INVESTIGATING THE POTENTIAL ROLE OF MOTHER SOILS FROM THE RESURRECTION PLANT *ERAGROSTIS NINDENSIS* IN IMPROVING THE DROUGHT TOLERANCE OF *E. TEF*

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Introduction & Background:

This study investigates the ability of soil conditions and microbes associated with the desiccation tolerant grass *Eragrostis nindensis* on improving drought tolerance in its sister species, *E. tef*. Teff is an important orphan crop across Africa, where it provides a staple cereal food for ~ 70 million people in the Horn of Africa(1). Improvements in the drought tolerance of teff will shed light on further strategies for improving drought tolerance of commercial crops in the face of climate change(2).

Materials & Methods:

Mother soils were collected from naturally-occurring *E. nindensis* populations. Five sites were chosen for preliminary studies. These sites were narrowed down to two sites that showed the most promise: Slate Mountain and Roseside Burn. Teff seeds were sown in mother soils collected from these sites, grown for 25 days and subjected to drought stress for 7 days until reaching a relative water content (RWC) of ~ 50%. In a parallel experiment, teff seeds were treated with a microbial inoculum derived from rhizosphere soil associated with *E. nindensis*, grown up for 25 days and subjected to the same drought stress until reaching RWC of ~ 50%. Assays used to determine the ability of the plant to withstand drought stress include the ferric reducing antioxidant power (FRAP) assay, malonaldehyde (MDA) assay, and pigment assays for chlorophyll and carotenoids.

Results: Mother Soils

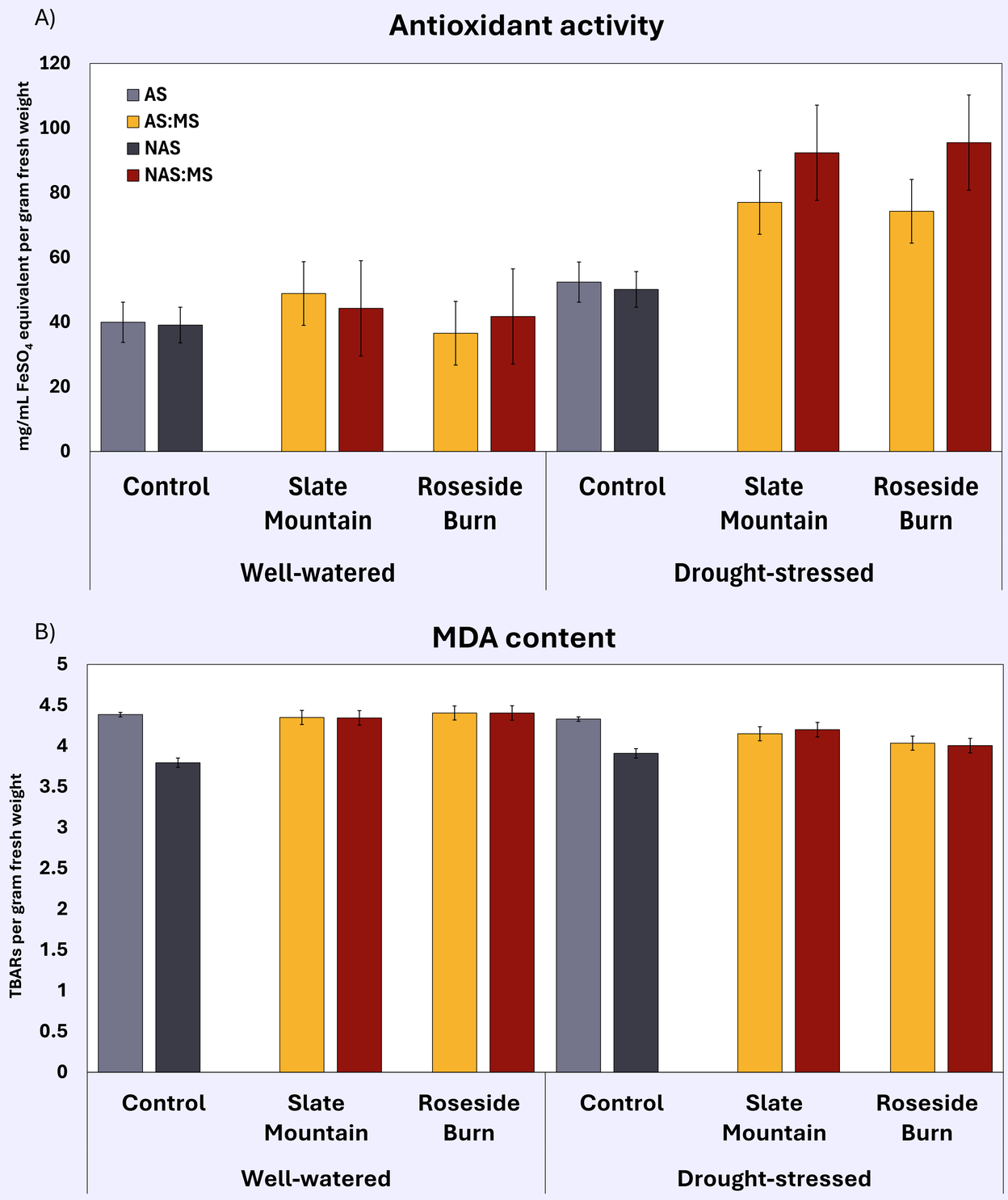

Figure 1: (A) FRAP showed improved drought tolerance of teff grown in mother soils due to induction of antioxidant response. (B) MDA (a proxy for lipid peroxidation) levels remained high in teff grown in mother soil ratios. AS = autoclaved potting mix soil; NAS = non-autoclaved potting mix soil; MS = mother soil. (n = 6).

