

Meta-analysis of 4R Nitrogen Management on Direct Nitrous Oxide Emissions from Croplands in Cold Climates

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Agricultural soils are one of the prominent sources of direct and indirect nitrous oxide (N₂O) emissions. Use of the 4R nutrient stewardship i.e., application of fertilizer source at right time, rate and place can greatly impact N₂O emissions and agronomic yield. We proposed a meta-analysis to review and compare the cumulative N₂O (Σ N₂O kg N-ha⁻¹) emissions reported by different studies conducted in Western Canada and areas with similar climatic conditions, using different fertilizer sources (conventional urea versus enhanced efficiency N fertilizers), applied at different rates, time (Spring versus Fall) and placement depths. Preliminary results showed that using nitrification inhibitors reduced N₂O emissions by nearly 55% for anhydrous ammonia, 50% for urea and deep band placement reduced emissions by almost 40% as compared to shallow band. Of the reviewed and sorted datasets, we expect that the use of 4R's can have a great potential to reduce N₂O emissions. This study will quantify the 4R impacts on crop yield and N₂O emission mitigation across regions with cold climates and help to optimize the fertilizer management practices for sustainable agriculture.