

**PERFORMANCE OF BORO RICE CV. BRRI DHAN29 AS INFLUENCED BY FOLIAR APPLICATION OF UREA FERTILIZER**

HM Al-Amin<sup>1</sup> MA Kader<sup>2</sup> MI Hossain<sup>1</sup> ML Kabir<sup>1</sup> MA Rahman<sup>1</sup> MH Rahman<sup>1</sup> HP Roy<sup>1</sup> and MM Ahmed<sup>1</sup>

**Address**

<sup>1</sup>Bangladesh Sugarcane Research Institute, Ishurdi Pabna <sup>2</sup>Bangladesh Agricultural University Mymensingh

Correspondence\*

[alamin.bsri@gmail.com](mailto:alamin.bsri@gmail.com)

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**Abstract**

The research work was conducted at the field Laboratory, Department of Agronomy, Bangladesh Agricultural University, Mymensingh during the period from January 2009 to May 2009 to study the effect of foliar application of urea on the yield and yield contributing characters of *Boro* rice cv. BRRI dhan29. The experiment included eleven treatments as follows- (i) no urea application (T<sub>0</sub>), (ii) application recommended dose of urea in soil (T<sub>1</sub>), (iii) foliar application of 1.5% urea solution (T<sub>2</sub>), (iv) foliar application of 2% urea solution (T<sub>3</sub>), (v) foliar application of 2.5% urea solution (T<sub>4</sub>), (vi) foliar application of 3% urea solution (T<sub>5</sub>), (vii) foliar application of 3.5% urea solution (T<sub>6</sub>), (viii) foliar application of 4% urea solution (T<sub>7</sub>), (ix) foliar application of 4.5% urea solution (T<sub>8</sub>), (x) foliar application of 5% urea solution (T<sub>9</sub>), (xi) foliar application of 5.5% urea solution (T<sub>10</sub>). In case of foliar application, urea solutions were sprayed in 8 weeks at every 7 days interval from 10 days after transplanting (DAT) to 66 DAT. The experiment was laid out in a randomized complete block design with three reapplications. Foliar application of urea had significant effect on plant height, number of total tillers hill<sup>-1</sup>, number of effective tillers hill<sup>-1</sup>, number of grains panicle<sup>-1</sup>, number of sterile spikelets panicle<sup>-1</sup>, grain yield, straw yield and biological yield. Number of non-effective tillers hill<sup>-1</sup>, panicle length, weight of 1000 grains and harvest index were not significantly influenced by foliar application of urea solution. The yield and yield contributing characters gradually increased with the increasing concentration of urea solution up to 5.5% (T<sub>10</sub>). The results revealed that the highest grain yield (6.28 ton ha<sup>-1</sup>) was observed at foliar application of 5.5% urea solution (T<sub>10</sub>). The lowest grain yield (4.2 ton ha<sup>-1</sup>) was observed from the treatment with no urea application (T<sub>0</sub>). The highest number of the total tillers hill<sup>-1</sup> (15.94), number of effective tillers hill<sup>-1</sup> (13.83), number of grain panicle<sup>-1</sup> (145.67), biological yield (13.33 ton ha<sup>-1</sup>) and the lowest number of sterile spikelets panicle<sup>-1</sup> (9.8) were observed at foliar application of 5.5% urea solution (T<sub>10</sub>). From the experiment it can be concluded that foliar application of urea fertilizer with varying concentrations significantly influenced yield and yield contributing characters of *Boro* rice cv. BRRI dhan29.

**Key Words: BRRI dhan29, foliar application, nitrogen, Yield.**

**Introduction**

Rice (*Oryza sativa* L.) is the world's most important food crop since nearly half of the population of the world use rice as their main food. In Bangladesh, rice is the most extensively cultivated cereal crop and the staple food which provided about 70% of the average per capita total calorie intake. The soil and climate of Bangladesh are favorable for rice cultivation throughout the year. Among the rice growing countries, Bangladesh occupied third position in rice area and fourth position in rice production (BRRI,2000).The average yield of rice in Bangladesh is quite low (2.35 ton ha<sup>-1</sup>) compared to that in other leading rice growing countries such as China (6.23 ton ha<sup>-1</sup>), Korea (6.59 ton ha<sup>-1</sup>), Japan (6.7 ton ha<sup>-1</sup>) and USA (7.04 ton ha<sup>-1</sup>) (FAO, 2004).Rice is growing throughout the year in the country. Rice crop area is decreasing day by day due to high population pressure. The area and the production of rice in the country were 11.25 million hectares and 29.75 million tons

