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Wheat rhizosphere selection on Pseudomonad community structure and function in soil from differing land management's

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Land management can alter the composition of the soil microbiome, potentially affecting the selection of plant beneficial microbes. Pseudomonas fluorescens is an important model example of a plant growth promoting rhizobacteria (PGPR) and a desirable candidate for microbial inoculant development. P. fluorescens has a plethora of beneficial traits including the amelioration of stress-induced ethylene production. Various strains can reduce levels of the phytohormone ethylene (which often inhibits growth) through degradation of its precursor 1-aminocyclopropane-1-carboxylate (ACC), via the enzyme ACC deaminase (ACCd). Utilizing ACCd-producing rhizobacteria therefore has the potential to improve stress tolerance and promote crop growth under various environmental stressors. First, a better understanding of factors affecting PGPRs is needed.

A culture library of 270 Pseudomonads from bulk soil and the rhizosphere of wheat grown in different soil managements (arable, grassland and bare fallow) was collected from the Highfield experiment at Rothamsted Research. The gyrB gene of isolates was amplified and sequenced. Subsequent phylogenetic analysis found that the Pseudomonad communities derived from the rhizospheres of wheat plants cultured in grassland and arable soils, were more diverse than those isolated from wheat grown in bare fallow soil. The functional potential of these strains to modify ethylene-mediated effects was then carried out through genetic screens for the presence of the acdS gene. In total 36 isolates were positive for the acdS gene, interestingly, 26 of these originated from the bare fallow soil. Further work will focus on understanding whether wheat grown in bare fallow soil promotes the selection of Pseudomonads functional in stress tolerance. In addition, inoculant experiments and the analysis of bacterial ACCd gene expression along with plant ethylene status will be studied in detail. Developing a durable PGPR microbial inoculant could contribute to improving sustainability within agricultural systems