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PRODUCTION POTENTIAL OF DIFFERENT VARIETIES OF HYBRID MAIZE (*Zea mays* L.) WITH GROUNDNUT (*Arachis hypogaea* L.) UNDER INTERCROPPING SYSTEM

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Abstract

The experiment was carried out at the Regional Agricultural Research Station, Bangladesh Agricultural Research Institute (BARI), Jessore to evaluate the performance of different varieties of hybrid maize under intercropping systems with groundnut in Rabi seasons for higher productivity and profitability. Four sole crops of hybrid maize varieties viz., BHM-1, BHM-3, Pacific-11, and Pacific-984, one sole crop of groundnut (var. Jhingabadam) and eight intercropping systems of maize + groundnut under two planting methods viz., normal and paired row made 13 treatments, were used for two consecutive years (2004 and 2005). Treatments were arranged in a randomized complete block design with four replications. Among the intercropped treatments, four rows groundnut in between paired rows of hybrid maize var. Pacific 11 showed higher total dry mater (TDM), leaf area index (LAI), crop growth rate (CGR), gross return, net return and benefit cost ratio (BCR) than the other planting systems tested in the experiment.

Keywords : Production potential, hybrid maize, groundnut, intercropping system.

Introduction

In Bangladesh, the condition of maize has been gaining popularity in recent years. It is now becoming an important cereal crop for its high productivity and diversity. Maize area, production and demands are increasing rapidly. In 1992-93, the area, production, and yields were 2834 ha, 3000 metric tons and 1.06 t/ha, respectively (BBS, 2002). By 2004-2005, the area increased 24 times (66,802 ha), production 119 times (356000 tons), and yield more than 5 times (BBS, 2005).

An estimate shows that at the present rate of consumption, the country would need more than one million tons of maize by 2012 (Mian *et al*., 2001). Maize is one of the most efficient crops which can give high biological yield as well as grain yield due to its photosynthetic mechanism. The agro-climatic condition of Bangladesh is favourable for its cultivation round the year. However, the average yield of maize in the country is considerably low. The national average yield is

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only 5.33 t/ha (BBS, 2005), whereas the newly released varieties have the potential to produce more than 8.0 t/ha. For fulfillment of the requirement of maize in Bangladesh, Bangladesh Agricultural Research Institute (BARI) has already released some hybrid maize varieties, such as BHM-1, BHM-2, and BHM-3, which are higher yielder with yield potential of about 9-10 tons/hha.

Groundnut *(Arachis hypogaea* L.) is the third most important legume crops in Bangladesh of which it was grown on 27073 ha with a production of 34240 tons in 2002- 2003 (BBS, 2005). It is used as edible oil, to make cake, biscuit and bakery in the food industries. Recently the area of groundnut is being decreased due to the competition with Rabi crops like wheat, potato, Boro rice and mustard (Biswas *et al*., 1997). Moreover, most of the char areas of Bangladesh become inundated in the Kharf season, which causes the decline of groundnut area. In Kharf season, only some high lands are used for groundnut cultivation.

In order to introduce maize and avoid competition from other crops, there is a need for developing technology like intercropping. Roy and Shahani (1970) have shown the potential of legume as a suitable crop for intercropping with maize. It is reported that the use of early maturing varieties, alternate row arrangement, spacing, and plant population are some of the tools that may promote the yield of the intercrop (Harrera and Harwood, 1974). Increase grain production per unit area of land has been reported elsewhere (Quayyum *et al.,* 1987; Akanda *et al*., 1982) by intercropping grain legumes with maize. The temporal way of increasing food production includes adoption of modern varieties, practicing of improved cultural techniques and following the appropriate cropping systems. Intercropping system is one of the important approach of cropping systems and emerged as an important tool for increasing crop production. Combination of groundnut (Jhinghabadam) and hybrid maize in intercropping systems may increase the production to fulfill the demand for maize and groundnut. Changing the planting arrangements of the main and component crops is an important agronomic approach in intercropping systems but has not been extensively studied. However, information relating to intercropping of groundnut in hybrid maize during Rabi season is inadequate. In this context, the experiment was conducted to study the performance of different varieties of hybrid maize under intercropping systems with groundnut for higher productivity and profitability.