Results: Microbial Inoculum

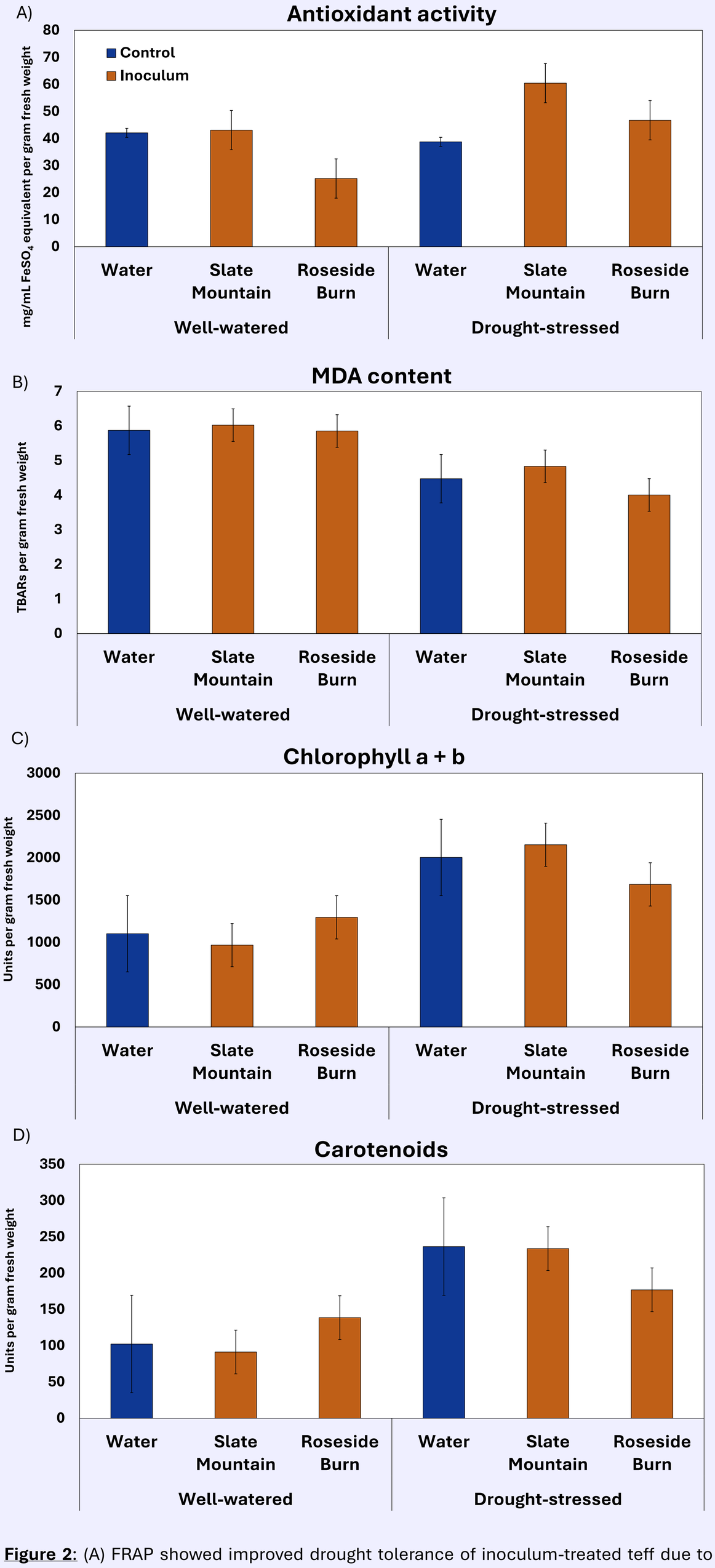

Figure 2: (A) FRAP showed improved drought tolerance of inoculum-treated teff due to induction of antioxidant response. (B) MDA levels are reduced in inoculum-treated plants under drought stress. (C) Chlorophyll a + b levels and (D) carotenoid levels are elevated in Slate Mountain inoculum-treated plants but reduced in Roseside Burn inoculum-treated plants under drought stress. (n = 6).

Discussion & Outlook:

Current results indicate that mother soils from *E. nindensis* have little or no clear effect on improving the drought tolerance of teff. However, the use of a microbial inoculum derived from these same sites appears to play a role in improving the overall drought tolerance of teff. The results also suggest that there are site-specific effects on overall drought tolerance of teff, but this requires further investigation. The results demonstrate that the associated microbes exert a greater effect on improving drought tolerance than use of mother soils alone. Future work should look at isolating microbes from promising mother soil sites and optimizing beneficial microbial interactions to improve the efficacy of the inoculum. Future applications include the development of an effective microbial biostimulant to improve the overall drought tolerance of commercial crops.

References:
1) Syngenta Foundation for Sustainable Agriculture: https://www.syngentafoundation.org/tef-crop-improvement
2) Ginbot, Z G, and Jill M Farrant. "Physiological Response of Selected Eragrostis Species to Water-Deficit Stress." African Journal of Biotechnology, vol. 10, no. 51, 30 Sept. 2011, pp. 10405–10417, https://doi.org/10.5897/ajb.9000398. Accessed 7 Sept. 2024.

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