Effect of Drainage Water Management on Nitrogen Losses to Surface Waters

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Abstract

Artificial drainage is necessary to farm some of the world's most productive soils. While subsurface drainage reduces surface runoff, sediment losses and the movement of contaminants, such as pesticides and phosphorus, into surface waters, it increases the losses of nitrogen (N), and has been cited as one of the primary sources causing algal blooms and hypoxia in major water bodies. Research conducted in the 1970s and 1980s in North Carolina showed that drainage volumes and N losses can be substantially reduced by a practice called Controlled Drainage (CD), or Drainage Water Management (DWM). The practice has been implemented on over 400,000 acres in North Carolina for reducing N loads to surface waters. More recent research has shown that the practice is effective for a wide range of soils and climatological conditions, and it is now being promoted and applied in the U.S. Midwest for water conservation and the reduction of N losses to the environment. A review of research on DWM shows a wide range of response depending on soil and site conditions. Drainage Water Management has reduced drainage volumes, compared to conventional or uncontrolled drainage, in all cases studied. The amount of reduction varied from 17% to over 90%. In some cases the reduction of N losses to surface and groundwater is nearly equal on a percentage basis to the reduction in drainage volume. In others it is clear that the route of N loss has been changed, but the magnitude of reduction, if any, is uncertain. Analysis of the results emphasizes the importance of scale in field experiments to determine the effect of DWM. The presentation will review results of previous field research and use simulation methods to analyze the effect of DWM on the hydrology of drained agricultural lands and on the loss of Nitrogen in drainage waters.