J. Agrofor. Environ. 4 (1): 27-30, 2010 ISSN 1995-6983

Effect of intercropping different vegetables with groundnut

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Abstract: The experiment was carried out is the Regional Agricultural Research station, Bangladesh Agricultural Research Institute (BARI), Rahmatpur, Barisal during two consecutive rabi seasons of 2007-2008, and 2008-2009 to select suitable vegetable for intercropping with groundnut. Monoculture produced the highest yield of individual crops. However all the intercropped and treatments involves red amaranth, spinach, coriander were found agronomically feasible and economically profitable. Results also showed that the highest groundnut equivalent yield 2.76 t/ha, LER 1.67 and the highest gross return of Tk. 74700 /ha were obtained from the intercropping treatment of one row of red amaranth in between two normal rows of groundnut. The highest net return of Tk. 60500/ha and benefit cost ratio 5.29 were also obtained from the same treatment.
Key words: Intercropping, Vegetables, Groundnut, Yield, Economics.

Introduction

Groundnut (*Arachis hypogaea* L.) is the third most important legume oilseed crop in Bangladesh (Anon, 2008.) which is grown in 27073 ha with a production of 34240 metric tons in 2002-2003 (BBS, 2005). Its seed contain 48-50% oil and 22-29% protein. It is used as edible oil, to make cake, biscuit and other confectionary purpose. 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 kharif season which causes decline of groundnut area. In kharif season, only some high lands are used for groundnut cultivation.

Mixed or intercropping as a method of crop intensification is practiced in densely populated countries to produce more food per unit area. Crop intensification is thought to be a method for maximum utilization of land. It is reported that the use of early maturing crop varieties, row arrangement, spacing and plant population are some of the important methods that help to increase the yield of intercrop (Harrera and Harwood, 1974). Intercrop is the practice of growing two or more crops simultaneously in same land area, particularly in the tropics (Andrews and Kassam, 1976). Intercropping offers more stability, less risk, better utilization of limited resources and wide diversity in the production of food. People of Bangladesh not only suffer from food deficit, but also suffer from different nutritional deficiency like protein and calorie as well as vitamins and minerals. All such malnutritional problems could have been considerably reduced if the people would have adequate access to vegetable of different kinds which are known to be rich in all vitamins and minerals. But the production and consumption of vegetables are extremely low in this country. As the land is limiting, so horizontal expansion like intercropping among other methods might play an important role in increasing production.

Recently, intercropping has been recognized as a potentially beneficial system of crop production. The intercropping system increases total production in addition to stabilization of production in the rainfed areas (Rao and Willey, 1980). By adopting appropriate standard geometry in the intercropping system, the total productivity can be enhanced (Umrani *et al.,* 1984). The returns from intercropping are higher and more dependable than those from the relevant crop (Rao *et al.*,1979).

Groundnut and vegetable are mainly row seeded crops and grown in the same season. The growth of groundnut is very slow in winter season. So, during this time the space between two rows of groundnut can be utilized by cultivating vegetable as intercrop. However, literature regarding inter/mixed cropping of vegetable with groundnut is meager. Hence, this experiment was conducted to select suitable vegetable for inter/mixed cropped with groundnut.

Materials and Methods

The experiment was conducted at Regional Agricultural Research Station Rahmatpur, Barisal during rabi seasons of 2007-08 and 2008-09. There were ten treatments in the experiment viz.:T_1 - Sole groundnut (40 cm x 15 cm), T_2 - Sole red amaranth (30 cm x 10 cm), T_3 - Sole coriander (30 cm x 10 cm), T_4 - Sole spinach (30 cm x 10 cm), T_5 - 100% GN + 68% R A in alternate row, T_6 - 100% G N + 68% coriander in alternate row, T_7 - 100%GN + 68% spinach in alternate row, T_8 - 100% GN +68% R A in broadcast, T_9 - 100% GN + 68% coriander in broadcast, T_{10} - 100%GN + 68% spinach in broadcast (GN = Groundnut, RA = Red amaranth).

In T_5, T_6 and T_7 1 row of red amaranth, coriander and spinach respectively were sown in between 2 rows of groundnut. But in T_8, T_9 and T_{10} 68% seeds of red amaranth, coriander and spinach, respectively were sown in between 2 rows of groundnut.

The experiment was laid out in a randomized complete block design with three replications having unit plot size 4 m x 3 m. Fertilizers were applied at the rate of 11-77.8-51-78-1-1 kg/ha of N P K S Zn and B, respectively for sole groundnut, (Anon, 2004), 100:20:35:5 kg/ha of N P K S, respectively for sole red amaranth, 50:20:35:5 kg/ha of N P K S, respectively for sole coriander , 50:20:35:5 kg/ha of N P K S, respectively for sole spinach and 50:40:85:35:2:1 kg/ha of N P K S Zn B, respectively for intercropping plot(Hossain *et al.,* 2006). Half of N and entire quantity of other fertilizers along with cowdung 10 ton/ha were applied during final land preparation and reaming half of N (as urea) was top dressed during 30 DAS in sole and intercrops. Groundnut variety-BARI chinabadam 6, Red amaranth variety-BARI Lalshak-1, Coriander variety-BARI coriander-1 and spinach variety-local were used for the experiment. Seeds were sown on 3 December 2007 and 2008 and harvested on May 2008 and 2009. Sole groundnut was sown with 40 cm x 15 cm spacing whereas

