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Impact of Irrigation on Establishment of STP Settlings and Yield Parameters of Sugarcane

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ABSTRACT

A field experiment was conducted to investigate effects of irrigation on establishment of STP settlings and yield contributing parameters of sugarcane. Different types of irrigation were applied on single-budded, two-budded soil bed settlings and polybag settlings. Equal number of settlings were transplanted in 88 sq.m plot size. Special care was taken to prevent horizontal seepage due to irrigation by inserting polyethene sheet in between plots. The effects of irrigation on mortality, tiller, millable cane, yield, sucrose content and height, weight, girth, number of internodes per cane were recorded. Flood irrigation showed better performance in establishment of settlings giving the highest number of tillers (170×10^3 ha^{-1}), millable cane (131.4×10^3 ha^{-1}) and yield (98.6 t ha^{-1}) compared to spot and rainfed crops. Polybag settlings proved superior to two-budded soilbed settlings followed by single budded settlings under all types of irrigation and gave the highest economic return.

INTRODUCTION

Although sugarcane is relatively tolerant to water stress but this crop during early growth period is subjected to inadequate water supply which predominately affects the ultimate yield of the crop. The formative phase (120 DAP) is the critical water demand period (Reddi, 1976).

The establishment and mortality of young settlings when transplanted into main fields is greatly influenced by available soil moisture. As the soils of Thakurgaon regions in general is almost sandy with poor organic matter, the water holding capacity of the soil is poor compared to other heavy textured soils. In absence of sufficient soil moisture survival of transplanted settlings is seriously hampered and the rate of mortality increases. Therefore, irrigation is essential for survivial of transplanted settlings specially at critical stage of sugarcane establishment and growth.

Previous research works on sugarcane irrigation showed positive impact of irrigation on various yield parameters of sugarcane. Hence the present study was carried out to know relative impact of different types of irrigation on settling-establishment and yield of sugarcane.

MATERIALS AND METHODS

An experiment was carried out at farmers field, Moheshpur, Thakurgaon in the cropping season 1989-90. Settlings of 45 days old of variety L. Jaba-C were transplanted in the 1st week of December, 1989. The experiment was laid out in split-plot design having three replications and comprised with the following treatments:

A. Sources of settlings:
S_1 - Polybag settlings
S_2 - Single-budded soil bed settlings
S_3 - Two-budded soil bed settlings

B. Irrigations:
I_0 - Control (No irrigation)
I_1 - Spot/live irrigation just after transplantation
I_2 - Flood irrigation (includes live irrigation and supplementary irrigations)

Unit plot size was 8m x 11m and settlings were transplanted at 1m row and 45cm plant to plant spacing. Each plot was surrounded by vertically inserted polyethene sheet upto 60cm depth below soil surface to prevent horizontal seepage in between adjacent plots. Recommended doses of fertilizers were applied as per schedule for the crop. All intercultural operations, pests and diseases control were done as and when necessary.

Data on mortality, number of tillers, millable cane, yield of cane and sugar recovery percent were recorded. Data on average height, diameter, number of internode and weight per cane were also recorded at harvest. Soil samples were collected with soil augar from different depths for measuring soil moisture.

The amount of irrigation water applied to the plots were measured by soil moisture depletion studies which involved fortnightly soil moisture monitoring from various depths (0-15cm, 16-30cm, 31-45cm and 46-60cm) by gravimetric method. When the soil moisture depletion attained at 50 percent of the total available water in the effective root zone (45-60 cm below soil surface) irrigation was applied to raise the moisture status at field capacity.

RESULTS AND DISCUSSION

The soil type of the experimental field was loamy and the soil moisture percentage at field capacity was recorded as 26 percent. The soil moisuture status of the field at different depths ranged from 19-23 percent during transplantation and 19-24 percent at harvest (Table 1). During dry period soil moisture percent started declining gradually due to moisture depletion till early light shower in February. 1990 when it began to increase considerably due to heavy shower in March, 1990.

The amount of irrigation water applied at different growth stages during drought period are shown in the Table 2.

Table 1. Moisture status (percent) at different growth stages and bulk density at different depths.

Depth / Time(Months)	Moisture percent				Remarks
	0-15cm	16-30cm	31-45cm	46-60cm	
1st week of December, 1989	19	20	22	23	Moisture percent at transplantation
Mid January '90	16	17	19	20	Drought/dry period
Mid February '90	18	20	23	25	Light shower in February '90
Mid March '90	22	25	27	28	Heavy shower started in March '90
Last week of December '90	19	21	23	24	Moisture percent at harvest
Bulk density gm/cc	1.38	1.39	1.38	1.43	In the cropping season 1989-90

Table 2. Amount of irrigation water applied at different growth stages.

