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PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 6 (2): 92-94, 2003
ISSN 1028-8880

Performance of Intercropping of Maize with Groundnut in Saline Area under Rainfed Condition

[1]M. Shalim Uddin, [2]M.J. Rahaman, [3]Shamim Ara Bagum, [4]M.J. Uddin and [5]M.M. Rahaman
[1]Plant Breeding Division, [2]Soil Science Division, [3]Seed Technology Division,
[4]On-Farm Research Division, [5]Farm Division, Bangladesh Agricultural Research Institute,
Gazipur-1701, Bangladesh

Abstract: Effect of intercropping of groundnut with maize in saline area under rainfed condition was studied. The highest groundnut seed yield and maize grain yield were obtained from their respective sole crop. The highest groundnut equivalent yield of maize (2485 kg ha^{-1}) obtained from T_4. The highest land equivalent ratio (1.37) and groundnut yield was reduced from 18.4 to 41.46% depending on treatment. Grain yield of maize reduced from 26.67 to 54.28% depending on treatment. The highest marginal rate of return (779.15%) was obtained from T_5= groundnut (30×15 cm^2) + maize (200×25 cm^2)

Key words: Intercropping, maize, groundnut, salinity

Introduction

Intercropping is widely practiced by farmers in the tropics, because of increased productivity and reliability in production. Intercropping gives a greater stability of yield over monoculture (Willey and Reddy, 1981). Besides, mixed or intercropping is widely practiced by the farmers because it often gives higher cash return and total production per hectare than growing one crop alone (Grimes *et al*., 1983; Kurata, 1986; Evans, 1960) and ensure greater resource use efficiency (Herrara and Harwood, 1974; Poathik and Malla, 1979). Groundnut is the third major oil crop in Bangladesh in area and production. It contains maximum oil content. It is grown in the char area during rabi season. Groundnut is a long duration crop that requires about 160-170 days to mature if sown in November. It is an important leguminous crop of Bangladesh and can be grown as an intercrop with maize and sugar-cane successfully (Abul Hossain, 1997).

At Farming System Research and Developing (FSRD) site Atkapalia, Noakhali farmers normally grow groundnut as sole crop. Farmers can not harvest it generally each year due to excessive rainfall in the month of April and May. The cropping intensity of the site area was 163%, which is very low due to excessive rainfall and salinity (Bhuiyan *et al*., 1998). Considering the above problems and scope the study was carried out to overcome the risk of sole crop and increasing the crop intensity through intercropping.

Materials and Method

The experiment was conducted under rainfed condition in saline soil at FSRD site Atkapalia, Noakhali during rabi season 2000-2001. The experiment was laid out in RCB design with five dispersed replications. Unit plot size was 8×5 m^2. The five treatments were T_1 = sole groundnut (30×15 cm^2), T_2= sole maize (75×25 cm^2), T_3= groundnut (30×15 cm^2) + maize (100×25 cm^2), T_4= groundnut (30×15 cm^2) + maize (150×25 cm^2) and T_5= groundnut (30×15 cm^2) + maize (200×25 cm^2). Seed of groundnut (var. Dhaka-1) and maize (var. Barnali) were sown on 12th December, 2001.

The land was prepared by ploughing three times followed by laddering. Fertilizers were applied as follows:

Treatments	N	P	K	S
	(Kg ha^{-1})			
T_1	15	35	20	15
T_2	70	45	50	30
T_3	35	35	20	15
T_4	35	35	20	15
T_5	35	35	20	15

All fertilizers were applied as basal at the time of final land preparation in the form of urea, triple supper phosphate, muriat of potash and gypsum, respectively.

