Bangladesh J. Sugarcane, 17: 85-90

July, 1995

Increasing Sugarcane Productivity through Manipulation of Fertilizer level and spacing

M.A.S. Miah and M.A. Hossain
Sugarcane Research & Training Institute,
Ishurdi, Pabna, Bangladesh.

Received on 3.5.95

ABSTRACT

An investigation was carried out at BSRI farm to increase the productivity of sugarcane through manipulation of fertilizer level and spacing. In this investigation two spacings viz 60 cm and 90 cm were practiced and three levels of nitrogen (355, 444 and 533 kg urea/ha) and three levels of phosphorus (250, 313 and 375 kg TSP/ha) were applied. The highest number of tiller, millable cane and yield were obtained in the narrow spacing (60 cm) compared to wider spacing (90 cm). But higher number of tiller and millable cane per clump were obtained at wider spacing compared to narrow spacing. Sugarcane productivity could be increased through application of higher level of nitrogen at wider spacing and could not be increased at narrow spacing. Higher level of phosphorus application had no impact on sugarcane productivity. Therefore, higher level of nitrogen (444 to 533 kg urea/ha) might be applied to get higher productivity in sugarcane at wider spacing in the Ganges flood plain soils of BSRI farm.

INTRODUCTION

Productivity of sugarcane depends on tillering, tiller mortality and ultimate millability of produced tillers. Tillering and tiller mortality are influenced by several internal and external factors. Tillering is affected by time of planting/transplanting, method of planting/transplanting, fertilization, mulching, moisture level, ambient temperature etc (Kanwar and Sharma, 1974; Bull, 1975; Miah and Rahman, 1981), while tiller mortality is influenced by spacing, solar radiation, fertilization, soil moisture level etc. (Singh and Singh, 1984; Srivastava *et al.* 1985; Miah *et al.* 1988; Matin *et al.* 1989). It is seen in the earlier studies in this laboratory and elsewhere that upto 78% tillers die out as a result of inter clump as well as intra clump competition for light, space, nutrients and incurs huge losses of photosynthates resulting lower rate of productivity. It is known that solar radiation and rainfall level could not be controlled or modified under field condition in Bangladesh. However, there could be some control over sugarcane spacing, rate and time of fertilizer application in the sugarcane field. Therefore, an investigation was carried out to increase sugarcane productivity through manipulation of inter clump sapcing and level of nitrogen and phosphorus fertilizer at BSRI farm.

MATERIALS AND METHODS

An experiment was conducted at the Bangladesh Sugarcane Research Institute (BSRI) farm during 1992-93 planting season using polybag setttings of variety Isd-18. The experiment was set up in RCB design with three replications in the month of January 1993. Row to row distance was maintained one meter, and two clump spacings such as 60 cm and 90 cm were maintained.Three levels of nitrogen such as 355, 444 and 533 kg urea/ha and three levels of phosphorus 250, 313 and 375 kg TSP/ha were applied along

with recommended doses of potash, zinc and sulphur. Entire amount of phosphorus of each level was applied in the trench at transplanting, while nitrogen was applied in four equal splits viz at transplanting, 45, 90 and 120 d after transplanting. Irrigation was given immediately after transplanting. Intercultural operations viz weeding, mulching supplimentary irrigation, insect pests and diseases control etc were done as and when required.

Data on tiller production and mortality were recorded at an interval of 30 d starting from 1st March, until 30th October. Final millable canes were recorded at harvest.

RESULTS AND DISCUSSION

The results of the experiment have been presented in the Tables 1-3 & Figures 1-2. The Table 1 shows that significantly higher number of tiller were produced at narrow spacing (60 cm) compared to wider spacing (90 cm). This finding conform earlier reports published elsewhere (Bull, 1975; Matherne, 1971; 1974; Matherne and Irvine, 1978). The Table 1 also shows that tiller production gradually increased as the level of nitrogenous fertilizer was increased at wider spacing while no consistant positive effects was recorded at narrow spacing. Tiller production also gradually increased at both spacings as the level of phosphorus application was increased at the lowest level of nitrogenous fertilizer (355 kg urea/ha) while no effects of phosphorus were recorded when nitrogen level was increased.

Table 1. Interaction of spacing and different combinations of nitrogen and phosphorus on tiller production.

