

Effects of Planting Time, Row and Plant Spacing and Environment on Sugarcane Cultivation in the Red Soil of Modhupur Tract

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ABSTRACT

An experiment was conducted in the farmer's field at Sreepur, Gazipur to find out the effects of planting time of sugarcane in the red soil tract of Madhupur under AEZ 28. It was placed in RCB design with four replications. Five transplanting times in October, November, February, March and April with recommended row and plant spacing were studied under rainfed condition. Results revealed that settling mortality was significantly (9.69%) higher in April transplanted cane in second year compared to first year. Tiller production fluctuated depending on monsoon rainfall where significantly higher number of 335.10.103 ha⁻¹ were produced in April transplanted cane during first year, but 237.04.103 ha⁻¹ in second year. Higher tiller mortality of 86.90% was found in March planting and lower 58.98 % in November planting. On the other hand, 41.02 % higher effective tiller was found in November planting and 14.10 % lower in March planting. Millable canes production in February and March planting were significantly higher in first year but lower in second year. In second year, there was no significant difference between plantings Q time, but November planting produced higher number of millable cane. Besides, November planting produced almost equal number of millable canes indicating its sustainability than other plantings. Significantly higher cane yield of 138.91 and 131.93 t ha⁻¹ were found in first year and second year respectively in November planting. The mean Brix of 19.43 and 19.00 per cent in October and November and sucrose content of 11.38 and 10.92 per cent in October and November plantings respectively indicates higher Brix in both the years compared to other plantings.

Key words: Sugarcane, planting time, row and plant spacing, red soil, environment, cane yield

INTRODUCTION

Planting time has great impact on the yield and yield contributing parameters of different crops. Studies on planting time with rice, wheat, potato, sugarcane and other major crops indicated that only a little change in the time of planting had significant effects on the yield and yield contributing characters or directly on the yield. (Ali *et al.* 1993; Rocheford *et al.* 1988; Ahmed *et al.* 1975; Aziz *et al.* 1985). It is reported that time of planting alone can increase yield of sugarcane by 25-30 per cent (Anon., 1981; Lameira, 1989; Sharma *et al.* 1991).

In Bangladesh, sugarcane is normally planted in autumn or in summer, and considered as early and late planting respectively. Early planting always produces significantly higher yield than late planting (Khan, *et al.* 1982). It is reported that November planting with variety Co.1158 at 75 cm row spacing is the best time and spacing for cane cultivation at Thakurgaon Sugar Mills Ltd. Imam, *et al.* (1988) found economic yield at 90 cm and 45 cm row and plant spacing under Ganges alluvium soils at present BSRI farm. Planting from 30th November to 1st January tended to produce more cane than those after this period (Anon., 1979). The effects of different time of planting and harvesting on various yield parameters of 11,12,13 and 14 months old crops planted in November, December, January and February were studied and suggested that germination and tillers were significantly greater for the November planted cane than for all other planting dates (Hoey *et al.* 1981). Significant differences in millable canes and yield can be attributed to planting dates. Imam *et al.* (1988) studied row and plant spacing of transplanted cane and reported higher mortality of tillers at closer spacing. He also reported that tillers and millable canes per clump and mean stalk weight were higher in wider row and plant spacing. In closer spacing (90 cm x 45cm row and plant) significantly higher number of millable canes and the highest cane yield were obtained. Sucrose per cent was significantly higher in wider (120cm x 120cm) spacing.

In general sugarcane planting depends on climatic condition, type of soils and socio- economic condition in different locations of Bangladesh. In Modhupur red soil under 28 AEZ, summer transplanted cane cultivation is practiced since a long time. The average yield of cane is lower than the national average because of late plantation and imbalanced lower dose of fertilizer use. The reason of late cane cultivation is due to water scarcity, cropping systems and environmental condition. Farmers usually transplant their cane depending on monsoon rain that naturally starts on April-May every year. They generally harvested their cane starting from January to May of the next year. Farmers has a opinion that transplanting sugarcane in autumn i.e., October-November or late spring i.e., February-March is not possible as these months are absolutely dry period and the transplanted settlings will die when severe drought will commence during February-March. Irrigation facilities is troublesome because the water table is very low and even with shallow tubewell it is sometimes uneconomic.

