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Brinjal (*Solanum melongena*) Fruit Yield in Response to Urea Super Granule Application

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Abstract

Experiments were conducted to assess the effects of USG on the number of branch and fruit production, fruit length, weight and yield of brinjal (*Solanum melongena*: cv Shingnath), compared to prilled urea as N source. The study was conducted at farming systems research and development site, Palima, Tangail district under AEZ 8 of Bangladesh during 2000, 2001 and 2002 using randomized complete block design (RCBD) with five treatments replicated 6 times. The treatments were $T_{1=}$ $N_{78}P_{36}K_{66}S_{17}CD_{3t}$ (Recommended dose for high yield goal (HYG), N as prilled urea), T_2= $N_{78}P_{36}K_{66}S_{17}CD_{3t}$ (Recommended dose for HYG, N as USG), $T_{3=}$ $N_{65}P_{36}K_{66}S_{17}CD_{3t}$ (N 10%< Recommended dose as USG), T_4= $N_{52}P_{36}K_{66}S_{17}CD_{3t}$ (N 20%<Recommended dose as USG) and T_5 = $N_{60}P_{35}K_{60}S_0CD_{5t}$ (Farmers' dose, N as Prilled urea). USG had significant ($P \leq 0.05$) effect on the brinjal fruit yield giving higher profits. Thus USG as $N_{78}P_{36}K_{66}S_{17}CD_{3t}$ was beneficial for brinjal cultivation in terms of yield and economics.

Keywords: Urea super granule (USG), prilled urea, yields attributes, brinjal.

1. Introduction

Brinjal (*Solanum melongena*) is one of the most important, popular and nutritious vegetables in Bangladesh which is a cheaper and economically feasible source of vitamin A, B, C and iron,. It is cultivated all over the country with an annual production of 378 thousand tons (BBS, 2007). Tangail is the most densely cultivated area in the country (BBS, 2007). However, average yield of the crop in Bangladesh is very low compared to those obtained in some advanced countries of the world. The low yield of brinjal in Bangladesh is primarily due to the lack of high yielding varieties, inadequate and imbalanced use of manure and fertilizers especially the nitrogenous ones.

Nutrient supply is a key factor in crop production but global crisis of energy and high costs of fertilizers necessitate economizing their use. Nitrogen is the most deficient nutrient element in Bangladesh soil and brinjal needs a large amount of nitrogenous fertilizer for good yield. Although different types of fertilizers are available in the market, USG is one of the available nitrogenous fertilizers and farmers are already applying it in boro rice. Nitrogen utilization was found higher in USG than prilled urea (PU) in rice and higher grain and straw yields were obtained from the former (Ahmed *et al*., 2000). Although, brinjal is an important and major winter vegetable in Tangail region, farmers of this locality do not know about the benefits of USG application in brinjal production. Moreover, higher brinjal yield could be achieved by the application of USG, even total profit and BCR were higher as 20% less N was applied as USG compared to recommended dose of prilled urea (Anonymous, 2003). However, a little works has been done on the effect of USG on upland crops like brinjal. Likewise, Crasswell and De Datta (1980) observed that point placement of USG at 10 cm depth could save 30% nitrogen than prilled urea.

Savant *et al.* (1991) reported that application of USG increases nutrient absorption rate, improves soil health and ultimately increases the rice yield. It was reported (Sarker and Faroda, 1993) that the highest grain yield of millet with BCUSG and lowest from Urea and in case of wheat, among N sources residual effects were in the order of BCUSG> USG>BCU > Urea. It was also reported that use of USG can save 10-20% nitrogenous fertilizer cost in upland crops (Anonymous, 2003). In a field experiment, wheat grain yield increased with increasing residual nitrogen rate and was highest after deep placement of 120 kg N as USG (Das and Sing, 1994). Modified urea materials under different moisture regimes influence ammonia volatilization loss and significantly less NH_3-N loss was observed for USG treatments than from surface applied urea (Muneshwar *et al*., 1992). In terms of economic returns USG application is more profitable than prilled urea (Rahman *et al*., 2004). Rahman *et al*. (2004) also reported that 10% less nitrogen as USG produced more tuber yield and economic return than recommended prilled urea. However, work on USG application in order to increase yield potential of brinjal is inadequate in Bangladesh. Therefore, the study was undertaken to determine the optimum and economic dose of USG on the yield and yield attributes of brinjal.

2. Materials and Methods

The experiment was carried out in the medium highland of Agro-ecological Zone (AEZ)-8 at the Farming Systems Research and Development site, Palima, Tangail during the rabi season of the years 2000-2001, 2001-2002 and 2002-2003. Before initiation of the experiment, soil samples were collected from a depth of 0-20 cm for each replication and analysed by ASI methods. The chemical properties of this soil are presented in Table 1. Soil is slightly acidic in reaction with medium contents of organic matter, very low content of total nitrogen and phosphorus, low in potassium, sulphur and boron and high in zinc. The rainfall during November, December, January and February were 0, 11, 3 and 177 mm in 2000-2001, 0, 0, 13 and 146 mm in 2001-2002 and similar in 2002-2003. The mean maximum temperature during November, December, January and February were 29.5, 25.5, 25.4 and 28.4 ^{o}C in 2000-2001, 30.1, 25.8, 21.0 and 28.3^{0}C in 2001-2002 and so on in 2002-2003.

