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Effect of Urea Super Granule on Growth and Yield of Wheat

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Abstract
A field experiment was carried out at Agronomy Field, Bangladesh Agricultural University (BAU), Mymensingh during the period from November 2009 to March 2010 with a view to finding out the effect of appropriate dose of USG on growth and yield of wheat. Six levels of nitrogen (T_0, T_1, T_2, T_3, T_4 and T_5) were applied as treatments for growth and yield of wheat var. Bijoy for this study. Among the application of USG, treatment T_5 produced the superior results on morpho-physiological and growth characters of wheat except number of non sterile spikelet where USG treatment T_2 performs the best (1.82). As results, T_5 produced the highest plant height (95.77 cm), number of total tiller hill^{-1} (4.96), no. of effective tiller (4.13), no of non effective tiller (1.00), number of total spikelet (20.22), no of spikelet spile^{-1} (10.92), sterile spieklet (18.70), no of grains spike^{-1} (46.27), 1000-grain yield (51.39 g), grain yield (2.42 t ha^{-1}) and straw yield (4.06 tha^{-1}).

Key Words: Dose of USG, Growth and yield of wheat

Introduction

Wheat (*Triticum astivum* L.) is one of the major cereal crops of the world ranking first both in acreage and production among the cereal crops. It also next to rice, is the second most important stable food crop in Bangladesh. The area under wheat cultivation during 2007-2008 was about 5.59 lakh hectares producing 9.76 lakh tons of wheat with an average yield of 1.75 tons per hectare (BBS, 2008). Wheat has higher food value over rice is that it contains 12% protein, 1.72% fat, 69.60% carbohydrates and 27.20% mineral matter (BARI, 1997). Bangladesh is a highly populated country and its population density is increasing day by day. Scarcity of food has become a chronic problem of this country. To mitigate the food shortages, measures should be taken to increase total food production. So, the yield of wheat in Bangladesh will be needed to increase its production by using different techniques. Proper using techniques and doses of fertilizers are mostly important for better growth for any crops. Among the fertilizers, nitrogen plays a vital role in producing higher grain yield. Nitrogen is the key element for the production of crops and it is highly difficult in Bangladesh soils. Optimum supply of N raises the protein content, nutritive value of grain and also improves baking qualities. Rate of N application has a great influence on growth, development and yield of wheat. Wheat yield increases with the increase of nitrogen fertilizer (Singh *et al*., 1986). Grain yield of wheat increases with increasing nitrogen level up to 120 kg ha^{-1} (Malik, 1981). Prilled urea is a fast releasing nitrogen fertilizer which is usually broadcast in splits, that causes considerable loss as ammonia volatilization, immobilization, denitrification and surface run of etc. On the other hand, deep placement of slow releasing nitrogenous fertilizer such as, urea supergranule (USG) reduces loss as well as increases its use efficiency in dry land *rabi* crops. The present study was, therefore, undertaken to observe the performance of three modern wheat varieties under the effect of USG and optimum levels while reduce the requirement of urea fertilizer.

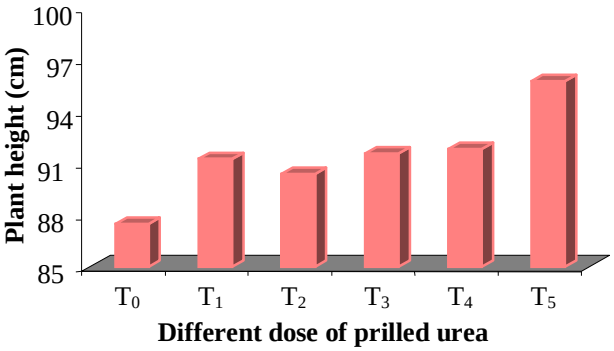
Materials and Methods

The experiment was conducted at the Agronomy Field, Bangladesh Agricultural University, Mymensingh, during the period from November 2009 to March 2010. The experimental field is a high land belonging to the Old Brahmaputra Floodplain Agro Ecological Zone (AEZ) (UNDP and FAO, 1988). The soil of the experimental field was sandy loam having pH 6.4. Variety Bijoy was used as plant materials for this experiment under six level of nitrogen (USG) viz. control (T_0), 100% nitrogen of BARI recommended dose applied as prilled urea (T_1); 25% nitrogen of BARI recommended dose applied as USG (T_2), 50% nitrogen of BARI recommended dose applied as USG (T_3), 75% nitrogen of BARI recommended dose applied as USG (T_4) and 100% nitrogen of BARI recommended dose applied as USG (T_5) on the growth and yield of wheat. Nitrogen was applied at the rate of BARI recommended dose as prilled urea 180 kg ha^{-1} at the time of final land preparation and the urea super granules were applied as per treatment in each plot. Plant protection measure was not required, as the crop was free from insect and disease attack. The crop was harvested at full maturity. Grain and straw were then dried in the sun for four days. For collecting data before harvesting. The harvested crops were threshed plot-wise and grain and straw yields were recorded plot-wise on 14% moisture basis and converted to t ha^{-1}. The experiment was laid out in a randomized complete block design with three replications. Analysis of variance was done with the help of computer package M-STATC (Gomez and Gomez, 1984). The mean

differences among the treatments were adjusted with Duncan's Multiple Range Test (DMRT).

