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Quantitively and novelty source fingerprinting N and P pollutants in sediment: Case study in a small catchment, North China

Hanqing Yu[1] and Joseph Adu-Gyamfi[2]
[1]Institute of Environment and Sustainable Development in Agriculture, Chinese Academy of Agricultural Sciences (CAAS), Beijing, China (yuhanqing@caas.cn)
[2]International Atomic Energy Agency, Vienna, Austria

The intensive farmland in north China accounts for more than 17% of China's arable land area and is main producing area of wheat and corn in China. The response of sources and loads of sediment of N and P pollutants to the high-intensity agricultural activities in north China still remains unclear. The study aims to quantify the source and magnitude of N and P pollutants in the sediment from different land use types using a novel application of compound-specific $\delta^{13}C$ isotopes (CSSI), ^{137}Cs and $^{210}Pb_{ex}$ (FRNs), in a representative agricultural catchment (Jiangou). Surface (0-2 cm) soil and sediment samples were collected from different plant species for CSSI and FRNs, while subsurface (5-30 cm) soil samples were collected from channel bank for FRNs. The ^{137}Cs cores (0-60 cm) collected at the outlet of the catchment and also at reference sites. Sediment sources from surface and subsurface soils were derived by FRNs data which accounted by 83±6% and 17±6%, respectively, while the sediment sources from maize, bean, vegetable farmlands and forestlands on the surface soil areas were identified by CSSI data. Combining FRNs and CSSI fingerprinting techniques, the dominant sediment source was derived from maize farmland which contributed by 60±8%, followed by channel bank, bean farmland and vegetable farmland which accounted for 17±6%, 12±3% and 8±3%, respectively, and the least contribution was from forestland (3±1%). According to the ^{137}Cs cores (0-60 cm) collected at the outlet of Jiangou catchment, a sedimentation rate of 23.38±0.22 t ha^{-1} yr^{-1} of this study catchment was quantified. The ^{137}Cs inventory of the reference site was 1162±131Bq m^{-2}. Based on the measured of N and P concentrations in source samples, and areas of land uses in this catchment, we quantitatively estimated the N pollutant in sediment (t yr^{-1}) from maize (2.19), bean (0.42), vegetable farmlands (0.31), forestland (0.49) and channel bank (0.05), while P pollutant (t yr^{-1}) were 4.39 for maize, 0.18 for beans, 0.28 for vegetable farmland, 0.37 for forestland and 0.04 for channel bank. This study shows that the novel conjunctive use of FRNs and CSSI techniques could quantify the N and P pollutants in sediment from different land uses in catchment, which is critical to assess and implement effective agricultural and land management practices.