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"Can agroecological farming feed the world?
Farmers' and academia's views"

Microbiome-based inputs: a technology to enhance agricultural productivity while replacing traditional synthetic inputs?

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Abstract

Global food production relies heavily on the availability of synthetic fertilisers and pesticides, which can have well-known side effects on environmental and human health.

Microbiome-based inputs, such as biofertilisers, biostimulants and biocontrol agents, have been gaining importance as promising alternatives to synthetic inputs, with estimated global market size of US$7.2 billion in 2019, according to a GVR report. This type of technology could reduce the quantities of chemical inputs used in agriculture while contributing to improved nutrient-use efficiency, plant resistance to abiotic stresses, and nutritional quality, thus contributing to some of the core principles of agroecology. Yet, the scientific evidence on the conditions under which microbiome-based inputs can fully deploy their potential is still inconclusive. The existing literature is scattered and disregards technological heterogeneities and the agroecological particularities of study sites. Against this background, this paper aims to synthesize findings from studies that quantify the effects of microbiome-based inputs on economic and environmental outcomes, such as yields and soil nutrient availability. We conduct a systematic review and meta-analysis, using the PRISMA protocol to structure the systematisation of literature and data. By using the package '*litsea*rchR', a novel semi-automated key term search approach, we expect a reduced selection bias in the literature review. We standardise the estimates, to compare effect sizes across studies, using Cohen's d. In addition, trial results and agricultural production systems are used as control variables to analyse under what agricultural conditions microbiome-based inputs are more effective. The outcomes will be presented by the type of microorganism used to develop the microbiome-based inputs, i.e. bacteria, root-associated fungi, and mycorrhizas. The findings of this paper will shed light on the role that microbiome-based solutions can play to boost productivity in agriculture while reducing environmental impact. Additionally, the paper can hint at knowledge gaps and possible research questions that help shape agroecological systems.

Keywords: Agricultural productivity, bio-based solution, input substitution, meta-analysis, plant soil microbiome, systematic review

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