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Evaluation of conventional and organic matrix entrapped urea and di-ammonium phosphate for growth and productivity of *Triticum aestivum* L. and mobilization of NO_3^-, NO_2^-, NH_4^+ and PO_4^{-3} from soil to plant leaves

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Abstract

Conventional Chemical Fertilizers (CCFs) i.e. Urea [$(NH_2)_2CO$] and Di-Ammonium Phosphate [DAP, $(NH_4)_2HPO_4$] in recommended dose (Urea , 150 kgha^{-1} and DAP, 75 kg ha^{-1}, CCF-I) as well as half of the recommended dose (RD, Urea, 75 kg ha^{-1} and DAP, 37.5 kg ha^{-1}, CCF-II) were applied in experimental plots of 2 x 2 M to study the effect of low fertilizer application for wheat cultivation. The same fertilizers were entrapped in an organic matrix (OM, 300 kg ha^{-1}) consisting cow-dung, *Azadirachtaindica* leaf powder and clay soil in 1:1:1 ratios and 15 % (w/w) saresh (plant gum of *Acacia* sp.) of OM as binder were applied in the same fields in half of RD (CCF-II) and 1/4th of RD (Urea, 37.5 kg ha^{-1} and DAP, 18.75 kg ha^{-1}) to investigate the efficacy of entrapped granular fertilizers (ECF-I and ECF-II respectively) with further reduction in chemical fertilizers blended with organic materials. ECF-I and ECF-II increased growth of wheat in terms of root and shoot length (25.46 and 22.15%, 18.81 and 14.81%), number of leaves and roots (22.64 and 16.28%, 22.78 and 16.31%) as well as fresh and dry weights of leaves (29.27 and 5.63%, 17.95 and 4.47%) and roots (24.82 and 7.27%, 27.78 and 13.33 %) over CCF-I on 120 DAS.It also increased the levels of NO_3^-, NO_2^- and NH_4^+ in the plant's rhizosphere (0-15 cm) and its mobilization from soil to the plant leaves. The grain yield and straw yield in ECF-I and ECF-II applied wheat plots were higher by 17.34 and 9%, 8.98 and 5.66% respectively over CCF-I applied plants. The entrapped fertilizers also enriched field soil by increasing its nutritional status in terms of NPK, organic carbon and organic matter over recommended dose of chemical fertilizers. The entrapped fertilizers (ECF-I and ECF-II) increased efficacy of chemical fertilizers by more than four times which indicates that even 1/4th of chemical fertilizers can be made more effective with organic blending.

Keywords*:Azadirachtaindica,* organic matrix, slow release fertilizers, *Triticum aestivum* L., urea.

Introduction

The growth, productivity and yield of wheat (*Triticum aestivum* L.) are largely correlated with the type and quantity of fertilizers applied (Adesemoye et al., 2009; Zou et al., 2009). It has been realized that the excessive use of synthetic chemical fertilizers is unsustainable for any farming practice from economic as well as ecological points of view (Monem et al., 2010; Wang et al., 2010). Nutrient deficiency is one of the major yield limiting factors for wheat, hence increased loading of N and P fertilizers is an essential input for enhancing its productivity (Al- Amoudi and Moujahed, 2006; Rajpar et al., 2006; Bakht et al., 2009).A large amount (about 30-50%) of the applied N get lost through the leaching of nitrate, nitrite, ammonium and other reactive N species and phosphate etc. resulting in contamination of ground and surface water (Singh et al., 2006, 2008a, b, 2010; Adesemoye et al., 2009; Rawat et al., 2010, 2012), volatization of gaseous ammonia (Wei-xinet al., 2007; Zaman et al., 2008), gaseous emissions of nitrogen oxides (NOx), which add to the