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Effects of Potassium on the Growth, Yield and Recovery of Sugarcane Variety L. Jaba - C

M. M. Kabir and G. K. Bose[1]
Department of Agronomy,
Rangpur Sugar Mills Limited,
Mahimaganj, Gaibandha, Bangladesh.

ABSTRACT

An experiment was conducted in RCB design with five treatments (0, 60, 120, 180 and 240 kg K_2O/ha), replicated four times at the farmers' field of Rangpur Sugar Mills (RSM). The objective was to find the effect of different levels of K fertilizer on the growth, yield and recovery of sugar of recommended cane variety L.Jaba-C. The initial soil (plough layer) analysis of the experimental field shows that it is slightly acidic in nature (pH 6.7), contains poor OM (0.59%), poor total N (0.071%), poor available N (NH_4-N 23 ppm), Zn (0.85 ppm) and poor B (0.3 ppm). The soil contains 0.23 meq/100 g soil of exchangeable K which is below critical level (CL) for cane cultivation. Significantly higher cane yield and increased recoverable sugar yield were obtained when 180 kg K_2O/ha was used.

INTRODUCTION

The sugarcane plant, *Saccharum officinarum*, has been described as the most storer of the sun's light. This rapidly growing perennial grass requires large amounts of potassium (K) to produce optimum cane yields and sugar. In our country, specially in Rangpur Sugar Mills (RSM) the L. Jaba-C recommended cane variety is usually harvested 12 to 16 months after planting except in a few cases. Growth of sugarcane plant, sucrose formation and storage is controlled by nutrition, water relationships and of course climatic factors. In plant, K plays the main role of an enzyme activator.

Soils constituted the unique habitat of all cultivated crops. Plants rely on soil for mechanical support and nutrients. Potassium is one of the major of the 16 nutrient elements needed in sufficient and balance amounts for sugarcane to grow normally. Arzola *et. al.* (1985) reported and recommended that no K should be applied when the soil content exceeded 0.33 meq/100 g. Alexander (1973) quoted that several authors found an apparent relationship between K deficiency and low sugarcane yields. Humbert (1962) observed that K-deficient cane had low sucrose contents. In RSM a vast area of cane growing soils are covered with light texture and low fertility. In such a soil loss of applied K is very high due to leaching by rain, flood and irrigation water, which severely affect the cane production. Therefore, an experiment was conducted to find the response of K-fertilizer to sugarcane variety L. Jaba-C at RSM zone.

MATERIALS AND METHODS

The experiment was conducted in the farmers' field at Chapriganj (Gabindaganj) of the RSM zone to determine the response of K-fertilizer to the recommended variety L. Jaba-C of that particular Agro-Ecological zone (AEZ) situation. The Experiment was set

1 : Senior Scientific Officer, Agricultural Statistics Division, BRRI, Joydebpur, Gazipur.

up following randomized complete block (RCB) design with four replications. The unit plot size was 8 x 6 m. The treatments used were :

T_0 : Control (0 kg K_2O)
T_1 : 60 kg K_2O/ha
T_2 : 120 kg K_2O/ha
T_3 : 180 kg K_2O/ha
T_4 : 240 Kg K_2O/ha

The source of K_2O is muriate of potash.

The blanket dose of nitrogen (N) from urea, phosphorus (P_2O_5) from TSP and sulfur (S) from gypsum were applied at the rate of 128.44 kg, 88.92 kg and 32.11 kg per hectare respectively.

The whole amount of P and S, and one third of N and K were applied in the trenches as basal dose before transplanting of the settlings. The remaining amount of N and K were applied in two equal splits, at maximum tillering stage and at the time of earthing up. Row to row and plant to plant distance was maintained 90 and 45 cm respectively. Forty five days old settlings were transplanted. Intercultural operations and proper pest and disease control measures were taken as and when necessary. Tiller number per clump at maximum tillering stage, plant height, number of millable canes, yield of cane and recoverable sugar content at harvest were recorded.

Soil Sample Collection : Approximately 2 kg dry composite soil (20 cm depth) sample was collected before setting up the experiment. The collected soils were dried, mixed thoroughly and chemical analyses were done from BARI Soil Science Laboratory at Gazipur.