Materials and Method

The experiment was conducted at the Regional Agricultural Research Station, BARI, Jessore during two consecutive Rabi seasons of 2003-04 and 2004-05. There were 13 treatments, viz., 4 sole crops of hybrid maize *(Zea mays* L.), one sole crop of groundnut *(Arachis hypogaea* L.) and 8 intercropping systems of maize + groundnut under two planting systems viz, normal and paired row. The treatments were as follows:

T_1 = Two rows of groundnut in between normal rows of hybrid maize (var. BHM-1)

T_2 = Two rows of groundnut in between normal rows of hybrid maize (var. BHM-3)

T_3 = Two rows of groundnut in between normal rows of hybrid maize (var. Pacific-11)

T_4 = Two rows of groundnut in between normal rows of hybrid maize (var. Pacific-984)

T_5 = Four rows of groundnut in between paired rows of hybrid maize (var. BHM-1)

T_6 = Four rows of groundnut in between paired rows of hybrid maize (var. BHM 3)

T_7 = Four rows of groundnut in between paired rows of hybrid maize (var. Pacific 11)

T_8 = Four rows of groundnut in between paired rows of hybrid maize (var. Pacific-984)

T_9 = Sole hybrid maize (var. BHM-1)

T_{10} = Sole hybrid maize (var. BHM-3)

T_{11} = Sole hybrid maize (var. Pacific-11)

T_{12} = Sole hybrid maize (var. Pacific-984)

T_{13} = Sole groundnut (var. Jhingabadam).

The experiment was laid out in a randomized complete block design with four replications in Rabi season. The unit plot size was 4.5 m x 6.0 m. Four maize *(Zea mays* L.) varieties, BARI Hybrid Maize-1 (BHM-1), BARI Hybrid Maize-3 (BHM-3), Pacific-11, and Pacific-984 were used. Groundnut variety Jhingabadam was tested in the experiment. Maize was sown at 75 cm apart rows with 25 cm between the plants both in sole (T_9, T_{10}, T_{11}, and T_{12}) and intercrop situation in normal row of maize (T_1, T_2, T_3, and T_4). On the other hand, maize was sown in paired rows 37.5 cm apart and 150 cm between two pairs with 25 cm between the plants (T_5, T_6, T_7, and T_8). The spacing maintained for sole groundnut was 30 cm × 10 cm. In case of intercrop situation, the population density of maize remained as that of the sole plot of maize, but it varied for groundnut. Germination of the seeds was above 95 percent in both the years. Sowing of both the crops was done on 13 November in 2003 and 2004. Fertilizer was applied for maize at the rate of 250-120-120-40-5-2 kg of N, P_20_5, K_20, S, Zn and B/ha from urea, triple superphosphate, muriate of potash, gypsum, zinc sulphate, and boric acid, respectively. Half amount of N and full dose of other fertilizers were incorporated into the soil at the time of final land preparation. The remaining urea was top dressed in two equal splits at 35 and 65 days after sowing (DAS) only in maize rows as band placement. For groundnut sole crop, fertilizer was applied at the rate of 12-32-43-31-4-2 kg of N, P_20_5, K_20, S, Zn, and B/ha from urea, triple superphosphate, muriate of potash, gypsum, zinc sulphate, and boric acid. Half amount of urea and full dose of other fertilizers were applied at the time of final land preparation. Additional fertilizers were not applied for groundnut in intercrop situation. Three irrigations were applied at 30, 60, and 90 DAS. Mulching and hand weedings were done as and when necessary to keep the field reasonably weed free. Dasban was sprayed at 20-day intervals as precautionary measure against insects attack. Dithane M-45 was sprayed at 15-day intervals at the later stages of groundnut as precautionary measure to prevent from tikka disease. An effective area of 3.0 m x 4.5 m was harvested from each plot. Grain, pod and straw yields at harvest were converted into t/ha after proper drying.

The growth of maize and groundnut was recorded at 30-day intervals and at the final harvest. At each harvest, 5 plants^{-1} treatment, variety^{-1}, replication^{-1} were selected. The plants were cut at the ground level and dry weights of these plants were recorded after oven drying at 70°C for 72 hours till they reached constant weight. Leaves of sample plants were separated manually. Leaves were oven-dried and weights were taken. One thousand of leaf cuts of 1 cm diameter were oven-dried along with the leaf samples for leaf area determination. The leaf area was measured at 30, 60, 90, 120 DAS and at the final harvest for maize and at 30, 60, 120, 150 DAS and at final harvest for groundnut. Crop growth rate (CGR) was determined from the dry weights of different plant parts between two successive harvests (Redford, 1967). Maize was harvested at physiological maturity at 15% moisture content, threshed and winnowed to determine the grain yield. Ten maize plants were selected randomly for recording data on yield attributes. Groundnut was also harvested at physiological maturity, threshed, and dried properly to determine the pod yield. Ten plants were selected randomly for the pod yield and yield components. The gross returns, cost of cultivation, gross margin, and net return was computed from different treatments on the basis of prevailing market price of maize grain, groundnut pod and both the crop-straw and biomass. Benefit cost ratio (BCR) of different treatments was computed as follows (Shah *et al.,* 1991):

