*J. Natn. Sci. Coun. Sri Lanka 1997 25(2): 113-119*

***SHORT COMMUNICATION***

# EFFECTS OF NITROGEN ON YIELD ATTRIBUTES OF HIGH YIELD VARIETY AUS RICE

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*Received: 03 January 1996; accepted: 04 April 1997)*

**Abstract:** Field experiments were conducted at the Bangladesh Agricultural University Farm to evaluate the effects of different nitrogenous fertilizers (urea, calcium nitrate and ammonium sulphate) on yield attributes of transplanted aus rice cv. BR3. The various nitrogenous fertilizers were applied @60, 70, 80 and 100 kg N/ha with basal doses of P and K @ 30 kg, $P_2O_5$/ha and 20 kg $K_2O$/ha from TSP and MP, respectively. Nitrogen application, irrespective of sources and levels, significantly increased rice grain yield over the control. The highest grain and straw yield (4.63 and 7.80 t/ha) were obtained by urea @ 80 kg N/ha. Application of nitrogen from various sources increased grain yield from 14 to 45% and straw yield from 19 to 73%. Amongst the various sources of nitrogen tested, urea @ 80kgN/ha appeared to be the best in respect of yield of rice followed by ammonium sulphate and calcium nitrate under conditions tested.

**Key words:** Aus rice, nitrogen source, rice yield, urea.

## INTRODUCTION

Nitrogen (N) is one of the key factors which determines the yield of crops, especially under intensive management. Since the price of fertilizer N is becoming higher, improvement of the efficiency of fertilizer N at levels required for achieving high yield is urgently needed.[1] The efficiency differs depending upon the nature of the crops, amount and source of fertilizer N applied, climatic conditions, nature of soils and so on. The application of proper doses of nitrogen in rice crop along with balanced supply of other fertilizer elements increased the grain yield up to 5.7 ton/ha. Singh & Sharma[2] reported that yield attributes and yield of pearl millet significantly increased over the control with the application of N at higher level. Prasad & Datta[3] found that proper level and source of nitrogen significantly augment the yield of rice. In Bangladesh, urea is the main source of nitrogen whereas calcium nitrate and ammonium sulphate may be considered as alternative sources of N for rice cultivation. The present investigation was undertaken to compare the efficiency of different carriers of nitrogen on yield and yield attributes of transplanted aus rice (BR3).

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## METHODS AND MATERIALS

The study was conducted from April to August, 1994 on a non-calcareous dark grey flood plain silty loam soil in Sonatala Series at Bangladesh Agricultural University Farm using rice as a test crop. The soil had pH (1:25) 6.8, total N 0.10% available P 17ppm, exchangeable K 0.38 m.e /100g, available S 14ppm, organic carbon 0.8% and organic matter 1.38%. The study consisted of the following treatments.

**A Sources of nitrogen**

a) Urea(U)
b) Calcium nitrate(CN)
c) Ammonium sulphate (AS)

**B. Levels of nitrogen**

a) Control(No nitrogen)
b) 60kg N/ha
c) 70kg N/ha
d) 80kg N/ha
e) 100kg N/ha

The experiment was carried out in a randomized block desion (RBD) with three replications. The unit plot size was 5m x 2m.with BR3 (Biplob) a high yielding variety of aus rice as the test crop in this study. The plots were fertilized with nitorgen @ 0,60,70,80 and 100kg N/ha through urea(U), calcium nitrate (CN) and ammonium sulphate(AS). A basal dose of 30kg $P_2O_5$ and 20kg $K_2O$ per hectare was also applied through triple superphosphate and muriate of potash, respectively. Total quantity of P,K and 1/3 of N were applied at the time of final land preparation. The rest of the N was applied in two equal doses after 20 and 45 days of trasplanting, respectively. Rice seedlings (35 days old) were transplanted in the experimental plot @ 4 seedlings per hill with 25 cm x 10 cm spacing. Intercultural operations like irrigation, weeding, thinning etc. were done uniformly in all the treatments as and when necessary. The data of the crop characters were collected in respect of (i) plant height (ii) number of effective tillers per hill (iii) panicle length (iv) number of filled grains per panicle (v) 1000 grain weight (vi) grain (yield/ha) and (vii) straw(yield/ha). The collected data were statistically analyzed and the means were adjudged by DMRT:

