Effects of Potassium on Yield of Sugarcane in Tista Meander Flood Plain Soils of Bangladesh

S.M. Bokhtiar, M.A. Majid, F. Alam and S. Rahman
Sugarcane Research & Training Institute.
Ishurdi, Pabna, Bangladesh.

Received on 12.4.95

ABSTRACT

Field experiment was conducted in the Tista Meander Flood plain soils of Polashbari and Gobindaganj, Bangladesh to study the effects of various Potash levels on growth and yield of sugarcane. There was significant increase in millable cane and cane yield by potassium application. The highest cane yield was obtained at 200 kg K_2O ha^{-1} in both the locations but further increase of potash application decreased both millable cane and yield. The increase in yield at 200 kg K_2O ha^{-1} compared to control was 37.7% at Polashbari and 26.3% at Gobindaganj. The highest net benefit was also found with the same treatment.

INTRODUCTION

The role of potassium in increasing yield and quality of crops is well established. This element plays important role in sugarcane plant. Rathi and Singh (1983) reported that potassium increased sugarcane yield and improved juice quality. It hardens plant tissues and in cane, prevents easy lodging. By prevention of lodging, sugar content is increased (Parthasarathy, 1972). Potash requirement of sugarcane varies depending upon the replaceable potash content in soil (Chowdhury and Rahman, 1990; Chowdhury *et al.* 1991; Singh *et al.* 1992). Singh *et al* (1992) reported that potassium is able to reduce the fibre content which is desirable for increased sucrose percent in sugarcane. The requirement of potassium by sugarcane is twice that of nitrogen (Pataskar, 1972). Cane growing area of Tista meander flood plain soils specially Rangpur Sugar Mill zones of Bangladesh is covered with light texture and low fertility, which severely affects the cane production (Kabir and Bose, 1993). Considering the above facts, the present experiment was conducted to study the response of sugarcane to K fertilizer in Tista Meander Flood plain soils and to determine the optimum potassium requirement for sugarcane.

MATERIALS AND METHODS

Field experiment was conducted in Tista Meander flood plain soils of Polashbari and Gobindaganj in farmers field during 1990-91 cropping season. Experiment was set up following randomized complete block design with three replications. The treatments used were 0,100, 150, 200, 250, 300 and 500 kg K_2O ha^{-1}. Plot size was 8mX6m. One month old single budded polybag settlings of sugarcane variety Isd 16 were transplanted in the month of November. In each plot 200 kg N, 150 kg P_2O_5, 40 kg S and 10 kg Zn ha^{-1} were applied in the form of urea, TSP, gypsum and Zinc sulphate respectively. After final land preparation full doses of TSP, Sulphur and Zinc were applied in trench before transplanting. One third of nitrogen and half of potassium were applied as top dressing

after 30 d of transplanting. Rest of Nitrogen and Potassium were applied in two equal installments within 100 d and 150 d after transplanting. All normal cultural practices appropriate to crop were done timely. Tiller, millable cane and yield of cane were recorded. Physical and chemical properties of soils of the experimental field (collected from a depth of 0-15 cm) were analysed which have been shown in Table 1.

Table 1. Physical and chemical characteristics of initial soils.

	Soil Characteristics	Content	Methods
a)	Physical Characteristics Textural class	Sandy Loam	Hydrometer
b)	Chemical characteristics pH	6.3	Glass electrode pH meter
	Total nitrogen (%)	0.06	Kjeldahl method
	Organic Carbon (%)	0.29	Walkley and Black
	Available P (ppm)	45	0.5M $NaHCO_3$ extraction
	Exchangeable K(meq/100g Soil)	0.06	1M NH_4Ac extraction
	Available S (ppm)	5.6	NH_4Ac turbidimetric method