respectively in 2007-2008 (AIS, 2008). However, the cultivation of *Boro* rice shows an increasing trend since few years with the rapid intensification of land. The area and production of *Boro* rice in the country were 4609717 hectares and 17809000 M tons, respectively in 2008-2009 and per acre yield was 1.53 M tons (BBS, 2009).Nitrogen is a primary nutrient which plays a vital role in vegetative growth, development and yield of rice. BRRI (1990) reported that nitrogen has a positive influence on yield components of rice. The important role of nitrogen fertilizers in increasing rice yield has been widely recognized particularly after development of modern varieties. The nitrogen content of Bangladesh soil is low due to warm climate accompanied by extensive cultivation. The efficiency of applied nitrogen use by the rice plant is also low. Our farmers usually do not apply nitrogen in their fields properly and timely. It is estimated that only about 25% of the added nitrogen is recovered by the crops and the rest 75% is lost due to leaching, surface runoff, NH<sub>3</sub> volatilization, decreased

nitrification and other processes. Besides, at present the nitrogen fertilizer is very costly. So, it has become very expensive to apply sufficient amount of nitrogen fertilizers. Under these circumstances, it is important to find out the effective method of application of urea fertilizer that would give higher yield of crops and also reduce chemical fertilizer cost, if applied in excess amount, has a harmful effect on soil physical, chemical and biological properties. It inhibits growth and development of soil microorganism. As foliar application reduces the use of excess chemical fertilizer significant effect on yield (Moeini *et al.*, 2006). Moreover, Application of urea though fertilizer, it will be beneficial for soil environment. Foliar application of urea can reduce the requirement of urea fertilizer by 80% of soil application (The Daily Jugantor, 20 January, 2009). So, fertilizer cost can be highly reduced. Under these circumstances, the present work has been undertaken to investigate the effect of foliar application of the yield and yield contributing characters of *Boro* rice cv. BRRI dhan29 and to find out the suitable concentration of urea fertilizer to be sprayed in *Boro* rice cv. BRRI dhan29.

### Materials and Methods

The research work was conducted at the Field Laboratory, Department of Agronomy, Bangladesh Agricultural University, Mymensingh during the period from January 2009 to May 2009 to study the effect of foliar application of urea on the yield and yield contributing characters of *Boro* rice cv. BRRI dhan29. The experiment included eleven treatments as follows- (i) no urea application ( $T_0$ ), (ii) application of recommended dose of urea in soil ( $T_1$ ), (iii) foliar application of 1.5% urea solution ( $T_2$ ), (iv) foliar application of 2% urea solution ( $T_3$ ), (v) foliar application of 2.5% urea solution ( $T_4$ ), (vi) foliar application of 3% urea solution ( $T_5$ ), (vii) foliar application of 3.5% urea solution ( $T_6$ ), (viii) foliar application of 4% urea solution ( $T_7$ ), (ix) foliar application of 4.5% urea solution ( $T_8$ ), (x) foliar application of 5% urea solution ( $T_9$ ), (xi) foliar application of 5.5% urea solution ( $T_{10}$ ). In case of foliar application, urea solutions were sprayed in 8 weeks at every 7 days interval from 10 days after transplanting (DAT) to 66 DAT. The experiment was laid out in a randomized complete block design with three replications. Plot size was 4m × 2.5m. There were 33 plots in the experiment. The land was fertilized with triple super phosphate, muriate of potash, gypsum and zinc sulphate @ 80, 125, 45 and 6 kg ha<sup>-1</sup>, respectively. All the fertilizers except urea were applied during land preparation. Urea was applied as per experimental treatments. Thirty five days old seedlings were uprooted carefully from the nursery bed and transplanted in the unit plot on 20 January 2009 at

the rate of 2-3 seedlings hill<sup>-1</sup>. Intercultural operations such as weeding, gap filling and water management were done as and when necessary. Five hills were randomly selected from each

unit prior to harvest for recording data on plant characters, yield components and yield. After sampling the whole plot was harvested when 90% of the grains became golden yellow. Data on yield contributing characters and yield were recorded on the following parameters: plant height, number of total tillers hill<sup>-1</sup>, effective and non-effective tillers hill<sup>-1</sup>, panicle length, number of grains panicle<sup>-1</sup>, number of sterile spikelets panicle<sup>-1</sup>, weight of 1000 grains, yield, straw yield, biological yield and harvest index. Data were analyzed statistically following ANOVA technique and means were adjudged by Duncan's Multiple Range Test (DMRT).

