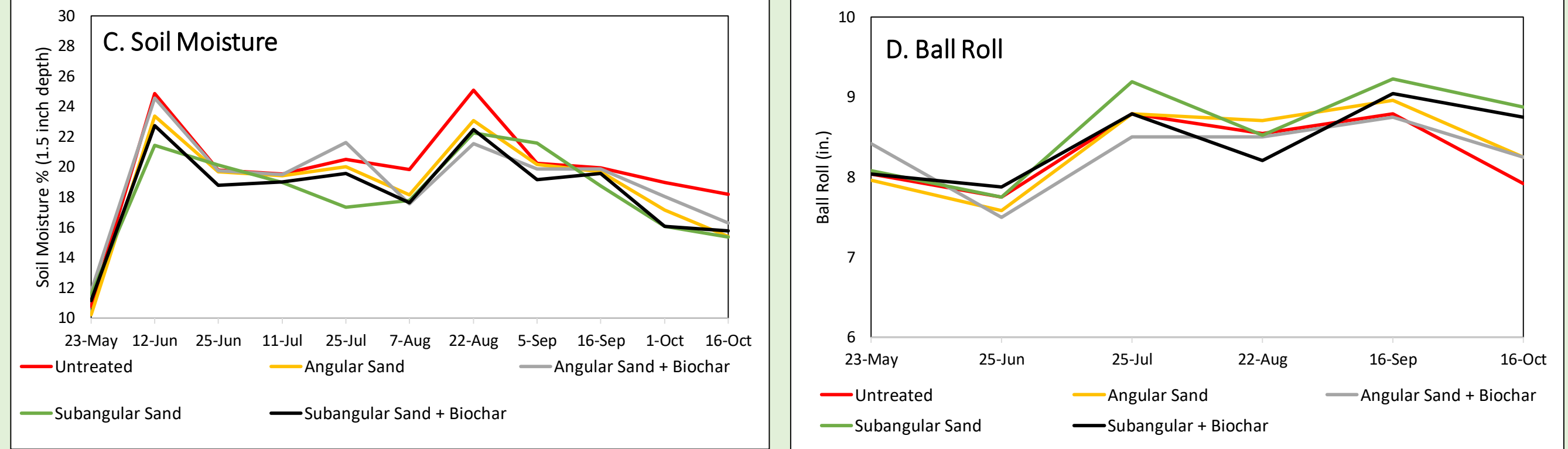
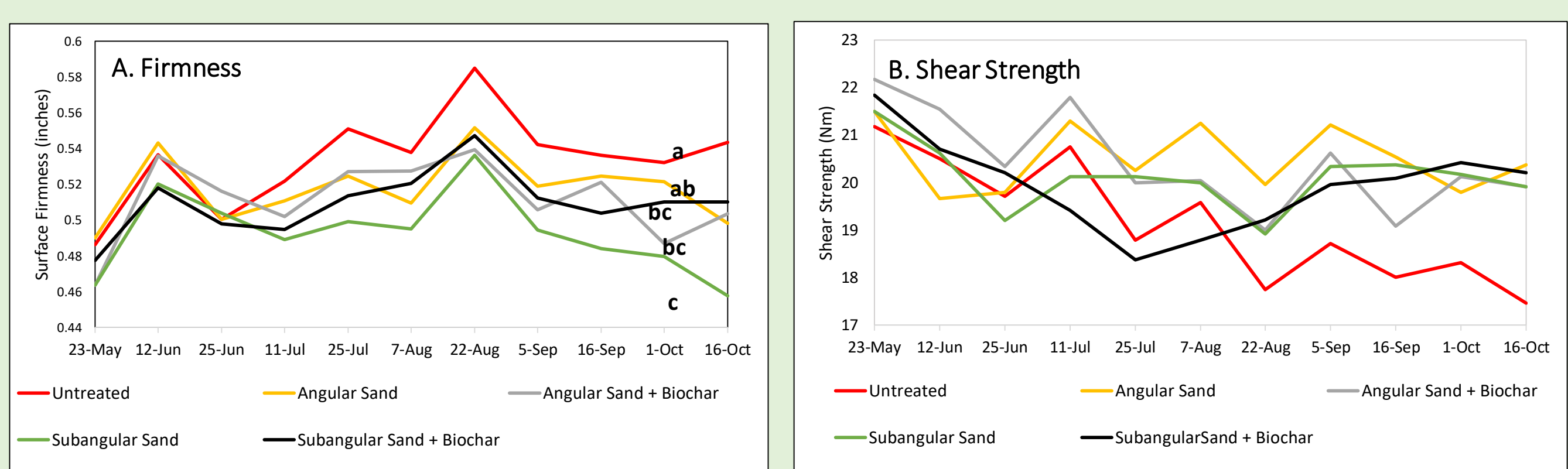