30 cm x 10 cm spacing was maintained for sole red amaranth, coriander and spinach. Two irrigations were applied at 25 and 50 DAS. Other intercultural operations such as weeding, mulching and earthing up were done as and when necessary. At maturity ten randomly selected plants of groundnut, red amaranth, coriander and spinach were uprooted from each plot for post harvest data collection. Collected data were statically analyzed separately. Economic analysis was done on the basis of prevailing market price of input and output (Reddy and Reddi, 1992)

LER method was used after Sharner *et al.* (1982) as mentioned below;

$$LER = \frac{\text{Yield of Intercrop}}{\text{Yield of Sole crop}} + \frac{\text{Yield of Intercrop}}{\text{Yield of Sole crop}}$$

Groundnut equivalent yield was calculated as Bondyopadhyay (1984): Groundnut equivalent yield

$$= \frac{\text{Yield of crops x price of crops}}{\text{Price of groundnut}}$$

Results and Discussion

Table 1 showed that the yield of groundnut, red amaranth, coriander and spinach in different treatments varied significantly. Table 1 also showed that groundnut pod yield in different intercrop combinations did not vary significantly. However, it ranged from 1.55-1.72 t/ha, the highest being in the combination of 100% groundnut + 68% coriander in broadcast and the lowest being in the combination of 100% groundnut + 68% spinach in row. The highest red amaranth yield (3.07 t/ha) was obtained for the sole crop. Red amaranth yield in line sown or in broadcast method were identical. However, in line sown method it gave higher (2.33t/ha) yield than in broadcast method. Similarly, coriander and spinach yields in the line sown treatments were better than the broadcast treatments. Coriander and spinach yields were 0.97 t/ha and 2.23 t/ha, respectively in the sole crops. The lowest coriander yield was 0.65 t/ha in 100% groundnut + 68% coriander in broadcast and the lowest spinach yield was 1.45 t/ha in100% groundnut + 68% spinach in broadcast.

Groundnut equivalent yield: Table 2 showed that all the intercropping treatments showed higher GEY than sole crop the maximum groundnut equivalent yield (2.76 t/ha) was obtained from the treatment with 100% groundnut + 68% red amaranth in row which was closely followed by 100% groundnut + 68% red amaranth in broadcast (2.72 t/ha). The lowest GEY (2.58 t/ha) was recorded in the treatment of 100% groundnut + 68% spinach in broadcast.

Table 1. Effect of inter/ mixed copping on the yield of groundnut, lalshak, coriander, spinach (2 years pooled)

Treatment	Yield (t/ha)			
	Groundnut	Red amaranth	Coriander	Sipnch
T_1	1.87	-	-	-
T_2		3.07	-	-
T_3	-	-	0.97	-
T_4	-	-	-	2.23
T_5	1.71	2.33	-	-
T_6	1.60	-	0.73	-
T_7	1.55	-	-	1.88
T_8	1.70	2.27	-	-
T_9	1.72	-	0.65	-
T_{10}	1.69	-	-	1.45
CV%	10.72	10.85	11.12	10.12
LSD (5%)	0.19	0.77	0.25	0.22

Table 2. Yield and groundnut equivalent yield and LER of different treatments (2 years pooled)

Treatment	Yield (t/ha)					
	G.nut	R.A.	Coriander	Spinach	GEY (t/ha)	LER
T_1	1.87	-	-	-	1.87	1.00
T_2		3.07	-	-	1.38	1.00
T_3	-	-	0.97	-	1.45	1.00
T_4	-	-	-	2.23	1.34	1.00
T_5	1.71	2.33	-	-	2.76	1.67
T_6	1.60	-	0.73	-	2.70	1.61
T_7	1.55	-	-	1.88	2.68	1.66
T_8	1.70	2.27	-	-	2.72	1.64
T_9	1.72	-	0.65	-	2.70	1.60
T_{10}	1.69	-	-	1.45	2.58	1.55

Table 3. Economics analysis of different treatment (2 years pooled)

Treatment	Gross return (Tk/ha)				Total (Tk/ha)	Total variable cost (Tk/ha)	Net return (Tk/ha)	BCR
	Ground nut	Red Amaranth	Coriander	Spinach				
T_1	56100	-	-	-	56100	15761	40339	3.56
T_2	-	30700	-	-	30700	12172	18528	2.52
T_3	-	-	29100	-	29100	12507	16593	2.31
T_4	-	-	-	26760	26760	11893	14867	2.25
T_5	51300	23300	-	-	74600	14100	60500	5.29
T_6	48000	-	21900	-	69900	14160	455740	4.94
T_7	46500	-	-	26760	73260	14200	59060	5.16
T_8	51000	22700	-	-	73700	14399	59301	5.12
T_9	51600	-	19500	-	71100	14504	56596	4.90
T_{10}	50700	-	-	17400	68100	15571	52529	4.37