### Results and Discussion

The results obtained from the present study regarding the effect of foliar application of urea on the plant characters, yield and yield components of *Boro* rice cv. BRRI dhan29 have been presented and discussed in the following tables.

#### *Plant Height*

Plant Height was significantly influenced by foliar application of urea fertilizer (Table.1). Plant height gradually increased with increasing concentration of urea solution used in the study except in 5% solution ( $T_9$ ). The tallest plant height (86.57cm) was observed at foliar application of 5.5% urea solution ( $T_{10}$ ), which was significantly higher than that of any other treatments even than that of recommended dose of urea in soil ( $T_1$ ). On the other hand, the lowest plant height (74.17cm) was observed from the treatment receiving no urea fertilizer (control  $T_0$ ). The plants obtained from the application of recommended dose of urea in soil ( $T_1$ ) did not show any significant difference from that of application of 3.5% ( $T_6$ ), 4% ( $T_7$ ) and 5% ( $T_9$ ) of urea solution. The increase in plant height with the increase in urea concentration might be related to the fact that more N was available to the plants as concentration of urea solution increased, which favorably enhanced plant growth.

#### *Number of Total Tillers per Hill*

Number of total tillers hill<sup>-1</sup> was significantly influenced by nitrogen application (Table.1). Number of total tillers hill<sup>-1</sup> gradually increased with increasing concentration of urea solution used in the study except in 4.5% solution ( $T_8$ ). The highest number of the total tillers hill<sup>-1</sup> (15.94) was observed at foliar application of 5.5% urea solution ( $T_{10}$ ) which was significantly higher than that of any other treatment even than that of recommended dose of urea in soil ( $T_1$ ). The lowest number (9.4) was found from the treatment receiving

Table1. Effect of different application of nitrogen fertilizer on the performance of Boro rice cv. BRRI dhan29

Name of Treatments	Plant height (cm)	No. of total tillers ha <sup>-1</sup>	No. of effective tillers ha <sup>-1</sup>	Length of panicle (cm)	No. of grains Panicle <sup>-1</sup>
No urea application (Control T <sub>0</sub> )	74.17d	9.04d	6.63f	20.90	92.63f
Recommended Urea dose in soil (T <sub>1</sub> )	84.38abc	14.22abc	12.98abc	21.97	143.13ab
Foliar application of 1.5% Urea (T <sub>2</sub> )	81.46c	12.75c	11.01de	21.93	116.97e
Foliar application of 2% Urea (T <sub>3</sub> )	81.40c	12.51c	10.62e	21.90	117.27e
Foliar application of 2.5% Urea (T <sub>4</sub> )	81.87bc	12.61c	10.58e	20.57	122.30cde
Foliar application of 3% Urea (T <sub>5</sub> )	81.67bc	13.60bc	11.03de	22.03	118.15de
Foliar application of 3.5% Urea (T <sub>6</sub> )	83.41abc	14.87ab	12.08cd	20.37	128.57
Foliar application of 4% Urea (T <sub>7</sub> )	84.74abc	15.00ab	12.60bc	20.93	125.20cd
Foliar application of 4.5% Urea (T <sub>8</sub> )	85.22ab	14.83ab	12.39bc	21.30	136.58b
Foliar application of 5% Urea (T <sub>9</sub> )	83.92abc	15.15ab	13.44ab	21.33	142.17ab
Foliar application of 5.5% Urea (T <sub>10</sub> )	86.57a	15.94a	13.83a	20.63	145.67a
Level of significance	**	**	**	NS	**

\* = Significant at 5% level of probability, \*\* = Significant at 1% level of probability and NS = Not significant

no urea fertilizer (control, T<sub>0</sub>). The plants obtained from the foliar application of 3.5% urea solution (T<sub>6</sub>) did not show any significant difference from that of application of 4% (T<sub>7</sub>), 4.5% (T<sub>8</sub>) and 5% (T<sub>9</sub>) urea solution.

