Characteristics of Saltgrass (*Distichlis spicata*) Establishment as a Turfgrass in the Desert Southwestern USA

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Abstract

Turfgrass industry is impacted by drought and heat stress across the Southwestern United States. Limited water availability for turfgrass irrigation also affects the utilization of certain naturalized turfgrasses in this region. Therefore, assessment of native grasses is deemed important to develop adapted species for use in specific turfgrass landscapes. Saltgrass (*Distichlis spicata*) is a hardy, perennial native grass that stays green even during extended periods of drought. This field study was conducted with 78 saltgrass accessions in Maricopa, AZ. The experiment was laid out in a split-plot design with two replications, where three irrigation treatments were assigned to the main plots, and the genotypes comprised sub-plots. In the 2024 establishment year, irrigation was applied four times per week to meet evapotranspiration replacement. Preliminary visual assessment and imaging data analysis shows statistically significant differences among the accessions for establishment rate and turfgrass density. These results suggest that saltgrass can serve as an alternative drought- and salinity-tolerant turfgrass in the desert environment for non-play areas of golf courses, recreational areas, and home lawns providing numerous ecosystem services. The naturally adapted native grass studied is expected to also offer significant benefit by reducing irrigation water requirement.

Background

Recent megadroughts and substantial high temperature in southwestern USA (Williams et al., 2022) has further strained the availability of fresh water for turfgrass irrigation. Research has shown that switching from managed turfgrass to low-input alternative native grasses and ground covers on desert golf courses can minimize water usage and improve turf management effectiveness (Burayu and Umeda 2021).

Research on identification and use of adaptable native grass species that are accepted for their aesthetic and functional qualities and drought tolerance is paramount. Numerous native grass species have been studied for low maintenance in various southern United States landscapes (Corley and Reynolds 1994; Aitken 1995; Ruter and Carter 2000; Dana 2002; Dunning 2014; Burayu and Umeda 2021).

Saltgrass (*Distichlis spicata*) is a warm-season grass grown in dry areas and has a potential to be widely used in a naturalized ecosystem with low input and maintenance requirements.

Objective

To evaluate and compare the adaptation and performance of salt grass accessions for low-input landscape conditions;
To better understand how available saltgrass germplasm may fare under high deficit irrigation for their turfgrass use in Arizona desert.

Materials and Methods

This field study was conducted with 78 saltgrass accessions obtained from USGA. The field experiment was established in Maricopa, AZ in August 2023. The experiment was laid out in a split-plot design with two replications, where three irrigation treatments were assigned to the main plots, and the genotypes assigned to sub-plots. In the 2023 establishment year, irrigation was applied four times per week to meet reference evapotranspiration (ET_o) replacement.
The individual genotypes were established on a plot size of 2.25 m2 (1.5 m x 1.5 m). RGB-image data were collected every other week from March to Sept 2023. Images were captured with a Nikon digital camera (Nikon Imaging Inc., Tokyo, Japan) mounted on a fixed height of 2m monopod designed specifically for this study in a nadir view position using consistent locked exposure settings. The images were cropped to 2.25 m^2 plot area using Python (Fig. 1).
The image data were analyzed using Turf Analyzer (Karcher and Richardson, 2013) and using a custom Python process to threshold green pixels and to determine percent plot cover (establishment), deep green color index (DGCI), and density metrics.

References

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Results

Percent threshold analysis using ortho-mosaics of RGB-image data revealed noticeable differences among the plots for percent area coverage (Fig. 1).

