Bangladesh J. Sugarcane, 21 : 97-100 *July, 1999*

Fertilizer Requirement for Sustainable Sugarcane Production under different AEZs Condition

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Received on 25.2.98

ABSTRACT

Field experiments were conducted to find out and update the present fertilizer requirement of sugarcane in different AEZs for higher yield during 1996-97 crop season. Experiment were set up at Ishurdi, Rajshahi, Joypurhat, Thakurgaon and Sreepur covering four AEZs, namely, High Ganges River Floodplain, Tista Mender Floodplain, Old Himalayan Floodplain and Madhupur Tract. The treatments were arranged on the basis of previous fertilizer Recommendation Guide (1989 and 1997) and on the basis of soil analysis for targated yield of sugarcane. The highest cane yields of 98.8, 89.0, 102.0, 65.0 & 130.0 t ha^{-1} were recorded in High Ganges River Floodplain at Ishurdi & Rajshahi Tista Mender Floodplain at Jaipurhat; Old Himalayan Piedmont plain at Thakurgaon; and Madhupur Tract at Sreepur, when fertilizer were applied (T_5) respectively @ $N_{210}P_{64}K_{120}S_{20}Zn_3$, $N_{210}P_{64}K_{96}S_{20}Zn_3$, $N_{210}P_{53}K_{114}S_{20}Mg_{15}Zn_3$, $N_{210}P_{35}K_{120}S_{25}Mg_{20}Zn_3$, $N_{170}P_{40}K_{60}S_{30}Zn_3$ in different AEZs for high yield goal of sugarcane on the basis of soil analysis.

Key words : Fertilizer requirement, sustainable sugarcane, AEZs.

INTRODUCTION

Due to intensive cropping the inherent capacity of soil to supply nutrient is declining over a time. Therefore there is a need to add balanced nutrients through fertilizers in order to get desired yield. Response of a crop to add fertilizer nutrients depend on soil-crop-climatic variable and production practices. Nutrients requirement of sugarcane varies from place to place according to soil and climatic conditions (Davidson, 1962). Bangladesh, though a small country, has a wide diversity of soil due to complex nature of physiography, parent materials, land hydrology and drainage conditions. As a result, continuous changes are taking place in the soil fertility status due to organic matter depletion, soil, erosion, nutrient deficiency, drainage impedance, water logging followed by degradation of soil physical and chemical properties. Sugarcane needs larger amount of nutrients compared to other crops and this requirement is changing day by day in different agroeclogical zones for high yield goal of sugarcane. A crop producing 100 tons of cane per hectare might remove 370 kg potassium (Morachan, 1984). With the advancement of technology there would be a continuos need for updating the nutrient requirement of sugarcane. This experiment has been undertaken at different agroecological zones to find out the present nutrient requirement for sustainable sugarcane production.

MATERIALS AND METHODS

The experiment was conducted during 1996-97 crop season five sugarcane growing areas at Ishurdi, Rajshahi, Joypurhat, Thakurgaon and Sreepur, which cover four AEZs as high Ganges river floodplain, Tista meander floodplain, old Himalayan floodplain and Barind tract. Except Ishurdi, all the experiments were set up at farmers field condition. Soil samples were collected from each main plots before transplanting of sugarcane setts and later

analyzed for nutrient status. Soil pH was measured in soil : water suspension at 1:2.5 by glass electrode, total N by Kjeldhal method (Jackson, 1973); organic C by Wakly and Black wet oxidation method; available P ($NaHCO_3$ extractable) by standard ammonium molybdate method of Olsen; exchangeable K (NH_4OAc extractable) by flame photometer; and available S (NH_4OAc extractable) by turbidimetric method of Bardsley and Lancaster (Black, 1965).

Table 1 . Initial soil analysis.

