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# The impact of long-term anaerobic digestion treated manure on soil organic matter, soil nutrients and ley yields in Norway

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### ABSTRACT

The global need to substitute fossil fuels, along with rising fertilizer costs, calls for a more efficient use of manure resources in agricultural systems. One option may be to treat more animal manure by anaerobic digestion to produce energy and co-produce an organic fertilizer. Here, we investigated the long-term effects of anaerobically digested (AD) dairy cow slurry on crop yields, soil organic matter (SOM) and chemical soil characteristics. The field experiment was established in a grass-clover ley in 2011 and comprised two fertilizer treatments, non-digested slurry and AD slurry, applied at two rates of total N (110 and 220 kg ha<sup>-1</sup> y<sup>-1</sup>), compared with a non-fertilised control. While the rate of manure application affected soil concentrations of extractable nutrients and pH, these variables were not affected by AD. SOM concentrations (0-20 cm) decreased in all plots, and faster on plots with high intrinsic SOM. The decrease was similar with application of non-digested slurry (US) and anaerobically digested slurry (ADS) and at low and high application rates. US and ADS gave similar yields of grass-clover ley and whole crop cereal, on average 0.79 and 0.40 kg DM m<sup>-2</sup>. The proportion of clover in the ley canopy was similar in manured treatments and the non-fertilised control. With respect to crop yields and chemical soil characteristics, long-term (10 years) effects of AD in an organic dairy cow farming system seem to be minor, not compromising grassland productivity or soil quality in the long term. However, with traditional application of the slurry (no incorporation), no yield increase was achieved with AD, as has been found in other studies.