The experiment was laid out in a Randomized Compete Block Design (RCBD) having 6 dispersed replications. Five treatments imposed were $T_{1=}$ $N_{78}P_{36}K_{66}S_{17}CD_{3t}$ (Recommended dose for high yield goal (HYG), N as Prilled urea), T_2= $N_{78}P_{36}K_{66}S_{17}CD_{3t}$ (Recommended dose for HYG, N as USG), $T_{3=}$ $N_{65}P_{36}K_{66}S_{17}CD_{3t}$ (N 10%<Recommended dose as USG) T_4= $N_{52}P_{36}K_{66}S_{17}CD_{3t}$ (N 20%< Recommended dose as USG) and T_5 = $N_{60}P_{35}K_{60}S_0CD_{5t}$ (Farmers' dose, N as Prilled urea). Fertilizer dose for each treatment were calculated on the basis of soil test values according to fertilizer recommendation guide (BARC, 1997). Farmers' dose was identified by the average dose of 30 farmers, practiced in that area.

Table 1. Initial soil test values of experimental plots.

Crop	%			K (meq/	ug/g			
	PH	OM	N	100g)	P	S	B	Zn
Cabbage	5.8	1.72	0.072	0.10	5.20	13	0.188	7.534
Status	S.acidic	Medium	V.low	Low	V.low	low	low	High

The unit plot size was 8m x 5m and the variety was Singnath. The 35 days old brinjal seedlings were transplanted on 6 November 2000 to 8 November 2000 in a spacing of 60 cm x 60cm. Except prilled urea and USG, all other fertilizers and 50% MP were applied during the final land preparation. For each year, USG was applied at 21 days after transplanting (DAT) in ring method as 9-10 cm apart from the seedling base and 7-8 cm depth in soil. Prilled urea was applied as 3 equal splits at 21, 35 and 55 DAT and covered with soil properly. The rest 50% MP was applied with USG and prilled urea at 21 days after transplanting. Three irrigations were applied at 22, 36 and 56 DAT. Three weedings and mulching were done at 18, 33 and 53 DAT. Bacterial wilt was observed and controlled by using Diathen M-45 and Nogos 50 EC was used to control fruit and shoot borer. The crop harvesting continued during the month of February to March. Data on yield and yield contributing characters were recorded from ten plants selected randomly for each plot and total yield was calculated through average plant yield by multiplying plant population. Cost and return analyses were done based on the data recorded at farm-gate prices. Data were collected and analyzed statistically using MSTATC package and means were separated by DMRT at 5% level of significance.

3. Results and Discussions

3.1. Plant height

Plant height was influenced by USG and significant ($P \leq 0.05$) differences were recorded among the treatments. The highest plant height (131.0 cm) was found with the recommended USG dose followed by USG 10%< recommended dose which was statistically similar to all other treatments except recommended prilled urea, which produced the lowest plant height (115.2 cm).

3.2. Yield contributing characters of brinjal

Yield contributing parameters were studied and three years (2000-03) pooled data are presented in Table 2. Economic analyses for 3 years average are presented in Table 3. Primary branch/plant, secondary branch/plant, No. of fruit/plant, Fruit length (cm), weight of fruit (g) and Yield (kg/plant) showed significant ($P \leq 0.05$) differences among the treatments.

Table 2. Effect of Urea Super Granule (USG) on the performance of Brinjal 2000-2003 (Poolled).

Treatment	Plant height (cm)	Primary branch/ plant (cm)	Secondary branch /plant	No.of fruit/ plant	Fruit length (cm)	Weight of fruit (g)
Prilled urea (Rec.)	115.2b	4.96cd	7.72d	14.75b	23.74bc	128.4a
USG(Rec.)	131.0a	6.08a	9.56a	17.80a	24.84a	133.2a
USG10%<(Rec.)	130.0ab	5.70ab	8.93b	16.67a	24.07ab	137.8a
USG20%<(Rec.)	129.6ab	5.30bc	8.31c	14.67b	23.75bc	130.6a
Farmers dose	117.5ab	4.58d	7.38d	13.37b	23.06c	118.4b
LSD (5%)	14.61	0.4982	0.4082	1.794	0.7717	9.165
CV%	6.22	4.97	2.58	6.17	1.72	3.75

Duncan's Multiple Range Test (DMRT): Means of triplicates followed by a common letter are not different significantly at 5% levels of probability.

Table 3. Cost and return analysis of the effect of USG on brinjal production during 2000-2003.

