Effects of Neem Coated Urea on the Yield of Lowland Rice on Bangkok Plain

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ABSTRACT

Neem (*Azadirachta indica* A. Juss) seed extract is considered as a nitrification inhibitor, and is cheaper than the synthetic nitrification inhibitors. A local manufacturer has produced urea coated with neem seed extract. Two field experiments with cultivar Suphanburi-90 were conducted during the dry season from February to June 1994 at AIT Experiment Station, Bangkok, to evaluate the effects of neem coated urea on the yield of lowland rice. N was applied at 30 kg N ha^{-1} as basal application and 32.8 kg N ha^{-1} as topdressing and P was applied basal at 16.5 kg ha^{-1}.

The first experiment consisted of four N sources viz. i) Ammophos (16-20-0) as basal and 21-0-0 as topdressing (AP+AM), ii) Urea (46%N) + triple super phosphate (TSP) as basal and urea as topdressing (Urea+Urea), iii) Neem coated urea (25%N, NCU)+ TSP as basal and NCU as topdressing (NCU+NCU), and iv) Urea+TSP as basal and NCU as topdressing (Urea+NCU) in a Randomized Block Design with five replicates.The grain yield showed no significant differences between the different N sources. Among the yield components, 1000 grain weight was decreased with NCU alone but number of panicles per m^2 and % filled grain were not effected by N source.

The second experiment comprised of three land preparation methods viz. i) Transplanted rice, ii) Wet seeded rice, and iii) Dry seeded rice with two N sources viz. urea and NCU in a completely randomized design with four replicates. Yield components and grain yield did not show any significant differences between urea and NCU. Furthemore, NCU showed no effect on either grain N uptake or N response.

From these experiments it was concluded that NCU does not have an advantage over other sources of N for lowland rice on Bangkok plain.

Keywords: Field experiments, N fertilizers, Grain N uptake, N response.

INTRODUCTION

Nitrogen fertilizer efficiency for rice seldom exceeds 30-40%. The low efficiency is principally due to loss of N via ammonia volatalization and denitrification in areo-anaerobic layers of lowland rice soils (De Datta, 1981). Fertilizer management practices can influence the magnitude of these losses and thus can influence fertilizer N uptake and efficiency. One way to increase fertilizer N efficiency is to use fertilizers of slow release formulations or with nitrification and urease inhibitors (De Datta, 1981). Slow release formulations such as urea formaldehyde, sulfur coated urea and isobutylidene diurea have been developed and used. In addition, nitrification inhibitor (2-chloro-6-(trichloromethyl) pyridine (N-serve) and dicyan-diamide (DCD) have been used to reduce the rate of nitrification processes but these are expensive. On the otherhand, neem (*Azadirachta indica* A. Juss) seed extract has been shown to have nitrification inhibition (Santhi *et al.*, 1987) and it can be locally produced at low cost. A local agrochemical firm on Bangkok Plain has produced urea coated with neem seed extract (NCU) for commercial purpose.

The principal objective of the study was to investigate the effect of locally produced NCU on the grain yield response of lowland rice in comparison to other N sources and under different land preparation practices.

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MATERIALS AND METHODS

Two field experiments with cultivar Suphanburi-90 were conducted on heavy clay soil, during the dry season from February to June 1994 at AIT Experiment Station, Bangkok. The soil is classified as Sulfic Tropaquepts with a pH of 5.6, and has 2.0% organic matter, 0.17% total N and 4.4 ppm Bray's II P. Following the Department of Agriculture Extension recommendations, N was applied at 30 kg N ha^{-1} as basal and 32.8 kg N ha^{-1} as topdressing. P was applied as basal at 16.5 kg P ha^{-1}. NCU (25% N) was provided by the Rangsit Agri-Economic Ltd., 265/54 Rangsit-Pathum Thani Road, Amphor Thanyaburi, Pathum Thani.

An Experiment to compare NCI with other N sources comprised of four treatments viz. i) Ammophos (16-20-0) as basal and 21-0-0 as topdressing (AP+AM), ii) Urea+triple super phosphate (TSP) as basal and urea as topdressing (Urea+urea), iii) NCU+TSP as basal and NCU as topdressing (NCU+NCU), and iv) Urea+ TSP as basal and NCU as topdressing (Urea+NCU). Experimental design was a Randomized Block Design with five replicates. Rice was grown with the wet seeding method of land preparation (sowing of pre-germinated seeds on to puddled soil). Except for the fertilizer type other field operations were the same in all treatments. Plots were of 46.8 m^2 to 56 m^2. $Ca(OH)_2$ was applied at the rate of 3.2 t ha^{-1} before the second ploughing. Application of basal and topdressed N was done at 29 and 78 days after sowing (DAS), respectively. At 7 DAS, herbicide challenge was sprayed at the rate of 320 ml in 40 l of water. Rice thrips were controlled by spraying Carbaryl on 14 and 21 DAS at the rate of 20 g in 30 l of water.

