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Performance of Tomato- Mungbean Sequential Intercropping in Paired Row Transplanted Sugarcane

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ABSTRACT

An experiment was conducted at the Bangladesh Sugarcane Research Institute (BSRI) farm under irrigated condition during 2006-2007 cropping season to study the performance of sugarcane with tomato as first and mungbean as second intercrop in paired row transplanting system of sugarcane. No significant effect of intercropping on tiller, millable cane, cane yield and pol % cane was found in the experiment. It was found that total adjusted cane yield of sugarcane and intercropping practices were found better compared to sole sugarcane cultivation. The highest cane yield (101.30 t ha^{-1}) was found from the treatment T_4 {PRC + tomato (3 lines)-mungbean}. Three lines tomato with paired row cane gave the most satisfactory yield (27.10 t ha^{-1}) followed by 2 lines tomato (24.20 t ha^{-1}). Mungbean as second intercrop after harvest of 3 lines tomato showed better performance. The highest adjusted cane yield (201.23 t ha^{-1}) and the highest gross margin of Tk 2, 05,160.50 ha^{-1} were recorded from the treatment T_4 compared to the control. Maximum benefit-cost ratio of 4.09 was found from PRC + tomato (3 lines)-mungbean combination. Growing mungbean as second intercrop with PRC helped in earning an additional income thus improving soil health by fixing atmospheric nitrogen and adding organic matter in soil. The overall result revealed that tomato as first and mungbean as second intercrop with paired row sugarcane was found suitable and PRC + tomato (3 lines)-mungbean combination was found best among the test combinations and may be recommended as the most profitable intercropping package for sustainable sugarcane farming in Bangladesh.

Key words: Transplanted sugarcane, intercropping, tomato, mungbean

INTRODUCTION

Sugarcane (*Saccharum officinarum* L) is a long duration food-cum-cash-cum industrial crop. From planting to harvest it requires 12 to 14 months. The growth of sugarcane is slow in earlier stages and it takes about 3 to 5 months to establish the full canopy of the crop (Yadava, 1991). During the early stage of sugarcane growth, some short duration crops can be grown as intercrop in the vacant spaces between two cane rows. To make intercropping more profitable per unit area and time with sugarcane, it is necessary to produce more than one intercrop (Hossain *et al.*, 1995 and Khan *et al.*, 1995). Recently intercropping has become the most important practice for sustainable sugarcane production to the marginal farmers. In Bangladesh, only 15 to 20 percent areas are intercropped while in Mauritius, about 70-77 percent cane areas are intercropped mainly with potato and tomato (Imam, 1990 and Anon., 1986). Potato, onion, garlic and cabbage were identified as most profitable intercrops with sugarcane,

which might help to get an interim benefit for the poor farmers (Matin *et al.*, 2001 and Alam, 1999). Tomato (*Lycopersicon esculentum* L.) is a nutritious winter vegetable which is rich in vitamin A. Nationally we are deficit in vegetable production and our people suffer from proper nutrition. Tomato was selected for its higher content of vitamin which is essential for human growth, reproduction and resistance to night blindness. The soil and climate of Bangladesh are favourable for quality tomato production. So, more tomato production is essential for fulfilling the demand. Tomato is a short day crop, which is cultivated as a vegetable crop in winter. There is a vast scope to produce tomato as vegetable in paired row planting system of sugarcane field as first intercrop. Paired row system of sugarcane planting has been designed to keep two rows of cane at 60 cm apart leaving 120-140 cm between two such paired rows for growing intercrops (Roach, 1977). The practice of intercropping may be more productive and economic through adoption of paired row systems following spaced transplanting of sugarcane which provides desired optimum plant population and facilitates higher space for intercropping. Therefore, the present experiment was designed to find out the suitability of tomato as first intercrop and mungbean as second intercrop with transplanted cane in paired row planting system.

MATERIALS AND METHODS

The experiment was conducted at the Bangladesh Sugarcane Research Institute (BSRI) farm, Ishurdi, Pabna during 2006-2007 cropping season under irrigated condition. The site represents High Ganges River Floodplain under Agro-ecological Zone-11 with medium high land of typical sandy loam soil having pH 7.6. BARI tomato-9 (Lalima) as first intercrop followed by mungbean (*Vigna radiata* L) variety BINAmung-5 as second intercrop were grown with sugarcane variety Isd 32. Lalima was selected for its determinant characters which helps to grow second intercrop. The experiment was laid out in a randomized complete block design with four replications. The unit plot size was 8m × 8m. The treatments were as follows:

