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# Effects of agricultural activities on nitrate contamination of groundwater in a Yellow River irrigated region

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**Abstract** Agricultural-induced increase of nitrate ($NO_3^-$) loading in groundwater is a worldwide problem. This study investigates the impacts of agricultural activities on groundwater $NO_3^-$ pollution in a Yellow River irrigated region. The agricultural land use patterns are dependent on the land and water conditions. Besides wheat–maize rotation, the most popular cultivation pattern, other patterns with high production/ income, such as greenhouse vegetables, watermelon–cotton, are also widely adopted. N-fertilizer is excessively applied for all land-use patterns, with the annual amount ranging from 500 to 1420 kg N $ha^{-1}$. The $NO_3^-$ loading in groundwater has large seasonal variation mainly caused by agricultural activities. Even in the best water quality season, 4 out of 27 samples show $NO_3^-$ concentrations in excess of the drinking water standard, with a maximum $NO_3^-$ concentration in well water of 100 mg $NO_3^-$ $L^{-1}$. The shallow groundwater of the study region, combined with poor water and $NO_3^-$ management practices, are creating a long-term legacy of contamination.

**Key words** nitrate leaching; groundwater; irrigation; agriculture; land use; Yellow River