

Anaerobic digestion of cow manure – long-term implications for soil fertility and crop yield

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Anaerobic digestion of animal manure can help farmers to produce renewable energy and reduce greenhouse gas emissions. Compared to non-digested slurry, digested slurry has a reduced content of organic matter, which may affect the soil fertility and crop productivity in the long-term. Hence, a field experiment with two slurry-application levels (ca. 110 vs. 220 kg of total N ha⁻¹ year⁻¹) was established in 2011, to study how application of anaerobic digested slurry (ADS) versus untreated dairy cow slurry (US) affects soil characteristics and crop yields. Anaerobic digestion of the slurry did not affect soil concentrations of extractable nutrients and pH, but the rate of slurry application did. A decline in SOM in all the plots from 2011-2021, contrasts with our expectations that long-term application of slurry would increase the SOM concentrations in the topsoil. The decrease of SOM concentrations (0-20 cm) was faster on plots with high intrinsic SOM (> ca 10 % ignition loss), and did not differ among slurry treatments. Higher slurry application rate led to a surplus of N, while a deficit was observed in the control and the treatments with low application rates. Treatments were not limited by P. Even in the treatments with low application rate, the total P deficit was minimal, 18 kg P ha⁻¹ across 2011-2021. For K, there was a deficit in all treatments. US and ADS gave similar yields of grass-clover ley, on average 7.9 Mg DM ha⁻¹ year⁻¹. Clover biomass was similar in manured treatments and the non-fertilized control. Anaerobic digestion of the slurry before its application into soil did not seem to reduce grassland productivity or soil fertility in the long term, but the decline in SOM over time deserves attention.

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