Global Opportunities to Increase Agricultural Independence Through Phosphorus Recycling

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Abstract

Food production hinges largely upon access to phosphorus (P) fertilizer. Most fertilizer P used in the global agricultural system comes from mining of nonrenewable phosphate rock deposits located within few countries. However, P contained in livestock manure or urban wastes represents a recyclable source of P. To inform development of P recycling technologies and policies, we examined subnational, national, and global spatial patterns for two intersections of land use affording high P recycling potential: (a) manure-rich cultivated areas and (b) populous cultivated areas. In turn, we examined overlap between P recycling potential and nation-level P fertilizer import dependency. Populous cultivated areas were less abundant globally than manure-rich cultivated areas, reflecting greater segregation between crops and people compared to crops and livestock, especially in the Americas. Based on a global hexagonal grid (290-km2 grid cell area), disproportionately large shares of subnational “hot spots” for P recycling potential occurred in India, China, Southeast Asia, Europe, and parts of Africa. Outside of China, most of the remaining manure-rich or populous cultivated areas occurred within nations that had relatively high imports of P fertilizer (net P import:consumption ratios ≥0.4) or substantial increases in fertilizer demand between the 2000s (2002–2006) and 2010s (2010–2014). Manure-rich cultivated grid cells (those above the 75th percentiles for both manure and cropland extent) represented 12% of the global grid after excluding cropless cells. Annually, the global sum of animal manure P was at least 5 times that contained in human excreta, and among cultivated cells the ratio was frequently higher (median = 8.9). The abundance of potential P recycling hot spots within nations that have depended on fertilizer imports or experienced rising fertilizer demand could prove useful for developing local P sources and maintaining agricultural independence.

Read the article in *Earth's Future* [1].

Associated Project:
Human Dimensions of the P Cycle [2]

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[1] https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2018EF001097
[2] https://www.sesync.org/project/workshop/human-dimensions-of-the-p-cycle