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Drought affects vineyard soil microbiome: approach to select micro-organisms adapted to drought.

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Abstract

Climate transition with frequent heat waves and long drought periods threatens grapevine productivity and wine quality in the Mediterranean regions. Microorganisms are known to contribute to plant fitness and to stimulate plant resilience against biotic and abiotic factors.

In this work, it was assessed the impact of long-term drought on soil microbiome associated to grapevine in open field in Alentejo, renowned Portuguese wine region.

Soil and plant tissues of drought tolerant Syrah cultivar exposed to three irrigation levels (100%- FI, 50%-DI ETc; rain-fed–NI) for 5 years were sampled for two years (2022-2023). Metabarcoding analysis of soil bacteria (16S V4 rRNA) and fungi (ITS sub-region) were integrated with soil physiochemical properties and leaves´ physiological data. Pre-dawn leaf water potential and stomatal conductance confirmed the imposed drought scenarios. Even though, α- and β-diversity of prokaryotic and eukaryotic microbial communities differed more by season than water availability, samples clustered according to soil water content and pH ($p<0.05$). Fungal communities show higher differences in the structure across treatments than bacteria. In 2023, 16 bacterial against 61 fungal ASVs were significatively different in abundance between NI and FI. Beijerinckiaceae, Bradyrhizobiaceae (Alphaproteobacteria) and Nocardioidaceae, Streptomycetaceae (Actinobacteria) families resulted to be significatively more abundant in NI, while Ascomycota, Basidyomicota and Mortierellomycota are the most important fungal phyla in NI.

With culturomics data, this study aims to gather insights into how soil microbiome is remodelled under drought and contribute to select bacterial and fungal taxa with potential to mitigate drought stress in vineyards.

Keywords: Soil Microbiome, Grapevine, Syrah, Drought, Crop Sustainability.