Implications of chemical waste water treatment on efficient P cycles in food production

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There is a growing awareness of the limitations in global mineral phosphorus (P) reserves, increasing the need to create efficient P cycles in food production. In Norway, about 1800 tons P is collected in waste water treatment plants each year, and 50-60% of collected P is returned to agricultural areas. For comparison, 8-9 000 tons mineral P are yearly applied in Norwegian agriculture. There are large uncertainties regarding plant availability of P in sewage sludge generated from chemical waste water treatment with aluminium (Al) and/or iron (Fe) as coagulants. Therefore, we performed a pot experiment with 11 different types of sewage sludge to study the relative P fertilisation effects of sludge compared with mineral P fertiliser. Further, six different extraction methods were tested in terms of their ability to predict plant-available P in sewage sludge in a short and longer term perspective. Plant-availability of P in these sludges was low compared to mineral fertilizer, also in a longer term. In sum of six harvests of ryegrass, P uptake from sludge ranged from 13 – 40% of P uptake from mineral P. Increasing concentration of Al in sludge had a clear negative impact on P availability, especially in short term. Fe also showed a negative impact on P availability, but to a lesser extent compared to Al. P extracted with 2% citric acid was the method that best predicted P availability (R^2 = 0.69).