Therefore, the experiment was undertaken to find out the optimum time of sugarcane transplanting for higher cane production by scientific intervention altering the transplanting time of sugarcane from summer to autumn.

MATERIALS AND METHODS

The experiment was carried out in the farmers' field at Sreepur, Gazipur in the red soil environment of Modhupur soil tract, (AEZ-28) during 1989-90 and 1990-91 cropping seasons. The most popular local sugarcane variety Misrimala was transplanted in RCB design with four replications. Five transplanting times with recommended row and plant spacing were studied under rainfed condition. The row and plant spacing, number of row/plot, type of settlings and number of settlings/ plot of each time were as follows:

Time of plantings	Row and plant spacing (cm)	Rows/plot	Settlings/plot (cm)	Type of settlings
T ₁ = October	100x60	6	72	Polybag settlings of 45 d old
T ₂ = November	85x45	7	112	
T ₃ = February	60x45	8	192	
T ₄ = March	60x30	10	240	
T ₅ = April	45x30	13	312	

Row and plant spacing, number of rows/ plot and number of settlings/ plot were calculated based on previous experimental results (Imam et al. 1988, Uddin et al. 1989, Haque et al. 1994, Rahman et al. 1994). The settlings of each planting time were transplanted on 15th of each month and recommended NPKS were applied as per schedule dose and time. Life irrigation immediately after transplanting of settlings and cultural practices appropriate to the crop was followed for each treatment. The experiment was repeated for the second year having all the practices equal in the same time and same manner.

Data on mortality of settlings at 30 DAT tillers at peak period, production of millable cane and cane yield at harvest was taken. Brix percent were taken on 12th month and sucrose contents were determined in 13th months. Stalk weight of individual plot was measured by spring balance and finally, yield of cane was calculated and analyzed statistically using IRRISTAT program of Computer of BRRI, Gazipur.

RESULTS AND DISCUSSION

Different time of plantings studied in the experiment showed significant impart on different growth and yield contributing parameters. Settlings mortality was found significantly lower in February planting than from other planting times (Table 1). In first year mortality was lower and did not differ between plantings but in second year lower mortality was found in February planting and differed with other planting times. Higher settling mortality in late-planted cane with closer spacing was reported elsewhere Anon., 1981.

Table 1: Effects of planting time on settlings mortality and tillers production.

Time of Transplanting	Parameters Studied							
	Mortality (%)				Tillers production (10^3 ha^{-1})			
	Year-1	Year-2	T-mean	Difference	Year-1	Year-2	T-mean	Diff.
T ₁ =October	0.05a	2.63b	1.34b	-2.57ns	118.05e	226.39a	172.22	-108.33**
T ₂ =November	0.32a	4.97b	2.65ab	-4.65*	143.59d	237.04a	190.31	-93.44**
T ₃ =February	0.05a	1.09b	0.57b	-1.03ns	231.40c	230.73a	231.05	0.67ns
T ₄ =March	0.16a	3.85b	2.01ab	-3.69**	299.15b	228.59a	263.86	70.55**
T ₅ =April	0.33a	9.69a	5.01a	-9.35**	335.10a	91.43b	213.26	243.67**
Year Mean	0.18	4.45	2.31	-4.26**	225.46	202.83	214.14	22.62

In a column, means followed by common letters are not significantly different at 5% level by DMRT differences between year mortality were lower in first year. Higher mortality was found in second year indicating that weather and other factors were not suitable in second year than first year (Fig.1, 2,3&4).