## RESULTS AND DISCUSSION

### Plant height

Plant height of rice was significatly influenced by the application of nitrogenous fertilizers irrespective of their sources (Table 1). The maximum plant height (74.2cm) was found by the application of urea @ 100 kg N/ha followed by ammonium sulphate at the same level whereas the minimum plant height (68.1 cm) was recorded in the control treatment. It revealed that application of N up to 100 kg N/ha significantly boost up the height of rice plant irrespective of the source of N. Similar results were reported by others.[4-6]

**Number of effective tillers per hill**

The results indicated that N application significantly increased the number of effective tillers per hill irrespective of their sources (Table 1). The maximum number of effective tillers per hill (10.4) was produced by the application of ammonium sulphate @ 100kg N/ha and the minimum (5.2) was obtained by the control treatment. The ammonium sulphate seems to be superior to other remaining fertilizer sources whereas calcium nitrate ranked in the lower grade in this regard. The different doses of urea did not reveal any significant difference in this context. Mondal *et al.*[5] reported that higher rates of N application significantly increased the number of effective tillers per hill. This might be due to better photosynthesis as well as balanced cell division of the rice plant. This experimental result was also confirmed by Bhuiyan & Shah.[7]

**Panicle length**

The data (Table 1) showed that the length of rice panicle was significantly influenced by the application of N. The longest size of panicle (24.0cm) was obtained by the application of urea @ 80 kg N/ha and the shortest panicle was in the control treatment. Among the various sources calcium nitrate at lower rate indicated promising results in this crop character. Similar result was observed by El-Kalla *et al.*[6]

**Number of filled grain per panicle**

Like panicle length, urea @ 80kg N/ha produced the highest number of filled grain per panicle (86.9) followed by the treatment ammonium sulphate at the same level of N (Table 1). Calcium nitrate failed to show better performance in this regard. The control treatment produced significantly the lowest number of filled grain per panicle. Sudhakara *et al.*[8] observed that nitrogen application increased the number of grain per panicle.

**1000 grain weight**

The application of N @ 80kg N/ha had a very significant effect on 1000-grain weight (Table 1). The next highest treatment (100 kg N/ha) irrespective of source decreased the weight of 1000 grains. The heaviest 1000-grain weight was obtained by the treatment of urea @ 80 kg N/ha followed by the application of calcium nitrate at the same level on N. The lightest 1000 grain weight was recorded in the control treatment. The results are in agreement with the findings of Sudhakar *et al.*[8] and Dalar & Dixit.[9]

**Table 1: Effect of different sources of nitrogen on yield attributes of rice.**

| Treatment | | Plant height (cm) | Number of effective tillers/hill | Panicle length (cm) | Number of filled grain/panicle | 1000 grain weight** (g) |
|---|---|---|---|---|---|---|
| Dose (kgN/ha) | Source* | | | | | |
| 60 | U | 69.6 abc | 9.1 abc | 21.1 de | 79.8 bc | 27.4 abc |
| 70 | U | 69.7 abc | 9.1 abc | 21.2 de | 79.7 bc | 27.3 cd |
| 80 | U | 72.3 abc | 9.4 abc | 24.0 a | 86.9 a | 29.1 a |
| 100 | U | 74.2 a | 9.4 abc | 22.4 bc | 80.3 bc | 25.5 de |
| 60 | CN | 68.6 bc | 8.1 c | 22.1 bcd | 78.0 c | 25.4 de |
| 70 | CN | 69.2 bc | 8.1 c | 22.4 bc | 79.0 c | 28.6 ab |
| 80 | CN | 71.7 abc | 8.5 bc | 22.7 bc | 79.7 bc | 28.8 ab |
| 100 | CN | 71.7 abc | 8.5 bc | 22.3 bc | 80.4 bc | 25.8 de |
| 60 | AS | 70.0 abc | 8.0 c | 21.2 de | 79.5 c | 25.6 de |
| 70 | AS | 71.4 abc | 9.4 abc | 21.8 bcd | 80.3 bc | 25.6 de |
| 80 | AS | 71.1 abc | 9.8 ab | 22.7 bcd | 85.4 ab | 25.8 de |
| 100 | AS | 72.8 ab | 10.4 a | 22.1 bcd | 83.7 abc | 27.2 e |
| Control | | 68.1 c | 5.2 d | 20.5 e | 75.8 cd | 24.6 e |

Letter (s) common in a column do not differ significantly at 5% level by DMRT

* U: Urea, CN: Calcium nitrate, AS = Ammonium sulphate.

