Research in
ISSN : P-2409-0603, E-2409-9325
AGRICULTURE, LIVESTOCK and FISHERIES
An Open Access Peer Reviewed Journal

Open Access
Research Article

Res. Agric. Livest. Fish.
Vol. 3, No. 2, August 2016: 271-278

EFFECTS OF DIFFERENT LEVELS OF UREA AND MAGIC GROWTH SPRAY SOLUTION ON THE YIELD AND YIELD ATTRIBUTES OF BRRI dhan29

Monika Nasrin, Md. Abdus Salam, Md. Akhter Hossain Chowdhury[1], Md. Arif Hossain Khan[2] and Md. Muzammel Hoque[3]

Department of Agronomy and [1]Department of Agricultural Chemistry, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; [2]Joint Director (Fertilizer), Fertilizer Management Division, BADC, Rajshahi; [3]Principal Scientific Officer, BANSDOC, Agargaon Dhaka, Bangladesh

***Corresponding author:** Md. Akhter Hossain Chowdhury; E-mail: akhterbau11@gmail.com

ARTICLE INFO

Received
18.06.2016

Accepted
14.08.2016

Online
17 August 2016

Key words

Urea,
Magic growth spray solution,
BRRI dhan29

ABSTRACT

Magic growth solution along with prilled urea in the rice leaf as foliar spray may save urea compared to soil application of urea alone. In this regard, an experiment was conducted at the Agronomy Field Laboratory of Bangladesh Agricultural University during *Boro Season* (December-April, 2015) to evaluate the effects of urea and magic growth spray solution on the yield and yield attributes of BRRI dhan29. The experiment consisted of ten treatments viz.,T_1 = Control, T_2 = 99 kg urea ha^{-1}, T_3 = 63 kg urea ha^{-1} + 2.16L ha^{-1} magic growth spray solution, T_4 = 99 kg urea ha^{-1} + 5.66L ha^{-1} magic growth spray solution, T_5 = 117 kg urea ha^{-1} + 1.44L ha^{-1} magic growth spray solution, T_6 = 117 kg urea ha^{-1} + 5.66L ha^{-1} magic growth spray solution, T_7 = 126kg urea ha^{-1} + 5.66L ha^{-1} magic growth spray solution,T_8 = 132 kg urea ha^{-1}, T_9 = 132 kg urea ha^{-1} + 5.66L ha^{-1} magic growth spray solution, T_{10}= 132 kg urea ha^{-1}+ 2.16L ha^{-1} magic growth spray solution and laid out in a randomized complete block design (RCBD) with three replications. The results revealed that urea and magic growth spray solution exerted significant influence on the yield contributing characters and yield of BRRI dhan29 except panicle length, sterile spikelets and 1000-grain weight. The highest grain and straw yields (6.16 and 9.33 t ha^{-1}, respectively) were obtained from T_7 treatment which could be the resultant effect of highest number of effective tillers $hill^{-1}$, highest number of grains $panicle^{-1}$ and lowest number of sterile spikelets $panicle^{-1}$. Grain yield was significantly and positively correlated with plant height, effective tillers $hiil^{-1}$, panicle length and grains per panicle. Economic analysis showed that net return and benefit cost ratio (BCR) was the highest (1.41) in T_7 treatment. Thus the overall results suggest that farmers may be advised to apply 126 kg urea along with 5.66L magic growth solution per hectare to produce economically highest grain yield of BRRI dhan29, under the agro-climatic condition of Bangladesh Agricultural University.

To cite this article: Nasrin M, MA Salam, MAH Chowdhury, MAH Khan and MM Hoque, 2016. Effects of different levels of urea and magic growth spray solution on the yield and yield attributes of BRRI dhan29. Res. Agric. Livest. Fish., 3 (2): 271-278.

