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Yield of Different Winter Crops with Cane as First and Mungbean as Second Intercrop in Rainfed Condition under Paired Row Planting System

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ABSTRACT

The experiment was conducted at the Bangladesh Sugarcane Research Institute (BSRI) farm under rainfed condition during 2005-2006 cropping season to study the performance of different winter crops as first and mungbean as second intercrop in paired row planting system of sugarcane. Five winter crops namely, Lentil (BARI Mosur-4), Chick pea (Hypro chhola), Linseed (Nila), Pea (IPSA) and Groundnut (BINA China Badam 3) as first intercrops followed by mungbean as second intercrop were tested in paired row cane (PRC). 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 higher compared to sole sugarcane cultivation. Maximum benefit-cost ratio of 2.22 was found from PRC + linseed - mungbean combination. Growing mungbean as second intercrop with PRC earned an additional income and helped to improve soil health by fixing atmospheric nitrogen and adding organic matter in soil. The overall result revealed that all the intercropping packages tested in the experiment were found suitable to grow with sugarcane in paired row planting system under rainfed condition but in chickpea second intercrop mungbean was used as green manure because of late sowing and in case of ground mungbean can not be sown due long duration of life cycle. However, it may be recommended for large scale adoption in farmers field. Proper care taken to utilize the residual moisture just after harvesting the previous crop and seed of intercrops need to soaked in water for at least 12 hours before sowing.

Key words: Sugarcane, rainfed intercropping, mungbean

INTRODUCTION

Sugarcane (*Saccharum officinarum* L) is a long duration 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 unit $^{-1}$ area and time with sugarcane, it is necessary to produce more than one

intercrop (Hossain *et al.*, 1995 and Khan *et al.*, 1995). Ali *et al.* (1989) observed that there was no significant adverse effect of row arrangement on the growth, yield and sucrose content of sugarcane. Successfully intercropping of various crops with sugarcane has been reported by many researchers (Rathi *et al.*, 1974; Behli and Narwal, 1977; Verma *et al.*, 1981 and Imam *et al.*, 1990). Potato, onion, garlic and cabbage were identified as most profitable intercrops with sugarcane under irrigated condition, which might help to get an interim benefit for the poor farmers (Matin *et al.*, 2001 and Alam, 1999). There is ample scope to produce winter crops in sugarcane field as 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. In view of this consideration an experiment was designed to find out the performance of different winter crops with sugarcane as first and mungbean as second intercrop in paired row transplanted sugarcane under rainfed condition.

MATERIALS AND METHODS

An experiment was conducted at the Bangladesh Sugarcane Research Institute (BSRI) farm, Ishurdi, Pabna during 2005-2006 cropping season under rainfed 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. Five different winter crops namely, Lentil (BARI Mosur-4), Chick pea (Hypro chhola), Linseed (Nila), Pea (IPSA) and Groundnut (BINA China Badam 3) as first intercrops followed by mungbean (*Vigna radiata* L) variety Binamoog-5 as second intercrop were grown with sugarcane variety Isd 36 to find out the growth of winter crops under rainfed condition for sustainable sugarcane farming.

Fig. 1 : Sugarcane + lentil

Fig. 2 : Sugarcane + chickpea

Fig. 3 : Sugarcane + linseed

Fig. 4 : Sugarcane + groundnut

Fig. 5 : Sugarcane + pea IPSA

The experiment was laid out in randomized complete block design with three replications. The unit plot size was 8mx 8m. The treatments were as follows:

T_1 : Paired row cane (PRC) only
T_2 : T_1 + lentil-mungbean
T_3 : T_1 + chick pea-mungbean
T_4 : T_1 + linseed-mungbean
T_5 : T_1 + pea-mungbean
T_6 : T_1 + groundnut-mungbean

Three budded sugarcane setts were planted in each plot during mid November, 2005 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). All TSP, Gypsum and one-third of MOP were applied in trench and mixed with soil prior to planting of setts. One-third of urea was applied at 21 days after planting (DAT) of setts. 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. Recommended fertilizers are apply for the intercrops. TSP and MP were applied @ 47 and 30 kg ha^{-1} for mungbean. To control insect pests, Furadan 5G was applied @ 40 kg ha^{-1} in three splits in December, 2005, March and May, 2006. Other intercultural operations like gap filling, weeding, mulching, earthing-up and 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 statistical procedures.

