The assessment of emission factors for various agricultural practices including typical crop rotation and modifications

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Abstract: The paper presents simulations of a plants productivity; carbon sequestration, nitrogen leaching and greenhouse gas balances for crop rotation, which has been defined for 16 regions of Poland, based on crop structure. The analysis were performed for the four types of crop rotation (standard (s), the standard with catch crop and mineral fertilization (b), the standard with catch crop and incorporating crop residues (c), the standard with manure fertilization (d)). The simulations used daily meteorological values from a 20-year series of data for each region (Recommendation Intergovernmental Panel on Climate Change - IPCC). To perform the simulation, a Denitrification-decomposition model (DNDC) was used. The obtained results indicated that leaving crop residues on the field in addition to the cultivation simplification produce a significant increase in carbon sequestration in the soil, compared with the practice of collecting all the field's crop residues. The increase was greater than in the case of regular fertilization with manure, which indicates that it could be suitable for crop farms (no livestock). Better results were obtained on heavy, medium and light soils. On very light soils, this practice is not effective. The introduction of catch crops for crop rotation where no manure was used, with the exception of heavy soils did not increase carbon sequestration in soils, and does not limit greenhouse gas emissions, this is if all the crop residues were collected from the field. In addition, catch crops have a limited main yield due to competition for nitrogen between microbes that decompose organic matter and cultivated plants. The results also indicate that the effective way of mitigation is to optimize the dose of mineral and natural fertilization. This is because the emissions of nitrous oxide are linearly dependent on the dosage of nitrogen. Factors that are important for carbon sequestration and emission balance is the correct rotation, and avoiding of crops rotation simplifications and monocultures.

Keywords: carbon sequestration, GHG emission, crop rotation, nitrogen leaching.