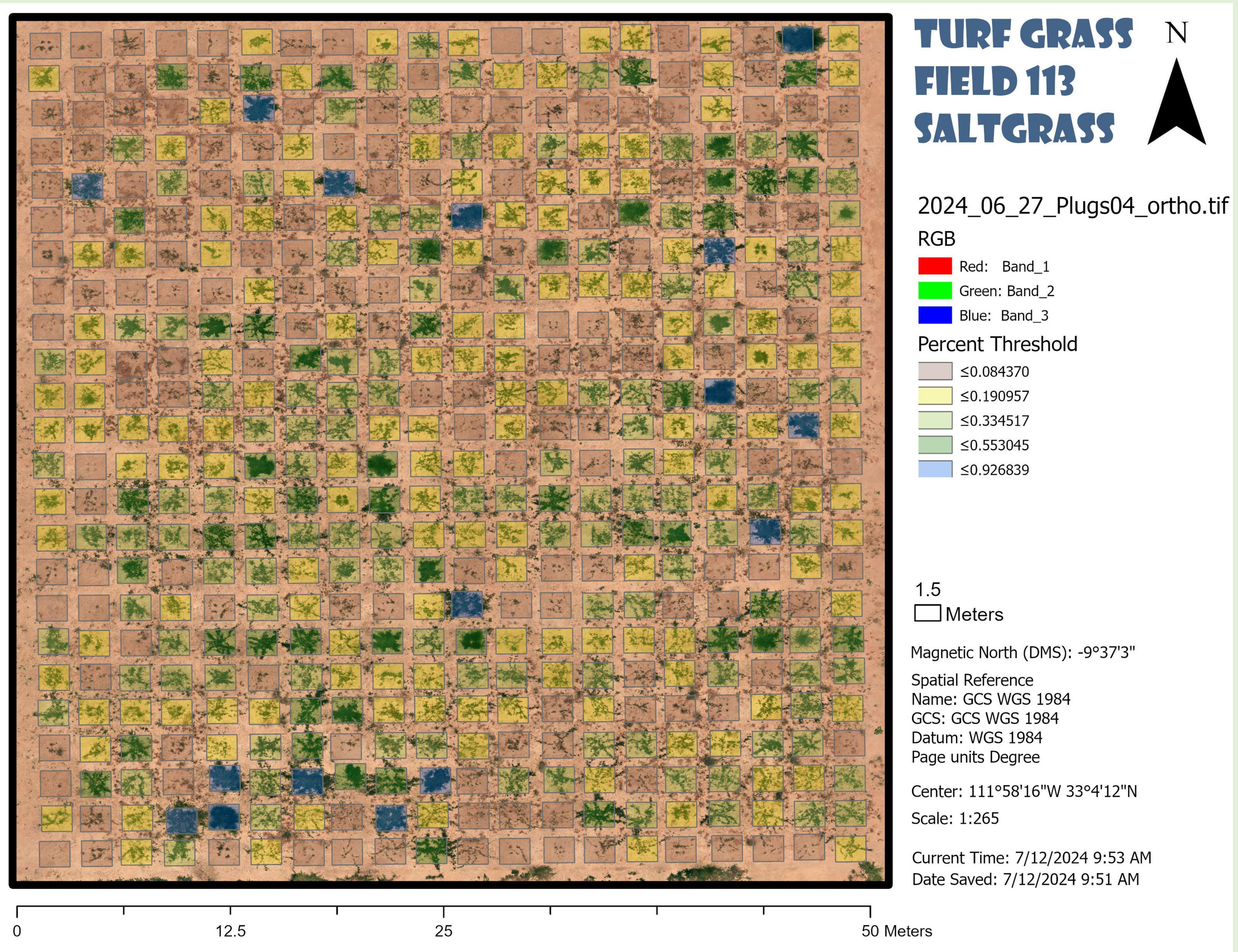


Fig. 1: Saltgrass plot coverage based on RGB-imaging analysis.

Deep green color index (DGCI) analysis revealed highly significant differences among the genotypes (Fig. 2).
Few genotypes with good percent of ground cover, density, and greenness were identified (Fig.3) during first year establishment.

