SOIL GHG (N_2O/CH_4) EMISSIONS IN THE FERTILISED ARABLE LAND

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Soil/atmosphere fluxes of N_20 and CH_4 were monitored for a 16 months period at the arable site "Petrodolinskoye", located on southern Chernozem black soil, using three SIGMA (System for Inert Gas Monitoring by Accumulation) autochambers - low-cost techniques for sampling cumulative gases over long time periods. These systems were constructed for the NitroEurope IP (017841) purposes. Chambers (0.3*1.5 m^2) were located 71 m equidistantly in the centre of a 30 ha field. Fluxes were measured 3 times per day by collecting gas samples into FlexFoil bags. Samples accumulated in these 3 bags over approximately 30 days. Samples (3 replica) were analysed by GC using an ECD-detector for N_20 and a FID-detector for CH_4 in the CEH, Edinburgh.

Samples were collected monthly from September 2009 to December 2010. Results of our measurements showed small N_20 emissions (-1.2 ± 6.7 g N ha"[1] month"[1]), with statistically insignificant difference between months, in the periods Sep to Dec 2009 and Aug to Dec 2010. We observed the same tendency of slightly increasing N_20 fluxes after tillage events in October 2009 and 2010. Significant increases ($p < 0.01$) in N_20 emissions from April to June 2010 with the peak in May (104 ± 36 g N ha^{-1} $month^{-1}$) were observed. Nitrogen loss in form of N_20 in this period was 187 ± 36 g N ha^{-1}.This increase coincided with fertilization at the end of March (14 kg N ha^{-1}) and middle of April (16 kg N ha^{-1}), tillage in March and April and increased rainfall. There was a correlation between N_20 and amount of precipitation ($r = 0.51$; $p < 0.07$). Previous studies have shown that precipitation is one of key factors influencing N_20 emission (Skiba and Smith, 2000). The 48 kg N ha^{-1} fertilization for winter onion in November 2010 did not significantly change N_20 emission. The average monthly N_20 flux was 17.9 ± 10.3 g N ha^{-1} for the investigated period (Jan - Dec 2010). The annual N_20 budget was 214.5 ± 123.3 g N ha^{-1} for 2010 and the N_20 emission factor for 2010 was 0.27 %. Significant changes in CH_4 fluxes during the study period were not observed, but large fluctuations in standard deviations of average fluxes pointed on large spatial variability. During Jan - Dec 2010 the monthly average CH_4 flux was -17.3 ± 42.6 g C ha^{-1} and the annual CH_4 budget was -207.6 ± 510.6 g C ha^{-1}. The overall tendency during the study period on this arable fertilized field was uptake of CH_4, this was also observed on other arable soils (Hutsch, 2001).

Presented results are the first data on GHG flux measurements in this area, derived in NitroEurope IP. Nitrous oxide fluxes were small, and responded positively to rainfall. Fertilizer induced emissions were considerably smaller (0.27 %) than the IPCC default emission factor 1 % (IPCC, 2006). Like most arable soils, also the southern Chernozem black soils are unlikely to be a CH_4 source, but instead are a small sink.