INTERCROPPING OF DIFFERENT SHORT DURATION CROPS WITH SUGARCANE

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Abstract

A field experiment was conducted at Multi Location Testing (MLT) site Barura under on-farm research division, Bangladesh Agricultural Research Institute, Cumilla (AEZ 19) during 2014-16 to find out suitable vegetable intercropping with sugarcane and also to estimate the profitability of intercropping with sugarcane at Cumilla region. From the research result it was revealed that yield of sole sugarcane was 92.47 t ha^{-1} whereas for different crop combination with sugarcane such as sugarcane plus cabbage, sugarcane plus cauliflower, sugarcane plus potato, sugarcane plus garden pea and sugarcane plus garlic the adjusted sugarcane yield were 143.36, 122.90, 99.02, 97.19 and 125.15 t ha^{-1} respectively. Maximum gross return of Tk. 1433600 ha^{-1} and net return of Tk. 683788 ha^{-1} came from sugarcane plus cabbage followed by sugarcane plus garlic, sugarcane plus cauliflower and sugarcane plus garden pea. On the other hand, for sole sugarcane gross return and net return were Tk. 924700 and Tk. 214388 ha^{-1} respectively significantly less than all intercropping combinations with sugarcane. From economic analysis it was showed that highest benefit cost ratio (1.91) came from sugarcane combination with cabbage and lowest from sole sugarcane (1.30).

Keywords
Intercropping, Vegetables, Sugarcane, Economic analysis

INTRODUCTION

Bangladesh is an over populated country with low land and high population growth rate. Rice being the staple food crop occupies two thirds of the cultivated land and sugarcane occupies 2% of the cultivated land and one of the important cash cum industrial crop. Due to many factors including growing of short duration high value vegetables and other crops the

sustainability of long duration sugarcane crop is at threat. To meet the situation, strategies are to be evolved to increase sugarcane yield, income and benefit from per unit area. Intercropping of one or more crops with sugarcane is an appropriate approach of getting additional farm income beside the main crop of sugarcane. Sugarcane 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 stages of sugarcane growth, some short duration crop can be grown as intercrop in the vacant spaces between two cane rows. To make per unit area profitable, it is necessary to produce more than one intercrop with sugarcane (Hossain et al., 1995 and Khan et al., 1995). 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). Farmers of Cumilla district specially in Barura upazilla nearest the Lalmai hilly areas cultivate huge amount of chewing type sugarcane. Most of the farmers do not cultivate short duration vegetable crops as intercropped with sugarcane and few of the farmers practice vegetables as intercropped with sugarcane as a single row system. In view of this consideration an experiment was designed to find out the suitable vegetable for intercropping with sugarcane under farmers' field condition for increasing cropping intensity as well as boast up the farmer's income.

MATERIAL AND METHODS

The experiment was conducted at Amratoli village, MLT site Barura under On-Farm Research Division of Bangladesh Agricultural Research Institute, Cumilla in Old Meghna Estuarine Floodplain (AEZ 19) during cropping season 2014-15 and 2015-16 to find out the suitable vegetable for intercropping with sugarcane under farmers' field condition for increasing cropping intensity and profitability. Five intercrops such as cabbage (var. Atlas 70), cauliflower (var. BARI Foolkopy-2), potato (BARI Alu-7), garden pea (BARI Motor-3) and garlic (BARI Rashun-2) were selected comprised with sole sugarcane. The experiment was laid out in Randomized Complete Block (RCB) Design with four dispersed replications. Unit plot size was 2.4 x 8 m^2. Forty days old two eyed soil bed settings of ISD 208 was used as test crop in the experiment. Row to row and plant to plant distance were 100 and 45 cm, respectively. Intercrops were planted between the vacant spaces of sugarcane during the last week of November in both the years. Cabbage and cauliflower were planted in two rows following the spacing row to row 30 cm and plant to plant 30 cm, potato tubers were planted in two rows following the spacing row to row 30 cm and plant to plant 20 cm, garden peas were planted in two rows following the spacing row to row 30 cm and plant to plant 15 cm and garlic were sown in two rows following the spacing row to row 30 cm and plant to plant 10 cm. Fertilizers were applied on the basis of fertilizer recommendation guide, 2012. All intercultural and pest control measures were done as and when necessary. Harvesting of Cabbage and Cauliflower were done 2nd week of February in both the consecutive years. Potato and garden pea were harvested last week of February and garlic was harvested in last week of April. Sugarcane of all plots was harvested during last week of September for selling chewing purpose. Data on yield and yield parameters of sugarcane and yield of intercrops were recorded and analyzed statistically by using computerized software Statistix10 and presented in the Table 1. Cost of production was calculated on the basis of cost of land preparation, seed cost, fertilizer cost, pesticide cost, labour cost and interest on current capital and presented in the Table 2.

