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Greenhouse Gas Emissions from Irrigated Agriculture in Khorezm Region (Uzbekistan)

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Abstract

Agricultural systems in the Khorezm region (Uzbekistan, Central Asia) are characterised by monocultures under irrigation in combination with intensive fertilisation. Irrigation and fertilisation of arid systems not only stimulates plant growth, but also a variety of microbial processes enhancing the turn-over of soil carbon and nitrogen (N) leading to elevated emissions of greenhouse gases (GHG) such as N_2O and CH_4.

In 2005, GHG emissions were measured from experimental fields at 6 research sites, encompassing 5 different land use types. Emission rates from irrigated agricultural fields were high and represent a significant source of GHG due to N_2O emissions from cotton and winter wheat as well as CH_4 emissions from flooded rice fields. Even an unfertilised plantation of poplar trees showed surprisingly high N_2O fluxes. In contrast, N_2O emissions were very low in spots with native vegetation, i.e. the 'Baday Tugai' riparian forest along the Amu Darya River.

The observed temporal patterns of N_2O emissions were similar for cotton and winter wheat fields. Periods of very high N_2O emissions were triggered by fertiliser application in combination with irrigation. These "emission peaks" accounted for 80 % of the total N_2O emissions over one cotton season. Cumulative N_2O emissions during the cropping season varied between 2.5 kg N_2O-Nha^{-1} - 5.6 kg N_2O-Nha^{-1}, which corresponds to 3.8 % of the total fertiliser applied.

The common management practice of concomitant fertilisation/irrigation in combination with the high soil temperatures during the season leads to an elevated soil microbial activity. Subsequently, the farming systems in Khorezm experience high losses of N via denitrification. This implies low N use efficiency of the fertiliser applied and large emissions of N_2O-gas. Modifications in the amount and timing and modalities of the fertiliser application in combination with improved irrigation techniques may improve the agronomic performance and reduce the environmental impacts.

Keywords: Emission, fertilisation, greenhouse gas, irrigation, N_2O

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