$$\text{BCR} = \frac{\text{Gross return (Tk./ha)}}{\text{Total cost of production (Tk./ha)}}$$

The data recorded for different characters were compiled and tabulated in proper way for statistical analysis. The significance of comparison was tested with ‘F” test and whenever the variance ratio was found significant, means were compared by Duncan Multiple Range Test (DMRT). The data were anglyzed statistically following computer package MSTAT-C and DMRT was used to determine the significant differences among the treatment means.

Results and Discussion

Plant growth parameter:

Leaf area index (LAI) was significantly influenced by all the intercropping systems in maize and groundnut at different harvests in both the years (Fig. I and 2). These results are in conformity with the findings of Shivay *et al.* (2002). The LAI of maize and groundnut reached maximum at 120 and 150 DAS, respectively, with the increasing number of leaves per plant and expansion of individual leaf. At the later stage of growth, LAI reduced slowly in maize but sharply in groundnut. LAI of maize decreased due to intercropping, but there was no remarkable difference between the sole and intercrop maize in both the years. The maximum LAI (4.97 in 2003-04 and 5.88 in 2004-05) was obtained from sole hybrid maize (var. BHM-3). Similar results were reported by Oljaca *et al.* (2000) who reported that sole maize produced higher LAI values than any other mixtures. On the other hand, LAI was also found maximum in sole groundnut (4.32 in both the years). This finding was in agreement with that of Ghosh (2002) and in contradiction with Oljaca *et al.* (2000). They reported that LAI values of beans as sole crop produced significantly lower leaf area than the mixtures. Number of leaves per plant decreased in the intercropping system, which might reduced the LAI of groundnut (Singh *et al.,* 2000).

Total dry matter (TDM) of different varieties of hybrid maize and groundnut increased with advancement of time irrespective of treatments (Figs. 1 and 2). Dry matter accumulation of hybrid maize varieties increased slowly and attained plateau at around 120 DAS and then the pattern of curves remained similar until the final harvest. The highest dry matter accumulation of hybrid maize (var. BHM-3) in monoculture was due to better utilization of solar radiation and CO_2 as there was no competition with intercrop and better nitrogen uptake and less weed infestation. Similar results were reported by Talukder *et al.* (2003) and Alam *et al.* (2005). Sole groundnut produced higher dry matter than any other intercropped groundnut. lntercropped groundnut with lower density faced different levels of shading from different planting geometry of maize and subsequently accumulated lower dry matter (Kephart *et al.,* 1992).

Irrespective of intercropping systems, CGR of maize increased progressively with the advancement of time and reached peak at 90-120 DAS and then declined (Fig. 1). The sole and interecropped maize varieties showed similar trend of CGR. The rapid decline in COR of maize varieties after 90-120 DAS might be due to rapid cessation of effective leaf area. There was a trend for higher CGR in sole