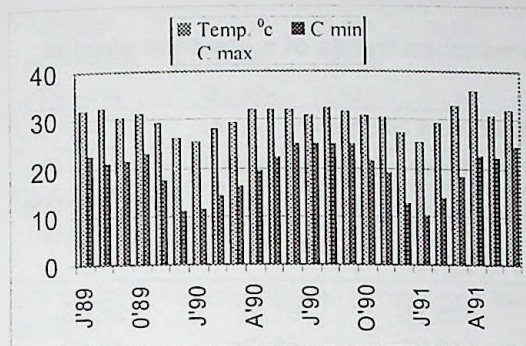


Fig.1 : Temperature record (1989-90 and 1990-91 planting season)

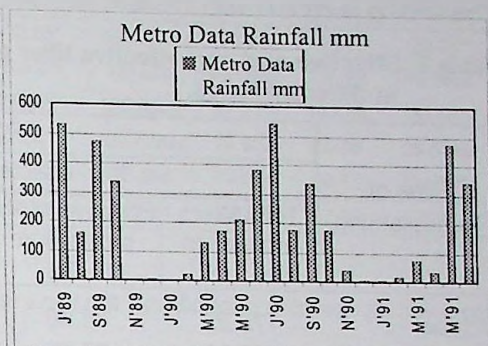


Fig.2 : Rainfall record (1989-90 and 1990-91 planting season)

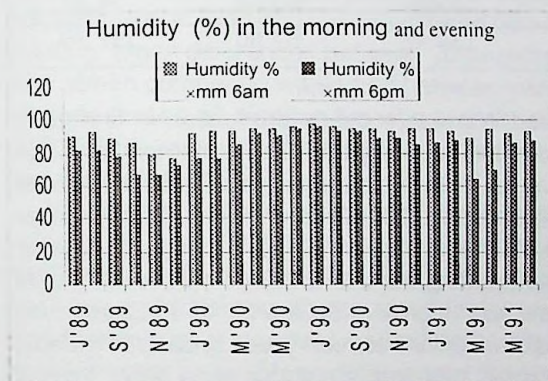


Fig.3: Humidity record (1989-90 and 1990-91 planting season)

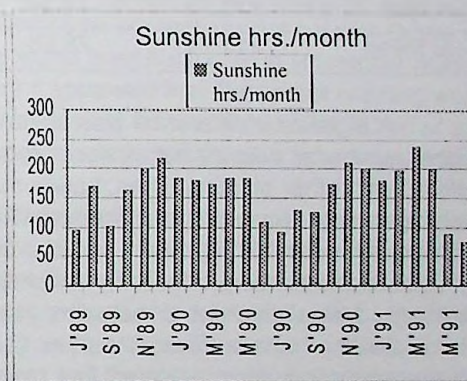


Fig.4: Sunshine record (1989-90 and 1990-91 planting season)

Tillers production in first year was significantly higher in April transplanted cane and differed significantly with rest of treatments (Table 1). In second year the highest tillers were produced in November planting and differed significantly with April planting but not with other planting times. When comparing between years mean differences were significantly higher in all treatments except in February planting. An unusual result among April planting in tillers production was observed. In first year significantly higher tillers were produced while significantly the lowest tillers were found in the second year in April transplanted cane. This variation might be due to seasonal fluctuation of metrological condition of the experimental site. In April during second year average rainfall was 34.50mm and average maximum temperature was 36°C that is 3.74 °C higher than the previous year (Fig.1&2). This suggested that closer spacing is not only the factor of lower tillering, it could be enhanced by the change of environment.

Tillers mortality and effective tillers production is presented in Table 2 where higher tillers mortality (86.90 %) was found in March planting. Lower mortality (58.98 %) was found in November planting. On the other hand, higher effective tiller production (41.02 %) was found in November planting and the lowest (14.10 %) in March planting. This finding is agreed with Imam *et al.* (1988) and Hoey *et al.* (1981).

Table 2: Effective and non-effective tiller production trends of sugarcane planted in different times.

Time of Transplanting	Parameters Studied				
	Non-effective/ Effective tiller production				
	Total tillers production (10^{-3}ha^{-1})	Effective tillers production (10^{-3}ha^{-1})	Tiller mortality (10^{-3}ha^{-1})	Tiller mortality (%)	Effective tiller production (%)
October	172.22	66.66	105.56	61.37	38.63
T ₂ = November	190.31	77.75	112.25	58.98	41.02
T ₃ = February	231.05	89.18	141.87	61.40	38.60
T ₄ = March	263.86	87.34	176.52	86.90	14.10
T ₅ = April	213.26	77.36	135.90	63.73	36.27
Year Mean	214.14	79.66	134.48	62.80	37.20