#### *Number of Effective Tillers per Hill*

Number of Effective Tillers Hill<sup>-1</sup> was significantly influenced by nitrogen application (Table.1). Number of Effective Tillers Hill<sup>-1</sup> gradually increased with increasing concentration of urea solution used in the study except in 1.5% urea solution (T<sub>2</sub>). The highest number of effective tillers/hill (13.83) was observed at foliar application of 5.5% urea solution (T<sub>10</sub>) which was significantly higher than that of any other treatments even than that of recommended dose of urea in soil (T<sub>1</sub>). The lowest number (6.63) was observed from the treatment receiving no urea fertilizer (control, T<sub>0</sub>). The plants obtained from the application of 1.5% urea solution (T<sub>2</sub>) did not show any significant difference from that of application of 3% urea solution (T<sub>5</sub>). Statistically insignificant result was found between foliar application 4% (T<sub>7</sub>) and 4.5% (T<sub>8</sub>) urea solution. The plants obtained from the application of 2% urea solution (T<sub>3</sub>) did not show any significant difference from that of application of 2.5% urea solution (T<sub>4</sub>) (Table.1).

#### *Panicle Length and Number of Grains per Panicle*

Result showed that panicle length was not significantly affected by the different concentration (Table1). Number of Grains Panicle<sup>-1</sup> was significantly influenced by nitrogen application (Table. 1). Number of Grains Panicle<sup>-1</sup> gradually increased with increasing concentration of urea solution used in the study except in 3% (T<sub>5</sub>) and 4% urea solution (T<sub>7</sub>). The highest Number of Grains Panicle<sup>-1</sup>(145.67) was observed at foliar application urea solution (T<sub>10</sub>). The lowest number (92.63) was observed from the treatment receiving no urea fertilizer (control, T<sub>0</sub>). Statistically insignificant result was found between application of

1.5% and 2% urea solution. The plants obtained from the application of recommended dose of urea in soil (T<sub>1</sub>) did not show any significant difference from that of application of 5% (T<sub>9</sub>) urea solution.

#### *Weight of 1000 grains and Grain yield*

Results showed that weight of 1000 grains was not significantly affected by the different concentration of nitrogen application (Table 2). On the other hand grain yield was significantly influenced by nitrogen application (Table.2). Grain yield gradually increased with increasing concentration of urea solution used in the study except in 1.5% (T<sub>2</sub>), 3% (T<sub>5</sub>) and 4% (T<sub>7</sub>) urea solution. As seen in the figure, the highest grain yield (6.28 ton ha<sup>-1</sup>) was observed at foliar application of 5.5% urea solution (T<sub>10</sub>). On the other hand, the lowest grain yield (4.2 ton ha<sup>-1</sup>) was observed from the treatment receiving no urea fertilizer (control, T<sub>0</sub>). Statistically insignificant result was found among 1.5% (T<sub>2</sub>), 2% (T<sub>3</sub>), 2.5% (T<sub>4</sub>), 3% (T<sub>5</sub>), 3.5% (T<sub>6</sub>) and 4% (T<sub>7</sub>) urea spray solution. The plants obtained from the application of 5% urea solution did not show any significant difference from that of application of 5.5% urea solution (T<sub>10</sub>).

#### *Straw Yield*

Straw yield was significantly influenced by nitrogen application (Table 2). The highest straw yield (7.11 ton ha<sup>-1</sup>) was observed at foliar application of 5% urea solution (T<sub>9</sub>) (Table-2). The lowest straw yield (5.26 ton ha<sup>-1</sup>) was observed from the treatment receiving no urea fertilizer (control, T<sub>0</sub>). The plants obtained from the application of recommended dose of urea soil (T<sub>1</sub>) did not show any significant difference from that of application of 5.5% urea solution (T<sub>10</sub>). Statistically insignificant result was found among application of 1.5% (T<sub>2</sub>), 2.5% (T<sub>4</sub>), and 3% (T<sub>5</sub>) urea solution. The plants obtained from the application of 2% urea solution (T<sub>3</sub>) did not show any significant difference from that of application of 3.5% urea (T<sub>6</sub>) and 4% (T<sub>7</sub>) urea solution.