Results and Discussion

Plant height differed significantly due to variation in USG levels (Figure 1). Among the USG treatments, the tallest plant (95.77 cm) was recorded in T_5 and the shortest plant (87.49 cm) was found in T_0. It was observed that the plant height increased with the increasing levels of nitrogen. Similar results were also found by Dhuka *et al.* (1991) who reported that plant height of wheat increased with increasing levels of USG. Different USG treatments also showed significant variation in terms of total tillers hill^{-1} (Table 1). The maximum total number of tillers hill^{-1} (4.96) was recorded in T_5 and the lowest total number of tillers hill^{-1} (3.40) was observed in T_0. The second highest total number of tillers hill^{-1} (4.467) was recorded in both T_3 and T_4. Similar result was observed by Singh *et al.* (1986) who reported that total tillers hill^{-1} increased with the increase of N levels and the highest number of total number of tillers hill^{-1} was obtained at 120 kg N ha^{-1}.

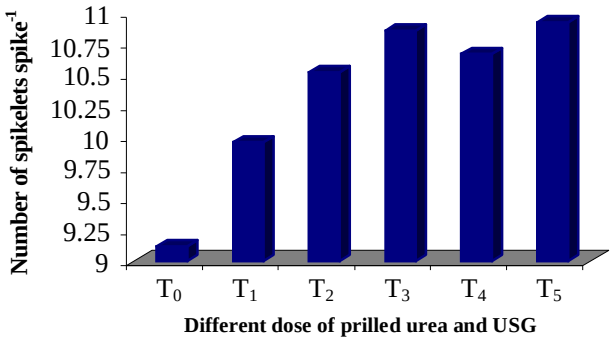


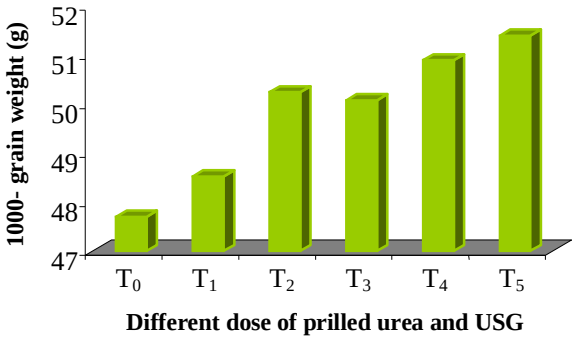
T_0 = Control (No nitrogen)
T_1 = 100% nitrogen of BARI recommended dose applied as prilled urea
T_2 = 25% nitrogen of BARI recommended dose applied as USG
T_3 = 50% nitrogen of BARI recommended dose applied as USG
T_4 = 75% nitrogen of BARI recommended dose applied as USG
T_5 = 100% nitrogen of BARI recommended dose applied as USG

Effective tillers hill^{-1} were significantly influenced by USG levels (Table 1). Among the treatments, the maximum effective tillers hill^{-1} (4.13) was recorded in T_5. The minimum effective tillers hill^{-1} (2.64) was recorded in T_0. Urea supergranule application methods encouraged effective tillers production and for that reason effective tillers increased with the increase of USG treatments. Non effective tillers hill^{-1} did not vary significant variation due to USG application treatments (Table 1). Non effective tillers hill^{-1} was highest (1.00) and lowest (0.53) were recorded in T_3 and both the treatment T_1 and T_2, respectively.