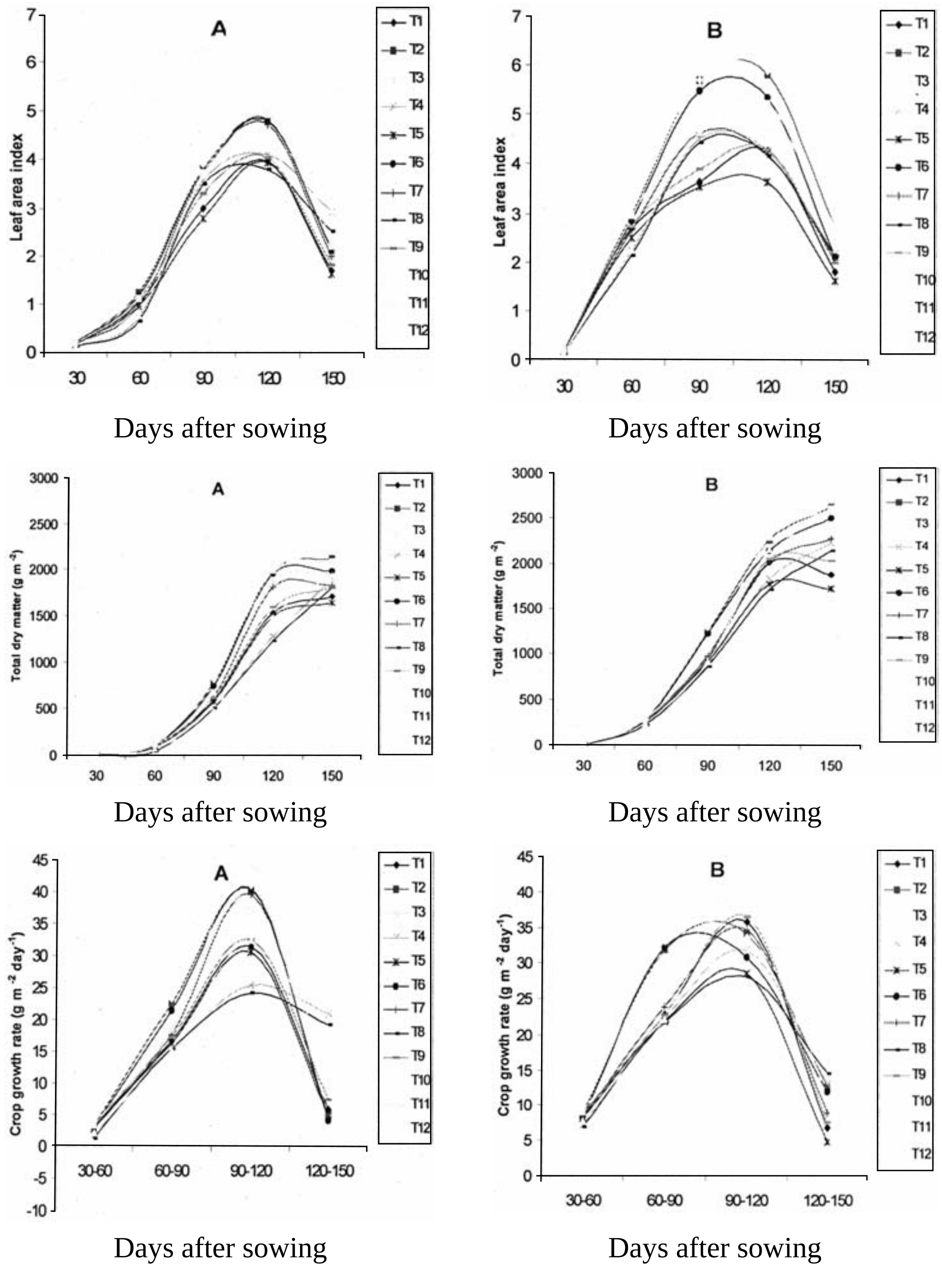

Fig. 1. Leaf area index, total dry matter and crop growth rate of maize in maizei in maize+groundnut intercropping systems over time in 2003-04 (A) and 2004-05 (B)

LSD (0.05) values are 0.02, 0.12, 0.11, 0.43 & *0.55* in A and 0.02, 0.28, 0.78, 0.63 & 0.54 in B for LAI; 0.65, 7.19, 50.13, 119.22 & 115.86 in A and 0.84, 15.97, 52.23, 214.21 & 160.11 in B for TDM at 30, 60, 90, 120 & 150 DAS, respectively, and 0.24, 1.06, 4.09 & 4.84 in A and 0.55, 1.79, 6.88 & 8.61 in B for CGR at 30-60, 60-90, 90-120 & 120-150 DAS, respectively.

