
Using plant-soil feedback knowledge to improve agricultural sustainability and productivity

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Abstract

A new vision for the sustainable management of agricultural systems is needed to address population demands for food production and declining ecosystem health. Wild and cultivated plant species both influence root-associated organisms, such as soil-borne pathogens, beneficial symbionts, and saprotrophs that break down plant litter. These organisms can, in turn, affect plant performance either negatively or positively. The sum of these negative and positive interactions determines the sign and strength of plant-soil feedback (PSF). Insights from natural systems, which contain the full complexity of diverse plant and soil communities, can help to tackle the grand challenges facing sustainable agriculture, such as disease control, nutrient retention, and resistance to extreme climatic events. Ecologists are

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accustomed to look across a range of communities, trophic levels and species, in interaction with their environment, over a range of different temporal and spatial scales. Coverage of this depth and breadth offers an opportunity to test the generality and context-dependent nature of PSF, which can in turn be applied to managing agricultural systems.

In this talk, I will demonstrate how the recent developments in PSF research in natural systems can assist in developing more targeted approaches in managing plant-soil organism interactions in agricultural systems and present avenues for future research. For example, targeting positive PSF effects might be the key to improve the sustainability of food production whilst maintaining productivity. This can be achieved by adding organic inputs to close the nutrient cycle, and to steer the decomposer community with the aim of increasing soil nutrient availability. Developing trait-based ecology for soil organisms are also promising to better understand the functional role of species and groups of soil organisms and will also be discussed together with few other examples of how plant-soil feedback can be manipulated to increase the sustainability of agro-ecosystems.