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Assessment of Nitrate-N Load in Subsurface Drainage Water from the Agricultural Fields in the Fergana Valley, Uzbekistan

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Leaching of nitrate-N (NO_3^-) from irrigated agricultural land and water contamination have become a worldwide concern. This study was conducted to investigate amount of nitrate-N leached to groundwater and surface water from irrigated cotton, winter wheat and maize fields in the Fergana Valley (Uzbekistan). Therefore at two sites ("Akbarabad" and "Azizbek") equipped with closed horizontal drainage system during 2010-2011 vegetation seasons we monitored water flow, nutrient concentrations and salinity at surface and subsurface drains, at irrigation canals and groundwater. We also applied stable isotopes (δ^2H and δ^{18}O) method in order to investigate the source of drainage water runoff. Discussed are results of 2010.

Farmers fertilized cotton fields with ammonium nitrate of 350-450 kg ha^{-1} in "Akbarabad" and 700 kg ha^{-1} in "Azizbek" sites. In winter wheat and maize fields (in "Akbarabad") about 500 kg ha^{-1} of ammonium nitrate were applied. Cotton fields were irrigated with 2700 m^3 ha^{-1} ("Akbarabad") and 3500 m^3 ha^{-1} ("Azizbek"). In winter wheat and maize fields applied irrigation water amounted to 3900 m^3 ha^{-1} and 723 m^3 ha^{-1}, respectively.

Frequent groundwater and subsurface drainage water sampling revealed that nitrate leaching occurred mostly during and right after the irrigation events. The estimated average nitrate-N concentration in subsurface drainage water in "Akbarabad" was slightly higher (9 mg l^{-1}) than in "Azizbek" (8 mg l^{-1}). During July-November (2010), in average, nitrate-N losses through subsurface drainage amounted to 24 kg ha^{-1} in "Akbarabad" and 18 kg ha^{-1} in "Azizbek". The salinity of drainage water at both sites was similar and varied between 2.3-2.7 dS m^{-1}.

Preliminary results of isotope signals of studied water (precipitation, drainage, irrigation and ground water) indicate that the source of drainage water runoff comes from the irrigation water, while the contribution of rainfall is negligible. It is planned to run simulations with DRAINMOD model for further investigation of water and N balances of the selected sites. Developed recommendations for farmers on optimum irrigation water amounts and N fertilization will allow reducing environmental risks in agricultural lands of the Fergana Valley.