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 129.27 x 10^3 and 122.50 x 10^3 ha^{-1} were found from treatments T_5 (T_1 + pea IPSA -mungbean) and T_4 (T_1 + linseed -mungbean) and the lowest were in treatments T_2 (T_1 + chickpea - mungbean). In case of millable cane production the highest were found in treatments T_5 (T_1 + pea IPSA -mungbean) and T_2 (T_1 + lentil -mungbean). But the lowest millable cane was found in treatments T_3 and T_6 where the first intercrops were chickpea and groundnut. 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, intercrops yield and total adjusted cane yield BSRI, 2005-2006

Treatments	Tiller ($\times 10^3$ ha^{-1})	Millable cane ($\times 10^3$ 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	120.93	89.75	78.69	14.16	-	-	-	78.69
T_2 = T_1 + lentil – MB	118.43	90.68	90.41	14.09	0.22	0.29	17.00	107.41
T_3 = T_1 + chickpea – MB	122.18	83.64	75.62	14.56	0.30	*	10.00	85.62
T_4 = T_1 + linseed – MB	122.50	85.99	87.50	14.29	0.37	0.25	17.92	105.42
T_5 = T_1 + pea IPSA – MB	129.27	91.40	78.80	14.56	0.46	0.22	20.96	99.76
T_6 = T_1 + ground nut – MB	120.08	83.32	79.27	14.66	1.66	-	36.89	116.16
LSD 5(%)	ns	ns	ns	ns	-	0.05	-	-

Price of crops :

Sugarcane	:	1350 Tk/ton	pea IPSA	:	40 Tk/kg
lentil	:	45 Tk/kg	ground nut	:	30 Tk/kg
chickpea	:	45 Tk/kg	Mungbean	:	45 Tk/kg
linseed	:	35 Tk/kg	*		Green manaure

Yield of cane:

There was no significant difference on cane yield among the different treatments (Table 1), which indicated that intercropping of sugarcane had no adverse effect on cane yield. Apparently the highest cane yield of 90.41t ha^{-1} was obtained in the treatment (T_2) where first intercrop was linseed and mungbean was grown as second intercrop. On the other hand, the lowest cane yield 83.32 t ha^{-1} and 83.64 were recorded from T_3 and T_6 where first intercrops were groundnut and chickpea produced.

Intercrop yield and adjusted cane yield :

Significant effect on yield was obtained in different winter crops-mungbean combinations. But yield of different intercrops and mungbean were found satisfactory in all intercropped plots under rainfed condition (Table 1). The highest yield of 1.66 t ha^{-1} was obtained from the groundnut followed by pea (IPSA) (0.46 t ha^{-1}) and the lowest was recorded from linseed (0.22 t ha^{-1}). Yield of second intercrop mungbean varied in small amount with different treatment combinations. The highest mungbean yield (0.29 t ha^{-1}) was obtained from T_2 treatment where first intercrop was linseed but in treatment T_6 second intercrop was not possible to grow where groundnut was as first intercrop and in treatment T_3 second intercrop was used as green manure. It was happened due to the long duration of first intercrops. 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 (116.16 t ha^{-1}) was recorded from T_6 treatment (T_1 + groundnut-mungbean} followed by T_2 (107.41 t ha^{-1}) {T_1 + linseed-mungbean} and the lowest total adjusted cane yield (78.69 t ha^{-1}) was from the T_1 (Paired row cane only). The total adjusted cane yield indicated that all the intercropped plots with different winter intercrops-mungbean combinations were superior to the sole cane plot.

