Bangladesh J. Sugarcane,8 :31 - 35. July, 1986

Effect of NPKSZn Fertilization on Sugarcane in Calcareous soils

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ABSTRACT

An experiment was conducted during 1980-81 season in calcareous flood plain soils of Ishurdi to study the effect of Nitrogen, Phosphorus, Potassium, Sulphur and Zinc on the yield of sugarcane. Significant yield increase was recorded with the rates of nitrogen. Yield of cane and sugar was increased when 130 kg P_2O_5/ha was added with 120 kg N/ha, but the results were insignificant. Inclusion of 110 kg K_2O/ha with 120 kg N and 130 kg P_2O_5/ha did not show any positive response. 30 kg S and 4 kg Zn/ha applications had no significant effect on yield increase. The results showed that nitrogen had a prominent effect on yield in this soils.

INTRODUCTION

Nitrogen is of prime importance in the economic production of sugarcane (Parishar, 1971, and Wang, 1976). Roy *et. al.* (1975) found that sugarcane crop yielding 63.5 tons/ha remove 123.9 kg N/ha. So, replenishment of required amount of fertilizer is essential for maximum crop production. Some soils are deficient in phosphate, some in potash or both and therefore, require a balanced dose of fertilizer for optimum crop yield. Phosphorus plays a vital role in the maturity of plants and help to encourage early development of a vigorous root system. Kadian *et. al.* (1981) observed that the application of 50 kg P_2O_5/ha increased yield of cane significantly over control. Humbert (1962) stressed the necessity of keeping potasium levels in sugarcane field adequate to produce optimum yield and help to regulate maturity so that maximum sugar is recovered.

Like major elements, secondary and micronutrients also play a vital role for the production of sugarcane. Clements (1971) reported that sulphur deficiency was found, where soil pH ranged from 5.8 to 6.5 and long term use of chemical fertilizer contained no sulphur. Juang *et. al.* (1974) found beneficial effects of zinc application on yield and quality of sugarcane.

In Bangladesh, no work, has so far been carried out on the requirement of sulphur and zinc for sugarcane. The present investigation was therefore, undertaken to find out the effects of these nutrients on the yield of sugarcane in calcareous soils of Ishurdi.

MATERIALS AND METHODS

A field experiment was carried out in the calcareous soils of Sugarcane Research & Training Institute (SRTI) farm, Ishurdi in 1980-81 cropping season under rainfed conditions. Physical and chemical properties of soils of the experimental field is shown in Table 1. The experiment was laidout following randomized complete block design with eight treatments and replicated four times. The treatment combinations were as follows :

1. Control (No fertilizer applied)
2. N_1
3. N_2
4. N_2P
5. N_2PK
6. N_2PKS
7. N_2PKSZn
8. N_3PKSZn

Where;
N_1 - 60 kg N/ha from Urea
N_2 - 120 kg N/ha from Urea
N_3 - 180 kg N/ha from Urea
P - 130 kg P_2O_5/ha
K - 110 kg K_2O/ha from M. P.
S - 30 kg S/ha from Gypsum
Zn - 4 kg Zn/ha from Zinc oxide.

Table 1. Physical and chemical characteristics of soils of the experimental field.

Texture	pH	Total-N (%)	Organic-C (%)	Available-P (ppm)	Exch.-K (m.e./100 gm soil)	Available S (ppm)
Clay loam	7.8	0.066	0.68	5	1.02	11

After final preparation of the land, all P, S, Zn and half of total N and K were applied in the trenches at planting. The remaining half of N and K were applied at boom tillering stage (approximately 150 days after plantation). The plot size was 10m x 7m.

Row to row and plot toplot distance was 1.0 m. Variety Isd-2/54 was used in the experiment. The three-eyed setts were placed end to end in the trenches in November, 1980 and harvested in January, 1982. Intercultural operations were done as needed. Proper pest and disease control measures were taken in due time. Data on yield of cane and sugar were recorded.

Particle size distribution was determined by hydrometer method; soil pH was measured in soil: Water suspension at 1:2.5 by glass electrode. Total-N was determined by kjeldhal method (Jackson,1973) and organic carbon by Walkley and Black (1947) wet oxidation method. Available P ($NaHCO_3$ extractable) and total P (ternary acid digest) were determined by standard ammonium molybdate method of Olson's, while exchangeable K (NH_4OAc extractable) and total-K (ternary acid digest) by flame photometer (Black, 1965). The available-S (NH_4OAc extractable) and total-S (di-acid digest) by turbidemetric method of Bardsley (Black, 1965).

RESULTS AND DISCUSSION

Data on yield of cane and sugar have been presented in Table 2. The results show that the yield of cane and sugar significantly increased when 60 kg N/ha or more was added to the soil. There was little further increase in yield when 120 kg N/ha was applied in the soil, although the yield difference between 60 kg N and 120 kg N/ha was not significant.

Higher dose of nitrogen (N_3) alongwith PKSZn had no beneficial effects on yield of cane and sugar. Parishar (1971) also obtained higher yield of cane with 112 kg N/ha. It is evident from the data that cane yield were significantly increased with the addition of P over control and 60 kg N/ha. P-application also increased sugar yield, but the results were insignificant. Results indicate the clear effect of P in this soils. Thakur *et. al.*(1979) found a significant effect of P upto 100 kg P_2O_5/ha in normal caleareous soils of India. The yield of cane and sugar did not increase, even when 110 kg K_2O/ha was applied in combination with N_2P.The result fully agrees with the previous reports (SRTI Annual Report, 1979). Ali *et. al.* (1984) found depressed yield of wheat at Ishurdi when K was applied with NP. Application of sulphur in combination of NPK slightly increased yield of cane and sugar but did not differ significantly from the N_2 application. Positive response on yield was observed when 4 kg Zn/ha was added. However, Ahmed *et. al.* (1975) obtained beneficial effect of Zn on yield and quality of sugarcane when 2 kg Zn/ha was applied in the soil.

