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Soil Nutrient Cycling
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PhD Project Abstract

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Diversified cropping systems: Carbon and nitrogen cycling in plant-soil systems under a changing climate.

Climate extremes continue to increase in frequency and severity. For Northern Europe, increases in extreme precipitation and summer drought conditions are predicted, which can cause major crop yield loss. Therefore, resilient agricultural management systems are needed to alleviate these conditions. This project aims to improve our understanding of crop diversification impacts on soil functioning. Specific focus will be on carbon and nitrogen cycling, which are large influencers of both plant and microbial activity. Most crop diversification research focuses on yield increase and disease resistance. Whereas the impacts of diversified inputs into soil on below-ground processes remains hard to determine. Spatial and temporal niche complementary suggests that diversified cropping system are more climate- smart and resilient compared to a monoculture system. A key area of focus is the rhizosphere, which is a hotspot for plant-soil interactions, as plants can release root exudates which attract certain microbial communities for a range of functions, such as nutrient acquisition.

Within this project, I aim to explore multiple methods which can be applied to study crop diversification impacts. For example, DNA analysis, metabolomics, simulated wet-dry cycles, and nitrogen and carbon stable isotope labelling. These can be used to determine changes in microbial and plant diversity, rhizosphere and exudate composition, and to determine metrics such as carbon and nitrogen use efficiency. This project is formed around the main hypothesis that diversified cropping systems will incur a more efficient plant-soil system in terms of carbon and nitrogen turnover. The focus will be on systems with increased intraspecific diversity, with and without intercropping.

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