Pol % cane:

No significant effect on pol % cane was recorded among the different winter crops-mungbean combinations (Fig.1). The highest pol % cane (14.66) was obtained from treatment T_6 {T_1 + groundnut-mungbean} followed by treatment T_3 and T_5 and the lowest pol % cane was recorded from treatment T_2 where linseed was as first intercrop. Intercropping different winter crops with sugarcane under paired row system did not show any adverse effect on pol % cane as the intercrops were harvested before start of grand growth period of cane.

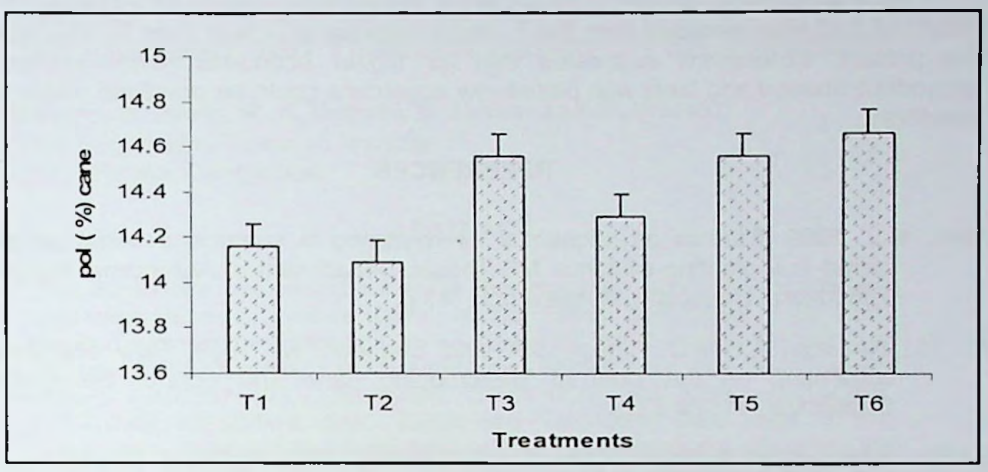

Figure 1. Pol % cane as affected by different winter crops-mungbean intercropping combinations

Economics:

The economic analysis of the experiment under different treatment combinations was shown in Table 2. Among the intercrop combinations, the highest total production cost of Tk. 69,500.00 was for treatment T_5 followed by Tk. 67,500.00 for treatment T_2 while the lowest Tk. 52,000 for treatment T_1 (Paired row cane) only. The total production costs were different due to variation of cost of production of sugarcane and intercrops.

Table 2. Economics and benefit-cost ratio (BCR) of different cane intercrops combinations at BSRI during cropping year 2005-2006

Treatments	Total of cost production (Tk. ha^{-1})	Gross return (Tk. ha^{-1})	Gross margin (Tk. ha^{-1})	BCR
T_1 = PRC only	52,000.00	1,06,366.50	54,366.50	2.05
T_2 = T_1 + lentil – MB	67,500.00	1,45,003.50	77,503.50	2.15
T_3 = T_1 +chickpea – MB	66,500.00	1,15,587.00	49,087.00	1.74
T_4 = T_1 +linseed– MB	64000.00	1,42,317.00	78,317.00	2.22
T_5 = T_1 + pea IPSA – MB	69500.00	1,34,676.00	65,176.00	1.94
T_6 = T_1 + groundnut – MB	62000.00	1,56,816.00	94,816.00	2.53

* lentil= 8000, chickpea= 7000, linseed= 5000, pea IPSA 10000, groundnut= 10000 Tk. Cost /ha

The highest gross return (Tk. 1,56,816.00) was recorded from T_6 followed by T_2 and the lowest was from the sole sugarcane crop (T_1). In case of gross margin, the highest gross margin (Tk. 94,816.00) was also obtained from T_6 followed by T_2 (Tk. 77,503.50) while the lowest (Tk. 52,000.00) was recorded from T_1. The highest benefit-cost ratio

(BCR) of 2.53 was recorded from the T_6 and the lowest BCR was from T_3. The results of the present experiment suggested that for higher economic return intercropping groundnut, linseed and lentil with paired row sugarcane could be practiced under rainfed condition.

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