Impact of Soil Microbial Diversity On Seed Microbiome And Plants Productivity

Uttam Kumar, Wout Yi Moe Oo, Max Kolton*

French Associates Institute for Agriculture and Biotechnology of Drylands, The Jacob Blaustein Institutes for Desert Research, Ben-Gurion University of Negev, Sde Boker Campus, Israel.

*Email- maxkolton@bgu.ac.il

Background

Species diversity allows more varied and flexible ecosystem responses to environmental changes. Nevertheless, the fast-changing ecological conditions are leading to soil microbial diversity loss. Unfortunately, despite the well-recognized importance of the plant-associated microbiome for plant productivity**, the consequences of soil microbial diversity decline on plant performances and seed microbial assemblage remain poorly understood. Moreover, the relative importance of stochastic and deterministic processes in seed microbial community assembly is illusive.** This study was conducted to determine the soil microbial diversity roles in plant development and productivity.

Hypothesis

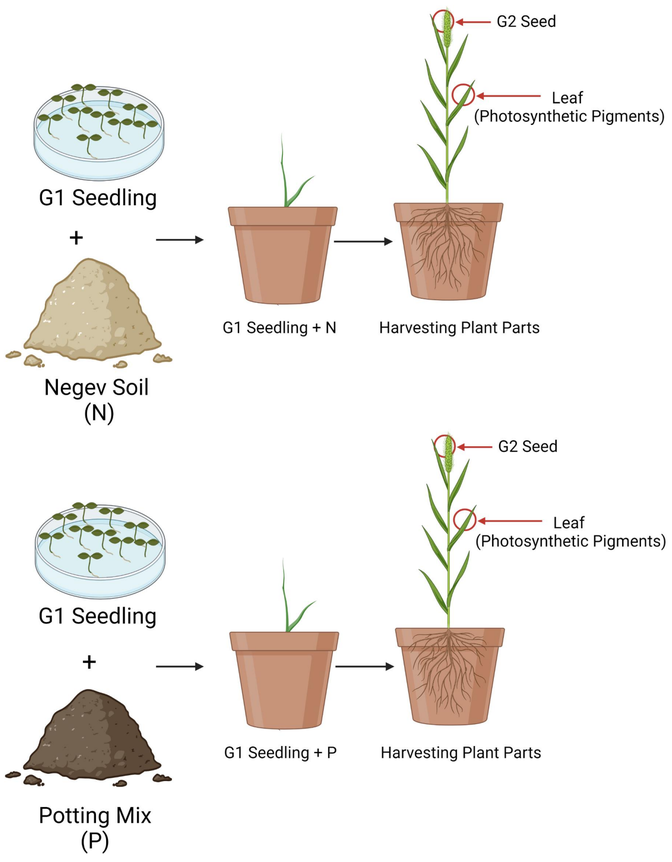
Higher soil microbial diversity would result in higher plant productivity and taxonomic diversity. Nevertheless, the functional diversity of the seed-associated microbial communities will remain constant, **a lottery theory of microbial community assembly.**

Objective

To assess the effect of soil microbial diversity loss on:

- ❖ Seed microbiome assemblage
- ❖ Plant morphology and physiology

Method



Plants were grown in growth chamber with 14 hours of daylight, 25 ± 3 °C, and 40-50 % relative humidity.
Measurement were taken from 15 replications per treatment.

Figure 1: Schematic representation of the experimental set up

- ❖ Plant Parameters ⟶ Photosynthetic pigments, plant height, plant compartment separation, root biomass, intact and damaged seed biomass.
- ❖ Microbial community amplicon-based metagenomic analyses of 16S and 18S ribosomal genes.
- ❖ Metagenomic analysis of seed-associated microbiome

