Residual phosphorus availability after long-term soil application of organic waste - DTU Orbit (05/10/2019)

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Phosphorus (P) accumulated in soil after surplus P applications can potentially serve as a P source for subsequent crop production. This study investigated residual P availability after long-term surplus P application with different organic waste products. Topsoil samples from a long-term field trial treated with different types of organic wastes were subjected to P characterization, including determination of total P, water-soluble P, and isotopically exchangeable P pools. The waste products were applied for 12 years before sampling, at rates according to crop nitrogen demand and thus typically in excess of crop P requirements. Residual waste P in soil was determined based on the difference between total soil P measured in the different specific waste-treated plots and a balanced reference treatment. After 12 years of surplus P balance (inputs – crop offtake) of 79–598 kg P ha−1 yr−1 with waste, significant amounts of P (636–4177 kg ha−1) had accumulated in the soil as residual P. The average fraction of residual waste P which could be recovered as rapidly exchangeable P (within 1 min) followed the order: composted household waste P (2.1%) < sewage sludge P (5.1%) < cattle manure P (10.9%), indicating that type of waste has an impact on residual P availability after long-term surplus P application. Unaccounted P (surplus P balance – residual P, i.e., P potentially lost from the topsoil) followed the same order, so compost P was better retained in the soil, but with a less clear difference between sewage sludge and cattle manure. For the latter two wastes, approximately half the surplus P balance could not be accounted for in the topsoil and was assumed to be transported down the soil profile. Three years after waste application was terminated, the fraction of rapidly exchangeable residual P had not declined significantly, suggesting sustained availability of residual P in the soil after long-term application of organic waste. Overall, the availability and mobility of residual P after applying composted household waste to soil was significantly lower than that of residual P from sewage sludge and cattle manure.

General information

Publication status: Published
Organisations: Department of Environmental Engineering, Air, Land & Water Resources, University of Copenhagen, Swiss Federal Institute of Technology Zurich
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Pages: 65-75
Publication date: 2019
Peer-reviewed: Yes

Publication information

Journal: Agriculture, Ecosystems and Environment
Volume: 270-271
ISSN (Print): 0929-1393
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
Original language: English
Keywords: Composted household waste, Sewage sludge, Cattle manure, Organic waste, isotopic exchange kinetics, P balance, Unaccounted P
DOIs: 10.1016/j.agee.2018.10.009
Source: Findit
Source ID: 2440524347
Research output: Contribution to journal › Journal article – Annual report year: 2019 › Research › peer-review