Assessing the Sensitivity of Agricultural Systems to Atmospheric N Deposition

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The estimation of air quality program benefits becomes increasingly important in difficult economic times. It is, however, difficult to anticipate every unintended consequence of these programs. For instance, there is now anecdotal evidence that farm managers are moving to new N fertilizer forms containing added sulphur sourced from industrial scrubbers. They are doing this to make up for decreased atmospheric sulphur deposition resulting from recent implementation of stricter SOx and Nox emission regulations. To date there have not been similar reports regarding the need for supplemental N applications but, in the past, the agricultural community has been critical of program analyses that neglect potential benefits of atmospheric N deposition for commercial crop production. The advent of the coupled agricultural management/CMAQ modeling system released in 2012 facilitates the generation of quantitative estimates of simulation uncertainty attributable to deposition inputs as well as potential production and biogeochemical benefits (as well as "dis-benefits") derived from atmospheric deposition. In particular, the USDA Environmental Policy Integrated Climate (EPIC) model, the agricultural engine of the linked agricultural management/CMAQ system, allows us to explore the sensitivity of agricultural soil nitrogen status to alternative deposition scenarios. The EPIC biogeochemical model is run for legume and non-legume crops under alternative deposition scenarios including; no deposition, EPIC default deposition (wet deposition only), unidirectional CMAQ deposition and "first guess" bidirectional CMAQ estimates. The sensitivity of EPIC ammonia fertilizer application rate and timing as well as soil N status indicators such as N-fixation and denitrification rates, biomass production, N-uptake, yield and patterns of surface and subsurface N losses will be examined. Benefits and "dis-benefits" will be summarized to support or refute the hypothesis of the importance of N-deposition to agricultural production systems.

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