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Response of *Glycine max* to drought under different semi-arid soil microbiomes

G.M. Castilho[1*], D.F. da Silva[1], F.D. Andreote[1]
[1]*Department of Soil Science, Luiz de Queiroz College of Agriculture, University of São Paulo, Piracicaba, SP, Brazil*
**castilho.gabriel@usp.br*

Drylands face rising threats from climate change, emphasizing the need for natural mechanisms that bolster crop resilience to drought. This study evaluated plant-microbe interactions in soybeans grown in Caatinga compared to Atlantic Forest soils, focusing on their effects on plant growth and metabolic responses under water deficit. Using a completely randomized design, microbial coalescence to combine different Caatinga soils (Native, Secondary, and Degraded) with Atlantic Forest soil across 13 treatments. Plants were maintained at 60% water holding capacity (WHC), followed by a 10-day stress period at 40% WHC. Data were analyzed via ANOVA and Tukey's test ($p < 0.05$). Coalesced microbiomes were associated with increased shoot fresh mass (up to 18.5 g) compared to pure Native Caatinga (8.8 g) and Atlantic Forest (14.4 g) soils, though this varied through combination. A similar tendency was observed for plant height, with coalesced treatments reaching higher values (~26 cm) compared to pure soils (22 cm in Native Caatinga and 21.7 cm in Atlantic Forest), despite overlapping statistical groups. These results indicate that microbial interactions can positively influence plant growth, with a more consistent effect on biomass accumulation. Treatments containing degraded Caatinga soil generally exhibited lower biomass values, highlighting the negative impact of soil degradation on plant performance. Biochemically, proline levels peaked in Atlantic Forest soil (0.24 nmol g^{-1}) and remained lower in Caatinga-derived treatments (0.03–0.08 nmol g^{-1}), with coalesced treatments showing intermediate values (~0.15–0.21 nmol g^{-1}). This pattern suggests a stronger physiological response to water deficit in Atlantic Forest treatments, whereas lower proline levels in Caatinga-derived microbiomes may indicate reduced stress perception or improved stress mitigation. Overall, microbial coalescence influenced plant growth and physiological responses under water deficit, suggesting than semi-arid microbiomes may contribute to improved plant performance and attenuation of stress responses.

KEYWORDS: Community coalescence, plant–microbe interactions, dryland soils, biomass allocation.

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