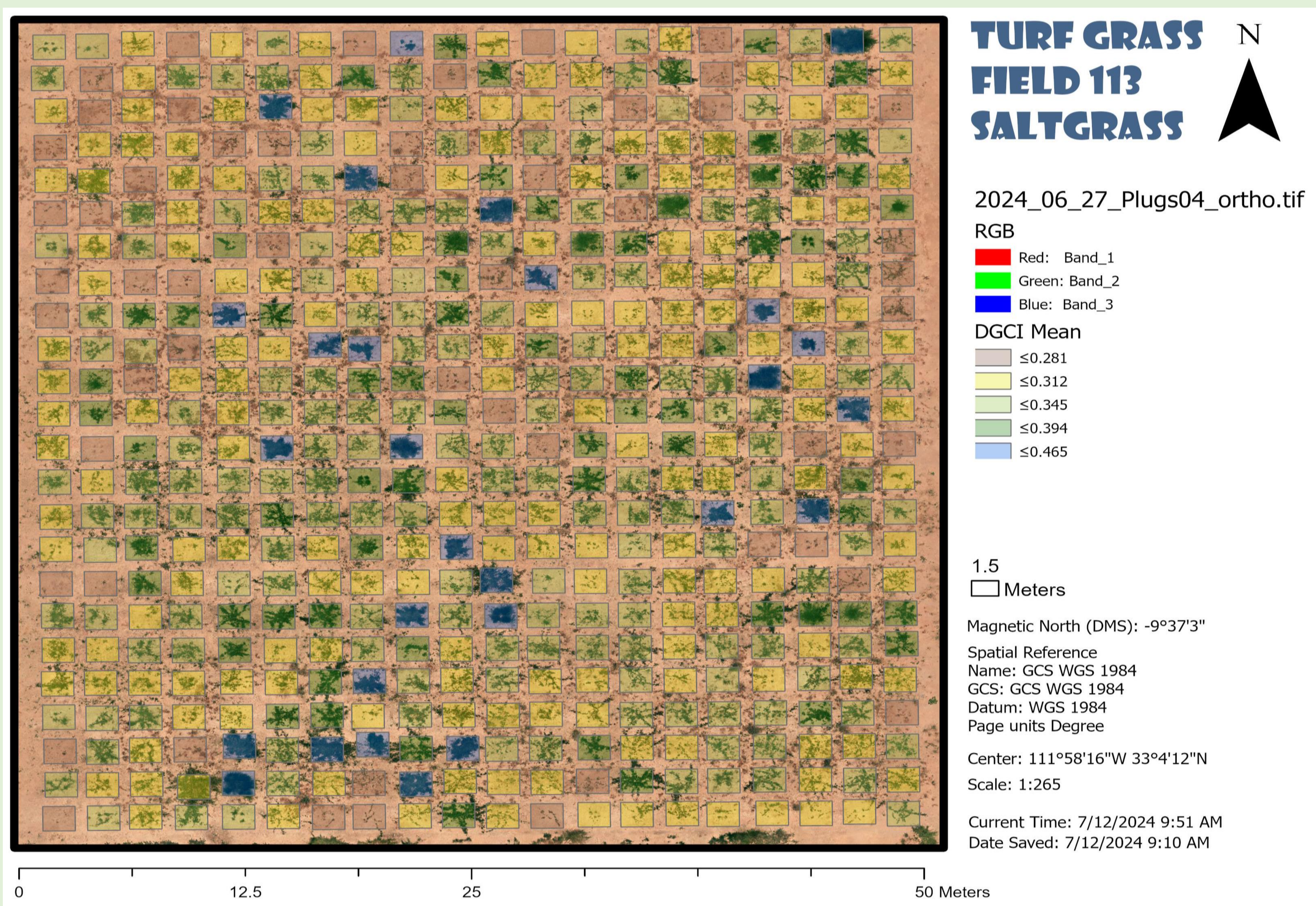


Fig. 1: Deep green color index (DGCI) of saltgrass accessions based on RGB-imaging analysis.

