Geophysical Research Abstracts
Vol. 18, EGU2016-9255, 2016
EGU General Assembly 2016

Surplus N in US maize production: Informing data-driven policies using the Adapt-N model

Shai Sela (1), Harold van-Es (1), Eileen McLellan (2), Rebecca Margerison (1), and Jeff Melkonian (1)

(1) Dept. of Soil and Crop Sciences, Cornell University, Ithaca, NY, USA (ssela@cornell.edu), (2) Ecosystems Program, Environmental Defense Fund, Washington, DC, USA

Maize (Zea mays L.) production accounts for the largest share of crop land area in the U.S, and is the largest consumer of nitrogen (N) fertilizers of all US crops. Over-application of N fertilizer in excess of crop needs often lead to surplus of N in the soil, resulting in well-documented environmental problems and social costs associated with high reactive N losses. There is a potential to reduce these costs through better application timing, use of enhanced efficiency products, and more precise rate calculations. However, promoting management changes by means of environmental policies requires robust analysis of the possible environmental outcomes associated with these policies. This research gap is addressed using Adapt-N, a computational tool that combines soil, crop and management information with near-real-time weather data to estimate optimum N application rates for maize. Using results from a large synthetic dataset of 8100 simulations spanning 6 years (2010-2015), we have explored the total applied N rates, surplus of N (total N applied minus N removed by the crop) and the environmental losses resulting from seven N management scenarios applied in the top 5 US maize production states – IL, IN, IA, MN and NE. To cover a wide range of weather and production environments, all scenarios were applied at five randomly selected locations in each state, using combinations of three soil texture classes and two organic matter contents. The results indicate that fall applications typically lead to the highest total amount of N applied, highest N surplus and substantial amounts of environmental N losses. Nitrification inhibitors were found to have a marginal benefits for fall applied N. Spring pre-plant N applications were found to have lower N surplus than fall applications, but could still lead to high N losses under wet spring conditions. These losses were reduced (12%) when nitrification and urease inhibitors were applied. Out of all simulated N management scenarios, applying a split application of a modest starter followed by the majority of N applied at sidedress was found to have on average the lowest total N applied amount and N surplus. A split application was found to reduce environmental losses by 46% and 17% compared with fall and spring pre-plant N applications (respectively). These results could be used to inform environmental policies and business models to reduce environmental costs associated with maize production in the U.S.