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Performance of Spaced Transplanting Method of Sugarcane in Farming Systems Research Sites

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ABSTRACT

An experiment was carried out at Farming Systems Research (FSR) Sites of Sugarcane Research & Training Institute (SRTI) such as Ishurdi, Jaipurhat and Thakurgaon to study the comparative performance of transplanted sugarcane compared to conventional under growers' conditions. Planting methods were conventional (three budded setts placed end to end in trench), spaced transplanting (STP) of soil bed settlings (SBS) and spaced transplanting of polybag settlings (PBS). Significantly higher yield was produced by STP-PBS in all FSR sites over other two methods studied. The highest yield of 113.9 t ha^{-1} was produced by STP-PBS at Jaipurhat site and the mean yield of three sites of this method was 91.1 t ha^{-1}. The second highest yield (98.4 t ha^{-1}) was found in STP-SBS method, at Jaipurhat site, mean yield of three sites of this method was 78.4 t ha^{-1}. The highest yield of STP-PBS cane was obtained by higher yield contributing attributes such as higher tillers and millable canes. The highest gross return (Tk 72628 ha^{-1}) and gross margin (Tk. 52046 ha^{-1}) were also obtained in STP-PBS and earned 69.2% higher income over conventional method of planting.

INTRODUCTION

Sugarcane is a cash-cum-industrial crop of Bangladesh where the yield of cane and sugar is very low. Lower productivity of sugarcane compared to potentiality of commercial varieties under cultivation is a major problem. Sugarcane is cultivated following conventional planting method where three budded setts are planted in trench. Germination of cane in this method is very low and irregular, resulting in lower number of plant population, and ultimately lower yield. It is reported to have minimum 100 to 120 thousand millable canes per hectare for higher yield (Srivastava *et al.*, 1988). Spaced transplanting (STP), a new planting technique of sugarcane, has been developed to minimize seedcanes requirement and to ensure optimum plant population (Srivastava *et al.*, 1981; Rahman and Rahman, 1979). In this method sugarcane settlings raised either in polybag or in soil bed are transplanted in the main field at a desired spacing. The method ensures required number of mother plants per unit area. This enables the crop to make the best use of solar radiation, soil nutrients, and moisture (Kanwar, 1977). In this STP method seedcane requirement is reduced to 1/3rd of conventional method of planting (Rahman and Rahman, 1979). Many reports on the advantage of spaced transplanting of sugarcane have been published elsewhere (Panjee, 1965; Srivastava *et al.*, 1981; Narasimhan *et al.*, 1984; Imam *et al.*, 1982; Miah *et al.*, 1983; Rahman *et al.*, 1987). STP technique reported to be an excellent planting technique of sugarcane is tested under growers' conditions. Possibility of transplanting settlings instead of setts, and comparative performance of these planting techniques have been tested under growers' conditions at SRTI Farming Systems Research sites for several years and finally has recommended two most promising transplanting techniques such as Polybag raised settlings (PBS) and soil bed raised settlings (SBS). Sugarcane being the number

one crop of the client group of FSR sites of SRTI, an experiment was conducted at Ishurdi, Jaipurhat and Thakurgaon sites to study the comparative performance of STP technique compared to conventional method under growers management and socio-economic conditions.

MATERIALS AND METHODS

The experiment was conducted at three Farming Systems Research sites which represent three different agro-ecological zones of Bangladesh. FSR site such as Ishurdi, Jaipurhat and Thakurgaon are situated in Gangetic Flood Plain, Tista Flood Plain and Old Himalayan Piedmont Plain areas respectively. Agro-climatic and soil nutritional information are given in Tables 1 and 2 respectively.

Table 1. Monthly average rainfall and temperature of FSR sites.

Months	FSR site, Ishurdi		FSR site, Jaipurhat		FSR site, Thakurgaon	
	Rainfall (mm)	Temp. (°C)	Rainfall (mm)	Temp. (°C)	Rainfall (mm)	Temp. (°C)
January	8.5	18.6	7.7	19.6	7.2	17.6
February	18.1	21.0	18.8	22.3	13.9	19.8
March	21.8	25.8	24.3	26.7	24.6	24.5
April	58.9	29.5	52.9	29.0	61.7	28.3
May	163.9	29.9	189.9	29.5	208.6	28.8
June	311.6	29.4	293.6	28.8	442.4	28.8
July	288.4	29.9	324.8	28.2	446.4	28.9
August	307.6	29.0	304.9	28.3	405.6	28.8
September	139.5	29.1	272.5	28.7	74.5	28.5
October	140.3	27.6	127.0	27.8	120.2	26.8
November	22.0	23.4	8.1	23.9	6.2	22.5
December	3.4	19.6	1.5	20.5	1.6	18.8
Total	1584.8		1606.0		2152.7	

(Source : Agro-climatic survey of Bangladesh, BRRI/IRRI).