T_1 : Paired row cane (PRC) only
T_2 : PRC + tomato (1 line) – mungbean
T_3 : PRC + tomato (2 lines) – mungbean
T_4 : PRC + tomato (3 lines) – mungbean

Previously raised single budded soil bed sugarcane settlings were transplanted in each plot during mid November, 2006 with 30 cm interplant spacing in 60 cm apart paired rows. Spacing between two paired rows was 140 cm. For sugarcane Urea, TSP, MOP and Gypsum were applied @ 347, 244, 184 and 222 kg ha^{-1}, respectively (BARC, 2005). Full quantity of TSP, Gypsum and one-third of MOP were applied in trench and mixed with soil prior to transplanting of settlings. One-third of urea was applied at 21 days after transplanting (DAT). The second dose of ($1/3^{rd}$) Urea and $1/3^{rd}$ MOP were applied as first top dressing at 90 DAT. Final top dressing of rest Urea and MOP were applied at 150 DAT. Urea, TSP, MOP and Gypsum @ 180, 120, 130 and 50 kg ha^{-1} for tomato and Urea, TSP and MOP were applied @ 20, 40 and 25 kg ha^{-1} for mungbean. To control insect pests, Furadan 5G was applied @ 40 kg ha^{-1} in three splits in December, 2006, March and May, 2007. Other intercultural operations like irrigation, gap filling, weeding,

mulching, earthing-up, tying and cross tying were done in time. Collection of data on yield and various yield contributing parameters of cane and intercrops were done. The yields of first and second intercrops were recorded at harvest. Tiller population of sugarcane was recorded at 90, 120, 150 and 180 DAT. Millable cane and yield were recorded at harvest. The cane equivalent yield for the intercropped plot were calculated by adding the cane yield with the equivalent cane yield obtained from the intercrops on the basis of sale value. Economic and statistical analysis on different parameters for sugarcane and intercrops were done following the standard procedures.

Fig. 1 : Sugarcane + Tomato (green stage)

Fig. 2: Sugarcane + Tomato (mature stage)

RESULTS AND DISCUSSION

Tiller and millable cane production:

Tiller and millable cane production under different treatments are presented in Table 1. No significant effect on tiller production and millable cane production among the different treatment combinations was found. The highest tiller population of 136.0 $x10^3$ was found from treatments T_1 (PRC only) where tomato and mungbean were not intercropped. In the treatments T_2, T_3 and T_4 tiller populations were identical where tomato was cultivated as first intercrop. Similar results were also reported by Matin *et al.*, (2001) in case of cauliflower, potato, carrot and knolkhol intercropped with paired row sugarcane.

Table 1. Tiller, millable cane, cane yield, pol % cane, equivalent cane yield of intercrops and total adjusted cane yield, BSRI, 2007

Treatments	Tiller ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Cane Yield (t ha^{-1})	Pol % cane	Intercrop yield (t ha^{-1})		Equivalent cane yield (t ha^{-1})	Total adjusted cane yield (t ha^{-1})
					1st	2nd		
T_1 = PRC only	136.0	97.6	94.6	11.76	-	-	-	94.60
T_2 = PRC + tomato (1 line)-MB	132.9	105.6	98.5	11.93	19.40	0.18	71.87	170.37
T_3 = PRC + tomato (2 lines)-MB	128.4	100.6	99.3	11.75	24.20	0.22	98.27	197.57
T_4 = PRC + tomato (3 lines)-MB	132.7	103.3	101.3	11.72	27.10	0.24	99.93	201.23
LSD 5(%)	ns	ns	ns	ns	5.74	ns	-	-

Price of crops : Sugarcane : 1350 Tk t^{-1}, Tomato : 5000.00 Tk t^{-1} and Mungbean (MB) : 60,000.00 Tk t^{-1}

Yield of cane

There was no significant difference on cane yield among the treatments (Table 1), which indicated that intercropping of tomato as vegetable with sugarcane had no adverse effect on cane yield. Apparently the highest cane yield of 101.3 t ha^{-1} was obtained in the treatment (T_4) where tomato was grown as first intercrop and mungbean was grown as second intercrop. On the other hand, the lowest cane yield 94.6 t ha^{-1} was recorded from T_1 where only sugarcane was produced.

