Abstract

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

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Over the past few decades, there has been a constant increase in the earth's temperature, which is mostly due to the atmosphere's concentration of greenhouse gases such carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4). Agricultural soils are a major source of direct and indirect N_2O emissions. Enhanced efficiency fertilizers (EEFs) are recommended as a mitigation strategy for N_2O emissions from agriculture. We conducted a meta-analysis to compare the cumulative N_2O (ΣN_2O kg N-ha^{-1}) emissions reported by different studies conducted in Western Canada and areas with similar climatic conditions, using different fertilizer sources, applied at different rates, times and placement depths. The preliminary results showed that the effect size of inhibitors is -0.3 (p=0.001), Super U is -0.4 (p=0.01), PCU is -0.35 (p=0.004) and UAN is -0.1 (p=0.1) on N_2O emission as compared to granular urea and UAN application, respectively. The banding of fertilizers resulted in lower N_2O emissions in comparison to broadcasting. It is anticipated that the 4Rs will significantly lower N_2O emissions across the analyzed and arranged datasets. This study will quantify the 4R effects on crop yield and N_2O emission mitigation across cold climate zones and help to optimize the fertilizer management techniques for sustainable agriculture.