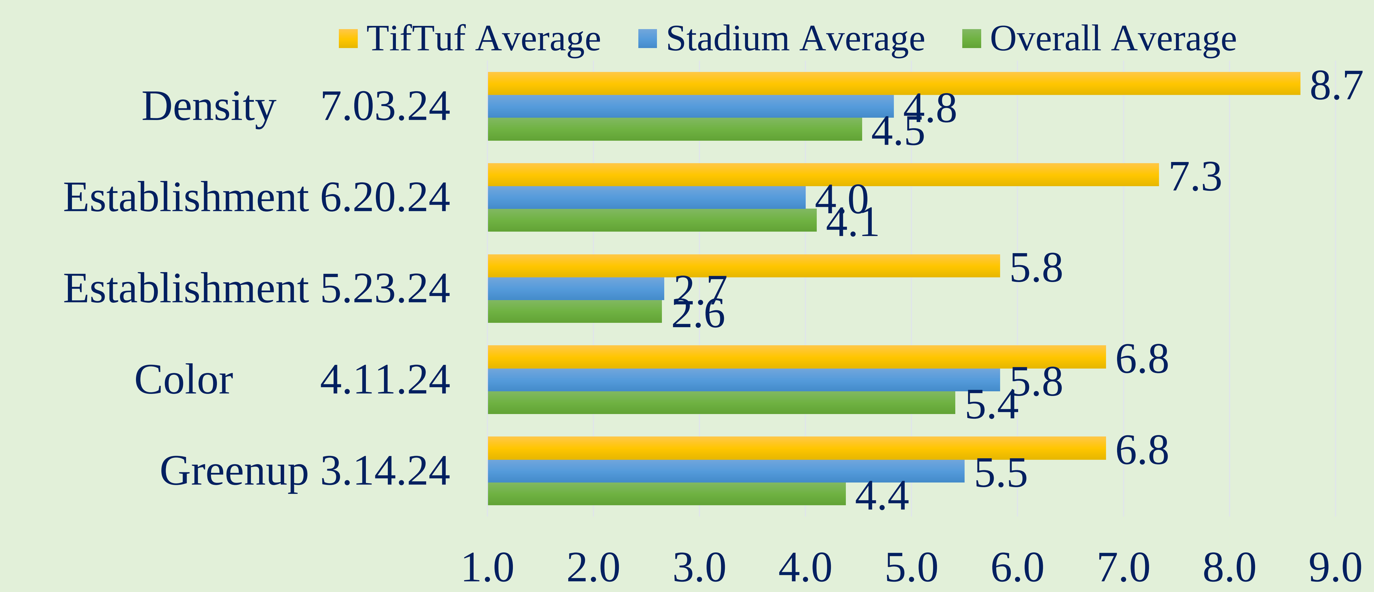


Fig. 3:Average scores of saltgrass accessions against bermudagrass and zoysiagrass checks (1-9 scale).

The percent threshold analysis of the RGB-image data showed several accessions with coverage and mean DGCI comparable to TifTuf (bermudagrass control) (Fig. 4).