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most extensively cultivated cereals of the world. It is the principal food crop of Bangladesh and constitutes 95% of food grain production in the country. The soil and climate of Bangladesh are favorable for rice cultivation throughout the year. About 75% of the total cropped area and over 80% of the total irrigated area is planted to rice (BBS, 2012). Nitrogen (N) is one of the major nutrients required for plant growth. For maximizing yield of rice, nitrogenous fertilizer is the kingpin in rice farming. The N content of Bangladesh soil is low due to warm climate accompanied by extensive cultivation. The efficiency of applied N use by the rice plant is also low. Farmers of the country usually do not apply N in their fields properly and timely. It is estimated that only about 25% of the added N is recovered by the crops and the rest 75% is lost due to leaching, surface runoff, NH_3 volatilization, decreased nitrification and other processes (Naznin et al., 2013). Besides, at present the N fertilizer is costly. Under these circumstances, it is important to find out the effective method of application of urea that would give higher yield of crops and also reduce fertilizer cost. Panir (2014) applied magic growth solution in the rice leaf as foliar spray which saved 44% urea compared to soil application, increased absorption rate, improved soil health and ultimately increased rice yield. Broadcast application of urea on the surface soil causes losses up to 50% but application of magic growth solution in leaf may result in negligible loss. The savings in applied N reached 44% of urea when applied as foliar spray during *boro* and *aman* seasons (Crasswell and De Datta, 1980). The objective of this study was, therefore, to investigate the effects of different levels of urea and magic growth spray solution on the yield and yield attributes of BRRI dhan29.

MATERIALS AND METHODS

The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from January to June 2015. The experimental area belongs to Sonatala soil series under Old Brahmaputra Floodplain (AEZ-9). The region occupies a large area of Brahmaputra sediments which are laid down before the river shifted into its present Jamuna channel about 200 years ago (UNDP and FAO, 1988). The field was a medium high land of silty loam soils having pH around 6.5. The experiment consisted of ten treatments viz., T_1 = Control, T_2 = 99 kg urea ha^{-1}, T_3 = 63 kg urea ha^{-1} + 2.16L ha^{-1} magic growth spray solution, T_4 = 99 kg urea ha^{-1} + 5.66L ha^{-1} magic growth spray solution, T_5 = 117 kg urea ha^{-1} + 1.44L ha^{-1} magic growth spray solution, T_6 = 117 kg urea ha^{-1} + 5.66L ha^{-1} magic growth spray solution, T_7= 126kg urea ha^{-1} + 5.66L ha^{-1} magic growth spray solution,T_8= 132 kg urea ha^{-1}, T_9= 132 kg urea ha^{-1} + 5.66L ha^{-1} magic growth spray solution, T_{10}= 132 kg urea ha^{-1} + 2.16L ha^{-1} magic growth spray solution. The experiment was laid out in a randomized complete block design with three replications. Each of the replication presented a block in the experiment. Each block comprised of 10 unit plots which were designed to assign the above mentioned treatments. Total numbers of unit plot were 30 (10 × 3). Spaces between blocks and unit plots were 1 m and 0.5 m, respectively. The size of unit plot was 20 m^2 (4.0 m × 5 m). The land was puddled with country plough, stubles were removed and leveled by laddering. The plots were fertilized with 100, 75, 60 and 10 kg ha^{-1} of triple super phosphate, muriate of potash, gypsum and zinc sulphate, respectively at the time of final land preparation (BRRI, 2010). Urea with magic growth spray solution was applied as per experimental treatments. Urea was applied at 10 DAT, 25 DAT, 40 DAT and magic growth spray solution was applied for three times. 1st spray was applied at 17 DAT, 2nd spray was applied at 29 DAT and 3rd spray was applied at 44 DAT. Weeding, gap filling, irrigation and pesticide application were done as and when necessary throughout the growth period of the crop. The crop was harvested at full maturity. The date of harvesting was confirmed when 90% of the grains become golden yellow in color. Harvesting was done on 25 April 2015. The harvested crop of each plot was separately bundled, properly tagged and then brought to the threshing floor. Grains were sun dried to a moisture content of 14% and then weighed. Straw was also sun dried and weighed. Yields of both grain and straw were converted to t ha^{-1}. Data were collected on plant height, total tillers $hill^{-1}$, effective tillers $hill^{-1}$, ineffective tillers $hill^{-1}$, panicle length, grains $panicle^{-1}$, sterile spikelets $panicle^{-1}$, 1000-grain weight, grain yield, straw yield and harvest index. Collected data were

analyzed statistically and mean differences were adjudged by Duncan Multiple Range Test (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Effects of different levels of urea and magic growth spray solution on various parameters of rice cv. BRRI dhan29 have been presented and discussed under the following heads

Yield attributes

Different levels of urea and magic growth spray solution had significant effects on almost all the yield and yield contributing characters of rice cultivar BRRI dhan29 except ineffective tillers hill^{-1}, panicle length, sterile spikelets panicle^{-1} and 1000-grain weight (Table 1 and Fig. 1). The tallest plant (92.33 cm) was obtained from T_7 treatment while the shortest one (81.40 cm) was from control. The increase in plant height due to the application of increased levels of urea and magic growth might be associated with stimulating effects of N on various physiological processes including cell division and cell elongation of the plant. In general, plant height increased with the increasing levels of N as urea and magic growth spray solution. These results explicitly confirmed the results obtained by Singh and Singh (1986) and Alam (2002) who recorded a positive effect of increasing levels of urea super granule (USG) on plant height.

