P347

Biosolids as a source of phosphorus in Australian agriculture

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The agricultural land application of biosolids (stabilised solid organic residuals from treated sewage sludge) as a source of nutrients for crop production is considered a long-term sustainable management option throughout many regions in Australia. Approximately 70% of the 330,000 tonne dry solids produced nationally are land applied per annum. The phosphorus (P) content of biosolids varies and is dependent on the wastewater treatment process, with mean total P values of 1.3-3.9% reported throughout Australia. It is estimated that approximately 6,000 tonne of P is returned to the soil annually in Australia from the land application of biosolids. Hence the recycling of P from biosolids is a useful substitute for inorganic fertiliser P and prevents the loss of P from the food chain. This paper presents findings for P availability in four biosolids products (dewatered mesophilic anaerobically digested, lime-amended, pelletised and alum sludge) relative to inorganic P fertiliser as investigated by combinations of field crop, laboratory and pot experiments in south-western Australia over several years. The risk of off-site movement of biosolids-P compared with inorganic fertiliser P at typical application rates was further examined on several soil types to assess the environmental implications of this practice in Australia. The effectiveness of biosolids-P compared to inorganic-P as a source of fertiliser in field experiments as measured by soil available P, uptake of P by shoots and crop yield was dependent on many factors over time including the soil conditions and biosolids type. Biosolids produced from wastewater treatment processes that used aluminium treatment to remove excess P had lower phytoavailability than those without chemical addition and pose additional challenges for land application as a source of P.

P348

Evaluating the impact of rising fertilizer prices on crop yields

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Due to tensions on fossil energy and phosphorus markets, the sharp rise in fertilizer prices observed during the last decades is expected to persist in the future, putting into question production pathways relying heavily on crop intensification. To evaluate how, in this context, economic choices may alter crop yields, we first construct different fertilizer price scenarios to 2050 based on an econometric relation with oil and gas prices, or on the continuation of recent trends. A scenario reflecting the possible depletion of phosphorus is also presented. The resulting changes in fertilizer price range between +0.8% and +3.6% per year over the 2005-2050 period. Once developed, these scenarios are tested into a global land use model incorporating an endogenous representation of the land-fertilizer substitution. In so doing, this paper shows that the crop yields in 2050 are reduced by 6%-13%, depending on the scenario, due to the supply-side response to rising fertilizer prices. To meet the demand for food and non-food products, the fall in crop yields implies a global increase in cropland area ranging from 100 to 240 Mha. On the other hand, the impact of phosphorus depletion on intensification and land use in 2050 appears to be relatively small. The sensitivity of the results is finally tested with regard to assumptions on food consumption, change in potential yield and nutrient use efficiency.