Bangladesh J. Sugarcane, **35** : 102-107 June, 2014

Paired Row System of Sugarcane Cultivation with Chilli as Intercrop under Tista Meander Flood Plain Soils

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ABSTRACT

An experiment was conducted at farmers' field of Joypurhat Sugar Mills area during the cropping season 2012-2013 and 2013-2014 to find out the suitability of chili as intercrop with paired row sugarcane for higher economic return in Tista Meander Floodplain Soils. Chilli varieties BARI Marich 1 and a local variety named Bogra Marich were used as intercrop. Significantly highest cane yield of 124.85 tha^{-1} and chilli yield of 3.7 tha^{-1} were produced in the treatment T_2 (PRC + 2 lines chilli BARI Marich) which resulted the highest gross return 3,93,250 $Tk.ha^{-1}$ with BCR of 3.14 in the cropping season 2012-2013 and in the cropping season 2013-2014, significantly highest cane yield of 126.87 tha^{-1} and chilli yield second highest of 3.2 tha^{-1} were produced in the treatment T_3 (PRC + 2 lines chilli local variety Bogra Marich) which resulted the second highest gross return 3,67,850 $Tk.ha^{-1}$ with BCR of 2.94. No significant variations were found in brix percent among the treatments in both the cropping seasons. The highest total adjusted yield of 157.3 tha^{-1} and 149.4 tha^{-1}, respectively was found in T_2 (PRC + 2 lines BARI Marich) treatment in both the cropping season 2012-13 and 2013-14 which was followed by T_4 (150.5 tha^{-1}) in cropping season 2012-13 and in 2013-14 T_3 (147.1tha^{-1}), respectively. The results of the experiment suggested that for higher economic return intercropping two lines of chilli (BARI Marich 1) with paired row sugarcane might be practiced at Joypurhat district under Tista Meander Flood Plain Soils.

Key words: Sugarcane, paired row cane, millable cane, intercropping, chilli

INTRODUCTION

Intercropping is an economic and unique approach of getting additional farm income and high agricultural production per unit area from same piece of land. Sugarcane is a long duration crop which requires 12-14 months from planting to harvesting. Bangladesh is an over populated country with low land man ration and high population growth rate. The average farm size is Bangladesh is about 0.5 hectare per house hold (BBS, 2009). Our poor farmers can't effort to invest their land for such a long period and they like to get an interior benefit. Due to many factors including growing of short duration high value vegetables and other crops the sustainability of long duration sugarcane is at threat. Short duration winter crops like potato, garlic, onion, tomato, cabbage, chilli and mustard are grown in vacant space to get an additional crop with minimum investment without affecting of main crop sugarcane (Ali *et al.*, 1989, Kabir,

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1988). This is more acute in high land where most of short duration crops grow well including sugarcane. To meet the situation, strategies are to be evolved to increase sugarcane yield, income and benefit in totality per unit area. Yadav and Verma (1984) have reported that intercropping of other crops with sugarcane was found profitable, particularly in the sub-tropical region of India. 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. In Bangladesh, only 15 to 20 percent areas are intercropped while in Mauritius, about 70 to 77 percent cane areas are intercropped mainly with potato and tomato (Iman *et al.*, 1990 and Anon., 1986). Successful intercropping of various crops with sugarcane has been reported by many researchers (Rathi *et al.*, 1974; Behli and Narwal, 1977; Verma *et al.*, 1981; Imam *et al.*, 1990).