Table 2. Soil nutrient status of FSR sites.

Nutrients	Project sites		
	Ishurdi	Jaipurhat	Thakurgaon
pH	7.0 - 7.5	5.4 - 6.5	4.5 - 5.5
Organic carbon (%)	1.14	1.14	1.50
Ca (meq %)	14.50	NA	1.30
Mg "	1.31	NA	0.10
K "	0.15	20.00	0.20
N "	9.00	10.06	12.30
P "	16.00	40.00	24.00
S "	13.00	6.00	10.00
B "	Tr.	NA	0.30
Cu "	2.00	NA	3.00
Fe "	27.00	NA	125.00
Mn "	4.00	NA	4.00
Zn "	2.00	NA	3.00

The experiment was laid out in RCB design with five replications. The following treatments were tested :

1. Conventional planting of three budded setts placed end to end in trench,
2. Spaced Transplanting of two budded settlings raised in soil bed nursery;
3. Spaced Transplanting of single budded settlings raised in Polybag.

The experiment was carried out under rainfed condition. The land under experiment was flood free high land, and was prepared mechanically. In all treatments distance between rows was 100 cm. In conventional method, three budded setts were planted end to end, in STP techniques, distance between settlings was 45 cm. The individual plot size was 200 m^2. The sugarcane variety under experiment was Isd 16. Chemical fertilizers NPK were applied in commercial form such as Urea, TSP and MP at the rate 120, 120 and 110 kg of N, P_2O_5 and K_2O per hectare respectively. In conventionally planted cane, fertilizers were broadcasted in the trench. In the case of transplanted cane, fertilizers were applied around the settling in ring. All recommended intercultural operations were made properly for all the treatments. In this experiment 45 d old settlings were transplanted in the main field. Date of planting/transplanting was mid November. Insect-pests were controlled both mechanically and chemically using Furadan 5G at the rate of 100 kg ha^{-1} in three splits.

RESULTS AND DISCUSSION

The results of the experiment have been presented in the Tables 3 and 4. It is seen from the Table 3 that methods have significant effect on seed rate, tiller formation, number of millable canes and ultimately on yield of cane. The lowest seedcane (1.8 t ha^{-1}) was required for STP polybag raised settlings, and the second lowest (2.8 t ha^{-1}) seedcane by soil bed raised settlings. The highest seedcane was needed in conventionally planted cane and it was 7.4 t ha^{-1}. Significantly the highest tiller was obtained in STP-PBS cane (243.9 × 10^3 ha^{-1}) followed by STP–SBS (210.3 × 10^3 ha^{-1}) and the lowest in conventional cane (124.2 × 10^3 ha^{-1}). The highest mortality of tillers was found in STP-SBS, followed by in STP-PBS, and the lowest in conventional cane, and these were 59.5, 55.7 and 42.0% respectively.

Table 3. Yield and yield contributing factors of cane grown in different planting methods (at Ishurdi site).

Methods	Seed rate (t ha^{-1})	Tiller (May)		Millable cane at harvest (10^3 ha^{-1})	Brix (%)	Yield (t ha^{-1})
		Total (10^3 ha^{-1})	Mortality (%)			
Conventional	7.4	124.2	42.0	72.0	19.0	73.8
STP-SBS	2.8	210.3	59.5	85.2	18.0	90.5
STP-PBS	1.8	243.9	55.7	108.1	18.0	108.4
LSD (5% level)	—	8.1	—	6.7	0.72	6.75

It is revealed from the Table 3 that the yield of cane were varied dependent on number of millable canes at harvest. The highest cane yield (108.4 t ha^{-1}) was found

from the highest number of millable canes (108.1×10^3 ha^{-1}) in STP-Polybag settlings. The second highest yield of cane (90.5 t ha^{-1}) was also obtained from the second highest number of millable canes (85.2×10^3 ha^{-1}) in STP-SBS. The lowest yield (73.8 t ha^{-1}) was found in conventionally planted cane, where number of millable canes was also the lowest (72.0×10^3 ha^{-1}). Yield contributing factors such as stalk weight and plant height were found almost similar in all planting methods. Similar trend was found in case of brix.

