

Corn yields increased under constant fertilizer without reducing nitrate export

Chelsea C. Clifford, Carl H. Pederson, Emily R. Waring, Matthew J. Helmers

Iowa State University Agricultural & Biosystems Engineering

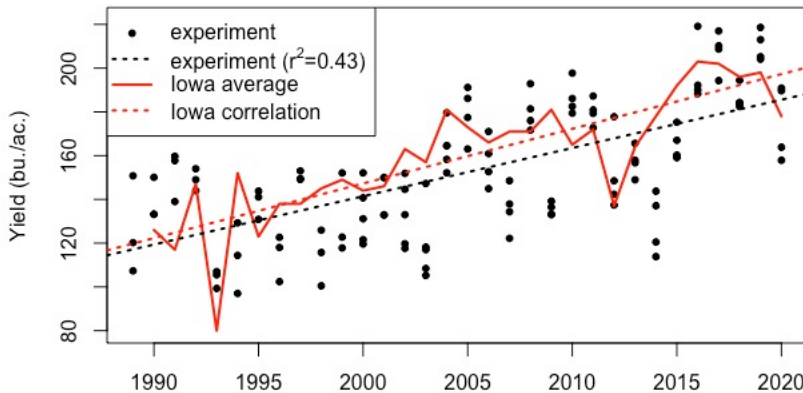
Did my increased corn yield require increased fertilizer?
Has it cut my nitrate exports?



Agricultural Drainage Water Research & Demonstration Site

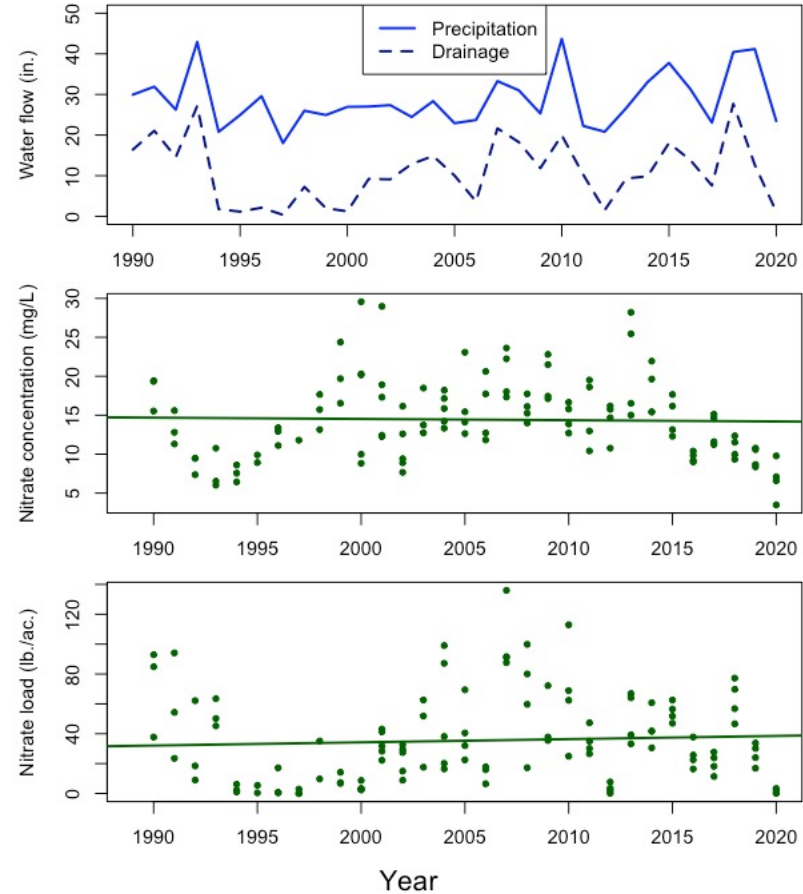


My consistently fertilized (150-160 lb./ac./year) plots have an answer!



Without increasing fertilizer in our experiment, our yields grew at a similar rate (2.2 bu./ac./year) to all Iowa's (2.5 bu./ac./year).

Drainage nitrate loads stayed nearly flat (increased 0.22 lb./ac./year on average, $r^2 < 0.01$). Loads rose with drainage ($r^2 = 0.77$), which rose with precipitation ($r^2 = 0.44$). Concentration had little effect on load ($r^2 = 0.08$), and stayed nearly flat (decreased 0.016 mg/L/year on average, $r^2 < 0.01$).



Our decades' yield growth, though close to Iowa's, did not require a fertilizer increase. Yield growth did not cut nitrate exports.

Acknowledgements: Dozens of Iowa State University students and staff collected experimental data and maintained the experiment over the years. This experimental data is part of Iowa Agricultural Drainage and Nutrient Studies which are a cooperative project between the Iowa Department of Agriculture and Land Stewardship and Iowa State University and have been supported, in part, through funds authorized by the Iowa Groundwater Protection Act. In addition, research from 2011-2015 was part of a regional collaborative project supported by USDA-National Institute of Food and Agriculture, award number 2011-68002-30190, "Cropping Systems Coordinated Agricultural Project: Climate Change, Mitigation, and Adaptation in Corn-based Cropping Systems." Statewide data comes from the U.S. Department of Agriculture National Agricultural Statistics Service, and gaps in our own precipitation data were filled with data from the U.S. National Oceanic and Atmospheric Association weather station GHCND:USC00136719.