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Sustainable nutrient management: Exploring transformation pathways across intervention levels

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Abstract

Today's agricultural systems largely depend on finite nutrient resources (N, P) that support food security but also pose a risk for mismanagement, which can lead to the eutrophication of ecosystems through leaching. In both cases, prudent management, recycling, and alternative sources of nutrients are inevitable, which calls for an urgent systems transformation. The positive influence of a wide range of agricultural practices for sustainable nutrient management has been demonstrated in many studies. However, studies on identifying efficient practices and assessing their environmental and socio-economic impacts remain often limited to one of the farm, landscape or food system intervention levels. For a systematic and comprehensive analysis of transformation pathways across levels, this study first identified publications related to nutrient management in intensive farming with a connection to transformative potential based on literature. It is followed by an analysis of barriers and benefiting actions concerning the transformation process, the key actors and factors delivering transformative changes across the farm, community, district/region, nation, and value chain levels. Finally, connections are drawn between these levels to explore potential transformation pathways through aspects such as involved actors and their interaction, rapidity of transformation, political feasibility, and social acceptance. The study's findings support the identification of common patterns and general rules or central determinants for un-/successful performance along the levels of transformation pathways in agrifood systems. Furthermore, it may provide an overview of the potential up- and out-scaling of sustainable nutrient management from different intervention levels. By drawing connections between intervention levels for selected criteria, this study contributes to the greater understanding of upscaling sustainable nutrient management and fostering its transformation. This understanding is crucial for addressing global challenges like food security and environmental drawbacks from misusing nutrients and promoting sustainable nutrient management as a viable option for addressing them.

Keywords: Nutrient management, sustainability, scales, transformation pathway

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