Development Of Micronutrient-Coated Fertilizer For Rice

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Introduction

Urea is the main fertilizer used in the rice production in the world. Like other N fertilizers the efficiency of urea in rice soils is generally low due to high losses through volatilization, denitrification and leaching. Slow release amended urea fertilizers can be used to minimize loss of N.The largest rice-growing area of Malaysia is located in the Muda Irrigation Scheme, Kedah. Recent investigations indicated that there are deficiencies of Copper in soils of many sites in this 95,000-hectare irrigation scheme. Therefore Copper fertilization is important to meet the crop requirement. Since the amount of Copper needed is small, conventional methods of fertilizer application are not feasible. This study utilizes the technique of Copper-coated urea whereby slow release of Nitrogen with the addition of Copper through copper coating will increase the rice yield.

Materials and Methods

In this study, three types of materials were used for coating: - palm oil sludge (POS), neem oil (NO) and palm stearin (PS). The Copper Sulphate as a source of Copper was incorporated in the coating of the urea granules. These Copper-coated amended urea granules were evaluated for their effectiveness as a slow release N fertilizer and as a micronutrient carrier under rice soils conditions in laboratory incubation and greenhouse studies using two types of soil:-i)Kangar (Typic Endoaquert) and ii) Kundor soil (Typic Tropaquept). A twenty-one day incubation studies were conducted under flooded condition. The micronutrient-coated fertilizers were applied at the rate of 120 Kg N ha^{-1} for both laboratory and greenhouse studies. The soils were analyzed for urea-N (Douglas and Bremner, 1970), NH4+-N (Bremner, 1965) and available Copper (Ponnamperuma et al., 1981) at daily intervals. Most of the urea was released after 7 days incubation from all coated fertilizers.

Results and Discussion

Effects of urea amended with copper coating of palm stearin
(PS) palm oil sludge (POS), neem oil (NE) and uncoated (urea alone) on NH3 volatilization and N-use efficiency in Kundor and Kangar soils series using 120 kg N ha^{-1} of Cu-coated urea, showed that the rate of urea release decreases in order of: PS>POS>NE>uncoated urea (control). NH3 volatilization was measured from the rate of urea hydrolysis using the urea-N remaining at different incubation periods. Kinetics of NH3 volatilization over a 22-day period showed that the peak rate of NH3 loss was on day 1 with the unamended urea, whilst it occurred on day 3 with all amended urea fertilizers. Total release of urea-N (NH3 loss) from the unamended urea was 93.4% of the applied N on the first day, which was reduced to 56.62%, 83.68% and 44.74% with POS, NE and PS treatments, respectively. As compared to urea, all amended urea fertilizers resulted in a significantly higher dry matter yield, N uptake and Urea- N utilization efficiency by rice crop. In Kangar series POS, NE and PS increased the yield by 34 %(2.19kg ha^{-1}), 29% (2.02 kg ha^{-1}) and 23% (1.86 kg ha^{-1}) respectively over the control (unamended urea).

Conclusions

Coating materials of palm oil sludge (POS) Neem (NE) and Palm Stearin (PS) were successfully utilized to coat the urea granules with copper sulphate additives in order to modify the urea to become a slow release fertilizer and thereby successfully reduced the amount of urea losses and increase N utilization efficiency with the resultant increase in the yield of rice.
Since the chemical additives also have a fertilizer value besides being effective in controlling NH3 loss from urea and improving N-use efficiency, their use as amendment to urea could be a viable option.

Benefits from the study

Paddy farmers will benefit from this new fertilizer in terms of high yield and savings on cost of buying and application of fertilizers

Patent(s), if applicable:

Copper coated urea production process

Stage of Commercialization, if applicable:

Presently applying for patent

Project Publications in Refereed Journals

1. CHOUDHURY, A.T.M.A. and KHANIF, Y.M. (2003). Potassium adsorption behavior of three Malaysian rice soils. Pakistan J. Sci. Ind. Res. 46 (2): 117-121.
2. CHOUDHURY, A.T.M.A. and KHANIF, Y.M. (2002). Effects of magnesium fertilization on rice yield, and magnesium and potassium uptake by rice at variable applied potassium levels. Pakistan J. Sci. Ind. Res. 45 (5): 345-349
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Project Publications in Conference Proceedings

1. CHOUDHURY,A.T.M.A., KHANIF,Y.M. AMINUDDIN, H. and ZAKARIA, W. (2002). Effects of copper and magnesium fertilization on rice yield and nitrogen use efficiency: A ^{15}N tracer study WCSS. Bangkok, Thailand.
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3. KHANIF, Y.M., PANCRAS, H and DAUD C. (1994) Cation effects on amnonia volatilization loss from urea applied to a tropical soil.8th nitrogen workshop, University of Ghent, Belgium. 5-8 Sept. 1994.

Graduate Research

Name of Graduate	Research Topic	Field of Expertise	Degree Awarded	Graduation Year
Yong Ching Yun	*Efficiency of Urea, Ammonium Nitrate and Ammonium Sulphate as N Sources*	Soil Chemistry	B Sc (Bioindustry)	(2002)
Narma bt Yakub	*Efficiency of Copper coated Urea in reducing ammonia volatilization loss.*	Soil Chemistry	B Sc (Bioindustry)	(2002)
Maria Melati bt Abdul Hamid	*Transformation of Urea based compound and mixed fertilizers in flooded and non flooded soils.*	Soil Chemistry	B Sc (Bioindustry)	(2002)

Mohd Rusli bin Deraman	*Efficiency of urea- based compound fertilizer on the Uptake of Nitrogen in maize.*	Soil Chemistry	B Sc (Bioindustry)	(2002)

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