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Impact of crop species and tillage on potentially suppressive soil microbes

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Tillage and crop rotation are agricultural practices, which are known to cause changes in soil microbial communities. Microbial communities play a key role in soil processes such as organic matter transformation, nutrient cycling and maintaining soil structure. The appearance of antagonistic microbes or more diverse microbial community as such, are shown to suppress pathogenic microbes via antibiosis, competition or stimulation of plant host defences. Turning to non-tillage may cause higher risk for soil born plant diseases. The purpose of this study is to focus on how soil beneficial microbes might be affected by reduced tillage practices and crop diversification, and to find sustainable methods for cereal production.

Ten crop plants with randomized block design with five replicates were grown both in a greenhouse and in a field experiment. The annual test plants were barley (*Hordeum vulgare*), buckwheat (*Fagopyrum esculentum*), linseed (*Linum usitatissimum*) false flax (*Camelina sativa*) and quinoa (*Chenopodium quinoa*), and perennials were timothy (*Phleum pratense),* reed canary-grass (*Phalaris arundinacea*), nettle (*Urtica dioica*), caraway (*Carum carvi*) and woad (*Isatis tinctoria*). L.). Tillage and non-tillage systems, with spring wheat monoculture, or crop rotation with spring wheat, barley, turnip rape and pea were studied in another field experiment. For soil microbiological studies, bulk and rhizosphere soil samples were taken in the autumn after harvest before tillage. PLFA (phospholipid fatty acids) and NLFA (neutral lipid fatty acids) were analyzed and different microbial indicators calculated: the total amount of PLFA for the total microbial biomass, the sum of PLFA 10-Me-16:0 and 10-Me-18:0 for actinobacterial biomass, the quantity of NLFA 16:1ω5 for biomass of arbuscular mycorrhizal (AM) fungi, and the PLFA profile representing the microbial community structure.

Bulk and rhizosphere soils had their own characteristic microbial communities. A clear trend in microbial community structure between annual and perennial plant species was seen at the end of the study. Non-tillage systems change the vertical distribution and fungal/bacterial biomass ratio of soil microbes. The potentially beneficial microbes AM-fungi and actinobacteria have the tendency to become more abundant in the non-tillage soil on the soil surface layer.

The results suggest that diversity of soil microbial community can be affected by selection of crop species. The results can be applied when generalising the relative importance of different special crops on microbial communities in agricultural soil ecosystems. By accumulating to the soil surface, the beneficial microbes have the potential to contribute to the general suppression of soil- and residue-borne diseases in non-tillage systems. Management of the resident soil microbial community by reduced tillage together with crop rotation holds promise as a means to diminish the activity of soil born plant pathogens and to improve plant health.