A STUDY ON THE EFFECT OF APPLICATION OF NPK FERTILIZERS ON GROWTH, YIELD AND SUCROSE CONTENT OF SUGARCANE

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SUMMARY

An experiment was conducted at Sugarcane Research Institute (SRI) farm during 1976-1977 cropping season with different levels of NPK fertilizers, using a factorial arrangement, in order to determine a suitable combination of these fertilizers for best growth, yield and % recovery of sugarcane. The levels were 0, 70, 110 lbs N/acre; 0, 110 and 150 lbs P_2O_5/acre and 0, 100 and 140 lbs K_2O/acre. Variety Co 1158 was used in the experiment and the treatment combinations numbering 36 were replicated thrice. The cane planted in November, 1976 and harvested in January, 1978 was grown under rainfed conditions.

N and P showed significant effects on germination, tillering, number of millable cane and yield of cane. Cane height has a significant increase but only due to application of N whereas P or K failed to do so. Application of K did not show any significant infllluence on any of the parameters studied. The highest yield of cane was obtained at $N_3P_2K_0$ treatment i.e. where 150 lbs N and 150 lbs P_2O_5 per acre with no K were applied. Percent recovery of sugar due to application of any combinations of fertilizers remained statistically identical with the control.

INTRODUCTION

Sugarcane is a biennial crop, and it needs nutrients in greater amount than any other field crops for its proper growth. Judicious use of NPK fertilizers alone can increase both cane yield and total sugar production by many folds.

Applications of N, P or K alone or in combinations have shown significant increase in these parameters (Gumaste and Brave, 1960; Tabayoyong and Rabeniol, 1972; Humbert, 1968; Parthasarathy, 1972; Singh and Singh, 1972 and Islam and Ali, 1978) though only a few research work were done in the past in these lines for sugarcane crop under Bangladesh agroclimatic conditions. On the other hand, balanced fertilization is the theme of any present-day nutrition schedules (Ali and Khan, 1972) and though response of these elements may vary according to their functions and needs in the plant system or to climate, soil and its fertility status, the best is to use them together in a well suited combination taking into consideration the factors mentioned above.

This work was undertaken to make a systematic study on NPK fertilizers for sugarcane under SRI farm soil conditions to determine the best combination of these for better yield and sugar production.

MATERIALS AND METHODS

The experiment was conducted during 1976-1977 cropping season on a typical Gangetic flood plain soil of SRI farm, some characteristics of which are given below :

Texture	pH	% organic matter	% N	Available P in ppm.	Exchangeable K in ppm.	CEC meq/ 100 gm.
Loam	7.8	1.28	0.071	15	123	16.07

Different levels of N, P and K from urea, triple super phosphate and muriate of potash respectively, used in the experiment, were as follows:-

N-0, 70, 110 and 150 lbs N/acre

P-0, 110 and 150 lbs P_2O_5/acre

K-0, 100 and 140 lbs K_2O/acre

The design of the experiment was rendomised complete block with a factorial arrangement of the treatments. The variety used was Co 1158 and treatments numbering 36 were replicated thrice.

The size of each plot was 28'x28' and distances between blocks, plots and rows were 6', 5' and 3.5' respectively. Three budded equal number of assorted sets were planted end to end in each plot at the rate of 60 mds/ acre.

Total quantity of triple super phosphate and ⅓ of urea and muriate of potash fertilizers, wherever applicable, were applied at planting time in the trenches. The rest ⅔ of urea and muriate of potash were split into two and applied as top-dress in early April and June. The cane was planted in November, 1976 and harvested in January, 1978 The experiment was conducted under rainfed conditions.

Data on germination, tillering, cane height, millable cane, cane yield, % recovery of sugar as well as total sugar production were collected, statistical analysed and represented here.

RESULTS AND DISCUSSION

The study undertaken considered effects of different levels of N, P & K and also their interactions but mostly single effect of different elements are presented here to point out the importance of respective fertilizer. Application of N and P fertilizers have shown significant effects on germination and tillering (Figs 1 & 2). Both the factors increased almost in early with N doses (from 40.06 at No to 43.48 at N_{150} and from 4.28 per clump at No to 4.84 per clump at N_{150} for germination and tillering respectively) but P had the same effect only on tillering which increased from 4.18 per clump at P0 to

4.45 per clump at P_{150}. The germination was maximum (42.89%) at P1 level i.e. where 110 lbs P_2O_5 per acre was applied. Enhancement of germination and tillering due to N or P applications are not uncommon and have been reported by Van Dillewijin, 1962 and Islam et al, 1976. The effect of K on these parameters was not significant and higher levels of K had even a depressing effect on % germination when we consider 41.79% at K_{140} against a 42.26% at K_{100}. This could be due to K salt effect as suggested by Tisdale and Nelson, 1975.

Significant positive effect due to N and P application was found on number of millable cane (fig. 3) though cane height increased only with N (fig-4) K had, once again, no significant influence on either of these characters.

