Nitrogen leaching from paddy field with different nitrogen and water management practices

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Abstract

An experiment was conducted growing rice (cultivar Pusa-44) for assessing leaching losses of inorganic nitrogen as affected by water management practices and nitrogen treatments. The treatments were unfertilized control, Prilled urea, Neem coated urea (NCU), Leaf colour chart based Neem coated urea (NCU-LCC), and integrated treatment of farm yard manure, neem coated urea and bio fertilizer in continuous flooding and intermittent flooding water regimes. The leachate was collected using porous suction cups installed in different treatment plots and leachate was analysed for nitrate and ammoniacal N. Loss of applied N ranged from 9.23 to 12.53% in different treatments.

Keywords: Percolation, nitrogen leaching, paddy, nitrate and ammoniacal nitrogen

1. Introduction

Leaching losses of nitrogen from agricultural fields is responsible for eutrophication and ground water pollution. High nitrate nitrogen concentrations in ground water is also harmful for human health. The N leaching losses from paddy fields are dependent on type of fertilizer, soil and water regimes. Need based N application, use of nitrification inhibitors, and bio fertilizers may help in reducing N losses.

2. Material methods

Measurement of mineral N leaching from rice fields was carried out from two water management practices (continuous flooding (CF) and intermittent flooding (IF)) of north west India under different nitrogen treatments namely unfertilized control, Prilled urea, Neem coated urea (NCU), leaf colour chart based application of Neem coated urea (NCU-LCC), and 50%N through FYM + 50% N through NCU + Biofetilizer from the rice fields of ICAR-Indian Agricultural Research Institute, New Delhi, India. The percolation water (leachate) was collected by porous suction cups made of clay materials (4.4 cm in inner diameter, 5 cm in length) embedded in a polyvinyl chloride (PVC) pipe placed in each treatment plot at 70 cm depth.

3. Results

The amount of the water percolated was affected by water management practices. Total amount of percolation varied between 169 m^3ha^{-1} and 250 m^3 ha^{-1} in different treatment. The NO_3^{--}+ NO_2^{--}-N and NH_4^+-N concentrations in the percolation water were affected by water management practices as well as N treatments. The total NH_4^+-N in percolation water was high in CF treatment compared to IF, whereas NO_3^{--}-N concentrations was lower by 33.67% in CF compared to IF treatment under the same N treatment during the rice season. The mineral N leaching losses in LCC based NCU and NCU treatments were lower by 39.4% and 11.9% respectively compared to prilled urea treatment. Loss of applied N was 9.23 to 12.53% in water management practices and 9.96 to 11.76% in different N treatments.

4. Conclusion

The % of mineral N lost ranged from 9.23 to 12.53% of applied N in water management practices and 9.96 to 11.76% of applied N in different N treatments. The LCC based NCU performed best amongst the different N treatments where both NO3--+NO2--N and NH4+-N concentrations in percolation water were lowest.

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