Table 1. Effects of different levels of urea and magic growth spray solution on the yield attributes and harvest index of BRRI dhan29

Treatment	Plant height (cm)	Total tillers hill^{-1} (no.)	Panicle length (cm)	Grains panicle^{-1} (no.)	Sterile spikelets panicle^{-1} (no.)	1000-grain weight (g)	Harvest index (%)
T_1	81.40d	9.67d	20.81	74.33e	18.67	21.00	44.99a
T_2	85.13cd	11.33cd	22.79	82.33d	22.33	21.10	42.38ab
T_3	86.90bc	12.00c	23.51	83.33cd	22.67	21.27	42.87ab
T_4	87.76bc	13.00bc	23.89	84.33c	33.67	21.08	42.05ab
T_5	88.37b	12.33bc	23.87	89.33bc	24.67	21.57	44.76a
T_6	86.47bc	12.33bc	23.02	91.33b	25.67	20.95	43.93ab
T_7	92.93a	15.00a	24.92	100.00a	27.00	21.21	39.38b
T_8	83.60c	14.33ab	23.52	80.00d	33.00	21.84	39.25b
T_9	88.33b	13.67b	23.00	88.67bc	27.00	21.45	37.05c
T_{10}	84.07cd	12.00c	23.19	83.33cd	35.33	21.27	39.13bc
CV (%)	2.28	5.34	4.65	9.96	6.68	2.88	8.39
S_X	0.15	0.11	0.62	0.93	0.72	0.35	0.01
Sig. level	0.01	0.05	NS	0.01	NS	NS	0.05

In a column figures with dissimilar letter/s differ significantly as per DMRT.
Sig. = Significance, NS = Not significant

[**T_1**= No urea application (control), **T_2**= 99 kg urea ha^{-1} ,**T_3**= 63 kg urea ha^{-1} + 2.16L ha^{-1} magic growth spray solution, **T_4**= 99 kg urea ha^{-1} + 5.66L ha^{-1} magic growth spray solution, **T_5**= 117 kg urea ha^{-1} + 1.44L ha^{-1} magic growth spray solution, **T_6**= 117 kg urea ha^{-1} + 5.66L ha^{-1} magic growth spray solution, **T_7**= 126 kg urea ha^{-1} + 5.66L ha^{-1} magic growth spray solution, **T_8**= 132 kg urea ha^{-1},**T_9**=132 kg urea ha^{-1} + 5.66L ha^{-1} magic growth spray solution ,**T_{10}**= 132 kg urea ha^{-1} + 2.16L ha^{-1} magic growth spray solution]

The highest number of total tillers hill^{-1} (15.00) was produced in T_7 treatment which was identical with the tillers of T_8 treatment but significantly different from all other treatments. On the other hand the lowest number of total tillers hill^{-1} (9.67) was recorded from T_1 (control) treatment. The progressive improvement in the

formation of tillers with urea and magic growth levels might be due to the availability of N which could be responsible for enhanced tillering of the plant. These results are in compliance with those of Kamal *et al.* (1991) who recorded increased number of tillers hill^{-1} with increased levels of N as urea super granule (USG). Application of treatment T_7 produced the highest number of effective tillers hill^{-1} (12.00) which was statistically similar with the treatments T_5 and T_8 but significantly different from other treatments. The T_1 treatment produced the lowest number (9.00) of effective tillers hill^{-1} (Fig. 1). Adequacy of N as magic growth probably favored the cellular activities during panicle formation and development which led to increased number of productive tillers hill^{-1}. Singh et al. (1983) also agreed to this view. Numerically the highest number (3.67) of ineffective tillers hill^{-1} was produced when crop was fertilized with T_9 treatment and the lowest number (1.00) was found in T_5 treatment (Figure 1). Though the treatment effects were not significant on panicle length, application of treatment T_7 numerically produced the longest panicle (23.79 cm) and T_1 (control) produced the shortest one (21.81 cm).

