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Climate change induced rainfall patterns affect wheat productivity and agroecosystem functioning dependent on soil types

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Wheat is a crop of global importance supplying more than half of the world's population with carbohydrates. We examined, whether climate change induced rainfall patterns towards less frequent but heavier events alter wheat agroecosystem productivity and functioning under three different soil types. Therefore, in a full-factorial experiment Triticum aestivum L. was cultivated in 3 m2 lysimeter plots containing the soil types sandy calcaric phaeozem, gleyic phaeozem or calcic chernozem. Prognosticated rainfall patterns based on regionalised climate change model calculations were compared with current long-term rainfall patterns; each treatment combination was replicated three times. Future rainfall patterns significantly reduced wheat growth and yield, reduced the leaf area index, accelerated crop development, reduced arbuscular mycorrhizal fungi colonisation of roots, increased weed density and the stable carbon isotope signature (δ13C) of both old and young wheat leaves. Different soil types affected wheat growth and yield, ecosystem root production as well as weed abundance and biomass. The interaction between climate and soil type was significant only for the harvest index. Our results suggest that even slight changes in rainfall patterns can significantly affect the functioning of wheat agroecosystems. These rainfall effects seemed to be little influenced by soil types suggesting more general impacts of climate change across different soil types. Wheat production under future conditions will likely become more challenging as further concurrent climate change factors become prevalent.