Sustainable sugarcane cultivation and to meet national requirement for sugar and goor, it is utmost necessary to find the possible ways of increasing economic benefit from sugarcane cultivation. Intercropping of various economic important crops eg., winter vegetables with sugarcane through utilization of our present limited resources as well as improved modern technologies might solve this problem to a greater extent. Usually, one line of winter crops is intercropped in between two single rows of sugarcane and this system of conventional intercropping could not give satisfactory intercrop yield in most of the cases. To overcome this problem, paired row system of sugarcane plantation has been developed at BSRI to facilitate higher intercrop population and raising more intercrops. Paired row facilitates growing more than one intercrop by providing adequate space, light, air, water and nutrients for their proper growth. It does not adversely affect the cane yield because of availability of equal number of cane clumps as in the case of single row. Roach (1977) found that the most significant yield increase (15-29%) over conventional spacing has been reported from planting two rows of cane at 40-50 cm apart leaving 150 cm between two such paired rows for growing intercrops. Chilli is one of the important spices crops of Bangladesh which is rich of vitamin C. Nationally we are deficit in spices production. The soil and climate of Bangladesh are favorable for quality chilli production.

More production of chilli is essential for fulfilling the country demand. In Joypurhat under AEZ 3 (Tista Meander Floodplain Soils) area farmers cultivated local variety (Bogra Marich) in winter season and sometimes cultivate year round. Bangladesh Sugarcrop Research Institute has recommended several intercrop combination after intensive studies at research station and at farmers' field. But much less effort has been given to implement the recommendations of BSRI or even to select the most suitable intercrop combination to be practiced by the farmers in particular agro climatic and edaphic conditions. However, an attempt has been made to study paired row system of sugarcane cultivation with chilli as intercrop at Joypurhat region under AEZ 3 with following objectives: (i) observing the suitability of chili as intercrop with sugarcane, (ii) popularizing chili as intercrop with paired row sugarcane cultivation and (iii) finding the BCR of chilli as intercrop.

MATERIALS AND METHODS

The experiment was conducted at farmers' field at Aima Rasulpur under Joypurhat district during 2012-2013 and 2013-2014 cropping seasons. The site represents Tista Meander Flood Plain Soils under Agro-Ecological Zones 3. BARI Marich 1 and a local variety (Bogra Marich) were used as chilli varieties. The experiment was laid out following Randomized Complete Block (RCB) design with four replications. The unit plot size was 6m x 6m. The treatments were as follows:

T_1: Paired row cane only
T_2: PRC + Chilli (BARI Marich 1) - 2 lines
T_3: PRC + Chilli (Local variety as Bogra Marich) - 2 lines
T_4: PRC + Chilli (BARI Marich 1) - 3 lines
T_5: PRC + Chilli (Local variety as Bogra Marich) - 3 lines

Cane variety Isd 39 was planted at 45 cm inter-plant spaces on well prepared trenches in paired row on 02 December, 2012-13 and 05 December, 2013-14 respectively. The trenches were made at 140 cm distance. Chilli seedlings were planted in according to the treatment. For sugarcane and intercrops, fertilizers were applied following the recommended rates (BARC, 2005). Pest management and necessary intercultural operations were done according as and when needed. Data on number of tiller, millable cane, yield, brix percent and intercrop yield were recorded for sugarcane. Cane equivalent yield of intercrops and the adjusted cane yield were also calculated. Total production cost, gross return, gross margin and benefit cost ratio were calculated for economic analysis of chilli intercropping with paired row sugarcane.

RESULTS AND DISCUSSION

Number of tillers (000' ha^{-1})

In the cropping season 2012-13, the highest (201.60 x 10^3 ha^{-1}) tiller population was counted in T_4 where 3 lines chilli (BARI Marich 1) were intercropped with paired row sugarcane followed by T_3 treatment 2 lines chilli (Local variety as Bogra Marich) with PRC (194.50 x 10^3 ha^{-1}) and the lowest (189.10 x 10^3 ha^{-1}) in T_5 treatment where 3 lines chilli (Local variety as Bogra Marich) were intercropped with PRC. In the cropping season, 2013-14, there was no significant difference in number of tillers. However, the highest number of tillers was found in treatment T_2 (193.19 x 10^3 ha^{-1}).