Figure 6. A) Surface Firmness (inches), B) Shear Strength (Nm), C) Soil Moisture (%), and D) Ball Roll (inches) of five sand topdressing treatments applied on a creeping bentgrass putting green in 2024. Different letters indicate significant differences using Area Under the Curve analysis, Fisher's LSD at P = 0.05.

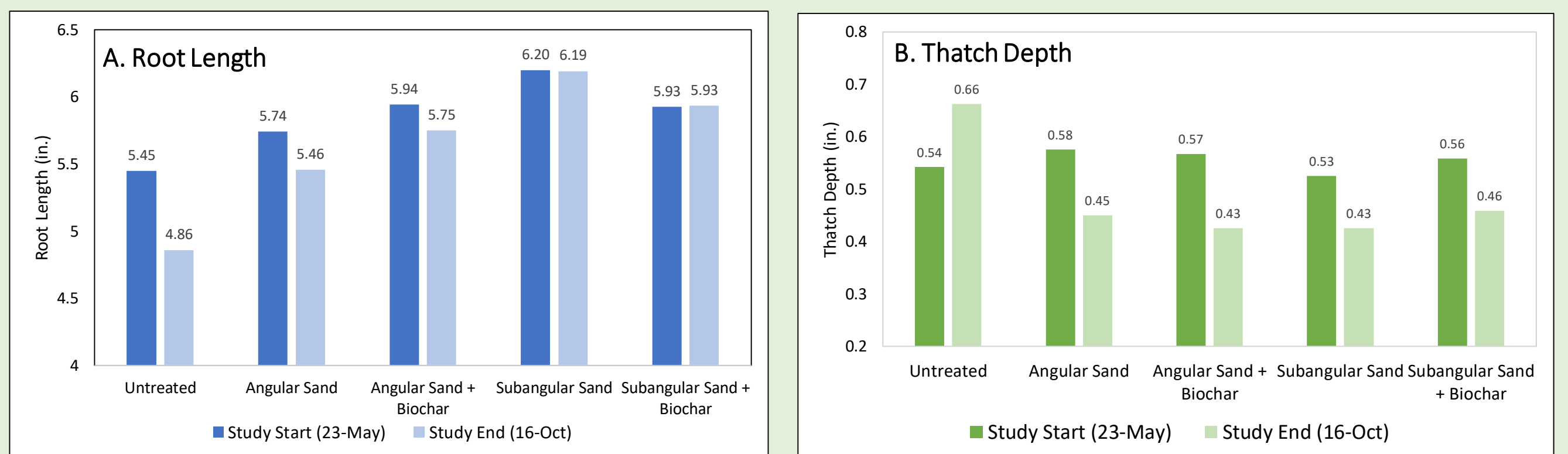


Figure 7. A) Root Length, B) Thatch Depth, C) Matt Layer Depth, and D) Soil Cores (Oct 16, 2024) of sand topdressing treatments applied on a creeping bentgrass putting green in 2024. Different letters indicate significant differences using Area Under the Curve analysis, Fisher's LSD at P = 0.05.