Type of irrigation	Time and quantity of irrigation water applied (cm)				Total water applied (cm)	Remarks
	1st week of Dec.'89	Mid Jan. '90	Mid Feb. '90	Mid Mar. '90		
Flood	6.5	7.0	7.0	6.0	26.5	Heavy rainfall started from 2nd week of March '90
Spot	2.0	-	-	-	2.0	

Among different types of irrigations flood irrigation (I_2) significantly reduced settling mortality ranging 2.8 to 12.0 percent in all types of settlings compared to spot (I_1) and no irrigation (I_0) treatments (Table 3). This might be due to sufficient moisture generation in the soils with flood irrigation which subsequently helped in the establishment of settlings and withstand the shock of root system after transplantation. On the contrary the highest mortality ranging from 4.1 to 25.6 percent were recorded in non-irrigated plots followed by spot and flood irrigated plots. Thus irrigation showed significant positive effects on establishment of transplanted settlings.

It is also observed that mortality depends upon the types of settlings. Polybag settlings were found to be superior to all other sources of settlings and had the lowest mortality range 2.8 to 4.1 percent. Single budded soil bed settlings suffered from significantly higher mortality percent ranging from 12.0 to 25.6 followed by two-budded soil bed settlings ranging from 5.6 to 8.9 percent (Table 3).

Table 3. Effects of irrigation on different yield contributing parameters of sugarcane.

Treatments		Mortality (Percent)	Number of Tillers ($10^3 ha^{-1}$)	Number of Millable cane ($10^3 ha^{-1}$)	Yield of cane (t ha^{-1})	Sucrose content (percent)	Yield increase over control (percent)
Sources of settlings	Types of Irrigation						
Polybag settlings	Flood	2.8 b*	170.0 a	131.4 a	98.6 a	9.6 a	21.4
	Spot	3.6 ab	150.6 b	127.7 b	90.6 b	9.5 a	11.6
	Control (No irrigation)	4.1 a	145.6 c	112.8 c	81.2 c	9.4 a	-
Two budded soil bed settlings	Flood	5.6 c	166.0 a	131.0 a	91.7 a	9.5 a	13.8
	Spot	7.4 b	154.9 b	124.1 b	85.5 ab	9.4 a	6.2
	Control (No irrigation)	8.9 ab	124.7 c	102.0 c	80.6 b	9.1 a	-
Single budded soil bed settlings	Flood	12.0 c	154.9 a	112.8 a	86.8 a	9.6 a	19.0
	Spot	14.1 b	129.9 b	109.7 b	85.6 a	9.1 a	17.3
	Control (No irrigation)	25.6 a	124.4 c	79.3 c	73.0 b	9.0 a	-

* Figures accompanied by same letters in a column do not differ significantly at 5% level of probability as per DNMR test.

Data on tiller production indicated that flood irrigation significantly induce tillering with all types of settlings compared to spot and non-irrigated plots (Table 3). Polybag settlings produced the highest tiller population (170×10^3 ha^{-1}) in flood irrigated plots followed by spot irrigation plots (150.6×10^3 ha^{-1}). Polybag settlings in flood irrigated condition had 16.8 percent higher tiller population over non-irrigated plots. Similarly in case of two-budded soil bed settlings under flood irrigation, the tiller population was 33.2 percent higher over non-irrigated followed by spot irrigated cane which was 24.3 percent higher over control. In flood irrigated condition single budded soil bed settlings produced 24.5 percent higher tiller population over control followed by spot irrigated cane 4.4 percent. Results on tiller mortality (percent) have been shown in Table 3.

Millable cane formation in all types of settlings were significantly influenced by irrigation (Table 3). The highest number of millable cane was obtained under flood irrigation with all types of settlings compared to spot and non-irrigated treatments. Polybag settlings gave significantly the highest number ($131.4x10^3$ ha^{-1}) of millable stalk followed by two-budded and single-budded soil bed settlings under flood irrigation. Non-irrigated plots gave significantly the lowest number of millable cane ($79.3x10^3$ ha^{-1}) with single budded followed by two-budded and polybag settlings (Table 3).

