How to harness chemical crosstalk of plants for sustainable agriculture

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Plants interact with organisms in their surroundings by regulating the release of metabolites, which are nutrients and signals to these surrounding organisms [1]. Characterizing the primary and secondary metabolites underlying these interactions would allow to boost interactions with beneficials and deter pathogens. In addition, plants adjust their metabolic profile in response to environmental factors [2]. In a sustainable agricultural setting, the engineering of plant metabolism and with that of plant-plant and plant-microbe interactions would allow to reduce input of fertilizers and pesticides while maintaining crop growth. Interestingly, ancient agricultural systems such as intercropping and crop rotation are based on optimizing temporal and spatial interactions of plants. The underlying molecular causes why some crop combinations are beneficial and others are not can likely be traced back to molecular interactions between crops, either directly via exchange of molecules or indirectly via shaping microbial communities or via shaping soil properties [3].

We investigate plant metabolic responses to various environmental stimuli, such as to the presence of beneficial or pathogenic microbes. Specifically, we investigate pea and barley grown in monoculture or intercropped to determine the molecular and microbial changes present across the differing agricultural systems. For this, we employ untargeted liquid chromatography mass spectrometry, flow injection analysis, and next generation sequencing.

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