RESULTS AND DISCUSSION

The results of the experiment have been shown in the Table 2. Tiller production of sugarcane was not affected by potash application and the treatment differences were statistically insignificant. Verma *et al.* (1964) showed insignificant effect of K on total plants and tillers. Number of millable cane was increased significantly at both locations and the highest number of millable cane was obtained at 200 kg K_2O ha^{-1} application and higher doses of K did not increase the millable cane. Khondaker *et al.* (1989) reported significantly higher number of millable cane when potash @ 160 kg ha^{-1} applied. Yield of sugarcane was significantly affected due to application of potash in soil (Table 2). The highest cane yield was recorded at 200 kg K_2O ha^{-1} in both the locations but beyond that dose yield gradually decreased. Etwali and Gascho (1983) reported that higher rate of K_2O (678 kg ha^{-1}) reduced sugarcane yield and significantly higher cane yield was found at 339 kg K_2O ha^{-1} level compared to control. The yield increase due to application of 200 kg K_2O ha^{-1} compared to control was 37.7% and 26.3% in Polashbari and Gobindaganj respectively (Figure 1). Kabir and Bose (1993) showed that potash application @ 180 kg K_2O ha^{-1} gave 25.7 t ha^{-1} higher yield over control at farmers field of Rangpur Sugar Mills (RSM) area. Application of 250, 300 and 500 kg K_2O ha^{-1} failed to further increase in millable cane and cane yield compare to 200 kg K_2O ha^{-1} at both the locations. The chemical analysis of initial soils shows that soils of the experimental plot contains low potash (0.06 m.e/100g soil) which assumes a definite response of potash application. Yield obtained in this study shows that soil contains 0.06 m.e/100 g soil replaceable K requires 200 kg K_2O ha^{-1} application in obtaining desired sugarcane yield. Chowdhury *et al* (1991) reported that when replaceable potash was 0.15 to 0.22 m.e/100 g soil in Old Himalayan piedmont soil. required 110 kg K_2O ha^{-1} to obtain maximum yield.

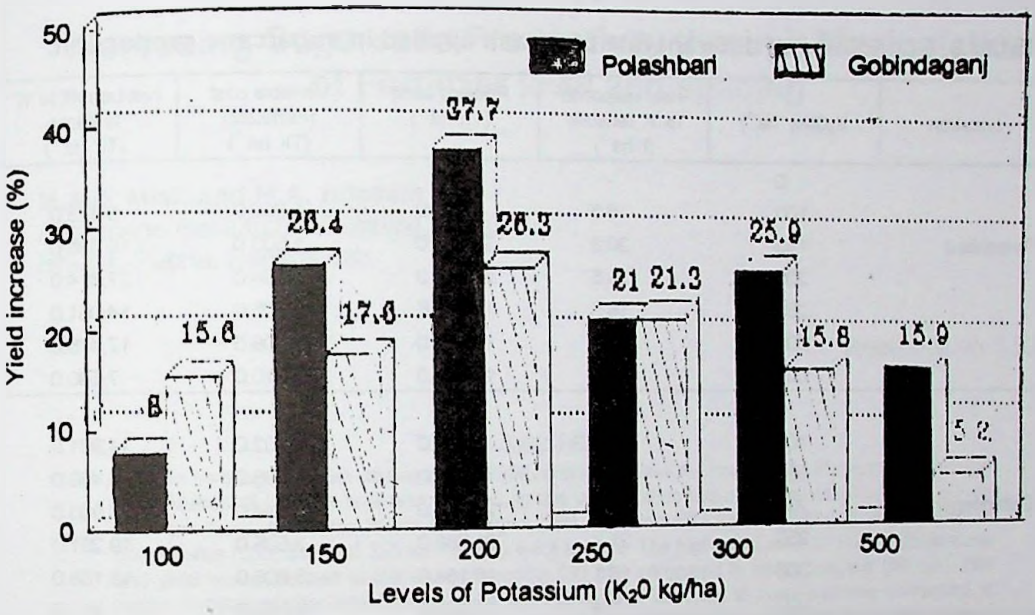

Figure 1. Yield increase (%) with different doses of potash fertilizer.

Table 2. Effects of different levels of potash on yield and yield contributing parameters of sugarcane.