Table 2. Effect of different application of nitrogen fertilizer on yield performance of Boro rice cv. BRRI dhan29

Name of Treatments	1000 grain wt (g)	Grain yield ton ha <sup>-1</sup>	Straw yield ton ha <sup>-1</sup>	Biological yield ton ha <sup>-1</sup>	Harvest index (%)
No urea application (Control T <sub>0</sub> )	22.83	4.2d	5.26e	9.46e	44.39
Recommended Urea dose in soil (T <sub>1</sub> )	23.31	6.12a	6.97b	13.09a	47.83
Foliar application of 1.5% Urea (T <sub>2</sub> )	23.53	5.32c	5.8d	11.12cd	45.98
Foliar application of 2% Urea (T <sub>3</sub> )	23.36	5.18c	6.08cd	11.26cd	46.46
Foliar application of 2.5% Urea (T <sub>4</sub> )	23.51	5.19c	6.00d	11.19cd	46.98
Foliar application of 3% Urea (T <sub>5</sub> )	23.02	5.09c	5.75d	10.8d	46.11
Foliar application of 3.5% Urea (T <sub>6</sub> )	23.38	5.33c	6.23cd	11.57c	45.61
Foliar application of 4% Urea (T <sub>7</sub> )	23.67	5.21c	6.21cd	11.41cd	46.99
Foliar application of 4.5% Urea (T <sub>8</sub> )	22.8	5.82ab	6.57bc	12.39b	45.92
Foliar application of 5% Urea (T <sub>9</sub> )	22.76	6.14a	7.11a	13.25a	47.08
Foliar application of 5.5% Urea (T <sub>10</sub> )	23.14	6.28a	7.06ab	13.33a	46.75
Level of significance	NS	**	**	**	NS

\*\* = Significant at 1% level of probability and NS = Not significant

### Biological Yield and Harvest Index

Biological yield was significantly influenced by nitrogen application (Table 2). Biological yield was gradually increased with increasing concentration of urea solution used in the study except in 3% (T<sub>5</sub>) and 4% (T<sub>7</sub>) urea solution. The highest biological yield (13.33 ton ha<sup>-1</sup>) was observed at foliar application of 5.5% urea solution (T<sub>10</sub>) which was significantly higher than that of any other treatments except recommended dose of urea in soil (T<sub>1</sub>) and foliar application of 5% urea solution (T<sub>9</sub>). On the other hand, the lowest biological yield (9.46 ton ha<sup>-1</sup>) was observed from the treatment receiving no urea fertilizer (control, T<sub>0</sub>). Statistically insignificant result was found among application of 1.5% (T<sub>2</sub>), 2% (T<sub>3</sub>), 2.5% (T<sub>4</sub>) and 4% (T<sub>7</sub>) urea solution. The plants obtained from the application of recommended dose of urea in soil (T<sub>1</sub>) did not show any significant difference from that of application of 5% (T<sub>9</sub>) and 5.5% (T<sub>10</sub>) urea solution. On the other hand result showed that harvest index was not significantly affected by the different concentration of nitrogen application (Table 2).

### Conclusion

Foliar application of urea had significant effect on plant height, number of total tillers hill<sup>-1</sup>, number of effective tillers hill<sup>-1</sup>, number of grains panicle<sup>-1</sup>, grain yield, straw yield and biological yield. Panicle length, weight of 1000 grains and harvest index were not significantly influenced by foliar application of urea solution. The yield contributing characters gradually increased with the increasing concentration of urea solution up to 5.5% (T<sub>10</sub>). The results revealed that the highest grain yield (6.28 ton ha<sup>-1</sup>) was observed at foliar application of 5.5% urea solution (T<sub>10</sub>). The lowest grain yield (4.2 ton ha<sup>-1</sup>) was observed from the treatment with no urea application (T<sub>0</sub>). The highest number of the total tillers hill<sup>-1</sup> (15.94), number of

effective tillers hill<sup>-1</sup> (13.83), number of grains panicle<sup>-1</sup> (145.67) and biological yield (13.33 ton ha<sup>-1</sup>) were observed at foliar application of 5.5% urea solution (T<sub>10</sub>). From the experiment it can be concluded that the yield contributing characters gradually increased with the increasing concentration of urea solution up to 5.5%.

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