EGU21-13596
https://doi.org/10.5194/egusphere-egu21-13596
EGU General Assembly 2021

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Phosphorus solubilisation with varying drying and rewetting stresses under four contrasting soils from different regions of China

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Abstract

We tested the hypothesis that agricultural soils with a recent history of drying and rewetting (DRW) can trigger phosphorus (P) solubilisation in the rhizosphere, with a subsequent growth response of maize (Zea mays). Specifically, it aimed at investigating a possible delayed effect of DRW stresses on the soils by studying the relationship between P solubilisation in the rhizosphere, plant P acquisition and performance, and root growth under different types of agricultural soils with the previous history of a series of DRW events. The soils were collected from four different agricultural regions of China, Shandong, Chongqing, Heilongjiang and Beijing (sieved <2 mm), and then treated with four varying cycles of DRW events prior to the experiment to raise levels of soil biotic and

abiotic activities. A controlled pot experiment was conducted in order to establish the Olsen's P concentration in the soil, maize shoot P concentrations, root morphology and other rhizosphere parameters, for a duration of 43 days after planting. The results show a positive relationship between plant biomass, plant P concentration and Olsen`s P. The effect was most clearly demonstrated by the level of plant growth and their biological performance in the rhizosphere, as the plants responded better in the soil with a DRW background than to a soil that did not have a history of DRW in the past. Notably, the most positive results were obtained from the Haplic Phaeozems soil of Heilongjiang, leading to an acceptance of the hypothesis. However, the soluble P concentration and plant growth response varied depending on P application rates and soil types.