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Estimation of the ICBM/2 Organic Matter Simulation Model parameters for biogas digestate mineralisaion in soil using Near Infrared Data.

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The use of simulation models to study the turnover of soil organic matter (SOM) can support experimental data interpretation and the optimization of manure management. Icbm/2 (Katter, 2001) is a SOM simulation model that describes the turnover of SOM with three pools : one for old humified SOM (CO) and two for added manure, CL (labile "young" C) and CS (stable "young" C). C outflows from CL and CR to be humified (h) and lost as CO_2-C (1-h). All pools decay with firs-order kinetics with parameter kYL, kYR and kO (fig. 1).With this model of SOM turnover, during manure decomposition into the soil, only the evolved CO_2 can be easily measured. Near infrared spectroscopy has been proved to be a useful technique for soil C evaluation. Since different soil C pools are expected to have different chemical composition, it was proven that NIR can be used as a cheap technique to develop calibration models to estimate the amount of C belonging to different pools). The aim of this work was compare the calibration of ICBM/2 using C respiration data or optimal NIR prediction of CO and CL pools.
A total of six laboratory treatments were established using the same soil corresponding to the application of five fertilisers and a control treatment: 1) control without N fertilisation; 2) ammonium sulphate; 3) anaerobically digested dairy cow slurry (Digested slurry); 4-5) the liquid (Liquid fraction) and solid (Solid fraction) fractions after mechanical separation of Digested slurry; and 6) anaerobically stored dairy cow slurry (Stored slurry). The "nursery" method was used with 12 sampling dates. NIR analysis were performed on the air dried grounded soils. Spectra were collected using an FT-NIR Spectrometer. Parameters calibration was done separately for each soil using the downhill simplex method. For each manure, a C partitioning factor (Fi) was optimised. In each optimization step respiration measured data or NIR estimates CL and CO were used as imput for minimisation objective function. At the end the algorithm found those parameters that gave the lowest averaged RMSE between errors in the estimation of respired C. The model parameter extimations obtained using C respiration data and NIR predictions were comparable indicating a general ability of the NIR method to estimate model parameters together with a good prediction of C mineralisation.