Treatment	Gross return (Tk/ha)	TVC (Tk/ha)	Gross margin (Tk/ha)	BCR	MBCR
Prilled urea (Rec.)	*288300	60001	228299	4.80	5.71
USG(Rec.)	*349080	60001	289079	5.82	12.58
USG10%<(Rec.)	*331698	59853	271845	5.54	10.80
USG20%<(Rec.)	*311640	59705	251935	5.22	8.64
Farmers dose	*237840	51159	186681	4.65	-

TVC = Ttotal variable cost, BCR= Benefit-cost ratio and MBCR= Marginal benefit-cost ratio.
*Values are means of three years data.

Market price of inputs: Tk/kg		Market price of output: Tk/kg	
Urea	: 5.70	Brinjal	: 6.00
USG	: 6.00		
TSP	: 12.00		
MP	: 9.00		
Gypsum	: 4.00		
ZnSO4	: 35.00		

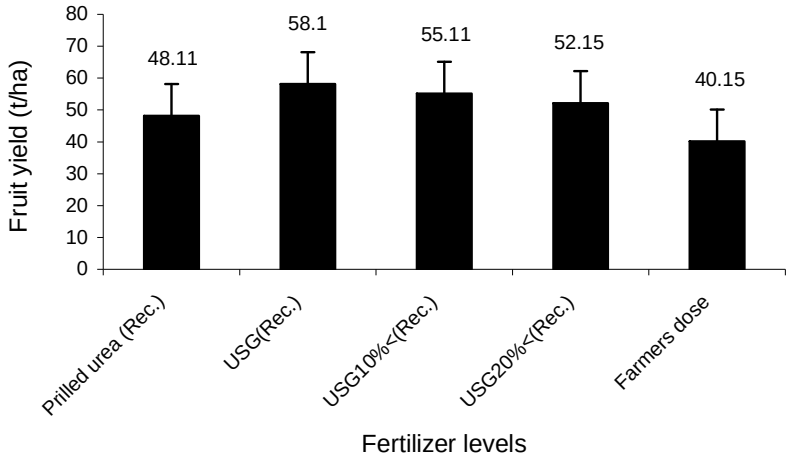

Fig. 1. Fruit yield of brinjal as affected by different levels of USG.

Highest primary branch/plant (6.08), no. of fruit/plant (17.8) and fruit length (24.48cm) were produced by the USG at recommended dose, which was statistically ($P \leq 0.05$) identical with USG 10%< recommended dose, but the highest secondary branch/plant (9.56) was produced with recommended USG dose which was significantly ($P \leq 0.05$) different from all other treatments (Table 2). Similarly fruit yield/plant (kg) was found highest in USG recommended dose, which was statistically identical with USG 10%< recommended dose and USG 20%< recommended dose but, significantly ($P \leq 0.05$) higher than recommended prilled urea as well as farmers' practice. But no significant ($P \leq 0.05$) differences were observed among the treatments except farmers' dose in case of fruit weight (g) although highest fruit weight (137.8 g) was recorded in USG 10%< recommended dose. These results are in conformity with those of Sarker and Faroda (1993), Saha (1984), Rutkauskiene and Poderys (1999) and Das *et al.* (1994), respectively.

3.3. Fruit yield of brinjal

Fruit yield of brinjal was significantly ($P \leq 0.05$) influenced by the different doses of applied prilled urea and USG (Fig 1). It was revealed that the yield of brinjal was increased by the application of USG in comparison to prilled urea and the highest yield (58.10 t/ha) was obtained from recommended USG dose which was statistically identical with USG 10% <Rec. dose and USG 20%<Rec. dose, but different from recommended prilled urea and farmers dose. Similar results were reported for potato (Rahman *et al*., 2004) where 10% less than recommended dose of USG produced more tuber yield, gave higher economic return. Setty *et al.* (1987) confirmed that USG produced the highest grain yield in rice and proved remarkably superior to the split application of urea. Similarly, an experiment with wheat, Das *et al*. (1994) found that grain yield increased with USG application.

3.4. Economic analysis

The economic evaluation of different treatments is shown in Table 3. Though higher cost was involved in recommended USG and 10% less USG than recommended dose in comparison to prilled urea, the higher gross margin (Tk. 289079) was obtained from the dose of recommended USG among the treatments. Even 10% and 20%< USG gave higher gross return (Tk. 331698 and Tk. 311640) and gross margin (Tk. 271845 and Tk. 251935) than prilled urea and farmers dose. The highest benefit cost ratio (BCR) of 5.82 was achieved from recommended USG and was followed by USG 10% < recommended dose (5.54). But the lowest BCR (4.65) resulted from farmer's dose was due to higher fertilizer cost and lower yield performance. Marginal benefit-cost ratio (MBCR) also was higher in USG treated plot and the highest MBCR (12.58) was obtained from recommended USG dose followed by USG 10% < recommended dose (10.80). Similar results were reported by Rahman *et al*. (2003) in case of tomato and potato (2004).

4. Conclusions

Brinjal fruit yield and relevant cost-benefit ratio as revealed in the investigation suggest that USG as an N source is more potential than prilled urea. Based on yield and economic analysis, it can be concluded that USG is more profitable for brinjal cultivation compared with prilled urea.

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