Data on yield of cane is presented in table-1. Tons cane/acre increased at 1% level due to both N and P application (from 33.82 TCA at No to 39.86 TCA at N_{150} and from 34.03 TCA at P_0 to 38.53 TCA at P_{110}. Very much like germination or tillering, the yield response to increasing N was a linear

TABLE-I

Table : I Effect of NPK fertilizer application on tons cane/acre

(a) Combined effects of NP and Single effect of N and P on yield of Sugarcane (tons cane/acre).

P-levels	P_0	P_{110}	P_{150}	Single effect of N.
N-levels	31.58	36.62	33.25	33.82b
No				
N_{70}	32.93	38.91	36.54	36.13ab
N_{110}	33.64	37.21	36.56	35.81ab
N_{150}	37.98	41.36	40.23	39.86a *
Single effect of P	34.03b	38.53a	36.65ab	

(b) Combined effect of NK and Single effect of K on yield of Sugarcane (tons cane/acre).

K-levels	K_0	K_{100}	K_{140}
N-levels	34.38	32.28	34.80
No			
N_{70}	34.30	35.96	39.12
N_{110}	34.17	36.73	36.52
N_{150}	42.53	37.54	39.51
Single effect of K	36.34	35.63	37.24

(c) Combined effect of PK on yield of Sugarcane (tons cane/acre).

K-levels	K_0	K_{100}	K_{140}
P-levels			
P_0	33.76	33.18	35.13
P_{110}	38.83	37.25	39.50
P_{150}	36.42	36.45	37.07

*Letter followed by same letter is not significantly different at 1% level as per DMR test.

one but in case of P, it was highest at P_{110} level. Neither the effect of K nor the interaction of N, P or K on cane yield was found significant. Islam and Ali, 1978 conducted experiment on a similiar type of soil and reported that cane yield increased significantly with increasing N levels. The yield increase due to N and P applications is also reported by many investigators (Parihar, 1971; De Geus, 1967; Singh and Singh, 1972; Humbert, 1972 and Islam **et at**, 1976). The fact that K failed to increase yield of cane over control whether in presence or in absence of N and P is also not uncommon (annonymous, 1965-1966). Tabayoyong and Robeniol (1962) pointed out that signicant increase in yields of cane from potash fertilization was found when the soil available K was below 95 ppm. No response was obtained from soils with available K above 120 ppm. and this explains the non-response of K on SRI soil (K-content 123 ppm).

Percent recovery, another importance parameter of sugar production was also studied and application of NPK did not change % recovery over control significantly (table 2). That N application upto 250 lbs per acre does not change sucrose content appreciably was reported by Humbert(1968) and also annonymous (1965-1966). Islam **et al** (1976) and also Islam **et al** (1978) reported that P or K did not show any effect on sugar recovery. On the other hand, application of NPK fertilizers enhanced total sugar production significantly and the increase is most prominent in case of N (fig.5) where it reached about 18% (from 3.70 TSA to 4.38 TSA). There is increase with P and K also (fig. 5) but not as linear as N effect.

The results of the experiment show that the requirement of nitrogen for plant cane on this type of soil is higher than the present dose. The response of P was rather peculiar. So far single P is concerned, the yield increased

Table-2 Effect of N P K fertilizer application on % recovery of Sugarcane.

(a) Combined effect of NP and single effect of N and P on% recovery of Sugar.

P-levels	P_0	P_{110}	P_{150}	Single effect of N.
N-levels	10.89	11.12	10.80	10.94
N_0				
N_{70}	10.94	10.91	10.74	10.86
N_{110}	10.70	11.05	11.33	11.03
N_{150}	11.03	11.02	10.88	10.98
Single effect of P0	10.89	11.03	10.94	

(b) Combined effect of NK and Single effect of K on % recovery of Sugar.

K-levels	K_0	K_{100}	K_{140}	
N-levels	11.21	10.83	10.77	
N_0				
N_{70}	10.95	10.93	10.70	
N_{110}	10.94	10.95	11.20	
N_{150}	11.12	10.89	10.92	
Single effect of K	11.06	10.90	10.90	

(c) Combined effect of PK on % recovery of Sugar.

K-levels	K_0	K_{100}	K_{140}	
P-levels	10.99	10.88	10.79	
P_0				
P_{110}	11.07	10.98	11.03	
P_{150}	11.11	10.84	10.87	

at 1% level at 110 lbs P_2O_5/acre but when NPK were applied together, the highest yield was obtained at N_{150} P_{150} Ko. This is highly natural since N & P interaction, though not significant, has raised not only the cane yield but also the need of each other. This is a well known synergistic effect. Since 150 lbs N (4 mds urea) and 150 lbs P_2O_5 (4 mds TSP) per acre have significantly increased both cane and sugar yield, application of these higher dose of N and P fertilizers in comparison to present practice of applying 110 lbs N (3 mds urea) and 110 lbs P_2O_5 (3 mds TSP)/acre would result in an increase of cane and sugar yield on this type of soil. The case of K is a bit different. There was no significant response at any levels of K but altogether stoppage of application of K cannot be advocated. This element has many physiological functions in plant system including protein synthesis, translocation of sugar and entry of water etc. Moreover, to save the soil-K from depletion and also to maintain the fertility balance of the soil, the present practice of applying 100 lbs K_2O (2 mds MP)/ acre may continue.

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