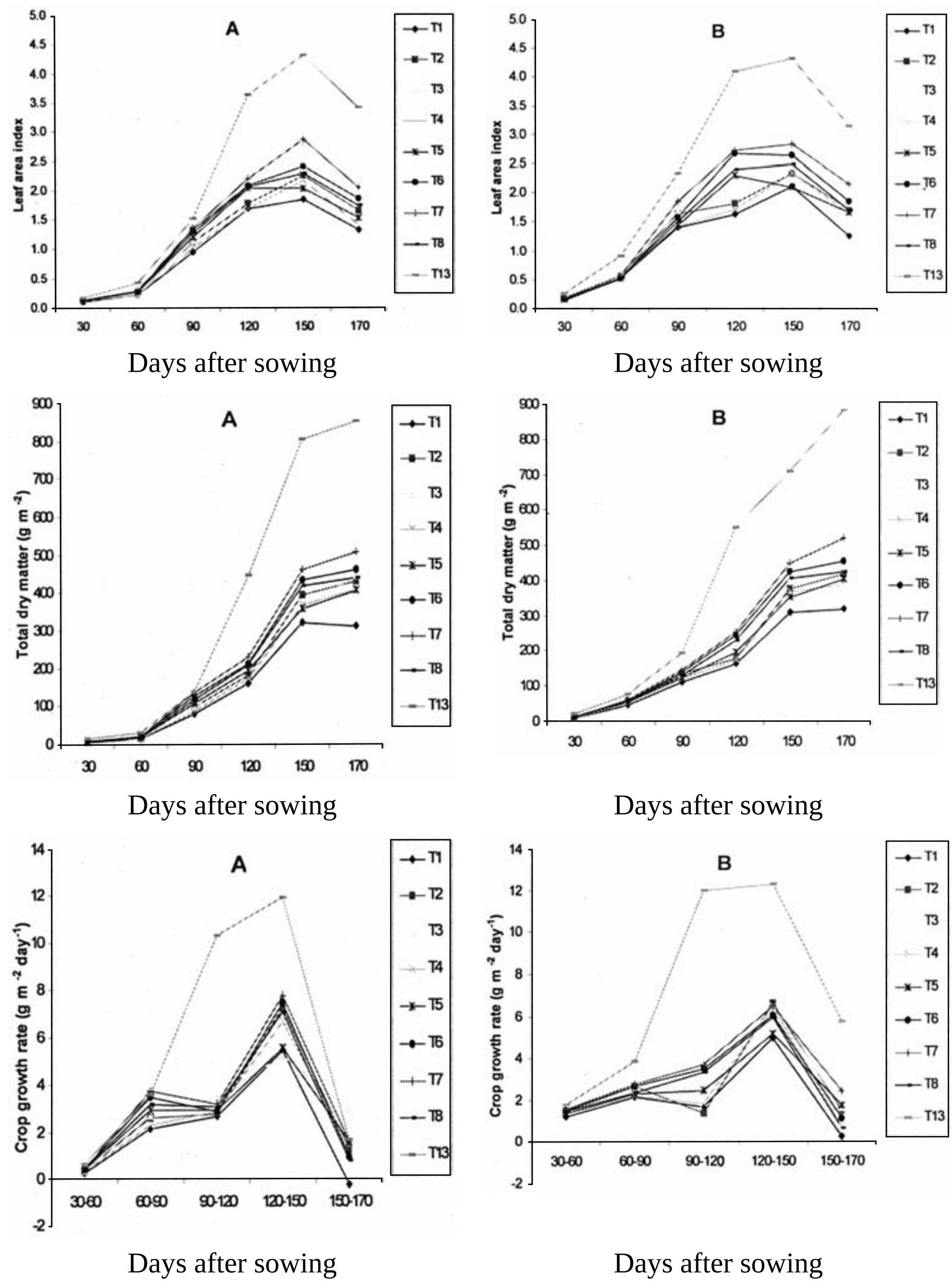

Fig. 2. Leaf area index, total dry matter and crop growth rate of groundnut in maize + groundnut intercropping systems over time in 2003-04 (A) and 2004-05 (B).

LSD (0.05) values are 0.01, 0.03, 0.13, 0.26, 0.34 & 0.19 in A and 0.04, 0.09, 0.03, 0.26, 0.34 & 0.29 in B for LAI; 0.89, 1.66, 12.31, 18.55, 53.01 & 37.59 in A and 1.01, 7.56, 9.31, 32.04, 32.36

& 31.54 in B for TDM at 30, 60, 90, 120, 150 & 170 DAS, respectively, and 0.07, 0.37, 0.61, 1.70 & NS in A and 0.17, 0.31, 1.26, 1.80 & 1.72 in B for CGR at 30-60, 60-90, 90-120, 120-150 & 150-170 DAS, respectively.

cropping compared to the intercropped in both the years due to less competition among the plants for air and solar radiation. El-Shaer *et al.* (1979) and Kumar *et al.* (1995) also reported similar results. CGR of groundnut increased steadily upto 120-150 DAS and thereafter, declined quickly till the final harvest (Fig. 2). These results are in agreement with the findings of Misa *et al.* (1994) in peanut. CGR of groundnut in the intercropped situation was much lower than sole groundnut. Such lower CGR of groundnut might be due to reduction of leaf area and availability of lower light to underneath groundnut canopy.