Location	pH	OM (%)	Total N (%)	Avail.P (ppm)	Exch K (meq %)	Avail. S (ppm)	Avail. Zn (ppm)
Ishurdi	7.8	0.40	0.40	6	0.16	15.0	1.5
Rajshahi	7.8	1.01	0.06	6	0.20	19.0	1.2
Jamalpur	6.5	0.74	0.06	10	0.12	17.0	1.2
Thakurgaon	5.5	0.80	0.80	22	0.15	25.0	0.5
Sreepur	5.5	1.81	0.10	20	0.23	37.0	1.0

The treatment were as follows :

T_0- Control

T_1-Farmers practice

T_2-Fertilizer rate as per AEZ, FRG' 89

T_3-Fertilizer rate as per AEZ, FRG'97

T_4-Fertilizer rate based on soil analysis (MYG 80 ± 8)

T_5-Fertilizer rate based on soil analysis (HYG 100 ±10)

Treatment details : Fertilizer rate (kg ha^{-1})

Sl. No.	Ishurdi	Rajshahi	Jaipurhat	Thakurgaon	Sreepur
T_0	-	-	-	-	-
T_1	$N_{100}P_{30}K_{60}S_{20}$	$N_{110}P_{25}K_{65}S_{20}$	$N_{90}P_{35}K_{70}S_{20}$	$N_{100}P_{35}K_{80}S_{30}$	$N_{95}P_{25}K_{85}S_{25}$
T_2	$N_{160}P_{47}K_{90}S_{40}Zn_3$	$N_{160}P_{47}K_{90}S_{40}Zn_3$	$N_{160}P_{43}K_{100}S_{30}Zn_4$	$N_{160}P_{50}K_{125}S_{40}Zn_5$	$N_{160}P_{50}K_{136}S_{30}Zn_4$
T_3	$N_{130}P_{35}K_{60}S_{20}Zn_3$	$N_{130}P_{35}K_{60}S_{20}Zn_3$	$N_{120}P_{40}K_{75}S_{20}Mg_{15}Zn_2$	$N_{120}P_{35}K_{100}S_{25}Mg_{20}Zn_2$	$N_{120}P_{40}K_{100}S_{30}Zn_2$
T_4	$N_{145}P_{44}K_{84}S_{20}Zn_3$	$N_{145}P_{44}K_{67}S_{20}Zn_3$	$N_{145}P_{37}K_{100}S_{20}Mg_{15}Zn_3$	$N_{145}P_{35}K_{88}S_{25}Mg_{20}Zn_3$	$N_{118}P_{40}K_{40}S_{30}Zn_2$
T_5	$N_{210}P_{64}K_{120}S_{20}Zn_3$	$N_{210}P_{64}K_{96}S_{20}Zn_3$	$N_{210}P_{53}K_{114}S_{20}Mg_{15}Zn_3$	$N_{210}P_{35}K_{120}S_{25}Mg_{20}Zn_3$	$N_{170}P_{40}K_{60}S_{30}Zn_3$

Treatment based on soil analysis were calculated on the basis of initial status of soil, another treatment based on farmers practice were fixed by collecting the rate of fertilizer used by the sugarcane growers (average of 40 growers) of that area. Fertilizer rate varies in different treatments in different locations as per treatment description.

Experiment were arranged in a randomized complete block design, maintaining a net plot size 8m x 6m. Two budded sugarcane settling of variety Isd 16, raised in soil bed were transplanted in November each year and harvested in December in the following year. P as triple super phosphate, S as gypsum and Zn as zinc sulfate were applied at a time in the trenches; N as urea and K as muriate of potash were applied in two splits, first after establishment of setts and second at tillering completion stage. Necessary intercultural operations and both chemical and mechanical control of insect pests were done as recommended practice.

RESULTS AND DISCUSSION

Application of fertilizer showed as a significant effect on different parameters of sugarcane like; tiller millable cane, yield and recoverable sucrose content of sugarcane (Table 2).

Table 2. Effect of fertilizer on different parameters of sugarcane.