Both urea and magic growth solution exerted significant influence on the number of grains of BRRI dhan29. Grains panicle^{-1} increased with the increase in levels of urea and magic growth solution. The highest number of grains panicle^{-1} (100) was recorded in T_7 treatment which was significantly different from other treatments. The second highest number of grains was obtained from T_6 treatment which was identical with the number of grains of T_5 and T_9 treatments and the lowest grains (74.33) was recorded from control treatment (Table 1). Adequate supply of N from magic growth contributed to grain formation which probably increased the number of grains panicle^{-1} with increasing N level. Numerically maximum number of sterile spikelets panicle^{-1} (35.00) was recorded from treatment T_{10} and the lowest number (18.67) was produced from T_1 treatment. Different treatments of urea and magic growth did not influence the weight of the grain (Table 1). However, the heaviest grain was produced by T_8 treatment while the lightest grain was observed in T_6 treatment.

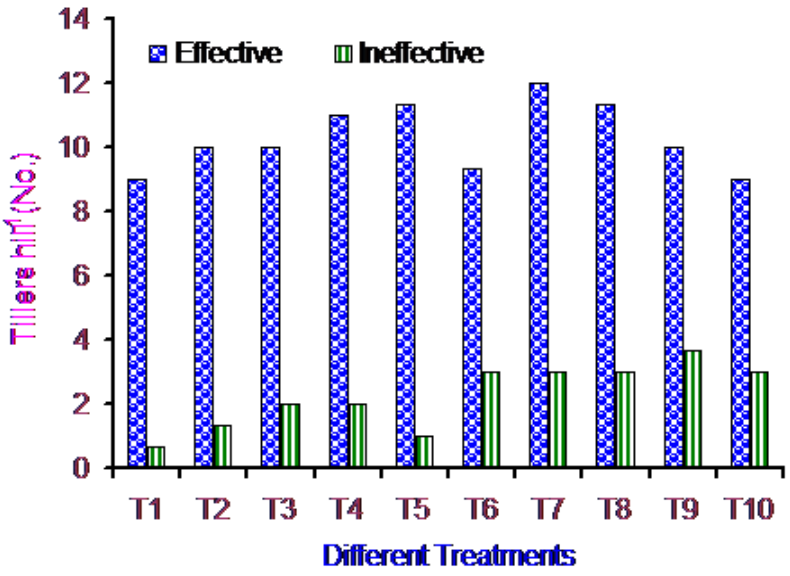

Figure 1. Effects of different levels of urea and magic growth solution on the number of effective and ineffective tillers hill^{-1} of BRRI dhan29

Grain and straw yield

Urea and magic growth solution also exerted significance influence on the grain and straw yield of BRRI dhan29 (Fig. 2). The highest grain yield (6.16t ha^{-1}) was obtained from T_7 treatment (126kg urea ha^{-1}+5.66L ha^{-1} magic growth spray solution). Highest yield from that treatment (T_7) might be due to the positive correlations among effective tillers, panicle length, grains per panicle with grain yield (Fig. 4) The lowest grain yield (4.33t ha^{-1}) was obtained from T_1 (control) treatment. These results are in agreement with those obtained

by Singh and Mahapatra (1989) who recorded the highest grain yield applying 90 kg N ha^{-1} as USG, but not with those reported by Quayum and Prasad (1994). They observed that grain yield increased with N application up to 112.5 kg ha^{-1} as USG. The differences might have been taken place because of dissimilarity in native fertility status of soil. However, when only urea was applied, the grain yield was found to be lower compared to only magic growth solution. Grain yield increase over control was influenced by different levels of urea and magic growth solution (Fig. 3). Yield increase was highest (42.26%) in T_7 treatment and the lowest (11.55%) in T_8 treatment. Grain yield was gradually increased with increasing levels of urea and magic growth solution.