Grain yield of maize

Higher grain yield of maize was observed in T_{11} (sole maize var. Pacific-11) which was statistically at par with T_3, T_4, T_7, T_8, T_{10}, and T_{12} in 2003-04 and T_2, T_3, T_4, T_6, T_7, T_8, T_{10}, and T_{12} in 2004-05 (Table 1). It showed that Pacific-11 variety of hybrid maize was higher yielder in monoculture (T_{11}) and its respective intercrops because of more number of cobs/ plant and higher 1000-grain weight or cumulative effect of yield attributes. Lower yield was obtained from T_5, which was statistically identical with T_1, T_2, T_6, T_8, T_9, and T_{10} in 2003-04 and T_1 and T_9 in 2004-05. Higher yield of maize was observed in monoculture compared to their respective intercrop situation might be due to no intercrop competition for light, nutrients, moisture, and space. This corroborates with the findings of Quayyum *et al*. (1987), Karim *et al.* (1990), and Uddin *et al*. (2003). The maize yield under intercropping treatment (both normal and paired row) was lower than that of respective monoculture, though the population of maize was constant regardless of treatment. The reduction of maize yield was probably due to intercrop competition between maize and groundnut. However, additional yield from groundnut not only compensated the deficit, but also gave extra income. This finding is in conformity with that of Quayyum and Maniruzzaman (1995), Uddin *et al.* (2003) and Pandey *et al.* (2003). The yield reduction of maize was more when intercropped in paired row system (4.47-6.50% in 2003-04 and 3.69-9.50% in 2004-05) than normal row system (1.78-3.83% in 2003-04 and 0.53-4.08% in 2004-05), which might be due to more interplant competition for growth resources. Similar results were reported by Karim *et al.* (1990).

Table 1. Grain and stover yield of different varieties of hybrid maize, and pod yield and biomass yield of groundnut in maize + groundnut intercropping systems in 2003-04 and 2004-05.

Trea-tment	Maize				Groundnut			
	Grain yield (t/ha)		Stover yield (t/ha)		Pod yield (t/ha)		Biomass yield (t/ha)	
	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05
T_1	7.98 bc	9.42 cd	8.08 gh	9.52 bc	0.91 d	0.82 f	2.52 c	2.79 b
T_2	8.28 be	10.28abc	11.09ab	11.91 ab	1.23 bc	1.11 de	3.34 b	3.66 bc
T_3	9.05 ab	10.89 a	9.12 def	10.96abc	1.34 b	1.23cde	3.41 b	3.74 b
T_4	8.83 ab	10.82 a	9.89cd	11.78 ab	1.07 cd	1.04 cf	2.85 bc	3.29bcd
T_5	7.62 c	8.57 d	7.71 h	8.66 c	1.23 bc	1.20cde	2.57 c	2.82 d
T_6	8.13 bc	10.18abc	10.03 cd	11. 88ab	1.40 b	1.43 bc	2.87 bc	3.12bcd
T_7	8.97 ab	10.68 ab	9.11 dcf	10.80abc	1.47 b	1.49 b	2.89 bc	3.24bcd
T_8	8.53 abe	10.62abc	8.82 efg	10.81abc	1.28 bc	1.32bcd	2.62 c	2.91 cd
T_9	8.15 bc	9.47 bcd	8.37 fgh	9.58 bc	-	-	-	-
T_{10}	8.61 abc	10.57abc	11.37 a	12.21 a	-	-	-	-
T_{11}	9.39 a	11.31 a	9.79 cde	11.50 ab	-	-	-	-
T_{12}	8.99 ab	11.28 a	10.18 bc	12.00 ab	-	-	-	-
T_{13}	-	-	-	-	2.25 a	2.06	5.02 a	4.54 a
F-test	**	**	**	**	**	**	**	**
CV (%)	5.84	4.60	5.07	9.00	9.01	7.44	9.54	9.12

Mean values in a column having the dissimilar letter/letters indicate significant differences at 0.05 (*) and 0.01 (**) level of significance (DMRT)

