STUDY OF ROLE OF NITROGEN USE EFFICIENCY FOR RESTORATION OF ARABLE LAND AREA

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This study shows an estimation of Nitrogen (N) budget and N use efficiency in arable land area, located on typical Chernozem soils in Southern Ukraine. These Chernozem black soils (CH vec) have been farmed for more than 200 years and in many years between 85-90 % of these soils are ploughed. Crop rotation with fertilisation (2007 - 2010) and irrigation (2007 - 2008) was used on investigated area.

Soil/atmosphere exchange fluxes of N_20 were monitored for Sep 2009 - Dec 2010, using three SIGMA autochambers. Collected samples were analysed for GC using an ECD-detector for N_20 in the Centre for Ecology and Hydrology, Edinburgh. Atmospheric bulk depositions were collected monthly in particulate collector (EMEP's standard) during 2010 and analysed with IC in ONU's laboratory. Samples for evaluation of NH_3 flux were collected (Jul 2009 - Dec 2010) using COTAG system and analysed with IC in the same laboratory. Assessment of crop / crop residues was conducted manually using frames 0.5*0.5 m^2 (2007 - 2010). Measurement of total N content in crop residues was performed using ANCA-SL elemental analyzer coupled with a 20-20 tracermass MS in University of Copenhagen. Details of fertilisation and harvest rates were collected from farmer.

N input and output for investigated area was estimated for each year from 2007 to 2010. The following was considered as N input: fertilizer, crop residues returned to the soil (aboveground part and roots), atmospheric deposition (mineral and organic), external organic sources, biological N fixation (BNF). Maximum fertiliser input was 114.2 kg N ha^{-1} for onion in 2007. Maximum of aboveground crop residues (173 kg N ha^{-1}) returned to the soil was applied after 2008 tomato season. Root residues were not measured. Non-organic annual bulk deposition rate for 2010 was 28.6 kg N ha^{-1} and organic - 10.9 kg N ha^{-1}. BNF was estimated as 0.5 kg N ha^{-1} per month for non-legume crop (Hattori, 1973). Maximum total N input (247 kg N ha^{-1}) was registered in 2008. As N output we accounted removal of crop products, crop residues for fodder, N emissions (N_20, NH_3, NO_x and N_2), and soil wind erosion (UN, 1999). We found that maximum N output with crop was for onion (296 kg N ha^{1}). N_20 and NH_3 emissions were measured for part of 2009 and 2010. No significant annual N losses (-0.2 ± 0.3 kg NH_3-N ha^{1} and 0.2 ± 0.1 kg N_20-N ha^{1}) took place for non-irrigated crop compared to other sinks. NO, NO_x and N_2 emissions and wind erosion were not measured. Peak N surplus (119 kg N ha^{-1}) was found after tomato in 2008 and N impoverishment (-62 kg N ha^{-1}) was detected after onion in 2007.

The annual N budget varied for studied period and depended on crop type, fertilisation and plant residue rates and irrigation. Total N budget (roughly) for 4 years was 152 kg N ha^{-1} with 79 % of N use efficiency and showed that crop rotation is important approach to support soil N supply and thus soil fertility.

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