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Effects of Nitrogen on Growth, Yield and Sucrose content of Transplanted Sugarcane under Tista Meander Flood Plain Soils of Bangladesh

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ABSTRACT

An experiment was conducted to study the effects of nitrogen on different growth prameters of transplanted sugarcane under Tista meander flood plain soils of Rangpur, Bangladesh. Nitrogen was applied @ 120,160,200 and 240 kg/ha from urea. All the levels of nitrogen produced significantly higher yield of cane compared to control. Application of 160 kg N/ha produced significantly higher number of tillers, millable canes and yield of cane and sugar over control. Further increase in the level of N 200 and 240 kg N/ha reduced sugarcane yield compared to lower rate 160 kg N/ha. The cane yield were 35.1 and 41.9% higher over control was also found with the same treatment 160 kg N/ha in the 1st and 2nd year respectively. Nitrogen did not show any positive effect on percentage recoverable sucrose content.

INTRODUCTION

Sugarcane is a long duration exhaustive crop. Balance fertilization is a prerequisite for obtaining optimum yield potential of any crop. Nitrogen is an important element for sugarcane nutrition. It influences the vegetative growth of the plant. Standford and Ayers (1969) reported that sugarcane requires 1 kg N for each metric ton of millable cane. Therefore, additional nitrogen is required for growth and development and to supplement losses of N from soil through leaching, denitrification, volatilization etc. The rate of nitrogen application varies from place to place on the basis of soil fertility, productivity and agro climatic conditions (Sing & Sing, 1972).

Chowdhury *et al.* (1982) reported that the highest yield of cane was obtained at 120 kg N/ha in Ganges river flood plain soil. Boramanikar and Borale (1983) obtained the highest result from timely application of 250 kg N/ha. Yadav (1980) observed that higher cane yield was obtained when applied 150 kg N/ha in Uttar Pradesh and 120 kg N/ha in Bihar, India. The recommended dose of Nitrogen fertilizer application for sugarcane in Bangladesh is 125 kg N/ha (Ali, 1974). Most of the experiments in Bangladesh were conducted following conventional method of sugarcane planting Now-a-days spaced transplanting technique (STP) of sugarcane plantation is gaining popularities among the sugarcane growers of Bangladesh due to production of higher number of millable stalks than conventional planting technique, which ultimately gives higher tonnage and return. Investigation on the requirement of Nitrogen nutrition for STP cane has not yet been conducted. In Bangladesh a significant quantity of sugarcane is produced in Tista meander flood plain soils. Considering the above situation, the present studies were conducted with a view to findout the N fertilizer requirement for spaced transplanted sugarcane in this soil type.

MATERIALS AND METHODS

Field experiments were conducted in growers field condition in Tista meander flood plain soils of Rangpur, Bangladesh. Major properties of soils collected at a depth of 30 cm before planting were studied and presented in the Table 1. Five treatments were tested in randomized complete block design with four replications and the plot size was 6m x 8m. Six weeks old two budded soil bed settlings of variety Isd-16 were transplanted during mid October. The treatments were as follows:

T_1 — 0 kg N/ha
T_2 — 120 kg N/ha
T_3 — 160 kg N/ha
T_4 — 200 kg N/ha
T_5 — 240 kg N/ha

Table 1. Major physico chemical-properties of preplanting experimental plots.

Crop years	Texture	pH	Total (N%)	Available P (ppm)	Exchangeable K (meq%)	Available S (ppm)
1st year	sandy loam	6.9	0.05	13	0.09	26
2nd year	Sandy loam	6.6	0.07	16	0.12	24

Recommended rate of P, K, S and Zn were also used in the experiments at the rate of P_2O_5 - 100 kg, K_2O - 120 kg, S-30 and Zn 10 kg/ha. The sources of N, P, K, S and Zn were urea, Triple super phosphate, Muriate of potash, Gypsum and Zinc sulphate respectively. Full dose of P, S and Zn were applied at the time of transplanting. Nitrogen and Potash were applied in three equal instalments at 20, 90 and 150 d after transplanting.

