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Crop residues amendments quality and effect on greenhouse gas emissions and aggregate stability

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The organic residues amendments have been widely studied for their essential role of enriching the soil with organic matter. Although the pathways of the fresh organic matter additions are very complex, so is the effect. Thus, the quality of the crop residues incorporated into the soil is a valuable attribute when deciding to switch to conservation agriculture. The different C/N ratio and biochemical composition of the crop residues will affect in various ways soil CO2, N2O and CH4 emissions and soil structural stability. The study explores the effect of different crop residues incorporated in the soil on greenhouse gas emissions and aggregate stability. The incubation experiment consisted of five treatments: control (just soil), sand (as reference), soil mixed with wheat straw, soil mixed with green fresh rye residues and soil mixed with green fresh oilseed rape residues. The residues were applied into the soil at a rate of 6 g C kg-1 of soil. The pots of all the treatments were placed for incubation for 105 days at approximately 23 oC and covered with dark plastic bags. The wetting procedure was done five times at 0-11-26-46-75 days to bring the soil to field capacity for water. The sampling for the gas emissions and aggregate stability was done before wetting and after wetting. The gas emissions were sampled using the chamber method and analysed in a Gas Chromatographer. The water-stable aggregates were analysed using the wet sieving method. The plant material was chemically analysed for total carbon and nitrogen and the biochemical composition on Fourier Transform Infrared Spectroscopy. The results revealed that the cumulative CO2 emissions in oilseed rape were 8% higher than in rye treatment. Also, it was 76% higher than in wheat straw treatment and 95 % higher than in control treatment. The highest cumulative N2O emissions were registered in rye treatment 18.79 (±0.48) mg m-2 h-1. Oilseed rape treatment had 19% lower cumulative emissions compared to rye and 98 % higher compared to control and wheat straw treatments. Both rye and oilseed rape had a low C/N ratio 12 and 10, respectively whereas wheat straw had 98 C/N ratio. From a biochemical point of view, the wheat straw was richer in stable compounds such as lignin, cellulose and hemicellulose followed by rye and oilseed rape which had a higher content of labile compounds such as sugars and easily decomposable proteins. In general mean aggregate stability increased significantly only in the wheat straw treatment being 34.69% ±1.35.

In conclusion, this study showed that crop residues with low C/N ratio have a negative effect on greenhouse emissions. But do not have a long term effect on the increase of aggregate stability. On the contrary, the wheat straw has a positive impact on greenhouse gases, and it increased

aggregate stability.