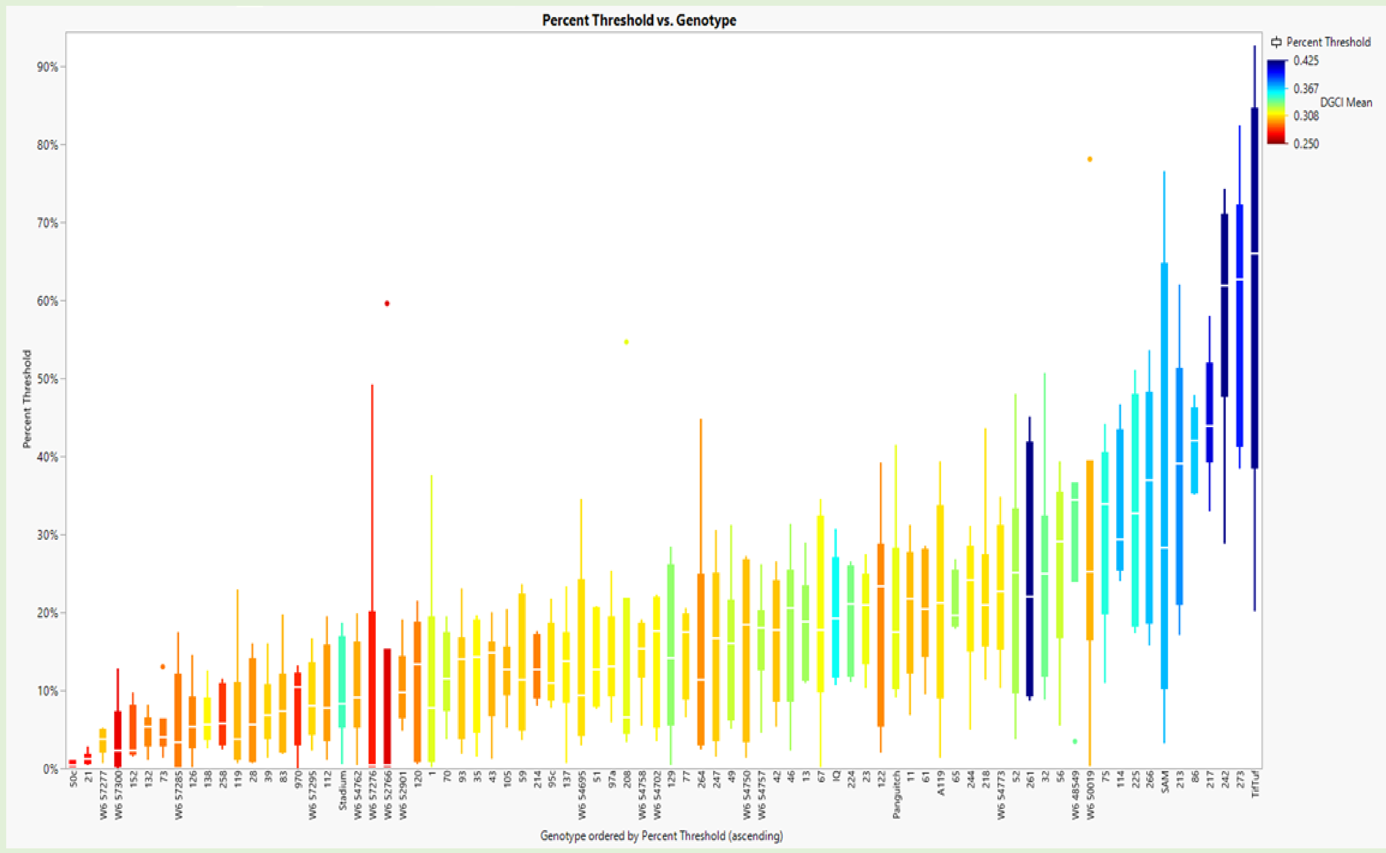
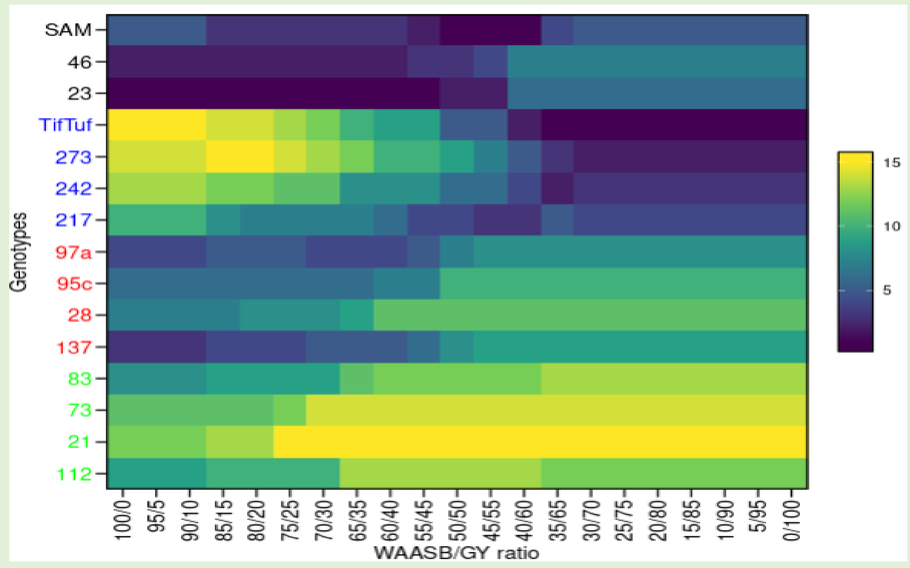