Locations	Treatments /ha '000'	No. of tiller /ha '000'	No. of millable content (%)	Yield of cane (ton/ha)	Recoverable sucrose (%)
Ishurdi	T_0	150.8e*	50.0e	45e	9.00d
	T_1	202.0d	71.0d	65.0d	9.10ed
	T_2	251.0c	87.9c	81.0c	9.20bcd
	T_3	262.0bc	97.0b	91.0b	9.40bc
	T_4	272.0b	98.0b	92.0ab	9.5ab
	T_5	295.0a	105.0a	98.0a	9.80a
	LSD (P=0.05)	*14.36*	*6.505*	*6.679*	*0.3267*
Rajshahi	T_0	117.0e	40.9	38.0d	8.8e
	T_1	172.0d	62.0	57.0c	8.9bc
	T_2	234.0c	82.0	74.0b	9.0bc
	T_3	262.0b	92.0	84.0a	9.2abc
	T_4	265.0ab	93.0	84.0a	9.3ab
	T_5	285.0a	97.0	89.0a	9.6a
	LSD (P=0.05)	*21.05*	*NS*	*5.896*	*0.4368*
Jaipurhat	T_0	154.0d	54.0d	49.1	9.12
	T_1	229.0c	78.0c	71.0	9.20
	T_2	271.0b	95.0b	87.0	9.3
	T_3	291.0ab	105.0ab	96.0	9.5
	T_4	298.0a	106.0ab	97.0	9.6
	T_5	306.0a	112.0a	102.0	9.9
	LSD (P=0.05)	*22.02*	*11.5*	*NS*	*NS*
Thakurgaon	T_0	114.0e	39.0	36.0d	8.5
	T_1	131.0d	46.0bc	42.0cd	8.6
	T_2	148.0c	52.0b	48.0c	8.7
	T_3	180.0b	63.0a	58.0b	8.9
	T_4	191.0ab	65.0a	59.0ab	9.0
	T_5	206.0a	71.0a	65.0a	9.3
	LSD (P=0.05)	*15.26*	*8.788*	*6.018*	*NS*
Sreepur	T_0	176.0e	85.0e	77.0e	20.20e**
	T_1	198.0d	99.0d	91.0d	21.50
	T_2	207.0c	104.0cd	95.0c	22.30c
	T_3	219.0b	107.0bc	97.0c	22.60c
	T_4	220.0b	112.0b	115.0b	23.00b
	T_5	267.0a	125.0a	130.0a	23.40
	LSD (P=0.05)	*3.327*	*5.369*	*3.135*	*0.3567*

* Figures accompanied by the same letters in column are not significant at 5% level of probability as per DNMR test.
** Brix (%) in Sreepur location.

In all the locations significant higher number of tiller were recorded with T_5 treatments, where fertilizer were applied on the basis of soil analysis for high yield goal (HYG100 ±10). Compared to the control all the fertilizer treatments significantly produced higher tiller in all the location. This results agree with the findings of Majid *et al.* (1995), where they reported different NPKS rates significantly influence tiller production. Significant highest number of millable cane were produced with same treatment (T_5) except Rajshahi location. All the fertilizer treatment produced significantly higher yield of cane compared to the control except Jaipurhat location, where yield is also higher but not significant. However, the highest yield of cane 98.8, 89.0, 102.0, 65.0 & 130.0 t ha^{-1} were recorded at Ishurdi, Rajshahi, Jaipurhat, Thakurgaon and Sreepur respectively, when fertilizer were applied on the basis of soil ananlysis for high yield goal (HYG 100 ±10). In Thakurgaon location present fertilizer dose for sugarcane on AEZ basis achieved its target of yield (60 ±6), but target for MYG and HYG on the basis of soil analysis failed to achieve its target. In all the location AEZ based present fertilizer dose successfully achieve the target of yield. In all the location second highest yield was found with T_4 treatment where fertilizer were applied on the basis of soil analysis for moderate yield goal (MYG 80 ± 8). Compared to the control recoverable sucrose content is significant in Ishurdi, Rajshahi and Sreepur but in case of Jaipurhat and Thakurgaon it was insignificant. Danial *et al.* (1980) and Chowdhury *et al.* (1982) reported that fertilizer application did not show any significant effect on sucrose content of sugarcane.

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