Result

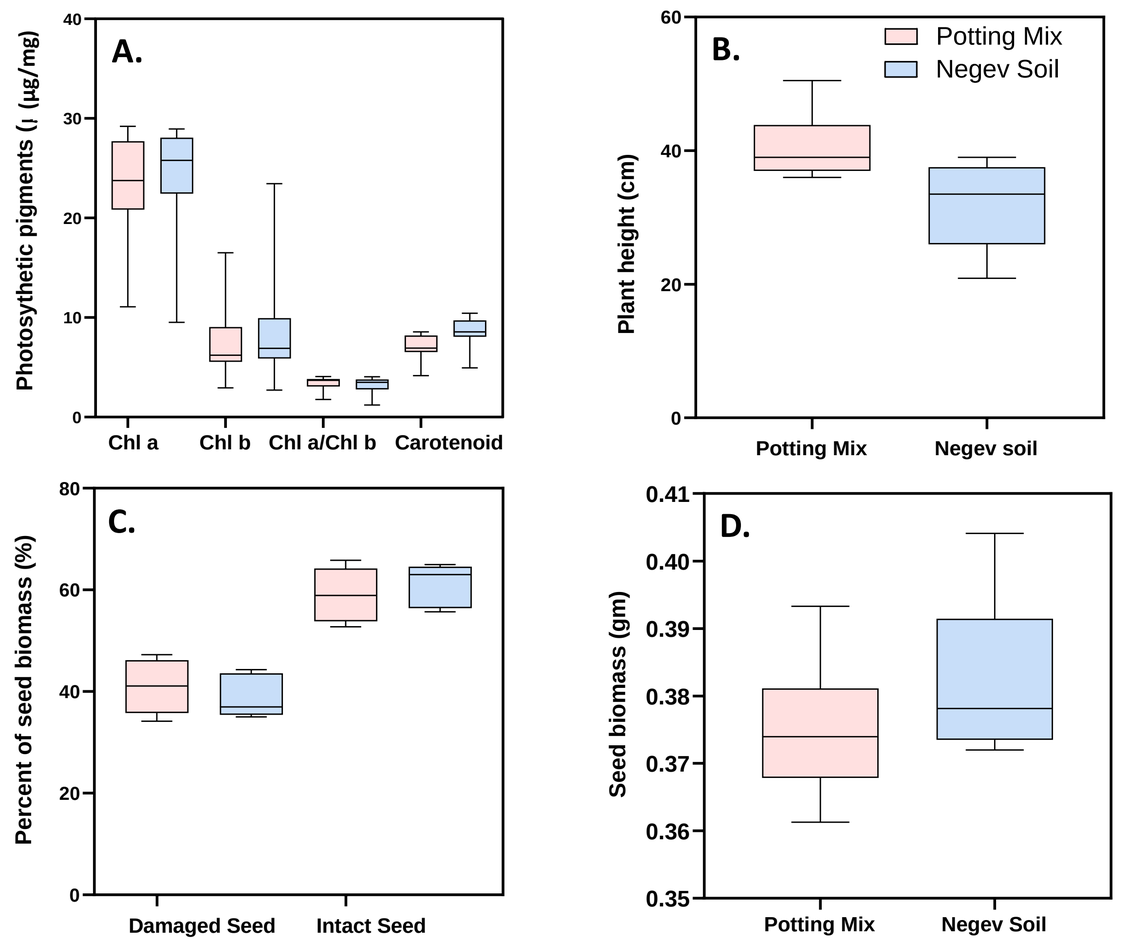


Figure 2: Variability in physiological parameters: A) Photosynthetic pigments, B) Plant height, C) Percent of seed biomass, D) Seed biomass

Discussion

Photosynthetic pigments and seed biomass are considered useful parameters for knowing the plant productivity. The present study showed that plants grown in Negev soil had a higher amount of photosynthetic pigments and seed biomass (Fig. 2b, 2c, 2d) than pot mix soil; but statiscally there was no significant difference. This might be attributed to higher soil microbial diversity of Negev soil. **Therefore, decoding the roles of ecological forces that govern the rhizosphere- and seed-associated microbial community assemblage is important for better understanding the evolution of plant-bacteria interaction and how plants cope with environmental perturbations.**

Future Aspects

The lottery theory of microbial community assembly reconciles the neutral hypothesis with niche/deterministic mechanisms (two competing hypotheses). In the context of our study, we will investigate whether the patterns of microbial community assembly across terrestrial ecosystems could be robustly postulated by the lottery hypothesis model, as established in the aquatic ecosystem. This study will expand our knowledge of the associations and driving forces behind the microbiota in distinct plant microhabitats and offers new insight into boosting plant performance.