Sole spinach (30 cm x 10 cm), T_5 - 100% GN + 68% R A in alternate row, T_6 - 100% G N + 68% coriander in alternate row, T_7 - 100%GN + 68% spinach in alternate row, T_8 - 100% GN +68% R A in broadcast, T_9 - 100% GN + 68% coriander in broadcast, T_{10} - 100%GN + 68% spinach in broadcast (Price of crops: Groundnut TK.30/kg, Lalshak TK.10/kg, Coriander TK.30/kg, Spinach TK.12/kg)

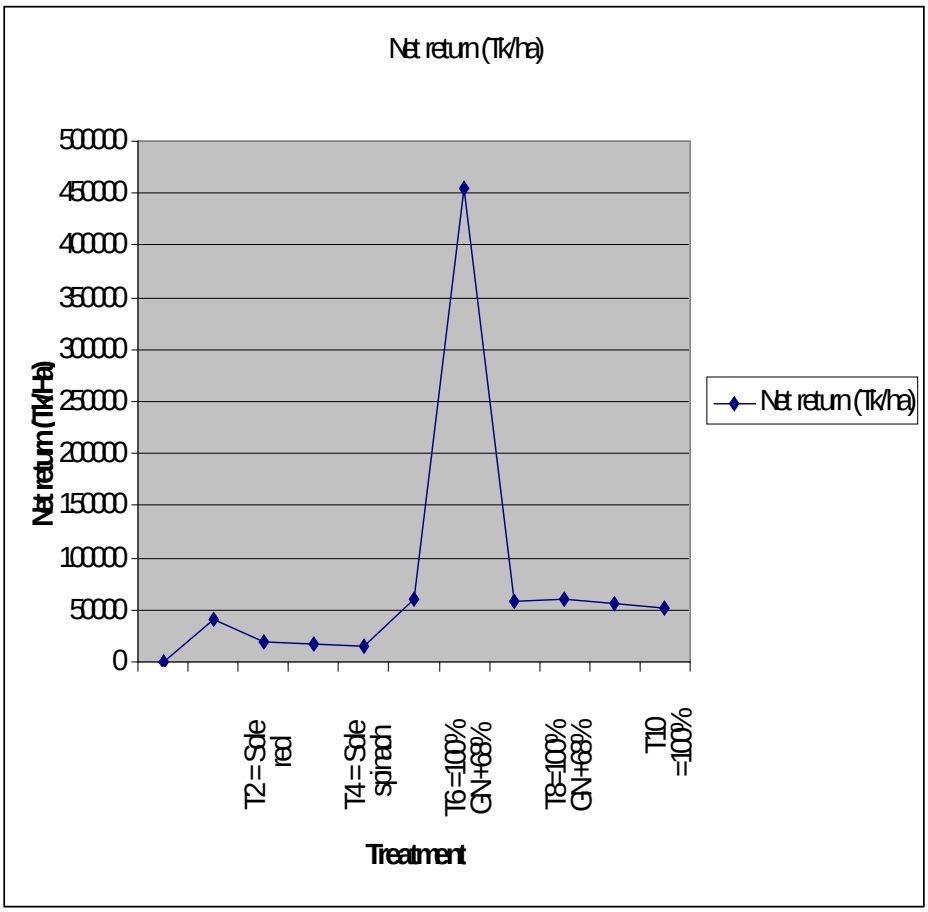

Fig. 1. Economic analysis of different treatment

Land equivalent ratio (LER): The LER is the total land required by the sole crop to produce as much yield as can be obtained from an intercropping treatment. The LER in different intercropping treatments ranged from 1.55-1.67 (Table-2). The highest LER (1.67) was obtained form the treatment of 100% groundnut +68% red amaranth in row. The second highest LER (1.66) was recorded form100% groundnut +68% spinach in row (T_7). The result indicated that row intercrop of red amaranth or spinach with gave the highest land advantage over the mono cropping system.

Economic analysis: The highest total gross return (Tk. 74700/ha) was obtained from the intercrop combination of 100% groundnut + 68% red amaranth followed by the combination of 100% groundnut + 68% red amaranth in broadcast (Table-3). The lowest total gross return (Tk. 26760/ha) was obtained from the sole crop of spinach. The

maximum net return (Tk. 60500/ha) over variable cost was obtained from 100% groundnut +68% red amaranth inter row combination and the lowest (Tk. 14867/ha) by sole spinach (Figure1). The benefit cost ratio (BCR) was higher in 100% groundnut _68% red amaranth (5.29) closely followed by 100% groundnut + 68% spinach in row combination (5.16). All the intercrop combination gave higher gross return, net return and benefit cost ratio than their sole crops. The finding is in agreement with Singh and Srivastava (1981) who found the highest gross return and net return when tomato was intercropped with palak although tomato yield was higher in monoculture. Kotosokoane (1985) also found higher net return in tomato intercropping than sole cropping.

From the results of the experiment, it may be concluded that all the intercropping combinations either in row or broadcast sowing (except spinach broadcast) in between two normal rows of groundnut are agronomically feasible and economically profitable for higher yield and economic return.

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