Table 4. Comparative yield and millable canes grown in different methods at different locations.

Methods	Project sites						Mean	
	Ishurdi		Jaipurhat		Thakurgaon			
	Millable canes (10^3 ha^{-1})	Yield (t ha^{-1})	Millable canes (10^3 ha^{-1})	Yield (t ha^{-1})	Millable canes (10^3 ha^{-1})	Yield (t ha^{-1})	Millable canes (10^3 ha^{-1})	Yield (t ha^{-1})
Conventional	76.0	73.8	83.4	88.0	54.0	39.9	71.1	67.2
STP-SBS	85.2	90.5	86.0	98.4	60.2	46.2	77.1	78.4
STP-PBS	108.1	108.4	90.1	113.9	65.1	51.0	87.8	91.1
LSD (5% level)	9.2	7.0	10.0	6.3	7.4	5.1		

It is seen from the Table 4 that the yield and number of millable canes irrespective of planting methods varied to a great extent depending on soil type, soil fertility and microclimatic conditions. The highest number of millable canes and yield of cane in all planting methods were found in FSR Jaipurhat site having fertile Tista Flood plain soil, and ample soil moisture during the entire growing period of the crop. Ishurdi site shows moderate number of millable canes and cane yield. But in Thakurgaon site, the yield of cane and number of millable canes irrespective of planting methods were the lowest than that of other two sites. It is reported that the sugarcane crop in this area is subject to heavy infestation of white grub, nematode and root-stock borers (Anon, 1987). It is evident from Table 2 that the Jaipurhat site is rich in major soil nutrients followed by Ishurdi site. The Thakurgaon site having highly acidic soil shown poor nutrient content resulting poor yield of sugarcane. Considering mean number of millable canes and yield of sugarcane under different planting methods of three FSR sites, it is evident that the highest number of millable canes, (87.8×10^3 ha^{-1}) and yield of cane (91.1 t ha^{-1}) were obtained from spaced transplanted cane by polybag raised settlings followed by STP soil bed raised settlings (77.1×10^3 ha^{-1} and 78.4 t ha^{-1}; millable canes and yield respectively). The lower number of millable canes and yield were found in conventional method where it was 71.1×10^3 ha^{-1} and 67.2 t ha^{-1} respectively. From the above results it is found that the yield and yield contributing factors studied in the present experiment were significantly superior in polybag raised settlings compared to rests the planting methods. STP soil bed raised settlings was also superior to conventional method.

The cost and return analysis of three planting methods is presented in the Table 5. It is seen that the total variable costs of STP polybag raised settlings due to cost of

Table 5. Economic analysis of different planting methods of sugarcane.

Methods	Total variable costs (Tk ha^{-1})	Gross return (Tk ha^{-1})	Gross margin (Tk ha^{-1})	Increasing gross margin over conventional method (%)
Conventional	18678	49446	30768	—
STP-SBS	18705	60635	41930	36.2
STP-PBS	20582	72628	52064	69.2

nursery and other operations was found slightly higher (Tk 20582 ha^{-1}) compared to conventional canes (Tk. 18678 ha^{-1}) but STP soil bed raised settlings costed Tk 18705 per hectare which was almost similar to that of conventionally planted cane. Since yield of STP (both PBS and SBS) was higher compared to conventional method of planting and gross return and gross margin were also higher. The highest gross margin of Tk. 52064 ha^{-1} was obtained in STP-PBS and was followed by STP-SBS (Tk. 41930 ha^{-1}). the lowest gross margin was earned in conventionally planted cane and was Tk 30768 ha^{-1}. Considering percentage of increasing gross margin over that of conventional cane, identical trend as above also may be noted. Results obtained in the present experiment conform the results published elsewhere (Srivastava *et al*, 1981; Rahman and Rahman, 1979). It is observed that planting method plays a vital role in producting tillering and formation of millable canes. Results of the experiment indicated that spaced transplanted canes able to produce higher number of tillers, and millable canes resulting higher yield. Wider as well as uniform spacings help plant to get proper exposure to sunlight, efficient use of soil nutrients and moisture. It may be concluded that the newly developed planting method spaced transplanting of sugarcane was found to be superior planting method over the conventional. This method ensures optimum plant population at a desired space, minimizes seedcanes requirement and increases number of millable canes per unit area resulting in higher cane yield. This method creates rural employment during lean period (July to September) and can be followed by growers even under rainfed condition. It is recommended to use STP-SBS under irrigated condition, while STP-PBS can be practiced under rainfed condition.

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