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Field experiments of Controlled Drainage of agricultural clay soils show positive effects on water quantity (retention, runoff) and water quality (nitrate leaching).

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Despite best management practices, agriculture is still facing major challenges to reduce nutrients leaching to the aquatic environment. In deltas, most of total nutrient losses from artificially drained agricultural soils are discharged via drains. Controlled drainage is a promising measure to prevent drainage of valuable nutrients, improve water quality and agricultural yield and adapt to climate change (reduce peak runoff, manage water scarcity and drought). In The Netherlands, this technique has attracted much attention by water managers and farmers alike, yet field studies to determine the expected (positive) effects for Dutch conditions were scarce. Recently, a field experiment was set up on clay soils. Research questions were: how does controlled, subsurface drainage perform on clay soils? Will deeper tile drains function just as well? What are the effects on drain water quality (especially with respect to nitrogen and salt) and crop yield?

An agricultural field on clay soils was used to test different tile drainage configurations. Four types of tile drainage systems were installed, all in duplicate: eight plots in total. Each plot has its own outlet to a control box, where equipment was installed to control drain discharge and to measure the flow, concentrations of macro-ions, pH, nitrogen, N-isotopes and heavy metals. In each plot, groundwater observation wells and suction cups are installed in the saturated and vadose zones, at different depths, and crop yield is determined. Four plots discharge into a hydrologic isolated ditch, enabling the determination of water- and nutrient balances. Automatic drain water samplers and innovative nitrate sensors were installed in four plots. These enable identification and unravelling so-called first flush effects (changes in concentrations after a storm event). Water-, chloride- and nitrogen balances have been set up, and the interaction between groundwater and surface water has been quantified. The hydrological processes in the soil have been modelled with simulation model SWAP.

The experiment started in 2010 and is ongoing. Data, collected so far show that the plots with controlled drainage (all compared with plots equipped with conventional drainage) conserve more rain water (higher groundwater tables in early spring), lower discharges under average weather conditions and storm events, reduce N-loads and saline seepage to surface waters, enhance denitrification, show a different 'first flush' effect and show similar crop yields. The results of the experiments will contribute to a better understanding of the impact of controlled drainage on complex hydrological en geochemical processes in agricultural clay soils, the interaction between ground- en surface water and its effects on drain water quantity, quality and crop yield.