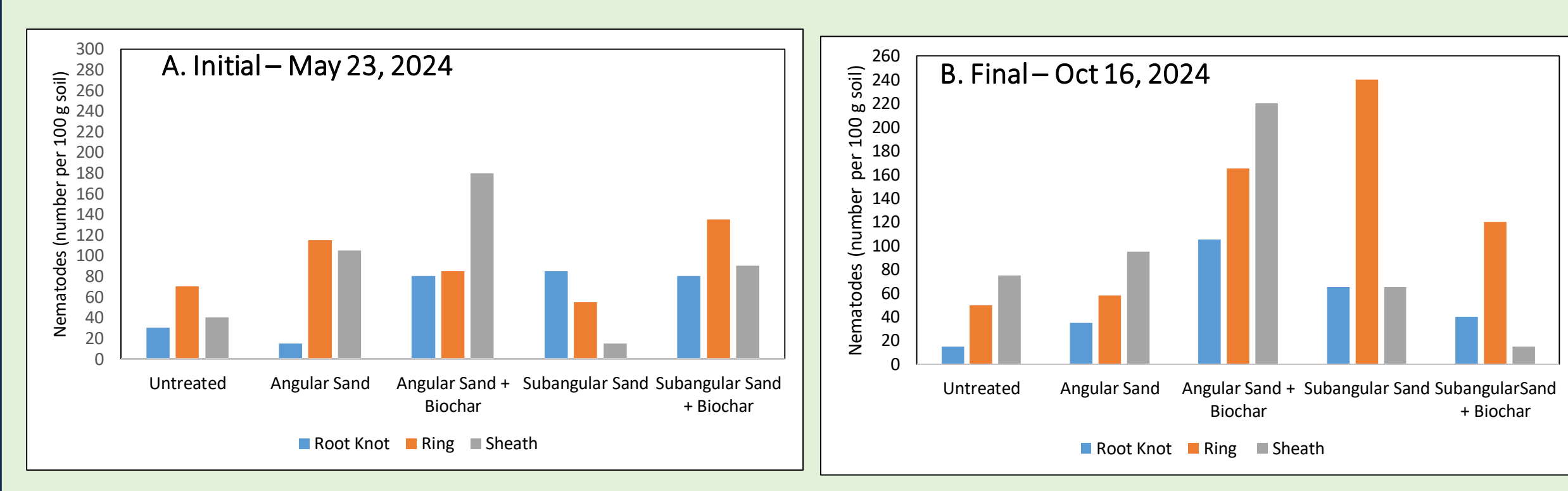


Figure 8. A) Initial nematode count, and B) Final nematode count, for five sand topdressing treatments.

Root Length: Root length was reduced for angular sand compared to subangular sand. (Fig. 7A)

Matt Layer Depth: The matt layer was pushed downwards for all sand applied plots. However, the matt layer was near surface for untreated plots. (Figs. 7A and D.)

Thatch Depth: Thatch depth was reduced in all sand topdressing treatments versus untreated. (Fig. 7B)

Nematodes: Root-knot, ring, and sheath nematodes were detected. (Fig. 8A and B) Sand topdressing treatments did not influence nematode population densities.

Conclusions

The current study is ongoing. Data in the first year found few differences among sand topdressing treatments for evaluated parameters. 1) Trends showed biochar may enhance green color when used in sand topdressing. 2) Subangular sand provided firmer surface than angular sand, but only on a few dates. 3) Shear strength was greater for angular sand than round sand, but only on a few dates. 4) Ball roll was not influenced by sand topdressing treatments. 5) Angular sand tends to reduce the root length of creeping bentgrass. 6) Thatch accumulation was reduced for sand topdressing treatments. 7) The matt layer was pushed down in the rootzone for all sand topdressing treatments. Preliminary findings will be confirmed by continuing this study in 2025 and 2026.