A significant difference was observed in millable canes production in first year. Higher number of millable canes were produced in February and March planted cane and differed with other planting times. Lower number of millable canes was found in October plantings where November and April plantings produced significantly higher than October planting but lower than February and March plantings. In second year the highest number of millable canes was produced in November planting but did not differ with other time of plantings. Mean differences between years was significantly higher in February and March plantings where November planting did not differ between years in case of millable canes production. This indicated that November planting is suitable than other time of planting. Though the numbers of millable canes in some other times were higher but these were not stable like November planting. The results are in agreement with the findings of several authors (Sharma *et al.* 1991, Khan *et al.* 1882 and Imam *et al.* 1988) and they recommended November planting is the best time for higher millable canes and yield of cane.

Table 3: Effects of planting time on millable canes production and cane yield.

Time of Transplanting	Millable canes production (10^3ha^{-1})				Yield of cane (TCH)			
	Year-1	Year-2	T-mean	Difference	Year-1	Year-2	T-mean	Different
T ₁ =October	61.33c	71.98a	66.66	-10.65*	92.61bc	120.83a	106.72	-28.21*
T ₂ =November	75.99b	79.51a	77.75	-3.51ns	124.95a	138.91a	131.93	-13.96ns
T ₃ =February	102.85a	75.52a	89.18	27.33**	120.05ab	87.21b	103.63	32.84*
T ₄ =March	100.84a	73.83a	87.34	27.00**	100.72abc	74.85b	87.78	25.86ns
T ₅ =April	83.56b	71.17a	77.36	12.39*	75.38c	44.07c	59.73	31.31*
Year Mean	84.91	74.40	79.66	10.51	102.74	93.17	97.96	9.57

In a column, means followed by common letters are not significantly different at 5% level by DMRT

A significant difference in yield of cane was found in both the years with different planting times. In first year, November planting produced significant higher yield and differ with October and April plantings. In second year November planting produced significantly higher yield of cane and differed with other time of plantings but not with October planting. Mean differences between years were found least fluctuated in November plantings. When comparing within and between years it appeared that November planting was the best among all planting times in respect of cane yield for the tested area. Khan *et al.* (1982) and Imam *et al.* (1988) also reported the same results and advocated early (November) planting.

In terms of brix and sucrose content, October and November plantings indicated higher percentage in both the years compared to other plantings. Results presented in (Table 4) reveals that significantly higher per cent Brix was found in October plantings in first year and differed with the remainders. In second year November planting indicated significantly higher per cent and differed with other plantings. This might be due to the environmental factor. Mean difference in November and February is significantly less than from other plantings. The same trend observed in per cent sucrose content. October and November planting indicated higher per cent Brix but did not differ significantly with other planting times. On the other hand, a significant difference is observed in second year where October and November planting indicated significantly higher per cent sucrose content. This clearly indicated that early planting with wider spacing is very important factor for harnessing sugar from sugarcane. This finding is in agreement with the finding of Imam *et al.* 1988.

Table 4: Effects of planting time of sugarcane on per cent Brix and sucrose content in sugarcane.

Time of Transplanting	Parameters Studied							
	Brix (%)				Sucrose (%)			
	Year-1	Year-2	T-mean	Different	Year-1	Year-2	T-mean	Different
T ₁ =October	20.81a	18.01b	19.43	2.79**	11.44a	11.33a	11.38	0.11
T ₂ =November	18.71c	19.29a	19.00	-0.57ns	11.02a	10.82ab	10.92	0.20
T ₃ =February	19.04bc	18.40b	18.72	0.64ns	10.61a	10.69b	10.65	-0.08
T ₄ =March	19.71b	17.08c	18.40	2.63**	10.96a	10.44bc	10.70	0.52
T ₅ =April	19.73b	16.54c	18.13	3.20**	10.71a	10.14c	10.42	0.57
Year Mean	19.60	17.86	18.73	1.74	10.95	10.68	10.81	0.27

In a column, means followed by common letter are not significantly different at the 5% level by DMRT

In conclusion, it can be suggested that November planting with polybag settlings at 85cm X 45cm row and plant spacing with life irrigation may replace the planting time from April-May to November in the tested environment.

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