Number of millable cane (000' ha^{-1})

In the cropping season 2012-13, the highest number of millable cane (89.62 x 10^3 ha^{-1}) was recorded from T_4 where 3 lines chilli (BARI Marich 1) were intercropped with PRC and the lowest (81.43 x 10^3 ha^{-1}) in T_3 treatment where 2 lines chilli (Local variety as Bogra Marich) were intercropped with PRC. In the cropping season 2013-14, there was no significant difference in number of millable cane among the treatments.

Cane yield (tha^{-1})

In the cropping season 2012-13, cane yield varied significantly different intercropping treatments Table 1 and the highest cane yield (124.85 tha^{-1}) was found in T_2-2 lines chilli (BARI Marich 1) were intercropped with PRC followed by T_4 where 3 lines chilli (BARI Marich 1) were intercropped with PRC (119.09 tha^{-1}). The lowest (106.10 tha^{-1}) cane yield was recorded from the treatment T_1 (paired row cane only). In the

cropping season 2013-14, the highest cane yield (126.87 tha^{-1}) was found in T_3-2 lines chilli (Local variety as Bogra Marich) were intercropped with PRC followed by T_2 where 2 lines chilli (BARI Marich 1) were intercropped with PRC (123.67 tha^{-1}). The lowest (108.45 tha^{-1}) cane yield was recorded from the treatment T_1 (paired row cane only).

Brix (%)

No significant variations were found in case of brix % among the treatment of the experiment in both the cropping seasons 2012-13 and 2013-14.

Table 1. Yield and yield attributes of sugarcane as affected by chilli intercropping practices at Aima Rasulpur, Joypurhat district during 2012-13 and 2013-14

Treatments	Tiller ($\times 10^3$ ha^{-1})		Millable cane ($\times 10^3$ ha^{-1})		Cane yield (t ha^{-1})		Brix %	
	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14
T_1	193.10 b	189.37	82.89 b	101.20	106.10 d	108.45c	20.16	18.33
T_2	192.30 bc	193.19	83.93 b	103.00	124.85 a	123.67ab	20.45	18.57
T_3	194.50 b	188.58	81.43 b	101.17	112.49 b	126.87a	20.17	18.43
T_4	201.60 a	187.35	89.62 a	97.83	119.09 a	119.86 b	20.41	18.43
T_5	189.10 c	190.97	83.38 b	98.43	110.41 c	120.97ab	19.77	18.33
LSD (0.05)	4.62	NS	5.32	NS	6.45	6.95	NS	NS

In a column, figures with similar letters do not differ significantly at 5% level

Adjusted cane yield (tha^{-1})

In the cropping season 2012-13, the highest adjusted cane yield (157.3 tha^{-1}) was recorded from T_2-2 lines chilli (BARI Marich 1) were intercropped with PRC followed by T_4 where 3 lines chilli (BARI Marich 1) were intercropped with PRC (150.5 tha^{-1}). The lowest (106.1 tha^{-1}) adjusted cane yield was recorded from the treatment T_1 (paired row cane only).

In the cropping season 2013-14, the highest adjusted cane yield (149.43 tha^{-1}) was recorded from T_2-2 lines chilli (BARI Marich 1) were intercropped with PRC followed by T_3 where 2 lines chilli (Local variety as Bogra Marich) were intercropped with PRC (147.14 tha^{-1}). The lowest (108.45 tha^{-1}) adjusted cane yield was recorded from the treatment T_1 (paired row cane only). From the findings it might be concluded that raising intercrop influenced cane yield and other yield contributing factors but found profitable compared to sole sugarcane grown in farmer's field in the experiment plots. In Joypurhat area generally local variety (Bogra Marich) cultivate by the farmers but production is not satisfactory. On the other hand, in case of BARI variety farmers got satisfactory result in both the cropping seasons.

