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Natural Resources Research Update

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Title: Nitrogen Source Effects on Nitrous Oxide Emissions

Effects of N fertilizer source and tillage on nitrous oxide (N_2O) emissions from soils under several irrigated, crop management systems were evaluated. Irrigated corn production systems [conventional-till continuous corn (CT-CC); no-till continuous corn (NT-CC); NT corn-dry bean (NT-CDb); and NT corn-barley (NT-CB)] receiving different N sources at fertilizer rates of 246 kg N ha^{-1} when in corn, 56 kg N ha^{-1} when in dry bean, and 157 kg N ha^{-1} when in barley were monitored. A controlled-release, polymer-coated urea (ESN®) and dry granular urea were compared in the NT-CC and CT-CC systems. A stabilized N source (SuperU®) was compared with urea in the NT-CDb and NT-CB rotations. Cumulative growing season N_2O emissions from urea and ESN application were not different under CT-CC, but were different under NT-CC, where ESN reduced N_2O emissions 49% compared to urea. SuperU reduced N_2O emissions 27% compared to urea with application of 56 kg N ha^{-1} to dry bean in 2007 and 54% compared to urea with application of 246 kg N ha^{-1} to corn in 2008 in the NT-CDb rotation. SuperU reduced N_2O emissions 19% compared to urea with application of 157 kg N ha^{-1} to barley in 2007 and 51% compared to urea with application of 246 kg N ha^{-1} to corn in 2008 in the NT-CB rotation. This work shows that current fertilizer N technologies that delay release and transformation of N can substantially reduce N_2O emissions from irrigated systems under specific cropping conditions, such as no-till. (1)

Another study assessed the ability of commercially available enhanced-efficiency N fertilizers to reduce nitrous oxide (N_2O) emissions following their application in comparison with conventional dry granular urea and liquid urea-ammonium nitrate (UAN) fertilizers in an irrigated no-till (NT) corn production system (2). Enhanced-efficiency fertilizers evaluated were:

two polymer-coated urea products (ESN and Duration III®), and two fertilizers containing nitrification and urease inhibitors (SuperU and UAN+AgrotainPlus®). Nitrous oxide fluxes were measured during two growing seasons using static, vented chambers and a gas chromatograph analyzer. Enhanced-efficiency fertilizers significantly reduced growing season N_2O-N emissions in comparison with urea, including UAN. SuperU and UAN+AgrotainPlus had significantly lower N_2O-N emissions than with UAN. Compared to urea, SuperU reduced N_2O-N emissions 48%, ESN 34%, Duration III 31%, UAN 27%, and UAN+AgrotainPlus 53% averaged over 2 yr. Compared to UAN, UAN+AgrotainPlus reduced N_2O emissions 35% and SuperU 29% averaged over 2 yr. The N_2O-N loss as a percent of N applied was 0.3% for urea, with all other N sources having significantly lower losses. Grain production was not reduced by the use of alternative N sources. This work shows that enhanced-efficiency N fertilizers can reduce N_2O-N emissions without affecting yields from irrigated NT corn systems in the semi-arid central Great Plains.

1. Halvorson, A.D., Del Grosso, S.J., Alluvione, F. 2010. Tillage and Inorganic Nitrogen Source Effects on Nitrous Oxide Emissions from Irrigated Cropping Systems. Soil Science Society of America Journal. Vol. 74:, No.2, 436-445.

2. Halvorson, A.D., Del Grosso, S.J., Alluvione, F. 2010. Nitrogen Source Effects on Nitrous Oxide Emissions from Irrigated No-Till Corn. Journal of Environmental Quality 39:1554-1562.

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