Experiment to evaluate the effect of NCU under different land preparation practices of lowland rice comprised of three land preparation methods viz. i) Transplanted rice, ii) Wet seeded rice, and iii) Dry seeded rice (sowing of seeds on to unpuddled soil),with two N sources viz. urea and NCU. The design was a completely randomized design with four replicates. The plot size was 100 m^2. Application of basal and topdressed N was at 15 and 77 DAS respectively. At 13 DAS,the herbicide Propanil was sprayed at the rate of 25 cc in 4 l of water. Sevin was applied at the rate of 30 g in 20 l water at 48 DAS to control thrips. At 78 DAS. monochrotophos was sprayed at the rate of 25 cc in 20 l water to control ear head bugs.

At maturity representative panicle samples from two 1 m^2 were taken from each plot,leaving a 1 m from the bunds. Individual plot grain yield was obtained from the remaining part of the plots excluding 1 m from the bund. Grain yield was calculated at 14% moisture content. The 1000 grain weight and moisture content were measured for filled grain. Grain N content was determined by micro-Kjeldahls method. Data were analyzed by single factor analysis of variance at 95% confidence level using Statgraphics Version 7.0.

RESULTS AND DISCUSSION

Among the rice yield components, only 1000 grain weight was significantly different between N sources (Table 1). Application of NCU+NCU produced lower 1000 grain weight than application of AP+AM and Urea+NCU. However, grain yield was not effected by the type of N fertilizer applied, thus indicating similar yield efficiency for the four N sources used.

In the land preparation experiment, since N source did not show any significant difference or interaction with land preparation methods

Table 1. Yield components and grain yield of lowland rice with different N sources. ± indicates 1 SE. Means in the same column followed by same letter are not significant at $p > 0.05$ using LSD.

Treatment*	No.of panicle per m^2	Filled grain (%)	1000 grain weight (g)	Grain yield (t ha^{-1})
AP+AM	418.0±57.5 a	92.5±1.9 a	26.3±0.4 b	5.2±0.3 a
Urea+urea	402.3±13.6 a	94.1±1.7 a	25.9±0.6 ab	5.4±0.3 a
NCU+NCU	409.5±22.1 a	93.3±0.4 a	25.3±0.4 a	5.4±0.3 a
Urea+NCU	386.3±35.1 a	93.7±0.6 a	26.4±0.4 b	5.5±0.3 a

* AP= 16-20-0; NCU= neem coated urea.

Table 2. **Yield components, grain yield, grain N uptake and N response of lowland rice with urea and neem coated urea (NCU) under different land preparations methods. ± indicates 1 SE. Means followed by same letter in the same column are not significant at p< 0.05 using LSD.**

Treatment	No.of panicle per m^2	Filled grain (%)	1000grain weight (g)	Grain yield (t ha^{-1})	Grain N uptake (kg ha^{-1})	N response (kg grain kg N^{-1})
Urea	317.0±22.2 a	95.6±0.3 a	27.8±0.1 a	4.1±0.02 a	45.6±1.2 a	64.45±0.02 a
NCU	350.0±25.9 a	94.6±0.6 a	27.9±0.2 a	4.2±0.09 a	46.9±2.3 a	66.56±0.09 a

(Thabonithy, 1994), statistical analysis was performed using single factor ANOVA (N source). Yield components showed no significant differences between urea and NCU under the three land preparation methods (Table 2). Furthermore, grain yield, grain N uptake and N response (kg grain per kg N) were also similar with urea and NCU applications.

Pyare *et al.* (1982) also found that grain yield of urea blended with 15% neem cake powder and urea best split applications were not significantly different. In contrast, Santhi and Palaniappan (1987) reported that application of fresh neem leaf with urea produced more grain than application of urea alone. Furthermore, fresh neem leaf application gave higher N recovery and N response. Thus, the form of neem product used is a factor in the effectiveness of neem treated urea.

In the present study, the lack of rice yield response to NCU could be due to the low concentration of neem extract on urea coating and/or the rapid dissolution of neem coat in the standing water due to the lack of proper adherence. Therefore, further studies should be conducted to find out the best concentration of neem extract and adhering materials.

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