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RESEARCH ARTICLE

Increase in Growth, Productivity and Nutritional Status of Rice (*Oryza sativa* L. cv. Basmati) and Enrichment in Soil Fertility Applied with an Organic Matrix Entrapped Urea

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Abstract

Field experiments were conducted to evaluate the effects of eco-friendly organic matrix entrapped urea (OMEU) on growth, productivity, and yield of rice (*Oryza sativa* L. cv. Basmati) and soil enrichment in the paddy field at Rohtak (Haryana) located near Delhi. The OMEU prepared in granular form contained cow dung, rice bran (grain cover of *Oryza sativa*), powder of neem leaves (*Azadirachta indica*), and clay soil (diameter of particles < 0.02 mm) in 1:1:1:1 ratios and saresh (plant gum of *Acacia* sp.) as binder along with half of the recommended dose of commercially available soluble urea (free urea; FU). Single basal application of OMEU showed an increase in plant growth in terms of fresh and dry weights, root length, root, leaf and tiller numbers, soluble protein, total N and ammonium in leaves, productivity in terms of grain and straw yield, and nutritional and microbial activities of field soil over free form of urea and no fertilizer application. Nutritional status of rice grains was also improved over the free urea and no fertilizer controls. Our data indicate that OMEU, which is low cost and based on bio-degradable, non-toxic, and locally available agro-waste, can be attempted to replace the conventional use of soluble urea in rice.

Key words: cow dung, grain yield, plant growth, rice bran, saresh (plant gum of Acacia), urease inhibitor

Introduction

Agriculture contributes about 22% of GDP and provides livelihood to about two-thirds of the Indian population. Rice is the major cereal crop in India, covering about 27.0 million ha of cultivated agricultural land which consume the maximum amount of nitrogen (N) fertilizers (Sharma et al. 2008). A decline or stagnation in rice productivity in the regions experiencing the green revolution is considered as a consequence of a decrease in organic matter and micronutrients of soil, though illiterate and semi-literate farmers are not aware of these facts. This persuades farmers to load more and more chemical fertilizers (Babu et al. 2001; Goyal et al. 1999; Liew et al. 2010; Satyanarayana et al. 2002; Singh et al. 2006; Quyen et al. 2002). It has caused serious environmental concerns such as emission of nitrogen oxides (NOx), ammonia volatilization, leaching of nitrate and other reactive N species in ground and surface waters resulting in water pollution and eutrophication of streams and lakes (Golloway et al. 2008; Gupta et al. 2008; Velmurugan et al. 2008; Weligama et al. 2010). The survey showed that many states in India including Haryana have been affected by nitrate pollution of ground water (Handa 1986; Kakar 2008; Rawat and Singh 2010). Thus, it appears that the excessive loading of N fertilizers causes a potentially alarming situation from an environmental, economic, and resource conservation point of view and indicates an urgent need to improve efficiency of fertilizer use. There are many alternatives adopted from last decades, e.g. biofertilizers, Integrated Plant Nutrient System (IPNS), and

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