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Influenced of sweet corn by sowing dates in potato–sweet corn intercropping system in Charland area of Jamalpur District

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Abstract

An experiment was conducted at the Regional Agricultural Research Station, Jamalpur during the rabi season of 2014-2015 to find out suitable sowing date of sweet corn as an intercrop with potato, to grow easily two crops in the charland farmers and to find out agro-economic performance of potato + sweet corn intercropping. Six treatments viz., simultaneous sowing of potato and sweet corn, sweet corn sown at 10 days after potato planting (DAPP), sweet corn sown at 20 DAPP, sweet corn sown at 30 DAPP, sole potato and sole sweet corn were tested in this study. Highest potato yield was obtained from sole potato treatment (27.4 t ha^{-1}) which was similar to simultaneous sowing of potato and sweet corn (26.7 t ha^{-1}) and sweet corn sown after 20 days of potato planting (26.7tha^{-1}). Potato equivalent yield (PEY) (38.4 t ha^{-1})highest gross return Tk. 460350 ha^{-1}, gross margin Tk. 351391 ha^{-1} and benefit cost ratio 4.23 was observed from simultaneous sowing of potato and sweet corn (T_1). The result indicated that simultaneous sowing of potato with sweet corn (T_1) best performed in potato yield, sweet corn yield, gross return BCR and PEY compared with the other treatments.

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Introduction

Intercropping can be explained as a system where two or more crop species are grown in the same field at the same time during a growing season (Ofori and Stern, 1987).Intercropping system is one of the important approaches of cropping systems by which production can be increased. Potato (*Solanum tuberosum* L.) is leading vegetable crop in the world and it is the third largest food crop in Bangladesh. The area under the crop is increasing rapidly and the farmers are gradually adopting it as a cash crop. It is a simple and inexpensive strategy and has been recognized as a potentially befitted technology to increase crop production due to its substantial yield advantage than sole cropping (Awal *et al.,* 2006). The purpose of intercropping is to generate beneficial biological interactions between the crops. Intercropping can increase yields, more efficiently use available resources, reduce weed, insect and disease pressures and provide greater biological and economic stability (Vandermeer, 1989). Intercropping has been an essential production method in tropical regions for hundreds of years (Vandermeer, 1989) and to a lesser extent in temperate regions (Li *et al*., 2001). Intercropping was once common in temperate regions, but has been largely replaced in the last 150 years by monocultures (Francis, 1986). Intercropping is the most common practice to the farmers of Bangladesh, because it increases the total productivity per unit area through the maximum utilization of land, labor and growth resources (Ahmed *et al.,* 2006). Greater productivity in intercropping system is commonly achieved by minimizing inter-specific competition and maximizing complementary use of growth resources (Islam, 2002). Sweet corn is produced for human consumption as either a fresh and processed product. It is a good source of vitamin C and A (Chrispher *et al*., 1996). Sweet corn is favorable for fresh consumption because of its delicious taste, delicate crust and soft and surgery texture compared to other corn varieties. Most of sweet corn sold is fresh and boiled. In addition, due to its early maturation, sweet corn plants can be used as a green forage crop. The inventory of main river char lands estimated their total area at 8,444 km^2 or almost 6% of Bangladesh (FAP 16/19, 1993a). As a result they deprived of from obtaining good yield from intercropping systems. Intercropping practices garden pea with onion (Rahman *et al.,* 2015), coriander with onion (Talukder *et al.,* 2015) and vegetables, pulse and oilseed crops with wheat (Talukder *et al.,* 2016), sweet gourd with onion are common practice to the farmers of char areas (Talukder *et al.,* 2015). Among the intercropping practices sweet gourd brinjal intercropping is a common practice to the farmers of char areas. The climatic condition of Bangladesh is suitable for corn cultivation round the year. So, there is ample scope for expansion of sweet corn in Bangladesh. But, there is problem in increasing the cropping area for corn as sole or monocrop in the country due to more completion with a large number of crops particularly in the dry season. However, the production of sweet corn can be increased if it can be included as an intercrop in the cropping system. Sowing of component crops in different times is an important agronomic approach in intercropping systems but has not been extensively studied. So, this experiment has been undertaken to find out suitable sowing date of sweet corn to intercrop with potato for maximum yield and profit.

Methods and materials

Experimental site

The experimental site was of medium high land belonging to the agro-ecological zone Old Brahmaputra Floodplain under Agro-Ecological Zone 9 (UNDP & FAO, 1988).

Cultivation procedure and experimental design

The experiment was conducted at the Regional Agricultural Research Station, Jamalpur during the rabi season of 2014-2015 to find out the suitable sowing date of sweet corn as an intercrop with potato and to find out agro-economic performance of potato + sweet corn intercropping. The treatments were-T_1= Simultaneous sowing of potato and sweet corn, T_2=Sweet corn sown after 10 days of potato planting, T_3=Sweet corn sown after 20 days of potato planting, T_4=Sweet corn sown after 30 days of potato planting, T_5=Sole potato and T_6 = sole sweet corn.

