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Post-harvest N_2O emissions were not affected by various types of oilseed straw incorporated into soil

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Oilseed rape post-harvest N_2O emissions are seen highly critical as so far they are considered as one of the most crucial drawbacks in climate-saving bioenergy production systems. N_2O emissions may substantially counterbalance the intended savings in CO_2 emissions. Carbon-rich crop residues in conjunction with residual soil nitrate are seen as a key driver since they may serve as energy source for denitrification and, they may alter soil-borne N_2O emissions. As oilseed rape straw is known to have high N/C ratio compared to other crop residues, its soil incorporation may specifically trigger post-harvest N_2O emissions. Therefore, the aim of the present study was to determine post-harvest N_2O emissions in soils amended with various types of oilseed rape straw (with different N/C ratio) and barley straw in field and incubation experiments. In the incubation experiment, oilseed rape or ^{15}N labelled barley straw were mixed with soil at a rate of 1.3 t DM ha^{-1} and studied for 43 days. Treatments consisted of non-treated control soil (**CK**), ^{15}N labelled barley straw (**BST**), oilseed rape straw (**RST**), ^{15}N labelled barley straw + N (**BST+N**), or oilseed rape straw + N (**RST+N**). N fertilizer was applied to the soil surface as ammonium-nitrate at a rate of 100 kg N ha^{-1} and soil moisture was adjusted to 80% water-holding capacity. In the field experiment, during the vegetation period ^{15}N labelled fertilizer ($^{15}NH_4^{15}NO_3$) was used to generate ^{15}N labelled oilseed rape straw (up to 5 at%). Here, the three fertilizer treatments consisted of 5 kg N ha^{-1} (**RST-5**), 150 kg N ha^{-1} (**RST-150**) and 180 kg N ha^{-1} (**RST-180**). Post-harvest N_2O emissions were determined during the period of August 2013 to February 2014 by using static flux chambers. In the incubation trial, cumulative N_2O emissions were 5, 29, 40 g N_2O-N ha^{-1} 148 $days^{-1}$ in non-fertilized control, BST and RST treatments, respectively. Here, emissions were slightly higher in RST than BST ($p<0.05$) which most likely was attributable to the lower C/N ratio of RST than BST. On the other hand, application of N to the straw incorporated soils increased N_2O emissions drastically being 673 and 593 g N_2O-N ha^{-1} 43 $days^{-1}$ in BST and RST treatments, respectively with no significant difference among straw types. Here, ^{15}N labelling showed that only about 0.72% and 0.46% of emitted N_2O originated from BST and BST+N treatments indicating a very low share of direct straw-borne N contributions to the formation of soil-borne N_2O. In the field experiment,5-month post-harvest N_2O emissions were about 1.6 kg N_2O-N ha^{-1} with no significant differences among non-amended control and straw treatments. Both, the incubation and the field trial clearly showed that oilseed rape straw amendment to soil alone without additional post-harvest N fertilizer application is highly unlikely to affect post-harvest N_2O emissions. Under the experimental conditions, which were close to typical farming practice, post-harvest N_2O emissions were low.