Fig. 4: DGCI of saltgrass accessions against bermudagrass and zoysiagrass checks based on RGB-image data

The overtime traits stability estimates (weighted average of absolute scores and performance ratio) for the accessions based on RGB-image based phenotyping (Fig. 5a) identified stable and superior genotypes that are comparable to the naturalized turfgrasses.



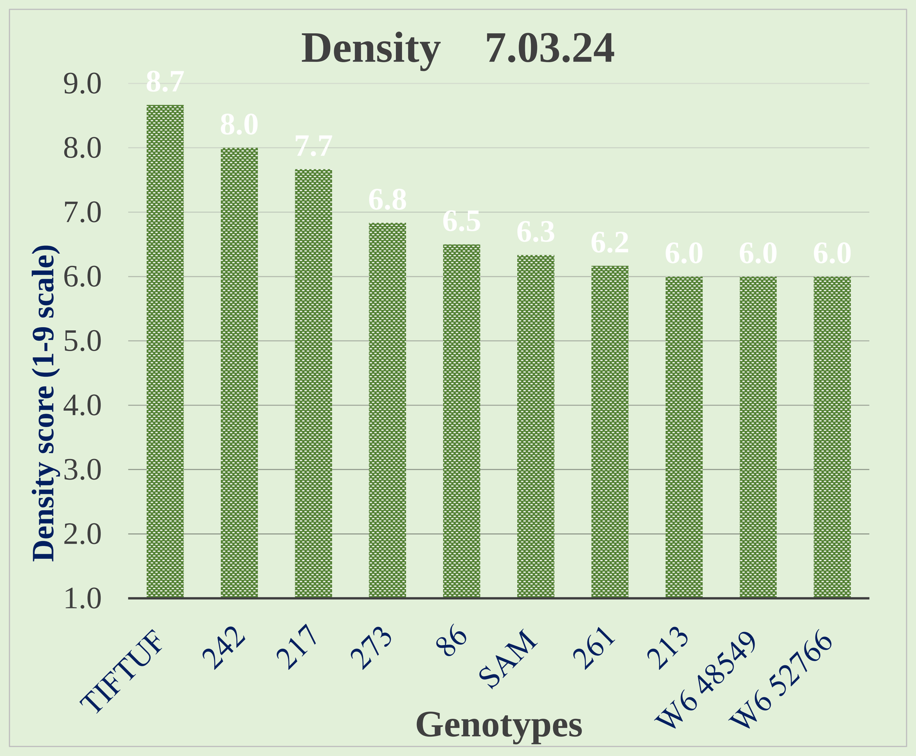


Fig. 5: Ranks of genotypes depending on (a) relative over time stability (WAASB/GY ratio) and (b) mean density of saltgrass accessions.

Conclusion

This study highlights the genotypic variation among saltgrass accessions for establishment, density, and greenness.

Assessment for percent of ground cover, density, greenness (DGCI) and stability analysis (WAASB/GY ratio) identified several superior accessions.