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Peak Phosphorus: Aligning Nutrient Management and Prevention of Eutrophication

Summary **Evidence is emerging that global supplies of rock phosphate used for the production of phosphorus fertilizers have peaked and are declining. If so, there will be increasing pressure to apply fertilizers precisely, to recycle the phosphorus in biowastes to agricultural land to meet agronomic needs, and to minimize erosional losses of phosphorus. The management of phosphorus on the land and the prevention of nutrient pollution of aquatic ecosystems are thereby aligned by the common goal of keeping phosphorus on the land for crops.**

The practices of food production and maintenance of healthy freshwater ecosystems have often been at loggerheads. Agriculture is an important source of the phosphorus that when supplied to water bodies in greater than natural amounts can result in eutrophication, poor water quality, and fish kills.

Phosphorus is absolutely essential for life and there is absolutely no substitute. It is one of the three essential components in agricultural fertilizer commonly comprised of NPK (nitrogen, phosphorus and potassium). It is an element, and is neither created nor destroyed. We can never run out of phosphorus in the absolute sense but we are running out of the economically-available form of phosphorus, phosphate rock. Phosphate rock is used directly in organic farming. Most industrial agriculture uses chemically-treated forms such as superphosphate triple superphosphate, or ammonium phosphate.

Recent analysis of the global supply of phosphate rock to produce fertilizers

required for food security indicates that the supply of phosphorus from the U.S. peaked in 1988 and in the world in 1989 (Déry and Anderson 2007) (Fig. 1). These conclusions are based on the use of methods developed to model the global production of oil. These analyses concluded that oil production in the US peaked in 1970 and will peak globally early this century. Thus, as recognition widens that phosphorus fertilizer will not always be there if we continue present trends, we will develop practices to keep phosphorus on the land for crops and out of natural water bodies.

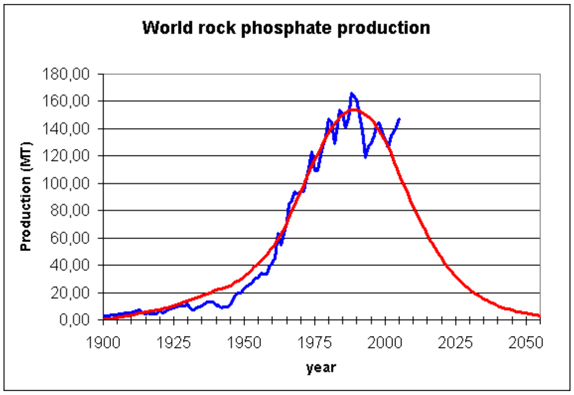

Fig. 1. World rock phosphate production (blue line) and the projected time course of production (red line).

This is expected to result in major change to the management of all fertilizers on the land, to the management of land use to reduce loss of nutrients, and to encourage precise recycling of nutrients in composts and manures. For the first time, pollution prevention and food production have a common interest – keep P for crops.

Field-based near infrared spectroscopy is a technology that can enable the precise recycling of the phosphorus in hog manure. The technology can be applied as hog manure is pumped from storage ponds or tanks on to the land, as manure is loaded into tanker trucks for transport or is transferred into centrifuges and biodigesters for processing. Although NIRS has not been found effective for the analysis of phosphate in whole soil, the NIR analysis of soil extracts for phosphorus compounds is a promising modification. On the aquatic side, NIRS has been found to be very effective in predicting the phosphorus in suspended material in lake water and in aquatic sediments, and would be a useful tool for monitoring the effectiveness of changes in land use and nutrient management practices.

References

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Figure 1 is from Déry, P and B. Anderson, 2007.

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