Phosphorus deficit may disrupt regional food supply chains

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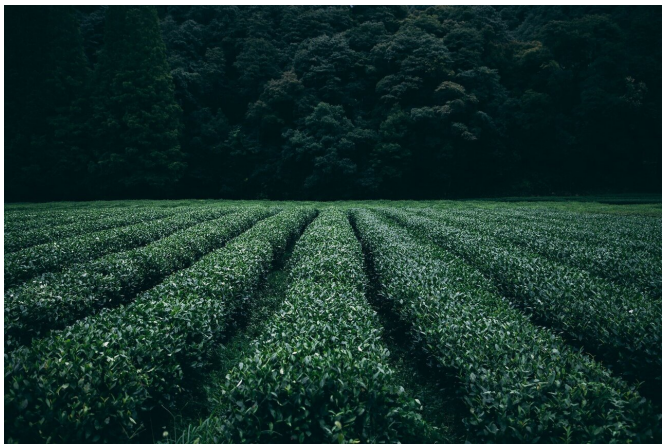

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Phosphorus is essential in agriculture to maintain higher production levels, where it is applied as a fertilizer. Some world regions are experiencing high population growth rates, which means more phosphorus will be needed to produce an increasing amount of food needed in the next decades. A new study—"Global phosphorus supply chain dynamics: Assessing regional impact to 2050"—published in the scientific journal *Global Food Security*, that was undertaken at Stockholm University, Sweden, University of Iceland, Iceland, and the Blekinge Institute of Technology, Sweden, shows that the world regions with high population growth rates are also the regions with the highest deficit in phosphorus supply. The study also quantifies the environmental impact of a business-as-usual scenario in the phosphorus supply chain to 2050 and identifies alarming rates of pollution and greenhouse gas emissions associated with the phosphorus supply.

Almost all of our phosphate fertilizers come from the mining and processing of phosphate rock (PR) and only a handful of countries produce and export this mineral. Losses along the Phosphorus (P) supply chain have been estimated in the literature at around 80-90% . At the same time, global population growth is expected to push food demand up by more than 50% to 2050, particularly in Latin America and Caribbean (LAC), South Asia (SA) and Sub-Saharan Africa (SSA) . Despite being a vital resource in food production, P is also a key pollutant in water bodies, where it can cause eutrophication. Processing PR is also an energy-intensive process, which uses significant quantities of water and produces large quantities of phosphogypsum (PG), a toxic and radioactive byproduct.

"Most of the focus in the literature has been on the sufficiency of the global phosphorus reserves. However, demand for phosphorus is unequal across regions so it was important to assess which regions require more phosphorus and what will that mean in terms of food security. Another valuable contribution of this study is that we quantified the negative environmental and climate impacts of the phosphorus supply chain at global and regional level. Our results indicate yet again the necessity of closing the loop when it comes to phosphorus and on reducing its usage through more sustainable farming practices" says Claudiu Eduard Nedelciu, researcher at the Department of Physical Geography and main author of the study.

The study, which is part of a larger European research project, Adaptation to a new Economic Reality (adaptecon.com), found that LAC, SA and ESEA will lead the increasing consumption of P in the coming decades. Surprisingly, SSA did not account for a significant increase in the P requirement to 2050, despite developing the highest population growth during the period. This is due to the historically low levels of fertilizer application in the region, but poses serious questions about food security, as this part of the world concentrates most of the undernourished people in the world. All the regions leading the increase in P requirement were also regions highly

dependent on phosphate imports and thus vulnerable to price spikes and supply disruptions.

"Hunger will increase in the parts of the world where phosphorous is lacking, unless actions are taken by governments and international institutions to secure imports", aid Prof. Kristin Vala Ragnasdottir from the University of Iceland, co-author in the study.

Perhaps the most striking results were related to the impact of the P supply chain on the environment and climate. The amount of P reaching water bodies will more than triple in North Africa and Western Asia and will double in South Asia and Latin America and the Caribbean. This trend will be driven by P runoff from agricultural land and it is an optimistic scenario, as it assumes that the 2030 wastewater treatment targets of the Sustainable Development Goals (SDGs) will be achieved in all world regions. At current P runoff rates and without ambitious prevention measures, more coastal areas and inland water bodies are likely to be subject to eutrophication.

"Not only the efficient use of Phosphorous in agriculture but wise management of Phosphorus resources along the supply chain, including environmental effects, will be major challenges for the coming decades" said Prof. Peter Schlyter of the Blekinge Technology Institute and co-author in the study.

Climate impact resulting from the mining and processing of PR will double in 2050 compared to 2000, while the amount of phosphogypsum production will reach 500 million tons/year if no technological improvements are made. Production of phosphogypsum raises serious questions with regard to its safe disposal and management, owing to its toxicity and radioactivity. On the other hand, phosphogyspum can be a rich source for P in the future, if technological advancements will allow the safe recycling of phosphorus.

More information: C.E. Nedelciu et al, Global phosphorus supply chain dynamics: Assessing regional impact to 2050, *Global Food Security* (2020). DOI: 10.1016/j.gfs.2020.100426

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