Table 2. Effects of N, P, K, S & Zn on yield of cane and sugar.

Treatment	Yield	
	TCH	TSH
Control	62.03 a*	7.25 a
N_1	81.63 b	9.69 b
N_2	90.37 bc	10.44 bc
N_2P	97.88 cde	11.57 bc
N_2PK	93.09 cd	10.57 bc
N_2PKS	100.87 cde	11.00 bc
N_2PKSZn	102.52 de	11. 76 c
N_3PKSZn	104.14 e	11.47 bc

* Figures in column(s) accompanied by similar letter(s) do not differ significantly at 0.05 level as per DNMR test.

No significant difference in sugar yield was obtained among the treatments 120 kg N/ha and 120 kg N/hain combination with P PK PKS or PKSZn. Table 2 shows that highest yield of sugar 11.76 Mt/ha was obtained when 4 kg Zn/ha applied along with NPK. It indicates the positive effect of zinc on sucrose content. The results of the study indicate that the soils of SRTI farm is highly deficient in Nitrogen. Phosphorus and zinc application also shows a positive effect on cane and sugar yield· but potash and sulphur application have no effect on yield.

Table 3 shows the levels of nutrient contents in the leaves of 5 months old sugarcane plants. Compared to control, a little increase in N content was obtained when 60 kg N/ha was applied in the soils. Further increase in N application did not increase N content of the plants. The yield obtained at 120 kg N/ha did not differ significantly from that of the yield obtained at 60 kg N/ha application. Table 3 also shows that N application did not increase P and K uptake in sugarcane. This indicates that increased

Table 3. Nutrient contents of cane leaves

Treatment	Total-N (%)	Total-P (%)	Total-K (%)	Total-S (%)
Control	1.36	0.055	0.95	0.13
N_1	1.50	0.059	0.96	0.15
N_2	1.51	0.056	0.98	0.15
N_2P	1.65	0.073	1.03	0.15
N_2PK	1.51	0.082	1.04	0.15
N_2PKS	1.53	0.064	1.11	0.18
N_2PKSZn	1.55	0.066	1.16	0.17
N_3PKSZn	1.61	0.063	1.12	0.18

yield mainly comes from N application. The application of P, K and S increased the contents of these elements but did not show any significant increase in the yield of cane and sugar. Therefore, it may be concluded that N application would be essential to obtain economic yield in this soil. It is also concluded that P and Zn helped to increased yield of cane and sugar at a certain level.

ACKNOWLEDGEMENT

The financial assistance is given by Bangladesh Agricultural Research Council, Dhaka is gratefully acknowledged. Sincere thanks are due to Mr. Abdul Ghafur, Associate Statistician for statistical analysis and Mr. Abdul Jabber, Associate Sugar Chemist for chemical analysis. The authors also gratefully acknowledge the help of Mr. Zulfiqul Alam for plant analysis.

REFERENCES

Ahmed, S. A.; Narasimhan, K. T.; Ramamoorthy, N.; Swayamprakasam, S. and Rajan, S. D. 1975. Studies on the efficiency of micronutrient application for sugarcane in the cuddalore tract. *Indian Sugar,* **25** (5): 395-399.

Ali, M. T.; Bhuiyan, B. H. and Razzaque, A. H. M. 1984. Yield response & fertilizer economy of a semidwarf wheat variety to fertilization on some soils of Bangladesh. *Proc.* International Symposium on soil test crop response correlation studies, Commission **IV,** *ISSS,* Dhaka . pp. 416-434.

Black, C. A. 1965. Method of soil analysis, Part-2. American Society of Agronomy. Inc. Pub. U. S. A. pp. 1022, 1102, 1370.

Clements, H. F. 1971. The crop logging system for sugarcane production. *Proc. ISSCT,* **14** : 657-672.

Humbert, R.P. 1962. Potash and sugarcane quality. *Proc. ISSCT,* **11** : 115–123.

Jackson, M.L.1973. Soil chemical analysis. Prentice Hall of India, P.R. Ltd, New-Delhi. 498p.

Juang, T.C. ; Isobe,M. and Uchera, G. 1974. Test for Zinc in sugarcane soils of Hawaii, *Proc. ISSCT,* **15** : 859-904.

Kadian, V.S. ; Srivastava, S.N.L. and Singh, V.R. 1981. Effect and quality of sugarcane. *Indian Sugar,* **31** (6) : 405-408.

Parishar, N.S. 1971. Nitrogen requirement of sugarcane in Rajasthan. *Indian Sugar,* **21** (8) : 555-558.

Roy, B.; Boshe, P.K. and Ashraf, A. 1975. Influence of nitrogen fertilization & Planting methods on yields & nutrient uptake in sugarcane. *Indian J. Agric. Sci.,* **20** : 133-136.

SRI Annual Report. 1979. Annual report of 1973-1978 (special issue). Sugarcane Research Institute, Ishurdi, Pabna, Bangladesh. pp.65-67.

Thakur, K. ; Bose, P.K. ; Sehi, B.P. and Raysharma, R.P. 1979. Response of sugarcane to nitrogen & phosphate in calcareous soils. *Indian Sugar,* **29** (5) : 277-280.

Wang, C.C. 1976. The effect of fertilizer application on sucrose content of sugarcane. *Taiwan Sugar,* **23** (4) : 167-171.