Harnessing and integrating disease suppressive microbes and synthetic soils for sustainable, low input horticulture.

The British horticultural industry currently contributes £2.2 billion to the UK economy. While the majority of this production occurs outdoors in fields, horticultural cultivation of high value soft fruits, tomatoes and salad crops takes place under glass or poly-tunnel conditions where the additional expenses associated with protected growth are economically viable. In 2017, 948 hectares of glasshouses and poly-tunnels were employed in horticultural production with around 75% dedicated to vegetable crops and 25% to fruit. While glasshouses and poly-tunnels afford extended growing periods and protection from extreme weather, they can become hot spots for pests and pathogens requiring expensive, and environmentally damaging, chemical control and expensive hygiene control.

This is especially important given these systems are biologically simplistic and thus there is limited competitive exclusion should a pathogen enter the system. Indeed, although the value of protected horticultural crops has increased year-on-year, gross productivity has fallen since a peak in 2015. Although the reasons for this decline are varied and complex they are, at least in part, attributable to losses due to pests and diseases. Specifically, bacterial diseases of horticultural crops can have devastating effects on productivity and in the worst case, lead to the complete loss of the crop.

With current pesticides rapidly becoming ineffective or facing constraints on their use, novel mechanisms for controlling bacterial diseases in covered horticultural systems are urgently required to safeguard future productivity. The overarching aim of this project is to develop a multi-intervention framework for the protection of fruit and vegetable crops against pests and diseases by exploiting the disease-suppressing capacity of the plant's own immune system and its interaction with beneficial soil microbes while deploying sustainable, novel substrates that enhance populations of disease suppressive soil microbes for horticulture.

The principal objective is to obtain a deep understanding of the microbial functions through which plant-beneficial microbes in the root microbiome promote growth and suppress disease, and to exploit this knowledge in innovative cropping systems to enhance production. We will focus on the tomato and Rhizobium radiobacter biovar 1 root mat disease pathosystem as a tractable and commercially applicable model. We will develop an integrated strategy that translates the latest evidence from basic research into effective crop protection methods.

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