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The role of soil communities in improving ecosystem services in organic farming

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Worldwide soil fertility decreases and it is generally believed that organic matter (OM) addition to agricultural soils can improve soil properties leading to beneficial ecosystem services. However, it remains unknown under which conditions and how fast biotic, physical and chemical soil properties respond to varying quality and quantity of OM inputs. Therefore, the aims of this research project are (1) to unravel biotic, physical and chemical responses of soils to varying quantity and quality of OM addition; and (2) to understand how we can accelerate the response of soils in order to improve beneficial soil ecosystem services faster. The first step in our research project is to determine how small-scale spatio-temporal patterns in soil biotic, physical and chemical properties relate to crop production and quality. To do this we combine field measurements on soil properties with remote and proximate sensing measures on crop development and yield in a long-term farming systems experiment in the Netherlands (Vredepeel). We hypothesize that spatio-temporal variation in crop development and yield are strongly related to spatio-temporal variation in soil parameters. In the second step of our project we will use this information to identify biological interactions underlying improving soil functions in response to OM addition over time. We will specifically focus on the role of soil communities in driving nutrient cycling, disease suppression and the formation of soil structure, all crucial elements of key soil services in agricultural soils. The knowledge that will be generated in our project can be used to detect specific organic matter qualities that support the underlying ecological processes to accelerate the transition towards improved soil functioning thereby governing enhanced crop yields.