Table 2. Intercrop yield, cane equivalent yield of intercrop and adjusted cane yield affected by chilli intercropping practices at Aima Rasulpur, Joypurhat district during 2012-13 and 2013-14

Treatments	Intercrop yield (tha^{-1})		Cane equivalent yield of intercrop (tha^{-1})		Adjusted cane yield (tha^{-1})	
	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14
T_1: Paired row cane	-	-	-	-	106.10 c	108.45 c
T_2: PRC + Chilli (BARI Marich 1) - 2 lines	3.70	3.40	51.20	40.90	157.30 a	149.43 a
T_3: PRC + Chilli (Local variety) - 2 lines	2.60	3.20	36.50	38.70	142.60 b	147.14 ab
T_4: PRC + Chilli (BARI Marich 1) - 3 lines	3.20	2.70	44.40	32.90	150.50 a	141.30 b
T_5: PRC + Chilli (Local variety) - 3 lines	2.60	2.70	36.30	33.00	142.40 b	141.45 b
LSD (0.05)	-	-	-	-	8.12	7.6334

In a column, figures with similar letters do not differ significantly at 5% level

Price: In cropping seasons 2012-13 and 2013-14, Chilli: 35 Tk kg^{-1} and 30 Tk kg^{-1}, respectively and Sugarcane: 2.50 Tk kg^{-1} in both the cropping seasons.

Economic analysis

In the cropping season, 2012-13 the highest gross return (3,93,250 Tk. ha^{-1}), gross margin (2,58,250 Tk. ha^{-1}) and BCR (3.14) was recorded from T_2 where 2 lines chilli (BARI Marich 1) were intercropped with PRC followed by T_4 where 3 lines chilli (BARI Marich 1) were intercropped with PRC {Gross return (3,79,250 Tk. ha^{-1}), gross margin (2,36,250 Tk. ha^{-1}) and BCR (2.91)}. The lowest BCR (2.52) economic return was recorded from the treatment T_1 (paired row cane only) (Table 3). The total production costs were different due to variation of cost of production of sugarcane and intercrop, as a result gross return, gross margin and BCR also different among the treatments.

In the cropping season, 2013-14 the highest gross return (3,93,575 Tk. ha^{-1}), gross margin (2,38,575 Tk. ha^{-1}) and BCR (3.14) was recorded from T_2 where 2 lines chilli (BARI Marich 1) were intercropped with PRC followed by T_3 where 2 lines chilli (Local variety as Bogra Marich) were intercropped with PRC {Gross return (3,67,850 Tk. ha^{-1}), gross margin (2,32,850 Tk. ha^{-1}) and BCR (2.94)}. The lowest economic return (BCR 2.58) was recorded from the treatment T_1 (paired row cane only).

Table 3. Economic analysis of chilli intercropping with paired row Sugarcane at Aima Rasulpur, Joypurhat district during 2012-13 and 2013-14

Treatments	Total cost (Tk. ha^{-1})		Gross return (Tk. ha^{-1})		Gross margin (Tk. ha^{-1})		Benefit cost ratio (BCR)	
	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14
T_1: PRC only	1,05,000	1,05,000	2,65,250	2,71,125	1,60,250	1,66,125	2.52	2.58
T_2: PRC + Chilli (BARI Marich 1) - 2 lines	1,25,000	1,25,000	3,93,250	3,93,575	2,58,250	2,38,575	3.14	3.14
T_3: PRC + Chilli (Local variety) - 2 lines	1,25,000	1,25,000	3,56,500	3,67,850	2,21,500	2,32,850	2.85	2.94
T_4: PRC + Chilli (BARI Marich 1) - 3 lines	1,30,000	1,30,000	3,79,250	3,53,250	2,36,250	2,13,250	2.91	2.71
T_5: PRC + Chilli (Local variety) - 3 lines	1,30,000	1,30,000	3,56,000	3,53,625	2,16,000	2,13,625	2.73	2.71

Sugarcane and chilli was the favorite crop in Joypurhat area during winter and summer season. But no substantial data on intercropping has been generated with these crops in intercropping situation. Thus the results of the experiment suggested that for higher economic return intercropping two lines of chilli (BARI Marich 1) with paired row sugarcane might be practiced at Joypurhat district under Tista Meander Floodplain Soils.

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