Spacing	Spacing		
	60 cm	90 cm	Mean
Nitrogen & Phosphorus levels	Tiller ($10^3 ha^{-1}$)	Tiller ($10^3 ha^{-1}$)	Tiller ($10^3 ha^{-1}$)
N_1P_1	97.7 abcd	76.9 d	87.3 b
N_1P_2	103.2 ab	82.4 bcd	92.8 ab
N_1P_3	112.0 abc	89.2 cd	100.6 ab
	104.3	82.8	93.6
N_2P_1	105.6 abcd	81.5 bcd	93.5 ab
N_2P_2	107.4 abcd	85.9 bcd	96.6 ab
N_2P_3	94.3 abcd	94.9 abcd	94.6 ab
	102.4	87.1	94.6
N_3P_1	114.1 ab	103.7 abcd	108.9 a
N_3P_2	101.4 abcd	95.3 abcd	98.3 ab
N_3P_3	106.0 abcd	88.9 bcd	97.5 ab
	107.2	96.0	101.6
Mean	104.6 A	88.7 B	96.7

Urea- N_1 = 355, N_2 = 444, N_3= 533 kg/ha; TSP - P_1 = 250, P_2 = 313, P_3 = 375 kg/ha.

The Table 2 shows insignificant millable cane production in between narrow and wider spacing although tiller production was found significantly higher in narrow spacing which indicates higher tiller mortality in narrow spacing compare to wider spacing. Similar results were published by the authors earlier (Miah and Rahman, 1981; Miah *et al*, 1983; Miah *et al*, 1988; Matin *et al*, 1989; Rahman *et al*, 1987; Rahman and Matin 1988). Millable cane production increased with the increased level of nitrogen at wider spacing. No positive effects of phosphorus was recorded at any level of phosphorus

application. The table 3 shows insignificant yield difference between narrow spacing and wider spacing. The table 3 also shows that yield of cane gradually increased as the level of nitrogenous fertilizer gradually increased in wider spacing. No effects of phosphorus was recorded at any level of applied phosphorus.

Table 2. Interaction of spacing and different combinations of nitrogen and phosphorus on millable cane production.

Spacing	Spacing		
	60 cm	90 cm	Mean
Nitrogen & phosphorus levels	Millable cane ($10^3 ha^{-1}$)	Millable cane ($10^3 ha^{-1}$)	Millable cane ($10^3 ha^{-1}$)
N_1P_1	90.1 abcd	78.6 cde	81.1 b
N_1P_2	94.3 ab	74.9 c	84.2 ab
N_1P_3	92.2 abc	73.7 e	80.7 b
	92.2	75.5	82.0
N_2P_1	87.5 abcde	79.6 bcde	84.2 ab
N_2P_2	90.4 abcd	91.0 abcd	89.4 ab
N_2P_3	76.6 de	89.7 abcd	78.3 b
	84.8	86.8	84.0
N_3P_1	101.4 a	97.9 a	98.1 a
N_3P_2	98.3 a	84.4 ab	92.1 ab
N_3P_3	93.8 ab	86.9 abcde	90.0 abcde
	97.8	89.7	93.4
Mean	88.9 A	84.1 A	86.5

Urea- N_1 = 355 N_2 = 444 N_3= 533 kg/ha
TSP - P_1 = 250 P_2 = 313 P_3 = 375 kg/ha

Table 3. Interaction of spacing and different combinations of nitrogen and phosphorus on yield.

Spacing	Yield of cane (TCH)		
	60 cm	90 cm	Mean
Nitrogen & Phosphorus levels			
N_1P_1	81.8 bc	73.3 g	77.6 efg
N_1P_2	91.8 abc	76.7 efg	84.3 b
N_1P_3	89.0 bc	72.4 g	80.7 b
	87.5	74.1	80.9
N_2P_1	86.5 cd	81.9 de	84.2 b
N_2P_2	92.1 abc	86.7 cd	89.4 ab
N_2P_3	75.2 fg	81.3 def	78.3 efg
	84.6	83.3	84.0
N_3P_1	95.2 a	98.0 a	96.6 a
N_3P_2	97.5 a	86.8 cd	92.2 a
N_3P_3	87.4 bcd	93.8 ab	90.6 ab
	93.4	92.9	93.1
Mean	88.5 A	83.4 A	86.0

Urea- N_1 = 355 N_2 = 444 N_3= 533 kg/ha TSP - P_1 = 250 P_2 = 313 P_3 = 375 kg/ha

