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Earthworm-plant-microbiota interactions

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Earthworms have a positive effect on plant growth; this is typically attributed to increased N availability. Earthworms can also increase Si availability; plant Si plays a role in drought tolerance. Finally, earthworms effect microfaunal diversity. We conducted a glasshouse experiment to investigate interactions between these factors. Wheat varieties (Skyfall and four ancient strains) were grown in a greenhouse under presence / absence of adult *Allolobophora chlorotica* and no-drought / drought watering regimes (39 days watering then a further 17 days of watering or no watering).

Despite earthworm aestivation in drought treatments, plant growth was greater in both the no-drought and drought treatments.

Plant %N was greater in the watered treatments; for the drought treatments, it was greater in the earthworm-present treatments. Plant %C was greater in the earthworm-present treatments. In the earthworm-absent treatments Plant %P and %Si was greater in the watered treatments. In the watered treatments %P and %Si was greater in the absence of earthworms.

Soil pH (c. 8.1) was slightly decreased in the earthworm-present and in the watered treatments. The watered treatments contained more extractable nitrate. Extractable P showed no difference across treatments. The droughted earthworm-present treatments contained more extractable Si than both the earthworm-present watered treatments and earthworm-absent drought treatments.

Different wheat strains behaved similarly with Skyfall showing greater biomass and, sometimes, elemental concentrations.

Bacterial and fungal beta-diversity varied with both watering and earthworm treatments; fungal diversity also varied between wheat strains.

Plants showed significant differences in RNA expression between both watering and earthworm

treatments including for genes linked to N uptake.

Earthworms promoted plant growth under both watered and drought conditions. Under drought conditions this does not appear to be related to Si availability or uptake. Similarly we observed no simple relationship between earthworm-presence, N (or P) and plant growth though under drought conditions the presence of earthworms promoted growth and %N in the plants despite lower extractable nitrate. The RNA response of plants suggests a N-related effect perhaps mediated by changes in microbial diversity.