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Soil types will alter the response of arable agroecosystems to future rainfall patterns

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Regional climate change scenarios for eastern Austria (pannonian region) predict fewer but heavier rains during the vegetation period without substantial changes in the total annual amount of rainfall. While many studies investigated the effects of rainfall patterns on ecosystem properties, very little is known on how different soil types might alter ecosystem responses. In order to test this, we conducted an experiment at the AGES lysimeter station using 18 3 m2 lysimeters where we simultaneously manipulated rainfall patterns according to regional climate scenarios (current vs. prognosticated rain) on the three main soil types of the region (sandy calcaric phaeozem, gleyic phaeozem and calcic chernozem). Lysimeters were cultivated according to good farming practice using crop varieties and crop rotations typically for the region. Here, we present results of the response of field peas (Pisum sativum) on important agricultural parameters. Lysimeters under progn. rain showed lower crop cover than under curr. rain while soil types had no effect. Total aboveground biomass production (comprising crops plus weeds) was significantly lower under progn. rain; sandy calcaric phaeozem showed the lowest plant biomass. Pea yields under progn. rain were substantially lower than under curr. rain; again, yields under sandy soils were lower than under the other two soil types. Root growth was significantly higher in progn. rain than in curr. rain; there was a trend towards less root growth in the gleyic soils. Mycorrhization of roots was not influenced by soil types, however under progn. rain colonization rates were lower than under curr. rain. Weed establishment and growth was increased under progn. rain in gleyic soils but decreased in the other soil types. Weed biomass was not affected by rainfall, however sandy soils had less weed biomass than the other soil types. Abundance of the insect pest pea moth (Cydia nigricana) was almost twice as high under progn. rain than under curr. rain, soil types had only little influence on this pest species. These results show that (i) changes in rainfall patterns predicted for the near future due to human-induced global climate changes will substantially affect crop production and management in the study region, and (ii) the influence of different soil types in altering ecosystem responses should be considered when trying to scale-up experimental results derived at the plot level to the landscape level.