It is seen from the results that both spacing and nitrogenous fertilization have impact on tillering, tiller mortality and ultimate sugarcane productivity. The impact of spacing is relatively higher compared to enhanced nitrogenous fertilization, and again

influence of nitrogenous fertilizer is higher than phosphorus fertilizer at Ganges flood plain soil of BSRI farm. It indicates these soils have adequate reserve of available phosphorus in relation to sugarcane requirement. Significantly higher tiller production was recorded in narrow spacing compared to wider spacing but millable cane production became insignificant. This indicates higher tiller mortality in narrow spacing. It is also seen that higher level of nitrogenous fertilizer application in narrow spacing could not reduce mortality. In narrow spacing higher level of nitrogenous fertilizer could not increase productivity and per clump tiller production was not increased, while tiller production per clump at wider spacing increased (Figure 1). Tiller production gradually increased with increased level of phosphorus in the both narrow and wider spacing at 355 kg urea/ha and at wider spacing upto 444 kg urea/ha level and beyond that showed no increase in tiller production, and reduced per clump tiller production.

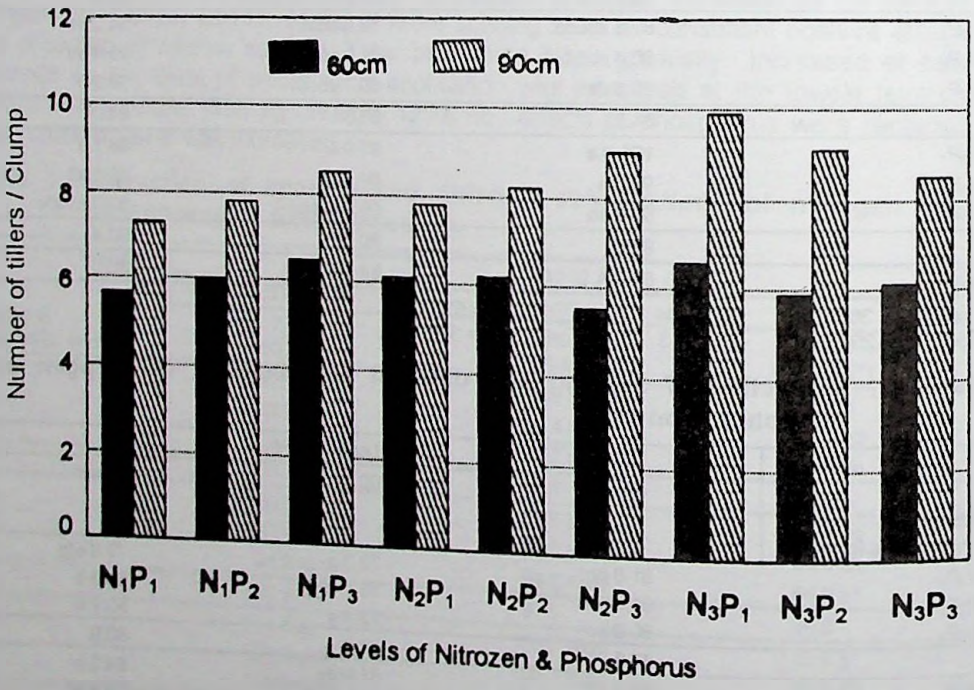

Figure 1. Interaction of spacing and different combination of nitrogen and phosphorus on tiller production/clump.

The results show that although significantly higher tillers were produced in the narrow spacing compared to wider spacing but failled to maintain higher level of millability. This indicates that due to wider spacing and higher doses of both nitrogenous and phosphorus fertilization (at lower level of nitrogen only) sugarcane productivity increased through reducing tiller mortality. In the wider spacing per clump tiller production was found higher compared to narrow spacing, and again per clump tiller production also increased as the level of nitrogenous fertilizer was increased (Fig. 2). It

can be stated that since higher doses of phosphorus had no impact on tiller production. while higher doses of nitrogen increased tillering and reduced tiller mortality, therefore application of 533 kg urea and 250 kg TSP/ha produced the highest productivity ie. 9.3 millable cane per clump.