Stover yield of maize

Stover yield of maize was influenced by maize + groundnut intercropping system in both the years (Table 1). Higher stover yield of maize was obtained from T_{10} (sole maize var. BHM-3), which was statistically at par with T_2 in 2003-04 and all the treatments except T_1 and T_5 in 2004-05. It was noted that the variety BHM-3 had the ability for quick growth compared to other varieties. So, monoculture of BHM-3 (T_{10}) had higher stover yield and so did its intercropped treatments (T_2 and T_6) in both the years. It might be due to varietal character and higher plant height compared to other varieties. In intercropping situations, stover yield was reduced compared to sole maize and it might be due to interplant competition among the different varieties of maize and groundnut. The lowest stover yield was obtained from T_5 followed by that of T_1 and T_9. The variety BHM-1 gave lower stover yielder in monoculture and also in its respective intercrop treatments among the varieties of maize. It might be due to varietal character and higher plant height.

Pod yield of groundnut

Pod yield of groundnut was significantly affected by maize + groundnut intercropping systems in both the years (Table 1). The highest pod yield was recorded in T_{13} (monoculture groundnut) in both the years. The pod yield differed mainly due to the highest number of plants/m^2, number of pods/plant and 100-pod weight. Ghosh (2002), Sarkar and Pal (2004) and Razzaque *et al.* (2007) also reported higher pod yield of groundnut in monoculture. The pod yield of groundnut in intercropping situation was considerably reduced. This corroborates with the findings of Karim *et al.* (1990), Ghosh (2002), Sarkar and Pal (2004) and Razzaque *et al.* (2007). The reduction of pod yield might be due to shading effect of maize on the groundnut. Similar results were reported by Patra *et al.* (1990). It was noted that yield reduction in groundnut was observed more in T_1 to T_4 than T_5 to T_8 treatments. It reveals that paired rows planting system of maize favoured the growth of intercropped groundnut. Similar findings were observed by Islam *et al.* (2006). Among the intercropping treatments, T_7 (4 rows of groundnut in between 2 paired rows of hybrid maize var. Pacific 11) had higher pod yield of groundnut. It might be due to paired row planting system of maize var. Pacific 11 which favoured the growth of intercropped groundnut and judicious use of growth resources compared to other intercropped combinations. The results are in conformity with the findings of Islam *et al.* (2006) who reported that paired row planting system of maize favoured the growth of intercropped bush bean.

Biomass yield of groundnut

Biomass yield of groundnut was significantly influenced by maize + groundnut intercropping systems in both the years (Table 1). The highest biomass yield was obtained from sole groundnut due to maximum plants/m^2, highest number of branches/plant and no intercrop competition. Reduced biomass yield of groundnut under different intercropping situations was due to lower plant population (67% in T_1 to T_4 and 53% in T_5 to T_8) compared with sole crop of groundnut (100%) and also shading effect of maize. The lowest biomass yield was recorded in T_1 because of short plant height and lower number of branches/plant in both the years.

Cost benefit analysis

Data pertaining to monetary return of maize + groundnut intercropping system indicated that higher total gross return was obtained from T_7 (four rows of groundnut in between two paired rows of hybrid maize var. Pacific 11) than sole crop of maize varieties or groundnut in consecutive two years (Table 2). Several authors (Santalla *et al.,* 2001 and Razzaque *et al.,* 2007) also reported higher monetary advantages from different intercropping systems than their respective sole crops. Total gross return increased 43.77% in 2003-04 and 35.18% in 2004-05 in T_7 (four rows of groundnut in between two paired rows of hybrid maize var. Pacific 11) over respective sole cropping of maize.

Table 2. Cost benefit analysis of sole maize, sole groundnut and intercropped maize with groundnut in 2003-04 and 2004-05.

