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Efficacy of Urea Super Granule (USG) as a Source of Nitrogen in Sugarcane Production

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ABSTRACT

A field experiment was conducted at Thakurgaon under Old Himalayan Piedmont Plain soils of Bangladesh(AEZ 1) with a view to comparing the traditional N source of prilled urea with Urea Super Granule (USG) and determining the optimum rate of USG for higher sugarcane yield. Results indicated that the treatment T_4 receiving full-recommended N from USG in two splits produced the highest cane yields of 72.7 and 63.96 TCH in 2005-06 and 2006-07 respectively, that was 2-7 % higher over full-recommended N from prilled urea (T_2) in three splits. The highest gross margin of Bangladesh Taka 85925 with MBCR 5.28 and Taka 74682 with MBCR 4.06 ha^{-1} was also recorded from T_4 treatment in 2005-06 and 2006- 07, respectively.

Key words: Urea super granule, nitrogen, sugarcane, production

INTRODUCTION

Nitrogen is the most deficient nutrient element in Bangladesh soil. In general, farmers' of the country apply at least nitrogenous fertilizer to their crops for better yield. Different types of nitrogenous fertilizers are now available in the market. Recently, Urea Super Granule (USG) has become available in the market. For optimum yields, sugarcane requires a large dose of N fertilizer, 125-150 kg N ha^{-1}, depending on the soil and climate of the country. One third of this is applied at planting and the rest amount is applied in two splits at 120 days after planting (DAP) and at 180 DAP to boost up tillering for sustaining crop growth. Heavy rainfall during the grand growth phase (May-August) causes poor N recovery due to leaching. Researchers reported that N losses through leaching could be minimized by increasing the size of the N fertilizer granules (Quayyum *et al.* 2006). Youngdahl *et al.* (1986) further reported that the use of N fertilizer as USG controlled N release rate i.e., steady N supply to crop and reduced losses compared to prilled urea. But such information is scarce in sugarcane. Thus, an experiment was conducted with the following objectives.

1. To compare the traditional N source of prilled urea with Urea Super Granule (USG) for improving N use efficiency in sugarcane.
2. To determine the optimum dose of USG for higher sugarcane yield.
3. To minimize the cost of N fertilizer for obtaining higher economic return.

MATERIALS AND METHODS

A field experiment was conducted at Regional Sugarcane Research Station farm, Thakurgaon under Old Himalayan Piedmont Plain soils of Bangladesh (AEZ 1) during 2005-06 and 2006- 07 cropping season. The experiment was laid out in randomized complete block design having eight treatments with three replications. The treatments were as follows:

T_1: Control (No fertilizer)

T_2: Recommended fertilizer dose of N as prilled urea in three splits as FRG'97

T_3: Recommended fertilizer dose of N as USG at basal

T_4: Recommended fertilizer dose of N as USG in two split

T_5: 10% less recommended dose of N as USG at basal

T_6: 10% less recommended dose of N as USG in two split

T_7: 20% less recommended dose of N as USG at basal

T_8: 20% less recommended dose of N as USG in two split

The unit plot size was 48sq.m.. The tested variety of sugarcane was Isd 32. It was transplanted in November with 1m row and 0.5m. interplant spacing . Full amount of triple super phosphate, gypsum, zinc sulphate and one-third of muriate of potash were applied as basal in the trenches and thoroughly mixed with soil by spade before plantation. Rest amount of muriate of potash were top-dressed in two equal splits at 120 and 180 days after plantation. For urea and USG application, it was applied either at full basal or top dressed in two to three splits as per treatment of the experiment. USG was deep placed in soil around cane plant. All the recommended cultural management practices were done as and when required. Crop was harvested after 14 months of transplantation at full maturity of the crop.