BARI sweet corn-1 and Diamant (potato) variety were used in the experiment. Sole sweet corn (T_6), Sole potato (T_5) and Simultaneous sowing of potato and sweet corn (T_1) treatments planting were done on 16 November 2014 while the other planting were done according to the treatments in RCBD design with three replications. Unit plot size was 5m × 4.5m. For sole potato and sole sweet corn fertilizers were applied @ N_{180}, P_{40}, K_{180}, S_{20}, Zn_6, $B_{1.2}$ and N_{160} P_{50}, K_{100}, S_{40}, Zn_4, B_2 kg ha^{-1}, respectively (FRG, 2012). For intercrop fertilizers were applied @ N_{320}, P_{73}, K_{170}, S_{50}, Zn_6 and B_2 kg ha^{-1}. The source of N, P, K, S, Zn and B was urea, TSP, MoP, gypsum, zinc sulphate and boric acid, respectively. In case of sole potato, half amount of urea and MoP and the whole amount of TSP, gypsum, zinc sulphate and boric acid were applied at the time of final land preparation. Remaining 1/2 amount of urea and MoP were applied at 30 days after sowing (DAS). For sole sweet corn, one-third of urea and whole amount of other fertilizers were applied at the time of final land preparation. Remaining 2/3 amount of urea was applied in two equal splits as side dressing at 30 and 55 days after sowing (DAS). In case of intercrop, one-third urea and of all other fertilizers were applied as basal. One-third urea and rest of all other fertilizers were side dressed at 30 DAP of potato and rest of urea was side dressed just after potato harvest followed by irrigation. Irrigation and other intercultural operations were done as and when required. Fungicide (Dithane M-45) was sprayed at every 10-day intervals beginning from 25 to 70DAP for preventing disease of potato. All data were taken at harvesting. Potato was harvested at 90DAP. Sweet corn was harvested at 115-120 DAS.

Data collection and statistical analysis

Randomly five potato plants were recorded earlier to collect the yield and yield contributing data. Yield attributes of sweet corn were also recorded from five plants selected randomly earlier and yield data was recorded considering the whole plot basis in case of both crops. Economic analysis was done in terms of total cost of cultivation, gross return and BCR. Data recorded on yield and yield attributes were analyzed statistically following MSTAT-C Programme. Mean separation was done as per LSD test at 5% level of significance.

Results and discussion

Yield and yield contributing character of potato Yield and yield components of potato were significantly affected in potato/sweet corn intercropping systems (Table 1).

Table 1. Yield and yield contributing character of potato in sweet corn + potato intercropping system during the *rabi* season of2014-2015.

Treatment	Plant ht. (cm)	Number of plants m^{-2}	Number of stem plant^{-1}	Number of tuber plant^{-1}	Tuber wt. Plant^{-1}(g)	10Tuber wt. (g)	Yield (t ha^{-1})
T_1	67.00	8.83	8.00	11.73	486.67	446.67	26.7
T_2	67.73	8.67	7.60	13.73	512.67	556.67	25.3
T_3	68.53	8.33	8.13	12.47	509.33	596.67	26.7
T_4	61.87	8.00	8.33	11.47	536.67	486.67	25.3
T_5	63.13	8.33	7.67	14.20	599.33	630.00	27.4
T_6	-	-	-	-	-	-	-
CV (%)	1.99	6.48	7.77	8.77	6.62	4.53	4.72
$LSD_{0.05}$	2.45	-	-	-	63.93	46.38	2.203
F-test	*	NS	NS	NS	*	**	**

T_1= Simultaneous sowing of potato and sweet corn, T_2=Sweet corn sown after 10 days of potato planting, T_3=Sweet corn sown after 20 days of potato planting, T_4=Sweet corn sown after 30 days of potato planting, T_5=Sole potato and T_6 = sole sweet corn.

The highest number of tuber plant^{-1}of potato was observed where sole potato followed by sweet corn sown at 10 DAPP and the lowest in sweet corn sown at 30 DAPP.

Similar trend was observed in tuber wt. Plant^{-1} (g), significantly the highest number of tuber/hill and tuber wt. Plant^{-1} (g) was recorded in sole potato.

These parameters were reduced with earlier planting of sweet corn in between two potato rows. The lower values of those parameters might be due to the shading effect of sweet corn plants as well as inter specific competition. The results indicated that potato yield was higher than sole potato when sweet corn sown 30 days after potato planting followed by sole potato in (27.4 t ha^{-1}),but higher PEY was found from simultaneous sowing of potato and sweet corn (T_1) treatment followed by the T_2 and T_3 treatment.

Table 2. Yield and yield contributing character of sweet corn in sweet corn + potato intercropping system during *rabi* 2014-2015.