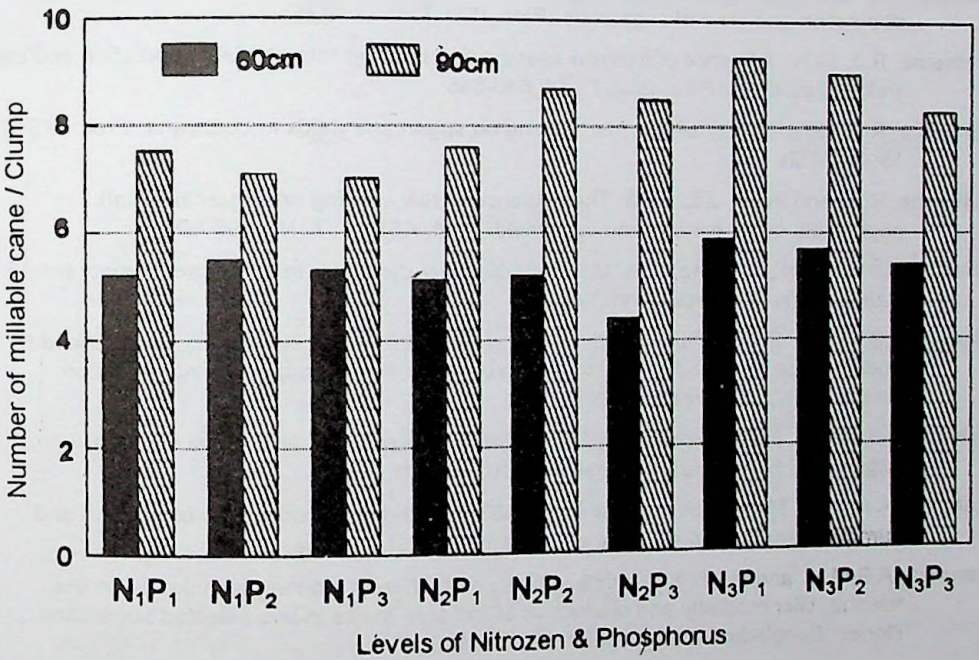

Figure 2. Interation of spacing and different combination of nitrogen and phosphorus on millable cane production/clump.

It is seen that significantly the highest yield of sugarcane produced in the inter clump spacing 60 cm compared to 90 cm spacing (Table 3). It is seen that sugarcane yield gradually increased as level of nitrogenous fertilizer was increased. The impact of nitrogen was recorded only in the wider spacing, and application of higher doses of nitrogenous fertilizer could not contribute in yield increase in narrow spacing. Phosphorus fertilizer could not show any impact on yield in combination with any level of nitrogen (lower to higher level). Yield of sugarcane could not be increased through application of higher doses of phosphorus fertilizer at BSRI farm soils. The highest yield of sugarcane could be obtained through application of 533 kg/ha urea in combination with 250 kg TSP/ha at wider spacing followed by 313 kg TSP/ha at narrow spacing.

Therefore, it may be concluded that to obtain significantly higher yield of cane 60 cm spacing need to be practiced. But to get the higher yield through higher productivity

of sugarcane it is required to be applied 533 kg urea and 250 kg TSP/ha in wider spacing 90 cm at BSRI farm soils.

REFERENCES

Bull, T.A. 1975. Row spacing and potential productivity in sugarcane. *Agron. J.*, **67**: 421-423.

Kanwar, R.S. and Sharma, K.K. 1974. Effects of interrow spacing on tiller mortality, stalk population and yield of sugarcane. *Proc. ISSCT*, **15**: 751-755.

Matherne, R.J. 1971. Influence of interrow spacing and planting rate on stalk population and cane yield in Louisiana. *Proc. ISSCT,*. **14**: 640-645.

Matherne, R.J. 1974. Effects of interrow spacing on sugarcane yields in Louisiana. *Proc. ISSCT*, **15**: 746-750.

Matherne, R.J., and Irvine, J.E. 1978. The influence of row spacing on sugarcane stalk population. sugar content and cane yield. *Proc. ASSCT*, **7** (NS): 96-100.

Matin, M.A.; Hossain, M.A. and Miah, M.A.S. 1989. Tiller dynamics in sugarcane variety Isd-16. *Bangladesh J. Sugarcane*, **11**:1-6.

Miah, M.A.S.; Saha, S.C.; Rahman, S.B. M.F. and Sarkar, M.A.A. 1983. Effect of enhanced N and P on the millable cane in Isd-16 grown under spaced transplanting condition. *Bangladesh J. Sugarcane*, **5**: 23-27.

Miah, M.A.S.; Matin, M.A. and Hossain, M.A. 1988. Optimization of productive tillers in sugarcane. *Bangladesh J. Sugarcane*, **10**: 114-116.

Rahman, A.B.M.M.; Matin, M.A. and Ali, M.Y. 1987. Tillering and productivity of autumn and summer transplanted sugarcane. *Bangladesh J. Sugarcane*, **9**: 1-8.

Rahman, A.B.M.M. and Matin, M.A. 1988. Influence of different planting techniques on the tillering, tiller mortality and production of millable stalks in two selected sugarcane clones. *Bangladesh J. Sugarcane*, **10**: 117-119.