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Consequences of increasing temperatures during the winter period for functional soil-plant interactions in temperate arable farming systems

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Climate change is affects the soil-plant system in multiple ways. Most research focusses on the growing season to investigate effects like drought, shifting growing periods, or shifting plant community structures, while neglecting the effects arising from warmer winter periods. Winter climate in temperate central Europe is predicted to feature higher average temperatures, less and/or shorter frost periods and a higher precipitation. Soil biological functioning in arable farming systems can be expected to be changed. Possibly microbial organic matter turnover will run faster and in larger extent. Hence, in spring the soil biological and soil chemical conditions for the growing crops in spring might be changed in terms of nutrient availability, soil organic matter composition and quality, soil microbial community, and survival of pathogen inoculum. In experimental settings in the lab, in controlled field experiments and on-farm field sites we investigated microbial indicators, litter decomposition and the survival rates of certain fungal plant pathogens in different simulated winter climate scenarios. Results - here just as a rough overview - show that soil organic matter turnover is affected by different temperatures even at figures ranging around the freezing point. Also, frost was identified as an important factor for the competition patterns among pathogens. Certain pathogens, as saprotrophic fungi, took advantage from the mild winter scenarios and were able to use a large share of crop residues in the soil. We conclude that impacts of microbial activity concerning decomposition and nutrient turnover will change and that we have to expect new or at least changed pathogen patterns for temperate farming systems. Both imply possible adaptions at the soil management level (e.g. crop residues management, tillage and/or rotations).