Location	Treatment (K_2Okg ha^{-1})	Number of Tiller ($X10^3$ ha^{-1})	Number of millilable cane ($X10^3$ ha^{-1})	Yield of cane (TCH)	Recovery (%)
Polashbari	0	128.9 a	83.3 c	78.5 d	8.7 d
	100	132.8 a	86.5 bc	84.8 c	8.9 cd
	150	128.1 a	90.8 ab	99.3 b	9.7 ab
	200	145.1 a	96.4 a	108.1 a	10.0 a
	250	139.7 a	86.9 bc	95.0 b	8.9 cd
	300	129.0 a	86.2 bc	98.9 b	9.3 bc
	500	126.0 a	86.3 bc	91.0 b	8.8 cd
Gobindaganj	0	167.2 a	90.5 b	101.7 e	9.0 a
	100	184.5 a	95.8 ab	117.6 c	8.3 a
	150	199.3 a	92.6 ab	119.6 c	9.1 a
	200	216.9 a	98.5 a	128.5 a	9.4 a
	250	196.4 a	93.6 ab	123.4 b	8.9 a
	300	210.8 a	94.3 ab	117.8 c	8.6 a
	500	199.3 a	97.1 a	107.0 d	8.3 a

Figures in a column with same letter do not differ significantly at the 0.05 level as per DNMR test.

Sugarcane response to potash fertilizer and its economical analysis are presented in Table 3. The highest net benefit was obtained at 200 kg K_2O ha^{-1} over other treatments in both the locations. From the field experiment carried out in both the locations it may be concluded that 200 kg K_2O ha^{-1} should be applied to obtain economic yield of sugarcane in Tista Mender Floodplain soils.

Table 3. Economics of different rate of potash applied in sugarcane production.

Location	K_2O(kg ha^{-1})	Yield response to 'K' fertilizer (t ha^{-1})	Price of cane (Tk ha^{-1})	Variable cost (Fertilizer) (Tk ha^{-1})	Net benefit to 'K' fertilizer (Tk ha^{-1})
Polashbari	0	-	-	-	-
	100	6.3	6,325.0	1,002.0	5,323.0
	150	20.8	20,883.0	1,503.0	19,380.0
	200	29.5	29,618.0	2,004.0	27,614.0
	250	16.5	16,556.0	2,505.0	14,051.0
	300	20.4	20,481.0	3,006.0	17,475.0
	500	12.5	12,550.0	5,010.0	7,540.0
Gobindaganj	0	-	-	-	-
	100	15.9	15,963.0	1,002.0	14,961.0
	150	17.9	17,971.0	1,503.0	16,468.0
	200	26.8	26,907.0	2,004.0	24,903.0
	250	21.7	21,786.0	2,505.0	19,281.0
	300	16.1	16,164.0	3,006.0	13,158.0
	500	5.4	5,421.0	5,010.0	411.0

Price of cane = Tk 1004 ton^{-1} , Cost of MP fertilizer = Tk. 6.00 kg^{-1}

REFERENCES

Chowdhury, M.K.A. and Rahman, M.H. 1990. Potash requirement of sugarcane in Gangetic river flood plain soils of Bangladesh. *Indian J. Soil Sci.*, **38**: 688-691.

Chowdhury, M.K.A.; Rahman, M.H. and Majid, M.A. 1991. Effect of Potash on the growth and yield of sugarcane in the old Himalayan piedmont plain soils. *Pakistan J. Agric. Res.* **12**: 183-187.

Etwali, A.M.O and Gascho, G.J. 1993. Sugarcane response to P.K. and DRIS corrective treatments on Florida Histosols. *Agron J.*, **75** (1): 79-83.

Khondaker, M.; Shaheen, M. and Wahid-uz-Zaman, 1989. Influence of Potassium on yield and nutrient composition of sugarcane. *Bangladesh J. Sugarcane*, **11**: 64-71.

Kabir, M.M. and Bose, G.K. 1993 Effect of Potassium on the growth, yield and recovery of sugarcane variety L. Jaba-C. *Bangladesh J. Sugarcane*, **12-15**:22-25.

Pataskar, M.R. 1972. Some observation on the performance of promising varieties tested 1968-70. *Proc. 24th conv. DSTA*, pp. 49-60.

Pathasarathy, S.V. 1972. Sugarcane in India. K.C.P. LTD. Madras-6. p. 330.

Rathi, K.S. and Singh, R.A. 1983 *Coop. Sug.*, **14**:417.

Singh, K.D.N.; Jha, B.K., Mishra, G.K. and Samad, A. 1992. Effect of potassium on yield and quality of sugarcane of Calciorthent under drought condition. *J. Indian Soc. Soil. Sci.*. **40**: 105-110.

Verma, S.S.; Guzshami, M.A. and Jain, R.K. 1964. *Proc. All Ind. conf. res. dev. workers.* New Delhi. p. 349.