RRES Press Release 12 March 2021 Fertilisers reduce plant-beneficial bacteria found around roots

Reduction in growth promoting microbes after application of inorganic chemical fertiliser

Chemical fertilisers reduce the number of nutrient solubilising bacteria associated with the roots of wheat, according to new research.

The Rothamsted led team found the addition of fertiliser decreased the proportion of bacteria that help make nutrients such as nitrogen, potassium, phosphorous, iron, and zinc more readily available from soil.

The results point to the idea that the addition of fertiliser means that plants no longer need to interact with these beneficial bacteria to access the nutrients required to grow.

The authors say this knowledge will benefit the development of more targeted biofertilization strategies.

Lead author Tessa Reid said: “Current high-yielding dwarf crop varieties rely on unsustainable levels of inorganic chemical fertilizers. Understanding the effect of fertilization regime on growth promoting bacteria is essential to optimize microbiome function in the sustainable intensification of agriculture.”

In the study, the beneficial plant-growth promoting bacteria were found to have decreased, both on and around the roots of fertilised plants.

Strikingly, the amount of growth promoting bacteria living on the roots fell from 91% of total bacteria for unfertilized plants to just 19% for those that received the fertiliser dose.

Although the mechanism behind the decline is unknown, it does back up other Rothamsted findings that fertilisers are essentially ‘short-circuiting’ the natural cycling of nutrients by soil microbes.

Study lead, Dr Tim Mauchline said: “This study gives evidence that wheat plants can select growth-promoting bacteria in their root environment to establish mutually beneficial associations and that high levels of inorganic chemical fertilizer application reduces this selection.”

Whereas most other studies on the soil microbiome have focused solely on describing the microbial community, here, the team complemented this approach with microbial functional screens.

They isolated bacterial species from the soil samples, grew them up in the lab and subjected them to a series of tests to monitor their ability to solubilise key macro and micro-nutrients.

“We hope that this work contributes to a shift from simple studies looking at which species are present to a conceptual framework which attempts to identify and explain patterns in the soil microbiome in both farmed and natural systems,” said Tessa.

The research is published in Frontiers in Microbiology and was funded by the BBSRC.

Publication :

Reid TE, Kavamura VN, Abadie M, Torres-Ballesteros A, Pawlett M, Clark IM, Harris J and Mauchline TH (2021) Inorganic Chemical Fertilizer Application to Wheat Reduces the Abundance of Putative Plant Growth-Promoting Rhizobacteria. Front. Microbiol. 12:642587.

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