The highest yield (98.6t ha^{-1}) of cane was obtained with polybag settlings under flood irrigation (Table 3). Statistically the lowest yield was obtained from the non-irrigated plots ranging from 73.0 to 81.2 t ha^{-1} with different sources of settlings. In case of polybag settlings 21.4 percent higher yield was obtained due to flood irrigation over non-irrigated plots followed by spot irrigation plots (11.6 percent) (Table 3). Two-budded soil bed settlings under flood irrigation gave (13.8 percent) higher yield over non-irrigated plots followed by spot irrigated plots (6.2 percent). Irrigated single-budded soil bed settlings showed 19.0 percent higher yield over control plots. The lower yields under spot and non-irrigated plots might be due to moisture stress leading to poor number of tiller and millable cane production which subsequently reduced yield of cane.

Irrigation showed no statistical significant influence on recoverable sucrose (percent) of sugarcane. But flood irrigated cane gave higher recovery percent than non-irrigated cane (Table 3). It is observed from the Table 4 that the cane height. internode formation, individual cane weight and diameter of cane were positively influenced by irrigation. Height of cane and internode formation were significantly increased with the increase of irrigation level. Maximum height (3.02m) and internode (28) were obtained from flood irrigated polybag settlings and minimum height (2.70m) and internode (25) in single budded soil settlings from non-irrigated plots. In case of polybag settling individual cane weight was statistically identical (0.72-0.75 kg/cane) but in two-budded and one-budded soil bed settlings the cane weights were significantly influenced by irrigation.

Table 4. Effects of irrigation on different yield contributing parameters of sugarcane.

Treatments		Average height/cane (m)	Average weight/cane (kg)	Number of internode/ plant	Diameter of cane (cm)
Sources of settlings	Types of Irrigation				
Polybag settlings	Flood	3.0 a*	0.75 a	28 a	2.9 a
	Spot	3.0 a	0.73 a	27 ab	2.8 b
	Control (No irrigation)	2.8 b	0.72 a	26 b	2.7 b
Two budded soil bed settlings	Flood	3.0 a	0.75 ab	27 a	2.8 a
	Spot	2.8 b	0.79 a	26 a	2.8 a
	Control (No irrigation)	2.8 b	0.70 b	26 a	2.7 a
Single budded soil bed settlings	Flood	3.0 a	0.78 ab	28 a	2.9 a
	Spot	2.9 ab	0.77 ab	27 a	2.7 a
	Control (No. irrigation)	2.7 b	0.70 b	25 b	2.6 b

* Figures accompanied by same letters in a column do not differ significantly at 5% level of probabiiy as per DNMR test.

In two-budded soil bed settlings the diameter (2.7-2.8 cm) were statistically identical but in case of polybag settlings and single budded soil bed settlings the diameter were significantly influenced by irrigation. The maximum cane diameter (2.9 cm) was obtained in polybag settlings under flood irrigated cane and minimum (2.6 cm) with non-irrigated single budded soil bed settlings.

It may be concluded that the highest economic retum can be obtained from polybag settlings under flood irrigated condition and two-budded soil bed settlings.

REFERENCES

Ahmad, S. and Hermann, D.F. 1988. Management Strategies for scheduling irrigation: Sugarcane. *Pakistan J. Agric. Res.*, **9**(4): 516-517.

Anonymous, 1990. Annual Report, 1989-90. Studies on Irrigation scheduling of Sugarcane and its impact on production. Annual report of BARC approved project SRTI, Ishurdi, Pabna.

Banwarilal, 1988. Effects of pre-monsoon irrigation on sugarcane varieties under north Indian conditions, *Indian J. Agron.*, **33**(2): 202-203.

Hossain, A.H.M.D.; Hossain, M.A. and Barman, A.C. 1993. Irrigation sceduling to Sugarcane for High Ganges River Flood Plain. Paper presented in the 6th BSSCT convention.

Hossain, M.A.; Hossain, A.H.M.D.; Eusufzai, S.U.K. and Hossain, S.M.I. 1993. Establishment of settlings and yield of spaced transplanted sugarcane as influenced by irrigation. *Bangladesh J. Sugarcane*, **12-15**: 79-88.

Kingstone, G. 1980. Irrigation Research More Important than Ever. pp. 6-8.

Michael, A.M. 1990. Irrigation Theory and Practice. Publisher: Vikas Publishing House Pvt. Ltd., New Delhi. pp. 448-490.

Rashid, M.H.; Islam, M.S.; Alam, M.J. and Hassan, M. 1987. Irrigation water Measurement mannual. Agri. Engg. Division, BARI, Joydebpur, Gazipur, Bangladesh. pp. 13-14.

Reddi, G.H.S. 1976. Management of Irrigation water. Andhra Pradesh Agril. Univ. Press. p. 22.