

MITIGATING NITROUS OXIDE (N₂O) EMISSION AND INCREASING PRODUCTIVITY THROUGH UREASE AND NITRIFICATION INHIBITORS UNDER FIELD CONDITIONS

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Abstract

Urease and nitrification inhibitors are proposed as these intend to lessen nitrogen losses, reducing environmental impacts associated with N fertilizer application, thereby enhancing crop nitrogen use efficiency (NUE) and productivity. A field experiment was established using silt loam soil (New Developmental Farm) to evaluate the effectiveness of urease (Agrotain) and nitrification (Nitropyrin) inhibitors coated urea on minimizing nitrous oxide (N₂O) emission and plant growth hormone (Gibberellic Acid salt) on harvest growth and yield of Maize at research area, The University of Agriculture Peshawar, during summer 2015. N fertilizer (Urea) @ 200 kg N ha⁻¹ with or without UI (Agrotain at 3 L t⁻¹), NI (Nitropyrin 200 g ha⁻¹) and plant growth hormone (GA-S at 60 g ha⁻¹) were applied in 2 splits at different growth stages. Each treatment had 4 replicates laid out in Randomized Complete Block Design. The results showed that N-Inhibitors and GA-S treated urea significantly ($p < 0.05$) increased the yield and yielding traits of maize over granular urea and control. Combined application of both inhibitors and GA-S showed superiority over nitropyrin, agrotain and GA-S in terms of increased yield. The highest biological yield (15295 kg ha⁻¹), grain yield (6067 kg ha⁻¹), stover yield (9228 kg ha⁻¹) and total N-uptake (161.2 kg ha⁻¹) of maize (grand mean increased 36.8 %, 40 %, 25.5 % and 48.4 % respectively) were recorded in combination of all treatments compared with urea. The results obtained on soil N mineralization of NH₄-N and NO₃-N concentration showed a significant variation over 28 days interval of fertilizer application with N inhibitors increasing the soil inorganic N availability and shifted the main form of soil inorganic N from NO₃-N to NH₄-N thus retaining more N in soil solution. N₂O fluxes varied through time and between treatments; mean N₂O flux was the highest in the urea alone, while the urea coated with nitropyrin, agrotain and combined nitropyrin + agrotain significantly lowered the mean N₂O flux by 17.1 %, 13.5 %, and 32.4 %, respectively, over urea alone. Total N₂O emission in the nitropyrin, agrotain and combined nitropyrin + agrotain and urea alone treatments during the 28 days experimental trial was 1.89, 1.97, 1.54, and 2.28 kg N₂O-N ha⁻¹, respectively. These results indicate that reducing the rate of urea hydrolysis and inhibiting nitrification with combined use of agrotain, nitropyrin in an alkaline calcareous soil is important to reduce N losses and N₂O emission, improve fertilizer use efficiency of applied urea with maximum bioavailability to plants thus increase the yield of Maize crop.