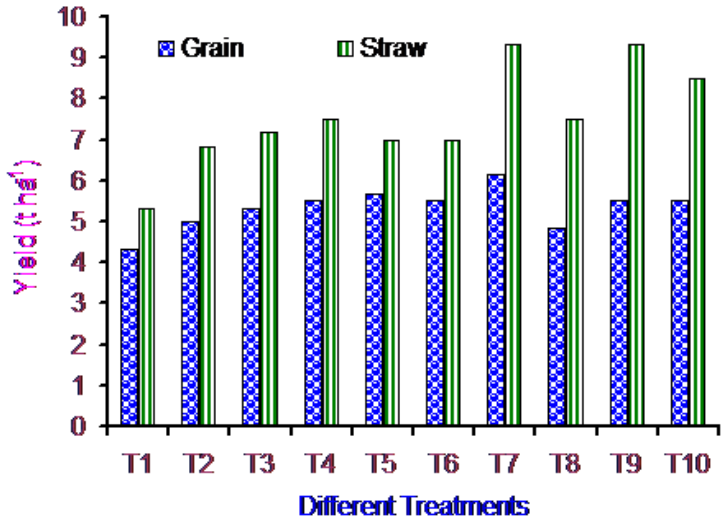

Figure 2. Effects of different levels of urea and magic growth spray solution on grain and straw yields of BRRI dhan29

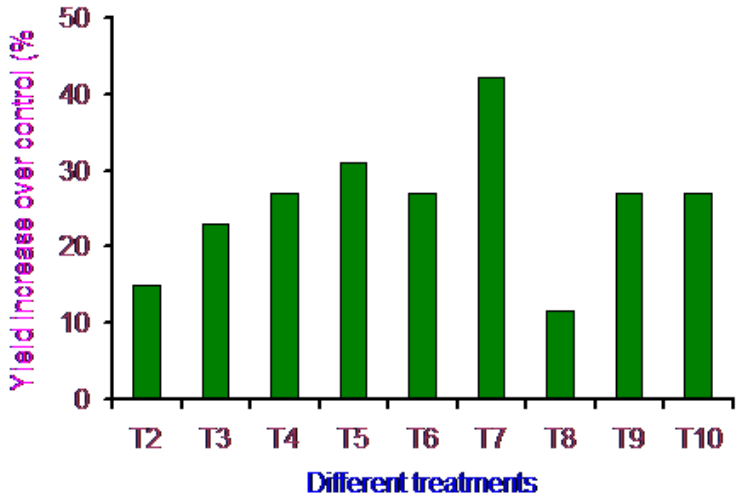

Figure 3. Yield increase of BRRI dhan29 over control as influenced by different levels of urea and magic growth spray solution

Straw yield was also significantly influenced by different treatments (Fig. 2). The highest yield (9.33t ha^{-1}) was produced by T_7 and T_9 treatment and the lowest yield (5.33t ha^{-1}) was obtained from control (Fig. 2). Nitrogen influenced vegetative growth in terms of plant height and number of total tillers $hill^{-1}$ which resulted in

differences of straw yield. These findings corroborate with those of Quayum and Prasad (1994). The harvest index (HI), defined as the ratio of grain to total dry matter production in crops, is used as an index of dry matter distribution. The highest harvest index (44.76%) was recorded in T_5 treatment of urea which was statistically similar with other treatments and the lowest (37.05%) HI was recorded in T_9 treatment (Table 1). It is now well established that partitioning of dry matter is related to increased yields in improved cultivars rather than total biomass production (Gifford and Evans, 1981)

Correlation and regression studies

Yield is a complex character which results from the interactions of various yield contributing characters. Hence, an attempt was taken to examine the extent of contribution of various yield attributes to grain yield. The relationship among plant height, effective tillers hill^{-1}, panicle length, grains panicle^{-1} with grain yield of BRRI dhan29 was studied. The correlation and regression lines of these parameters have been shown in Figure 4. Results showed that grain yield had significant positive correlations with plant height (R^2=0.815), effective tillers hill^{-1} (R^2=0.8954), panicle length (R^2=0.7265) and grains panicle^{-1} (R^2=0.8454). Regression analysis revealed that increase in plant height, effective tillers hill^{-1}, panicle length and grains panicle^{-1} resulted in the corresponding increase in the grain yield of BRRI dhan29. Haque (2002) also found positive correlations among straw yield, number of bearing tillers hill^{-1}, number of grains panicle^{-1}, 1000 grain weights of BRRI dhan30 and BRRI dhan31.