Treatments	2003-04									
	Gross return (Tk./ha)			Cost cultivation (Tk./ha)			Net return (Tk./ha)			Benefit cost ratio (BCR)
	Maize	Groundnut	Total	Maize	Groundnut	Total	Maize	Groundnut	Total	
T_1	65860	23380	89240	23678	6300	29978	42182	17080	59262	2.98
T_2	69013	31585	100598	24603	6300	30903	44410	25285	69695	3.26
T_3	74680	34353	109033	24973	6300	31273	49707	28053	77760	3.49
T_4	73113	27463	100576	25123	6300	31423	47990	21163	69153	3.20
T_5	62888	31393	94281	23678	4420	28098	39210	26973	66183	3.36
T_6	67548	35718	103266	24603	4420	29023	42945	31298	74243	3.56
T_7	74038	37473	111522	24973	4420	29393	49065	33053	82118	3.79
T_8	70445	32655	103100	25123	4420	29543	45322	28235	73557	3.49
T_9	67293	-	67293	23678	-	23678	43615	-	48045	3.03
T_{10}	71723	-	71723	24603	-	24603	47120	-	47120	2.92
T_{11}	77568	-	77568	24973	-	24973	52595	-	52595	3.11
T_{12}	74465	-	74465	25123	-	25123	49342	-	49342	2.96
T_{13}	-	63000	63000	-	18705	18705	-	44295	44295	3.37
	204-05									
T_1	77740	21198	98938	26591	6300	32891	51149	14898	66047	3.01
T_1	77740	21198	98938	26591	6300	32891	51149	14898	66047	3.01
T_2	85218	28665	113883	27516	6300	33816	57702	22365	80067	3.37
T_3	89860	31685	121545	27886	6300	34186	61974	25385	87359	3.56
T_4	89505	26823	116328	28036	6300	34336	66469	20523	81992	3.39
T_5	70725	30705	101430	26591	4420	31011	44134	26285	70419	3.27
T_6	84410	36530	120940	27516	4420	31936	56894	32110	89004	3.79
T_7	88140	38060	126200	27886	4420	32306	60254	33640	93894	3.91
T_8	87663	33728	121391	28036	4420	32456	59627	29308	88935	3.74
T_9	78155	-	78155	26591	-	26591	51564	-	51564	2.94
T_{10}	87613	-	87613	27516	-	27516	60097	-	60097	3.18
T_{11}	93355	-	93355	27886	-	27886	65469	-	65469	3.35
T_{12}	93240	-	93240	28036	-	28036	65204	-	65204	3.33
T_{13}	-	52635	52635	-	19650	19650	-	32985	32985	2.68

Price: Maize: 8.00 Tk./kg, Groundnut : 25.00 Tk./kg, Stover/biomass: 0.25 Tk./kg.

The data showed that the highest total cost of cultivation of Tk. 31423/ha in 2003-04 and Tk. 34336/ha in 2004-05 was incurred in T_4 (two rows of groundnut in between two rows of hybrid maize var. Pacific-984) (Table 2). The lowest total cost of cultivation was observed in T_3 (sole groundnut). The cost of cultivation increased in the intercropping systems compared with respective sole crop of maize varieties or groundnut. It might be due to additional inputs and management require for groundnut in the intercropping treatments. These results are in agreement with those of Quayyum and Maniruzzaman (1995) and Patel and Rajagopal (2001) under cereal + legume intercropping system.

The net returns obtained from different intercropping treatments were appreciably higher than from a sole maize and groundnut stand in both the years (Table 2). Two year's results revealed that the highest total net return was obtained from T_7 (four rows of groundnut in between two paired rows of hybrid maize var. Pacific 11). It might be due to better utilization of different growth resources in hybrid maize (var. pacific II) + groundnut intercropping system. The net return could be increased considerably on maize intercropped with blackgram as reported by Quayyum and Maniruzzaman (1995). Many investigators also reported higher net return obtained in rntercropping system than sole crop (Quayyum *et al.*, 1987; Biswas *et al.*, 1997; Sarkar and Pal, 2004 and Razzaque *et al.*, 2007).

Cost and benefit analysis is an important tool for evaluating the economic feasibility of intercropping systems. Data showed that T_7 (four rows of groundnut in between two paired rows of hybrid maize var. Pacific 11) gave the highest benefit cost ratio (BCR) of 3.79 in 2003-04 and 3.91 in 2004-05 followed by T_6 (four rows of groundnut in between two paired rows of hybrid maize var. BHM-3) of 3.56 in 2003-04 and 3.79 in 2004-05. Similar findings were reported by Sharma (1994). Maize hybrid variety as sole crop gave reasonable good yield and economic return but due to sustaining of soil fertility as well as ensures productivity from hybrid maize, intercropping with legumes is one of the way which could help in yield stability. In this situation, four rows of groundnut in between two paired rows of hybrid maize var. Pacific 11(T_7) would be better option in *Rabi* season.

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