RESULT AND DISCUSSIONS

3.1 Performance of Sugarcane in intercropping situation

A perusal of data summarized in Table 1 clearly revealed that the length of sugarcane among the treatments varied but was not statistically significant. The highest length (257.20 cm) of sugarcane was produced in T_5 (Sugarcane + garlic), which was closely followed by T_3 and T_4 and the lowest (221.47 cm) length of sugarcane was recorded T_6 (sole sugarcane) in sugarcane with different crops intercropped situation. So there was no relationship among the treatment as in case of cane length in intercropped situation may be the utilization fallow spaces of sugarcane fields by different vegetables at the early stages of sugarcane. This finding is in line with as observed by Ahmed *et al* (1997) and Muhammad *et al*. (2000), who reported that different intercropping treatments did not affect sugarcane length and tillering of sugarcane significantly.

Data presented in the table 1 indicates that variation among the average cane weight of various treatments are statistically non-significant. TreatmentT_5 (sugarcane +garlic) produced the highest individual cane weight(2.45 kg) while the lowest (1.96 kg) cane weight was obtained in T_2 treatment i.e sugarcane with cauliflower intercropping situation.

From the research result it was reveal that variation among the average cane number and yield of various treatments are statistically significant. TreatmentT_6 (sole sugarcane) produced the highest number of sugarcane per hectare that leads to produce highest yield (92.47 t ha^{-1}) of sugarcane. In intercropping situation, the highest (91.25t ha^{-1}) cane yield was obtained in T_3 treatment i.e sugarcane with potato intercropping situation while lowest yield was recorded in T_2 treatment. Treatment T_3produced the highest cane yield might be due to good and intensive management for potato which increased cane yield.

Sugarcane equivalent yield was calculated on sale proceeds received from intercrop equivalent sugarcane price. Equivalent yield of intercrop varied significantly. The intercrops of cabbage, cauliflower, potato, garden pea and garlic produced significantly different equivalent yield. Table 2 revealed thatT_1 (sugarcane+ cabbage) gave the highest sugarcane equivalent yield (60.76 t ha^{-1}) followed by T_2 (47.7 t ha^{-1}) whereas the lowest (7.6 t ha^{-1}) equivalent yield was observed from T_4 (sugarcane + garden pea) which is statistically different from other treatments.

In considering adjusted cane yield, it is evident that T_1 (Sugarcane + Cabbage) produced the highest yield of 143.36 t ha^{-1} which led to higher income and followed by T_5 and T_2 (122.9 t ha^{-1}), besides the lowest (97.40 t ha^{-1}) adjusted yield was calculated from T_4 (sugarcane+ garden pea) which was significantly different from other treatments. The lowest adjusted yield was found from T_4 (sugarcane+ garden pea) due to low intercrop yield and cane yield. The total adjusted cane yield indicated that all the intercrop plots with different high value vegetables combinations were superior to the sole cane plot. The increment of total production by intercropping than sole cropping was also reported by different Agricultural researchers like Farhad *et al*. (2014) and Bhowal *et al*. (2014).

