Calculating agriculture's phosphorus footprint

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Balancing phosphorus levels in crop lands is a key factor that is often overlooked in discussions of global food security, according to a paper published in the *International Journal of Agricultural Resources, Governance and Ecology*.

Current global issues include carbon footprints, water resources and climate change. However, the non-renewable element phosphorus for plant growth is often overlooked in the global context.

Biologist John Lott of McMaster University, in Hamilton, Ontario, Canada, and colleagues there and at the University of Sydney, Australia, point out that when food scarcity increases, instability in society increases. Given that the majority of the food we eat is from cereals and legumes, the phosphorus cycle is a critical element of food security. Phosphorus is essential for crop plant growth, but soils become depleted as it is removed from the land when the grain and seeds are harvested.

The researchers have analysed nine years of data on total dry cereal grain and total dry legume seed production, production of barley, maize, rice, soybean and wheat grains/seeds, yields, area farmed, the tonnage of phosphorus and phytic acid removed in these crops and the elemental phosphorus applied as mineral fertilizers to all plant crops.

The world estimate of the elemental P removed with the dry seed/grain and fleshy fruit crops that contain seeds is in the range of 56-71% of the elemental phosphorus applied as mineral fertilizer for all purposes

worldwide. Depending on the soil type, considerable amounts of phosphorus may become unusable by plants, the team explains.

An analysis of the phosphorus data by the team reveals several significant imbalances in the agricultural cycling of phosphorus that could seriously affect global food security. For instance, Asia consumes significantly more mineral phosphorus fertilizer in proportion to crop production than any other region, which could represent a potential environmental, economic and social problem for that part of the world.

"This is a particularly relevant and important topic in the light of the increasing global population since high quality P reserves are diminishing and the cost of fertilizers are escalating rapidly with few options available to increase fertilizer phosphorus use efficiency," the team says.

There are various approaches to improving the position of phosphorus in food production and security, Lott and colleagues suggest. More effort must be made to combine all possible factors to increase the supply of our most important cereal and legume grain/seed crops in an efficient and environmentally sustainable way, they explain. That means optimising the use of phosphorus fertilizers, using selective breeding and genetic modification to produce crops that require less phosphorus depending on whether they are destined for animal feed or human consumption. Most of all, improving agricultural and governance practices can all play important roles in improving food security, in general.

More information: "A review of the phosphorus content of dry cereal and legume crops of the world" in Int. J. Agric Resources, Governance Ecol, Vol. 8, 351-370

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