Sustainable phosphorus remediation and recycling technologies in the landscape

Charlotte Kjaergaard

Aarhus University, Faculty of Agricultural Sciences, Dept. of Agroecology and Environment, Research centre Foulum, 8830 Tjele, Denmark, c.kjaergaard@agrsci.dk

The quality goals of the European Water Framework Directive require a substantial reduction of diffuse phosphorus (P) loads from farmland in Denmark. Due to decades of surplus P additions with manure and fertilizers, the source of today's P losses is accumulated soil P, now posing a long-term risk. Mitigating agricultural P losses is particularly challenging, as critical losses are only a small fraction of actual soil P contents and not directly related to fertilizer P input. General regulations to reduce fertilizer P inputs have so far been ineffective. Tile drains and ditches connect fields to receiving waters and act as subsurface highways for both soluble and particulate P and nitrogen (N), but efficient mitigation options are lacking.

A newly launched research project "Sustainable Phosphorus Remediation and Recycling Technologies in the Landscape, SUPREME-TECH**"** (2010-2015) funded by the Danish Strategic Research Council, aims at developing cost-effective filter technologies targeting P-retention and N-removal in agricultural subsurface drainage. Filter technologies will be developed by (i) identifying the best performing filter substrates for retaining and transforming nutrients under highly variable flow regimes and nutrient loads, and by (ii) exploring technical solutions for field scale implementations of the filter technologies. Various designated natural and industrial filter substrates will be investigated for their suitability as filter substrates according to hydrological performance, P-retention efficiency and N-removal capacity. Based on their suitability selected filter substrates will be investigated in full scale experimental systems. The project studies different approaches of implementing the filter technologies including drainage well or drainage pipe filters, ditch filters as well as surface-flow and sub-surface flow constructed wetlands. The project also addresses the suitability of filter substrates for retaining other micro-pollutants as well as the potential for recycling P-saturated filter substrates as soil amendments. The project includes modelling of filter systems to provide design parameters and optimize filter performance, and analysis of the cost-effectiveness of implementing filter technologies in landscapes compared to other mitigation options. The project (www.Supreme-Tech.dk) is a collaboration between University of Aarhus and Copenhagen, five international universities and 15 participating industries.