3.2 Economic Analysis

The economic analysis of the experiment under different treatment combinations was shown in Table 2. Among the different treatments combinations the total production cost varies among the treatments. The total production cost was varied due to variation of cost of production of intercrops. The highest gross return (Tk. 1433600 ha^{-1}) was recorded from T_1 followed by T_2 (Tk. 1229000 ha^{-1}), T_5 (Tk. 1251500 ha^{-1}) and the lowest was from sole sugarcane crop T_6 (Tk. 924700 ha^{-1}). In terms of net income the highest income was recorded from T_1 (Tk. 683788 ha^{-1}) followed by T_5 (Tk. 491788 ha^{-1}) and the lowest from T_6 (Tk. 214388 ha^{-1}). The highest benefit cost ratio (BCR) of 1.91 was recorded from T_1 followed by T_5 (1.84), T_2 (1.63) and the lowest from T_6 (1.56) where sole sugarcane were grown. The findings of the above result strongly supports the statement of the researchers of Alam, *et al.*, 2000 and Goni and Paul, 2005 who stated that Intercropping in sugarcane with various short duration crops like cabbage, potato, mugbean etc. has been proven profitable in comparison to growing sugarcane as sole crop. This indicated that different short duration crops intercropped with sugarcane cultivation might be the source of additional income instead of sole sugarcane cultivation.

CONCLUSION

From the above discussion it can be concluded that for higher economic return high value vegetable cabbage as first, garlic and cauliflower as second intercrop with paired row sugarcane could be practiced under farmers' condition in different cane growing areas of Cumilla district (AEZ 19).

Treatments	Sugarcane length (cm)	Cane Wt. (Kg Cane^{-1})	Sugarcane No.(ha^{-1})	Sugarcane yield (t ha^{-1})	Intercrop yield (t ha^{-1})
T_1	255.33	2.27	37707	82.60	40.51
T_2	251.27	1.96	38367	75.20	31.80
T_3	256.20	2.41	38695	91.25	7.77
T_4	256.73	2.28	36225	89.59	2.19
T_5	257.20	2.45	36062	88.35	7.36
T_6	221.47	2.35	39352	92.47	-
LSD (0.05)	NS	NS	2752.57	4.89	3.59
CV %	9.91	2.89	4.73	9.89	13.24

Table 1. Effect of different intercrops on yield and growth parameters of sugarcane at Barura, Cumilla, Bangladesh (Pooled data 2014-15 and 2015-16)

* T_1 =Sugarcane+Cabbage, T_2= Sugarcane+Cauliflower, T_3=Sugarcane+Potato, T_4=Sugarcane+Garden pea, T_5=Sugarcane+Garlic, T_6=Sugarcane

Treatments	SEY (t ha^{-1})	Adjusted Cane Yield (t ha^{-1})	Total Cost (Tk. ha^{-1})	Gross Return (Tk. ha^{-1})	Net Return (Tk. ha^{-1})	BCR
T_1	60.76	143.36	749812	1433600	683788	1.91
T_2	47.7	122.9	749812	1229000	479188	1.63
T_3	7.77	99.02	750312	990200	239888	1.31
T_4	7.6	97.19	722662	971900	249238	1.34
T_5	36.8	125.15	759712	1251500	491788	1.64
T_6	-	92.47	710312	924700	214388	1.30

Table 2. SEY and Economic Analysis of different intercrop combination with sugarcane at Barura, Cumilla, Bangladesh

*Note: T_1 =Sugarcane+Cabbage, T_2= Sugarcane+Cauliflower, T_3=Sugarcane+Potato, T_4=Sugarcane+Garden pea, T_5=Sugarcane+Garlic, T_6=Sugarcane, Unit price of Urea-16, TSP-24, MP-17, Gypsum-10, Zinc Sulphate-120, boric acid Tk. 170/kg, Sugarcane selling price = 10Tk/kg, Cauliflower and cabbage price = Tk. 15 /kg, potato price = Tk. 10 /kg, garlic price= Tk. 50/kg, garden pea price= Tk. 35/kg, SEY: Sugarcane Equivalent Yield

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