Treatment	Plant ht. (cm)	Number of plants m^{-2}	Ear height (cm)	Days to maturity (Days)	Number of cob plant^{-1}	Cob length (cm)	Cob breath (cm)	Number of seed cob^{-1}	Yield (t ha^{-1})
T_1	159.1	7.30	44.87	116.0	1	15.47	4.59	343.47	9.33
T_2	157.7	7.44	48.93	121.7	1	17.34	4.55	434.00	6.75
T_3	159.5	6.71	51.40	115.3	1	17.34	4.57	466.53	5.47
T_4	157.5	6.12	49.40	112.0	1	15.72	4.05	297.47	4.63
T_5	-	-	-	-	-	-	-	-	-
T_6	180.4	7.12	51.73	115.0	1	17.00	4.78	534.00	11.27
CV (%)	2.59	3.95	7.14	0.52	5.21	6.20	5.77	7.48	8.45
$LSD_{0.05}$	7.93	-	-	1.14	-	-	-	136.6	2.04
F-test	**	NS	NS	**	NS	NS	NS	*	**

T_1= Simultaneous sowing of potato and sweet corn, T_2=Sweet corn sown after 10 days of potato planting, T_3=Sweet corn sown after 20 days of potato planting, T_4=Sweet corn sown after 30 days of potato planting, T_5=Sole potato and T_6 = sole sweet corn.

It might be for lower temperature due to shading during later growth stage of potato which favored tuber bulging for longer period and ultimately increased tuber yield when sweet corn sown 30 days after potato planting. Kuruppuarachchi (1990) also observed similar results in potato + maize intercropping. He reported that higher tuber yield was recorded where corn sown 14 days after potato planting. Hybrid maize sown after 20-25 days of potato planting gave 31.50-32.80 t ha^{-1} potato equivalent yields (Islam *et al.*, 2010). Begum (2015) found 25.78-31.30 t ha^{-1} also when hybrid maize intercropped with potato at 20-30 days after potato planting.

Table 3. Economic performances of sweet corn + potato intercropping system during the *rabi* 2014-2015.

Treatment	Potato equivalent yield (PEY) (t ha^{-1})	Potato yield (t ha^{-1})	Sweet corn yield (t ha^{-1})	Cost of cultivation (Tk. ha^{-1})	Gross return (Tk. ha^{-1})	Gross margin (Tk. ha^{-1})	BCR
T_1	38.4	26.7	9.33	108959	460350	351391	4.23
T_2	33.7	25.3	6.75	108959	404850	298891	3.72
T_3	33.5	26.7	5.47	108959	396600	287641	3.64
T_4	31.1	25.3	4.63	108959	373050	264091	3.42
T_5	27.4	27.4	-	79000	328800	249800	4.16
T_6	11.27	-	11.27	103876	169050	65174	1.63

Price: Potato Tk. 12 kg^{-1}, Sweet corn Tk. 15 kg^{-1}.

T_1= Simultaneous sowing of potato and sweet corn, T_2=Sweet corn sown after 10 days of potato planting, T_3=Sweet corn sown after 20 days of potato planting, T_4=Sweet corn sown after 30 days of potato planting, T_5=Sole potato and T_6=sole sweet corn.

Yield and Yield contributing character of sweet corn

The result presented in Table 2 revealed that plant height, number of seed cob^{-1} and yield differed significantly among the different treatments. The maximum number of cob plant^{-1} was obtained from the sole sweet corn (T_6) treatment. Number of seed cob^{-1} maximum showed in (T_6) treatment. The sole sweet corn (T_6) produced the maximum yield. In this treatment, germination of sweet corn was affected and seedlings growth was hampered due toheavy

shading produced by potato canopy that resulted poor growth and less number of cobs m^{-2}.Similar result was reported by Zaag and Demagante (1990). Yield of cobs gradually decreased with delay in sowing time of sweet corn owing to shorter growth duration and higher temperature at later growth stages.

Islam (2002) also reported similar results in maize + bush bean intercropping system. Ifenkwe and Odurukwe (1990) reported that potato yields increased with delay sowing in association with maize while maize yields decreased as its sowing date was delayed.

Economic Performance

Cultivation of potato with sweet corn with potato was more profitable than sole cropping of sweet corn. The maximum cost of cultivation Tk. 108959 ha^{-1} was found in potato sweet corn intercropping system while the minimum cost of cultivation Tk. 79000 ha^{-1} was found in sole potato cultivation systems. The maximum gross return Tk. 460350 ha^{-1} was obtained from the simultaneous sowing of potato and sweet corn (T_1) treatment followed by the T_2 treatment. Similar trends were observed in case of gross margin and BCR (Table 3).

Conclusion

From the result, it indicated that cultivation of potato with sweet corn sown at simultaneous sowing of potato with sweet corn, 10 DAPP and 20 DAPP might be agronomically feasible and economically profitable for sweet corn and potato intercropping system as compared to sole sweet corn. Simultaneous sowing of potato with sweet corn (T_1) best performed in potato yield, sweet corn yield, gross return BCR and PEY compared with the other treatments. In addition fodder yield could be possible from sweet corn plant to mitigate the livestock feed to some extent.

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