Effect of crop residue management on N_2O emissions in European cropping systems

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Abstract

Crop residue handling can significantly affect N_2O emissions. Four different scenarios of crop residues management were evaluated with two biogeochemical models in the European cropping systems. Preliminary results show the positive effect of nitrogen addition by residues on crop yields, highlighting a potential mitigation of N_2O emissions accompanied with rational fertilisation.

Crop residue management, nitrous oxide, cropping systems, ecosystem modelling

1. Introduction

Crop residue management is crucial to maintain or improve soil organic carbon and fertility. Their handling on the field can significantly affects nitrous oxide (N_2O) production. Ecosystem models represent a suitable tool to simulate biogeochemical processes in both time and space, facilitating the analysis of management scenarios. The aim of this work is to reproduce N_2O emissions from different management of crop residue in the European cropping systems.

2. Materials and methods

Two ecosystem models, Landscape-DNDC (Haas et al., 2012) and CERES-EGC (Gabrielle et al., 1995), were applied in the EU-27 cropping systems from 1970 to 2010. Four residue managements were evaluated: i) exported, ii) left on the surface, iii) incorporated into the soil, iv) exported or incorporated in function of the crop specie.

A spatialized dataset (0.25° × 0.25° latitude-longitude simulation units) composed by climate, soil and crop data was created to run the models. Daily climate data were providede by Sheffield et al., (2006), wherease soil characteristics were extracted from the European Soil Database. Crop species and management data were obtained from Eurostat statistics, retaining the two most frequent rotation for each simulation unit. N fertilisation ranged from a few dozen to 370 kg N ha^{-1} y^{-1} and was applied to 91% of the EU-cropping systems. Crop were automatically irrigated.

3. Results and discussion

Preliminary results with CERES-EGC model show a reduction of N_2O emissions of about 30% when the residues were exported from the field (i) compared to the residue management in function of the crop specie (iv). Residue incorporation (iii) mark a slight increase of N_2O compared to the scenario (iv). Crop yields were 13% lower and 15% higher for the exported and incorporated scenarios, respectively compared with scenario (iv).

4. Conclusions

These results underlying the effects of N addition with residue incroportation on yields, hihglighting a potential mitigation of N_2O emissions with rational fertilisation.

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