** Results expressed on sundry basis.

## Grain yield

Grain yield of rice was significantly influenced by N application irrespective of the source (Table 2). Among the various sources, urea @ 80kg N/ha produced the maximum grain yield (4.63t/ha) and the minimum grain yield (3.20t/ha) was recorded in the control treatment. The data indicated that the higher doses failed to significantly increase grain yield after a certain level except the treatments of ammonium sulphate. Application of nitrogen from the various sources increased the grain yield from 14.06 to 44.69% over control. This increase might be due to significant increase in the number of grains per panicle and grain weight.[7,8] The increase in grain yield of rice by nitrogen application is in agreement with the findings of many researchers.[1,2,5,6,10,11]

## Straw yield

The straw yield of rice in general, also boosted up significantly over control with the increasing level of nitrogen (Table 2). The highest straw yield was obtained by the application of urea @ 80 kg N/ha which was statistically superior to all other treatments. Ammonium sulphate @ 100 kg N/ha ranked second in this regard. The results indicated that application of nitrogen increased the yield of rice straw from 18.67 to 73.33 per cent over control. This increase might be due to the increase in plant height and number of effective tillers per hill. Bhuiyan & Shah[7] reported that the application of N produced more panicles per unit area than when no nitrogen was applied, and significantly increased grain and straw yields over control Similar findings were reported by others.[5,8,10,11]

The experimental findings show that, a general increase in the yield contributing characters, grain and straw yield seem to be associated with the increased N availability upto 80 kgN/ha from applied sources. The possible reasons are that the experimental soil was having total nitrogen much below the critical value as well as low organic matter content. Out of the N sources, however, urea proved to be the most efficient as it results in upto 44.69% grain yield and 73.33% straw yield over control as compared to other sources. This may be attributed to the very high solubility of urea.

**Table 2: Effect of different sources of nitrogen on yield (grain and straw) of rice.**

| Treatment | | Grain | | | Straw | | |
|---|---|---|---|---|---|---|---|
| Dose (kgN/ha) | Source* | Yield (t/ha) | Increase in yield over control (t/ha) | Per cent increase in yield over control | Yield (t/ha) | Increase in yield over control (t/ha) | Per cent increase in yield over control |
| 60 | U | 3.65 cd | 0.45 | 14 | 5.34 d | 0.84 | 19 |
| 70 | U | 4.34 abc | 1.14 | 36 | 5.76 cd | 1.26 | 28 |
| 80 | U | 4.63 a | 1.43 | 45 | 7.80 a | 3.30 | 73 |
| 100 | U | 4.01 abc | 0.81 | 25 | 6.9 ab | 2.40 | 53 |
| 60 | CN | 3.67 cd | 0.47 | 15 | 5.68 cd | 1.18 | 26 |
| 70 | CN | 3.93 abc | 0.73 | 23 | 6.25 c | 1.75 | 39 |
| 80 | CN | 3.86 bcd | 0.66 | 21 | 6.15 c | 1.65 | 37 |
| 100 | CN | 3.90 abcd | 0.70 | 22 | 6.00 c | 1.50 | 33 |
| 60 | AS | 4.33 abc | 1.13 | 35 | 7.20 ab | 2.70 | 60 |
| 70 | AS | 4.38 abc | 1.18 | 37 | 7.27 ab | 2.77 | 62 |
| 80 | AS | 4.49 ab | 1.29 | 40 | 7.25 ab | 2.75 | 61 |
| 100 | AS | 4.60 ab | 1.40 | 44 | 7.50 ab | 3.00 | 67 |
| Control | - | 3.20 d | - | - | 4.50 c | - | - |

Letter(s) common in a column do not differ significantly at 5% level by DMRT

* U: Urea, CN: Calcium nitrate, AS = Ammonium sulphate.

** Results expressed on sundry basis.

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