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Adapt-N: A Cloud-Based Computational Tool for Crop Nitrogen Management that Improves Production and Environmental Outcomes

Harold van Es, Shai Sela, Rebecca Marjerison, and Jeff Melkonian
Cornell University, Ithaca NY, USA (hmv1@cornell.edu)

Maize production accounts for the largest share of crop land area in the US and is the largest consumer of nitrogen (N) fertilizers, while also having low N use efficiency. Routine application of N fertilizer has led to well-documented environmental problems and social costs. Adapt-N is a computational tool that combines soil, crop and management information with near-real-time weather data to estimate optimum N application rates for maize. Its cloud-based implementation allows for tracking and timely management of the dynamic gains and losses of N in cropping systems. This presentation will provide an overview of the tool and its implementation of farms. We also evaluated Adapt-N tool during five growing seasons (2011-to-2015) using a large dataset of both side-by-side (SBS) strip trials and multi-N rate experiments. The SBS trials consisted of 115 on-farm strip trials in Iowa and New York, each trial including yield results from replicated field-scale plots involving two sidedress N rate treatments: Adapt-N-estimated and Grower-selected (conventional). The Adapt-N rates were on average 53 and 30 kg ha-1 lower than Grower rates for NY and IA, respectively (-34% overall), with no statistically significant difference in yields. On average, Adapt-N rates increased grower profits by $63.9 ha-1 and resulted in an Adapt-N estimated decrease of 28 kg ha-1 (38%) in environmental N losses. A second set of strip trials involved multiple N-rate experiments in Wisconsin, Indiana, Ohio and NY, which allowed for the comparison of Adapt-N and conventional static recommendations to an Economic Optimum N Rate (determined through response model fitting). These trials demonstrated that Adapt-N can achieve the same profitability with greatly reduced average N inputs of 20 lbs N/ac for the Midwest and 65 lbs N/ac for the Northeast, resulting in significantly lower environmental losses. In conclusion, Adapt-N recommendations resulted in both increased growers profits and decreased environmental N losses by accounting for variable site and weather conditions.