Soil texture was determined by the hydrometer method, pH by glass electrode pH meter and total nitrogen by macro Kjeldahl method. Available P was determined by using 0.05 M $NaHCO_3$ extraction and spectrophometer. Exchangeable K (NH_4OAC extractable) was determined by flame photometer and available S was determined by turbidimetric spectrophotometer method (Black, 1965).

RESULTS AND DISCUSSION

The salient results on the yield and yield contributing parameters of sugarcane are presented in the Table 2. Number of tillers increased with the increasing level of nitrogen upto 160 kg N/ha in both the years but further increase in the level of N did not show any effect on tiller production. Application of nitrogen from 120 - 160 kg N/ha significantly increased the number of millable cane in both the years, but further increase in the level of N upto 240 kg N/ha did not show any beneficial increase on the number of millable canes. Due to tiller mortality, number of millable canes, is always less than tillers. Similar observation was made by Rahman *et al.* (1989).

All the Nitrogen levels produced significant higher yield of cane compared to control. The highest yield of cane was found with the treatment 160 kg N/ha in both the years. Further addition of Nitrogen (200 and 240 kg N/ha) reduced sugarcane yield

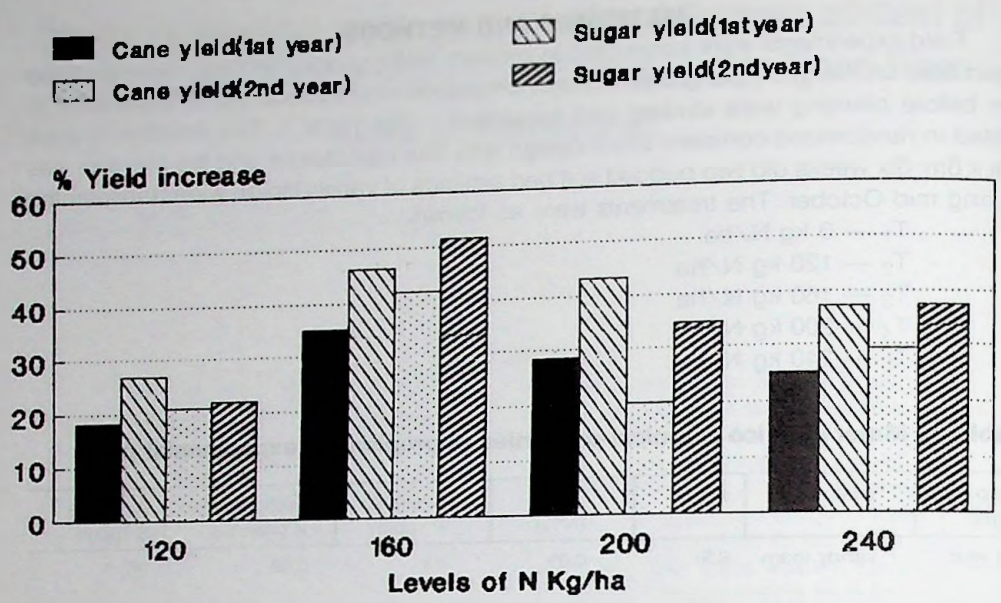

Figure 1. Cane and sugar yield increase over control with different levels of N-fertilizer.