RESULTS AND DISCUSSION

Table 1 shows initial soil chemical properties of the experiment. It is revealed from the table that the soil is slightly acidic (pH 6.7), poor organic matter (0.69%), both poor total N (0.071%) and available N (23.00 ppm NH_4-N); poor available B (0.30 ppm) and poor available Zn (0.85 ppm) contents. The soil contains 0.23 meq/100 g of exchangeable K which is below critical level (Critical level = 0.33 meq/ 100 g of exchangeable K) for cane cultivation (Moberly, 1982). Arzola *et al.* (1985) reported from 35 field experiments results that no K should be applied when the soil contents exceeded 0.33 meq/100 g soil. For rice soils the critical level of NH_4-N, Boron and Zn are 75 ppm, 4 ppm and 1 ppm, respectively (Ponnamperuma *et al.* 1982). Table 2 shows the yield and yield contributing factors and percentage recovery of sugar as influenced by different levels of K-fertilizers. At maturity the plant height ranged from 3 m in the K control plot to 3.5 m when K was applied @ 240 kg K_2O/ha. A significant increase of plant height was recorded for the higher doses of K treatment over control plots. At the maximum tillering stage the tiller number varied from 8.2 (0 kg K_2O/ha) to 10.1 (180 kg K_2O/ha). In this tillering stage significant increase of tiller number over control was observed but effect of different doses of K_2O are not statistically significant.

Table 1. Some chemical properties of the experimental soil (air dried), Chaprigonj (Gabindaganj), Mahimaganj, Gaibandha.

Sl. No.	Chemical properties*	Value
1.	Soil pH (1 : 1; Soil : Water)	6.70
2.	Organic matter (%)	0.59
3.	Total N (%)	0.07
4.	NH_4-N (ppm)	23.00
5.	Available P (ppm)	16.00
6.	Exchangeable K (meq/100 g)	0.23
7.	Exchangeable Ca (meq/100 g)	2.80
8.	Exchangeable Mg (meq/100 g)	1.86
9.	Available Fe (ppm)	272.00
10.	Available Zn (ppm)	0.85
11.	Available Mn (ppm)	58.00
12.	Available Cu (ppm)	3.00
13.	Available B (ppm)	0.30
14.	Available SO_4-S (ppm)	35.00

* Soil analysis was done at BARI Soil Science Laboratory, Gazipur.

Table 2. Effects of different rates of potassium on the plant height, tiller production, total millable cane production, cane yield and recovery percent of sugar of L. Jaba-C grown in the farmers' field at Chaprigonj (Gabindagonj) of Rangpur Sugar Mills Zone, Mahimaganj, Gaibandha.

Treatments	Plant height at harvest (m)	No of tiller/ Clump in May.	Millable Cane ($x10^3$/ha)	Cane yield (t/ha)	Recovery (%)
T_0	3.0 b*	8.2 b	73.1 b	127.9 a	8.8 a
T_1	3.3 ab	9.5 a	83.6 ab	133.2 bc	8.9 a
T_2	3.3 ab	9.9 a	90.9 a	137.9 ab	8.9 a
T_3	3.2 ab	10.1 a	92.3 a	153.6 a	9.1 a
T_4	3.5 a	10.0 a	91.6 a	145.6 ab	9.0 a
CV (%)	6.0	8.1	9.7	8.1	8.5

* Means followed by same letter(s) in the same column are not significantly different according to DMRT.

The highest $9.2 \times 10^3 ha^{-1}$ and the lowest $7.3 \times 10^3 ha^{-1}$ millable cane were observed in the plot where 180 kg K_2O/ha treated and untreated K plots respectively. A significant increase in millable cane was observed with the various level of K-application over control plot except for the lowest doses of K-treatment. The effect of K treatment was more pronounced in case of cane yield. The highest and lowest yields of 153.6 t/ha and 127.9 t/ha were recorded for the K-treated plot (180 kg K_2O/ha) and control plot respectively. Cane yield was increased with the increase of K-levels except for the highest dose of K. But the insignificant increase over control was observed for 60 kg/ha of K_2O. Though cane yield obtained from 240 kg/ha is lower than that of 180 kg/ha of K_2O but this is not statistically significant. The highest recovery percent of sugar (9.1%) were obtained when K was applied at the rate of 180 kg K_2O/ha. Recovery percent of sugar for all the treatments were higher than that of control but which were not statistically significant. One light texture soils, where the leaching loss of N and K is a problem, application of K at the rate of 180 kg K_2O/ha in three equal splits such as 1/3 basal, 1/3 at tillering, and 1/3 during earthing up increases sugarcane yield and percent sugar recovery.

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