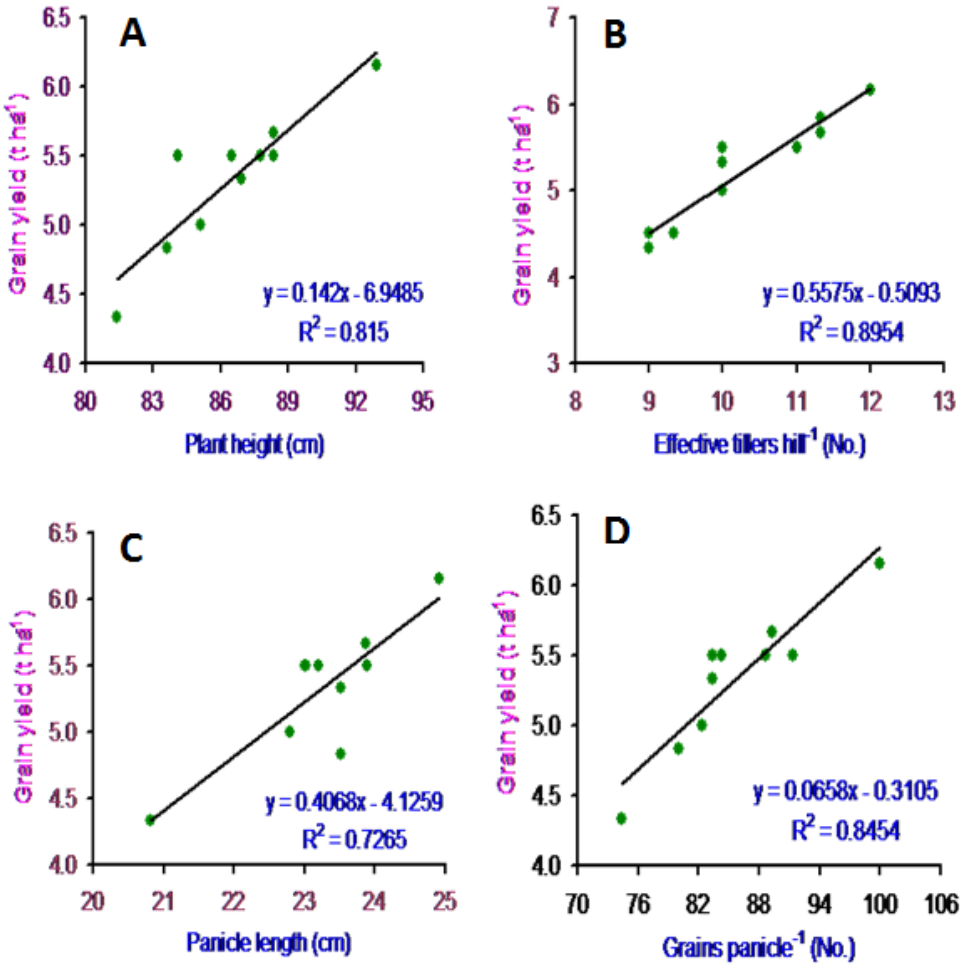

Figure 4. Relationships among grain yield vs plant height (A), grain yield vs effective tillers hill^{-1} (B), grain yield vs panicle length (C) and grain yield vs grains panicle^{-1} (D) of BRRI dhan29 as influenced by different levels of urea and magic growth spray solution.

Net return and benefit cost ratio

From the economic analysis, it is observed that the highest total return (Tk. 195967), the highest net income (Tk. 57891) and the highest BCR (1.41) were recorded from the T_7 treatment which was followed by T_9 treatment (BCR- 1.37). On the other hand, T_1 (control) treatment showed the lowest net return (Tk. 30140) and BCR (1.23) (Table 2).

Table 2. Per hectare cost and returns of BRRI dhan29 as influenced by different levels of urea and magic growth spray solution

Treatment	Total cost (TK.)	Total return (TK.)	Net return (TK.)	BCR
T_1	130400	160540	30140	1.23
T_2	131984	170080	38096	1.28
T_3	133548	171130	37582	1.28
T_4	137644	180998	43354	1.31
T_5	133712	182851	49139	1.37
T_6	137932	180637	42705	1.30
T_7	138076	195967	57891	1.41
T_8	132512	170588	38076	1.28
T_9	131172	180563	49391	1.37
T_{10}	134672	180060	45388	1.33