Number of total spilkelets was significantly affected by the effect of USG treatments (Table 1). The maximum number of total spikelet (20.22) was found in T_5, which was statistically more or less similar to T_2 (20.089). The minimum number of total spikelet (17.42) was recorded in T_0. Different USG treatments also showed significant variation in terms of number of spikelets spike^{-1} (Fig. 2). The highest number of spikelets spike^{-1} (10.92) was observed in T_5. The lowest number of spikelets spike^{-1} (9.12) was recorded in T_1. Kumar (1985) and Patel *et al.* (1995) also reported that progressive increase in nitrogen levels enhanced the number of spike m^{-2}. Number of sterile spikelets spike^{-1} was significantly affected by different rates of USG levels (Table 1) where the maximum number of sterile spikelets spike^{-1} (18.70) was obtained in T_5 and the lowest number of sterile spikelets spike^{-1} (15.84) was observed in T_0. A significant variation was also found on number of sterile spikelets panicle^{-1} (Table 1). Non sterile spikeletes spike^{-1} ranged was 1.29 to 1.82 where maximum was found in T_2 and minimum was recorded in T_3.There was significant effect of USG levels on number of grains spike^{-1} of whet (Table 1). Significantly the highest number of grains spike^{-1} (46.27) was found in T_5. The lowest number of grains spike^{-1} (32.24) was obtained in T_0. USG levels showed significant variation in case of weight of 1000-grains (g) (Fig. 3). However, numerically the highest weight of 1000-grains (g) was found in T_5 (51.39 g) while the lowest weight of 1000-grains (g) was noticed in T_0 (47.69 g).

A significant variation was observed in respect of grain yield due to the different USG treatments levels (Table 1). However, significantly the highest grain yield was recorded in T_4 (2.42 t ha^{-1}) and the lowest grain yield was recorded in T_0 (1.25 t ha^{-1}) where the second highest (2.28 t ha^{-1}) was recorded in T_5. USG treatments level exerted significant influence on straw yield (Table 1). The highest straw yield (4.06 t ha^{-1}) was obtained from T_5, which was statistically identical with T_4 (4.03 t ha^{-1}). Significantly the lowest straw yield (2.69 t ha^{-1}) was obtained in T_0. Singh *et al.* (1986) reported that the improvement of growth in terms of plant height and number of tillers plant^{-1} due to nitrogen fertilization resulted in the improvement of straw yield.





T_0 = Control (No nitrogen) applied as prilled urea
T_1 = 100% nitrogen of BARI recommended dose
T_2 = 25% nitrogen of BARI recommended dose applied as USG
T_3 = 50% nitrogen of BARI recommended dose applied as USG
T_4 = 75% nitrogen of BARI recommended dose applied as USG
T_5 = 100% nitrogen of BARI recommended dose applied as USG

Table 1. Effect of prilled urea and urea super granule on growth and yield of wheat

Treatment	No. of total tillers hill^{-1}	No. of effective tillers hill^{-1}	No. of non-effective tillers hill^{-1}	No. of total spikelet	Sterile spikelet	Non sterile spikelet	No. of grains spike^{-1}	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
T_0	3.40 d	2.64 d	0.76 ab	17.42 c	15.84 e	1.56 ab	32.24 d	1.25 c	2.69 c
T_1	3.78 c	3.27 c	0.53 b	18.60 b	17.18 d	1.47 ab	35.60 c	1.67 b	3.14 bc
T_2	3.69 c	3.27 c	0.53 b	20.09 a	18.27 ab	1.82 a	42.13 b	1.83 b	3.56 ab
T_3	4.47 b	3.44 bc	1.00 a	19.24 b	17.96 bc	1.29 b	42.44 b	2.17 a	3.89 ab
T_4	4.47 b	3.64 b	0.84 a	18.69 b	17.33 cd	1.36 b	43.67 b	2.42 a	4.03 a
T_5	4.96 a	4.13 a	0.82 a	20.22 a	18.70 a	1.44 ab	46.27 a	2.28 a	4.06 a
CV (%)	**6.39**	**8.23**	**33.95**	**3.37**	**3.61**	**23.25**	**4.99**	**19.48**	**19.14**
LSD$_{(0.05)}$	**0.2759**	**0.2933**	**0.2678**	**0.6734**	**0.6651**	**0.3639**	**2.118**	**0.03322**	**0.07427**
Sig. levels	**	**	**	**	**	*	**	**	**

*: Significant at $p \leq 0.05$. **: Significant at $p \leq 0.01$
T_0 = Control (No nitrogen) applied as prilled urea
T_1 = 100% nitrogen of BARI recommended dose applied
T_2 = 25% nitrogen of BARI recommended dose applied as USG
T_3 = 50% nitrogen of BARI recommended dose applied as USG
T_4 = 75% nitrogen of BARI recommended dose applied as USG
T_5 = 100% nitrogen of BARI recommended dose applied as USG

Conclusion

From the above observation, it was clear that the USG treatment T_5: 100% nitrogen of BARI recommended dose which was applied as USG showed superior performance on growth and yield of wheat var. Bijoy to compare with another USG levels. However, treatment T_2 showed greater result on non sterile spikelet which was not foremost characteristic for growth and yield of wheat. From the present study it may be concluded that the higher seed yield of wheat could be obtained by using 100% nitrogen of BARI recommended dose applied as USG. However, further trails are necessary at different agroecological zones of the country to confirm this result.

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