Intercrop yield and adjusted cane yield

Yield of different tomato line/lines and mungbean were found satisfactory in all intercropped plots (Table 1). The highest tomato yield of 27.10 t ha^{-1} was obtained from the treatment T_4 -PRC + tomato (3 lines)-MB followed by T_3 (24.20 t ha^{-1}) -PRC + tomato (2 lines)-MB and the lowest of 19.40 t ha^{-1} was recorded from the treatment T_2. Yield of second intercrop mungbean was not significant in different treatment combinations. Apparently the highest mungbean yield of 0.24 t ha^{-1} was obtained from T_4 treatment where tomato was in 3 lines and the lowest yield was obtained in T_2. Adjusted cane yield is an important parameter for determining the total yield potential of the intercropped plots (cane + intercrop) over the sole cane plot (Table 1). The highest total adjusted cane yield of 201.23 t ha^{-1} was recorded from T_4 treatment {PRC + tomato (3 lines)-mungbean} followed by T_3 {PRC + tomato (2 lines)-mungbean} and the lowest total adjusted cane yield of 94.60 t ha^{-1} was obtained from the T_1 (Paired row cane only). The total adjusted cane yield indicated that all the intercropped plots with different tomato line-mungbean combinations were superior to the sole cane plot.

Pol % cane

No significant effect on pol % cane was recorded among the different lines of tomato-mungbean combinations (Fig. 1). The highest pol % cane of 11.93 was obtained from treatment T_2 {PRC + tomato (1line)-mungbean} followed by treatment T_1 (PRC only) and the lowest pol % cane was recorded from treatment T_4 {PRC + tomato (3line)-mungbean}. Intercropping tomato in different lines with sugarcane under paired row system did not show any adverse effect on pol % cane as the intercrops were harvested before the start of grand growth period of cane.

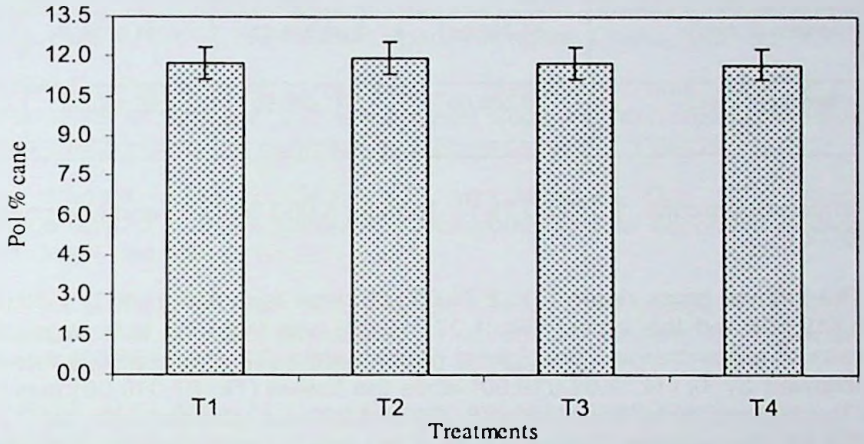

Figure 1. Pol % cane as recorded in tomato-mungbean intercropping combinations

Economics

The economic analysis of the experiment under different treatment combinations is shown in Table 2. Among the treatment combinations, the highest total production cost Tk. 66,500 was for treatment T_4 followed by Tk. 65,700 for treatment T_3 while the lowest Tk. 60,700 for treatment T_1 Paired row cane only. The total production costs varied due to variation of cost of production of first intercrop tomato.

Table 2. Gross margin and benefit-cost ratio (BCR) of different cane intercrop combinations at BSRI farm during 2006-2007 cropping season

Treatments	Total production cost (Tk. ha^{-1})	Gross return (Tk. ha^{-1})	Gross margin (Tk. ha^{-1})	BCR
T_1 = PRC only	60,700.00	1,27,710.00	67,010.00	2.10
T_2 = PRC + tomato (1 line)-mungbean	64,900.00	2,29,999.50	1,65,099.50	3.54
T_3 = PRC + tomato (2 lines)-mungbean	65,700.00	2,66,719.50	2,01,019.50	4.06
T_4 = PRC + tomato (3 lines) - mungbean	66,500.00	2,71,660.50	2,05,160.50	4.09

Price of crops : Sugarcane: 1,350.00 Tk t^{-1}, Tomato: 5,000.00 Tk t^{-1} and Mungbean : 60,000.00 Tk t^{-1}

The highest gross return (Tk. 2,71,660.50) was recorded from T_4 followed by T_3 (Tk. 2,66,719.50) and the lowest (Tk. 1,27,710.00) was from the sole sugarcane crop (T_1). In case of gross margin, the highest gross margin (Tk. 2,05,160.50) was obtained from T_4 followed by T_3 (Tk. 2,01,019.50) while the lowest (Tk. 67,010.00) was recorded from T_1. The highest benefit-cost ratio (BCR) of 4.09 was recorded from the T_4 and the lowest BCR (2.10) was from T_1. The results of the present experiment suggested that for higher economic return intercropping three lines of tomato sequentially followed by mungbean with paired row sugarcane could be practiced.

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