RESULTS AND DISCUSSION

Cane yield and other parameters

Results presented in Table 1 showed that fertilizer application significantly increased the tiller, millable cane, cane height and cane yield but no significant effect was found on cane girth and brix per cent in both cropping seasons. During 2005-06 the highest (162.1 $\times 10^3$ ha^{-1}) number of tiller was found in T_4 treatment having recommended dose of N from USG in two splits, which was statistically similar with T_5, T_7 and T_8. The highest number (79.20 $\times 10^3$ ha^{-1}) of millable cane was also recorded in T_4 treatment, which was statistically similar with all other treatments except T_7 and T_1. The lowest number (42.37 $\times 10^3$ ha^{-1}) of millable cane was recorded from control. The treatment T_7 produced the maximum cane height (2.90 cm) that was statistically similar with all other

treatments except control. It further indicated that the treatment T_4 produced the highest cane yield of 72.70 TCH, which was followed by T_2 (67.70 TCH) where recommended dose of nitrogen was applied in three splits as prilled urea. Treatment T_2 showed statistical similarity with other fertilizer treatments regarding cane yield. This results was at par with Quayyum *et al.* (2006) who obtained higher yields in cabbage, cauliflower, tomato, brinjal, potato, papaya and banana with USG as recommended or 10% less of recommended dose in their studies.

On the other hand during 2006-07 crop season the highest number of tiller (159.8×10^3 ha^{-1}) was also obtained from T_4 treatment which was statistically similar with all other treatments except control (Table 1). The highest cane height (3.16 cm) was recorded from the treatment T_4 and the lowest (2.29 cm) was from control. Receiving full-recommended dose of N from USG in two splits further produced the highest cane yield of 63.96 TCH, which was statistically identical with other treatments except T_6 and control. The present results corroborate the findings of Kadam *et al.* (2001) who found that application of USG up to 70 per cent of the recommended dose of N significantly increased sugar and sugarcane yields compared to prilled urea.

Cost and return analysis

In both the cropping seasons of 2005-06 & 2006-07, the highest gross margin of Bangladesh Taka (BDT) 85,925 and BDT 74,682 ha^{-1} were obtained from T_4 respectively (Table 2). The T_2 treatment showed second highest gross margin of BDT 79, 493 and BDT 73, 241 ha^{-1} respectively. Again the highest MBCR (5.28 and 4.06) was obtained from T_4 in both the crop season respectively. On the other hand the second highest MBCR of 4.47 and 3.87 was recorded in T_6 and T_2 treatments, respectively for the two seasons.

Soil fertility status

The initial soil of the experimental field had pH 5.5, Organic Carbon 1.40 %, total N 0.09%, available P 22.0 μg g^{-1}, exchangeable K 0.13 meq 100^{-1} g soil and available S 18.00 μg g^{-1} (Table 3). A slight increasing trend was observed for total N content in soil after harvest of the crop grown with N-fertilizers. However all other soil parameters were nearly unchanged.

Thus, it may be concluded that the application of N from urea super granule (USG) with full recommended dose in two splits would increase 2-7% higher sugarcane yield. It further demonstrated that higher gross margin of Bangladesh Taka 1441 to 6,432 ha^{-1} over recommended prilled urea is obtained in two consecutive seasons at Old Himalayan Piedmont Plain soils in Bangladesh (AEZ 1) .

Table 1. Cane yield and other parameters as affected by source and rate of N fertilizer