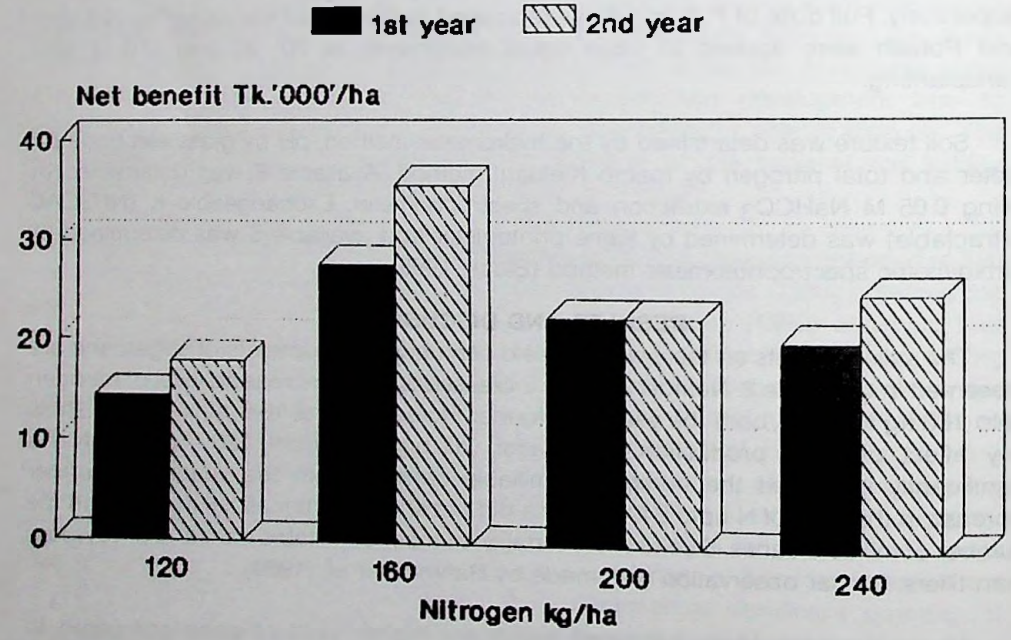

Figure 2. Monetary benefit of different levels of nitrogen fertilizer.

Table 2. Effects of different levels of nitrogen on yield and yield contributing parameters of spaced transplanted sugarcane.

Crop years	Treatments (kg/ha)	No of Tillers /ha (000)	No. of Millable canes /ha (000)	Yield of cane (TCH)	Recovery (%)	Yield of sugar (TSH)
1st year	N-0	190.1 a*	76.1 c	78.1 c	8.6 a	6.7 c
	N-120	209.6 a	82.2 bc	92.4 b	9.2 a	8.5 b
	N-160	214.1 a	100.0 a	105.5 a	9.3 a	9.8 a
	N-200	195.2 a	94.0 ab	100.4 ab	9.6 a	9.6 a
	N-240	202.1 a	90.1 abc	97.8 ab	9.4 a	9.2 ab
2nd year	N-0	173.5 c	66.6 d	84.4 c	8.6 a	7.2 d
	N-120	206.7 a	83.3 ab	102.1 b	8.6 a	8.8 c
	N-160	216.9 a	85.9 a	119.8 a	9.1 a	10.9 a
	N-200	190.4 b	75.2 c	106.6 b	9.1 a	9.7 bc
	N-240	213.3 a	81.7 ab	109.0 b	9.1 a	9.9 b

* Figures accompanied by the same letters are not significantly different at 0.05 level as per DNMR test.

compared to 160 kg N/ha. Similar results were obtained by Srinivas (1984). The increase in cane yield over control with the treatment 160 kg N/ha was 35.1 and 41.9 % for the 1st and 2nd year respectively (Figure 1). Chowdhury *et al.* (1982) reported that yield increases by 26% over control due to application of 120 kg N/ha. As other fertilizer like P, K, S and Zn were used in a fixed dose, it is assumed that higher dose of N after a certain level (N 160 kg N/ha) without increase of other fertilizers decreased yield and yield contributing parameters. Moreover, Table 1 indicates that most of the nutrient status initially present in the soil was below critical level for the growth and production of sugarcane. Disproportionate increase of N without increase of other nutrients failed for the crop to respond favorably to increased N after a particular level. Nitrogen fertilizer had no significant positive influence on percentage recoverable sucrose content. However, application of N fertilizer showed a significant positive influence on yield of sugar. The highest sugar yield was recorded with the treatment N 160 kg/ha in both the years. Sugar yield increased for this treatment over control was 46.3 and 51.4% for the 1st and 2nd year respectively (Figure 1).

Results revealed that Nitrogen application at different levels increased the cane yield differently (Table 2). Among the Nitrogen treatments, 160 kg N/ha gave the highest benefit over other N treatments and control (Figure 2). Higher dose of N (200 & 240 kg/ha) appeared to be uneconomical. Application of 160 kg N/ha is suitable and economical and may be recommended for Tista meander flood plain soils of Rangpur, Bangladesh.

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