CONCLUSION

The results revealed that urea and magic growth spray solution exerted significant influence on the yield contributing characters and yield of BRRI dhan29 except panicle length, sterile spikelets and 1000-grain weight. The highest grain and straw yields (6.16 and 9.33t ha^{-1}, respectively) were obtained from T_7 treatment which could be the resultant effect of highest number of effective tillers hill^{-1}, highest number of grains panicle^{-1} and lowest number of sterile spikelets panicle^{-1}. Grain yield was significantly and positively correlated with plant height, effective tillers hiil^{-1}, panicle length and grains panicle^{-1}. Economic analysis showed that net return and benefit cost ratio (BCR) was the highest (1.41) in T_7 treatment. Thus the overall results suggest that farmers may be advised to apply 126 kg urea along with 5.66L magic growth solution per hectare to produce economically highest grain yield of BRRI dhan29, under the agro-climatic condition of Bangladesh Agricultural University.

ACKNOWLEDGEMENT

The author desires to express sincere thanks and gratitude to National Science and Technology (NST) authority as the research was supported by a research fellowship from NST, Ministry of Science and Technology, Government of the People's Republic of Bangladesh. Special thanks to Mr. Arif Hossain Khan, Joint Director, BADC, Rajshahi for supplying Magic Growth Solution.

REFERENCES

1. Alam BMR, 2002. Effect of different levels of urea super granule on the growth and yield of three varieties of boro rice. MS Thesis, Department of Agronomy., Bangladesh Agricultural University, Mymensingh.
2. BBS (Bangladesh Bureau of Statistics), 2012. Monthly Statistical Bulletin of Bangladesh, June 2012. Statistics Division, Ministry of Planning, Government. Of the People's Republic of Bangladesh, Dhaka, p. 54.
3. BRRI (Bangladesh Rice Research Institute), 2010. *Adhunik dhaner chash* (in Bangla). 14thEdn. Bangladesh Rice Res. Inst. Joydebpur, Gazipur. PP. 17-30.
4. Crasswell ET and De Datta SK, 1980. Recent development in research on nitrogen fertilizers for rice. IRRI Research Paper, Series No. 49: 1-11.
5. Gifford RM and Evans LT, 1981. Photosynthesis, carbon partitioning and Yield. Annual Review of Plant Physiology 32: 485-509.
6. Gomez KA and Gomez AA, 1984. Statistical Procedure for Agricultural Research. 2nd Ed. John Wiley and Sons. New York. pp. 643-645.
7. Haque ME, 2002. Effect of time of nitrogen application in two varieties of transplant aman rice. MS thesis, Department of Agronomy., Bangladesh Agricultural University, Mymensingh.
8. Kamal J, Tomy PJ and Rajaappan Nais N, 1991. Effect of sources and levels of nitrogen on the growth, yield and nitrogen use efficiency of wetland rice. Indian Journal of Agronomy 36(1): 40-43.
9. Naznin A, Afroz H, Hoque TS and Mian, MH, 2013. Effects of PU, USG and NPK briquette on nitrogen use efficiency and yield of BR22 rice under reduced water condition. Journal of the Bangladesh Agricultural University, 11: 2015-220.
10. Panir S, 2014. Effect of Magic Growth on the performance of Transplant Aman Rice cv.BRRI dhan37. M.S. Thesis, Department of Agronomy., Bangladesh Agricultural University Mymensingh. pp. 27-39.
11. Quayum A. and Prasad K, 1994. Performance of modified urea materials in rainfed low land rice (*Oryza sativa* L.) Journal and Research of Birsa Agricultural. University, 6: 131-134.
12. Singh, BK. and Singh RP, 1986. Effect of modified urea materials on rainfed low land transplanted rice and their residual effect on succeeding wheat crop. Indian Journal of Agronomy, 31: 198-200.
13. Singh IC and Mahapatra IC, 1989. Economics of Fertilizer use. Fertilizer Marketing News, 5: 1-17.
14. Singh VP, Singh P, Agnihotri A and Singh R B, 1983. Effect of GA_3 on plant height of tall, semidwarf and dwarf strains of bread wheat Indian Journal of Plant Physiology, 26 (2): 266-269.
15. UNDP and FAO, 1988. Land resources appraisal of Bangladesh for Agricultural development. Report 2. Agro-ecological regions of Bangladesh. Bangladesh Agricultural Research Council, Dhaka- 1207.pp 212-221.