Cropping year	Treatment	Tiller ($x\ 10^3 ha^{-1}$)	Millable cane ($\times 10^3$) ha^{-1}	Height (m)	Girth (cm)	Brix (%)	Yield (TCH)
2005-2006	T_1	86.3 d	42.4 c	1.90 b	1.97	16.87	29.67c
	T_2	146.6 b	75.4 ab	2.60 a	2.27	17.37	67.70ab
	T_3	135.6 c	73.8ab	2.67 a	2.33	17.80	65.13 b
	T_4	162.1 a	79.2 a	2.77 a	2.27	17.83	72.70 a
	T_5	153.8 ab	74.4ab	2.73 a	2.17	18.47	66.37 b
	T_6	144.8 bc	76.3ab	2.80 a	2.30	18.07	67.03 b
	T_7	158.7 a	72.43 b	2.90 a	2.27	18.23	63.70 b
	T_8	160.4 a	74.9ab	2.80 a	2.23	18.23	65.27 b
	LSD (0.01)	10.56	6.205	0.5156	NS	NS	5.427
2006-2007	T_1	77.7 b	50.00 b	2.29c	1.96	17.05	28.18 c
	T_2	149.2 a	87.50 a	2.93ab	2.17	17.73	62.84 ab
	T_3	142.8 a	81.25 a	2.78b	2.22	17.82	59.65 ab
	T_4	159.86a	88.61 a	3.16a	2.26	17.71	63.96 a
	T_5	152.99a	87.08 a	2.88ab	2.24	17.78	61.60 ab
	T_6	142.08a	88.47 a	3.04ab	2.24	17.26	56.18 b
	T_7	157.91a	88.33 a	2.88ab	2.16	17.19	61.18 ab
	T_8	159.58a	87.08 a	3.05ab	2.20	17.69	59.65 ab
	LSD (0.01)	19.96	10.42	0.3589	NS	NS	7.432

Table 2. Cost and return analysis of different nutrient management for sugarcane

Treatment	Gross Return (Tk ha^{-1})	Fertilizer cost (Tk ha^{-1})	Total variable cost (Tk ha^{-1})	Gross Margin (Tk ha^{-1})	MBCR
2005					
T_1	38168	-	40790	38186	-
T_2	87089	7596	51686	79493	4.44
T_3	83783	7596	49486	76187	4.00
T_4	93521	7596	50586	85925	5.28
T_5	85378	7420	49310	77958	4.36
T_6	86227	7420	50410	78807	4.47
T_7	81944	7258	49148	74686	4.06
T_8	83963	7258	50248	76705	4.31
2006					
T_1	36251	-	40790	36251	-
T_2	80837	7596	51686	73241	3.87
T_3	76734	7596	49486	69138	3.33
T_4	82278	7596	50586	74682	4.06
T_5	79242	7420	49310	71822	3.80
T_6	72270	7420	50410	64850	2.85
T_7	78702	7258	49148	71444	3.85
T_8	76734	7258	50248	69576	3.60

Price of fertilizer (Tk per kg): Urea-6.80; USG-8.50; TSP-14.0; MP-14.0; Zypsum-4.0; Zinc sulphate-35, Price of cane (Tk per ton): 1286.40

Table-3. Status of initial and post harvest soil as affected by different fertilizer management options

Treatment	pH	OC %	Total N %	Available P ($\mu g\ g^{-1}$)	Exchangeable K (meq 100^{-1} g soil)	Available S ($\mu g\ g^{-1}$)
Initial soil	5.50	1.40	0.09	22.0	0.13	18.0
Post harvest soil						
T_1	5.70	1.35	0.08	20.0	0.12	13.0
T_2	5.90	1.39	0.12	21.0	0.15	16.0
T_3	5.80	1.30	0.09	20.0	0.12	17.0
T_4	5.51	1.36	0.09	20.0	0.14	15.0
T_5	5.57	1.36	0.08	21.0	0.13	16.0
T_6	5.36	1.40	0.10	21.0	0.15	18.0
T_7	5.47	1.36	0.10	20.0	0.15	17.0
T_8	5.35	1.36	0.08	20.0	0.15	16.0

REFERENCES

Kadam, J. R. 2001. Efficient Use of NPK Fertilizer Briquettes on the Yield and Quality of Crops. *Indian Sugar*, **51**: 115-118.

Quayyum, M. A., Choudhury, D. A., Hossain, M. A. Hasan, M. K. 2006. Effect of Urea Super Granule (USG) as A Source of Nitrogenous Fertilizer on Upland Vegetables and Fruits. Research Highlights and Mature Technologies, Integrated Soil Fertility and Fertilizer Management Project Phase II (1999-2000 to 2005-06), pp. 24-26 (Unpublished).

Youngdahl, L. J., Lupin, M. S. and Crasswell, E. T. 1986. New Developments in Nitrogen Fertilizers for Rice. *Nutrient Cycling in Agroecosystems*, **9** (1-2): 149-160.