EGU2020-19459
https://doi.org/10.5194/egusphere-egu2020-19459
EGU General Assembly 2020

Anaerobic Digestate Fraction and Nutrient Stoichiometry Significantly Influence the Carbon Cycle in Grassland Soils

Marta Cattin[1], Marc Stutter[2], Alfonso Lag-Brotons[1], Phil Wadley[1], Kirk T. Semple[1], Chris Parry[3], and Ben W.J. Surridge[1]

[1]Lancaster Environment Centre, Lancaster University, Bailrigg, Lancaster, LA1 4YW (m.cattin@lancaster.ac.uk)
[2]The James Hutton Institute, Aberdeen, AB15 8QH
[3]Cockerham Green Energy Ltd, Cockerham, Lancaster LA2 0DX

The application of digestate from anaerobic digestion to grassland soils is of growing interest as an agricultural practice. However, significant uncertainties surrounding the potential impacts of digestate application on processes associated with the soil microbial community remain, particularly for processes governing Carbon Use Efficiency (CUE) and the broader soil C cycle. In this research, we examined how the C:N stoichiometry of digestate and the nutrient status of soil influenced the impact of digestate application on the soil C cycle.

Three fractions of digestate (whole [WD], solid [SD] and liquid [LD]), spanning a range of C:N, were each applied to two soils of contrasting starting nutrient status (high and low) and compared to unamended controls (Ctr). Two short-term incubations, each lasting seven days, were undertaken. In the first, applications of WD, SD and LD each achieved the same total N input to soils. In the second, digestate applications were adjusted to provide consistent total C input to soils. In each incubation, CO_2-C efflux, microbial biomass C (C_{micro}) and pH were determined.

In each of the two incubations, the application of digestate significantly increased cumulative CO_2-C efflux compared to control soils. However, the precise effect of digestate application varied between the two incubations and with both soil nutrient status and digestate fraction. Microbial biomass C was largely unchanged by the treatments in both incubations. During the first incubation, soil pH decreased substantially following each digestate treatment in both soil types. A similar pattern was observed within the second incubation in the high nutrient soil. However, in contrast, soil pH increased substantially following LD and WD application to the low nutrient soil in the second incubation. Varying CUE responses are likely to be observed following the application of digestate to agricultural soils, dependent on digestate fraction, C:N ratio of the digestate, and the initial soil nutrient status. Therefore, digestate application rates and soil management must be carefully planned in order to avoid adverse impacts of digestate application to land.