Soil salinity was measured monthly in the top 0-15 cm soils during cropping season. Electrical conductivity in soil solution was measured using conductivity bridge (model- EIJKLKAMP pH/EC 18.38). Groundnut equivalent yield, LER and economic analysis were done for each treatment on a hectare basis considering the farm rate of crop. Groundnut equivalent yield (GEY) was calculated by converting the yield of maize to the yield of groundnut as follows:

$$GEY = \frac{\text{Maize yield (Kg ha}^{-1}\text{) x Maize price (Tk. ha}^{-1}\text{)}}{\text{Groundnut price (Tk. ha}^{-1}\text{)}}$$

Index of yield was calculated by the following formula:

$$\text{Index of yield} = \frac{\text{Intercrop yield}}{\text{Sole crop yield}} \times 100$$

Economic analysis: Economic analysis was done according to partial Budget Technique in cropping system research (Elias and Karim, 1984). The marginal rate of return was calculated by the following formula:

$$\text{MRR (\%)} = \frac{\text{Marginal increase in gross margin}}{\text{Marginal increase in variable cost}} \times 100$$

Results and Discussion

Soil salinity was low in the experimental sites during the time of sowing (below 3 ds/m). However, commencing from January, EC started to increase and reached the peak of 8-9 ds/m at the time of maturity (Fig. 1). Electric conductivity had reciprocal relationship with rainfall. Rainfall and temperature are the key factors, which influence intensities of soil salinity (Hoque, 1998; Husain *et al*., 1999).

Seed yield of groundnut and grain yield of maize were significantly differed by different treatments. Groundnut yield was significantly highest from sole crop due to more number of rows and higher yield attributes. The yield of groundnut reduced in intercropping situation (Table 1). Among the groundnut intercrop yields, seed yield of groundnut increases with wider row spaces of maize but significantly lower than sole crop because of unavailability of light and nutrient. The result was similar to the finding of Abul Hossain (1997) and Ahmed and Gunasena (1979) who reported significant reduction in legume yield intercropping with non-legume shady plants. Significantly highest grain yield of maize was obtained from sole crop. There was a trend to decrease gross yield of maize with the increase of spacing. The maximum grain yields of maize under intercropping situation were obtained from T_3 which was followed by T_2. It was due to higher plant population of maize than the other intercropping plots.

Maximum (2485.00 Kg ha^{-1}) groundnut equivalent yield (GEY) was obtained from T_4 and minimum (1624.62 kg ha^{-1}) SEY was obtained from T_2. Intercropping situation showed higher equivalent yield than either sole maize or groundnut due to symbiotic effect of groundnut on maize. Rathore *et al*. (1981) reported to have obtained highest equivalent yield from maize intercropped with blackgram due to favourable symbiotic effect of blackgram on maize. The highest land equivalent ratio (LER) for intercropping system was greater (1.3 to 1.37) than sole cropping system indicating better land utilization efficiency and more

Table 1: Seed yield, groundnut equivalent yield (GEY) and LER of groundnut-maize intercropping system

	Yield (kg ha^{-1})				Index of yield	
Treatments	Groundnut	Maize	GEY (Kg ha^{-1})	LER	Groundnut	Maize
T_1	1956	-	1956.00	1	100.00	-
T_2	-	2640	1624.62	1	-	100.00
T_3	1145	1936	2336.38	1.31	58.54	73.33
T_4	1461	1664	2485.00	1.37	74.69	63.03
T_5	1596	1207	2338.77	1.30	81.60	45.72
LSD (0.05)	144.5	217.9				
CV (%)	7.31	13.18				

LER=Land equivalent ratio

Table 2: Dominance analysis of groundnut-maize intercropping system

Treatments	Gross margin (Tk. ha^{-1})	TVC (Tk. ha^{-1})	Remarks
T_1= Sole groundnut (25×5cm^2)	11501	13927	UCD
T_2= Sole maize (75×25 cm^2)	9770	11350	UCD
T_3= Groundnut (30×15 cm^2) + maize (100×25 cm^2)	15314	15059	CD
T_4= Groundnut (30×15 cm^2) + maize (150×25 cm^2)	17548	14757	UCD
T_5= Groundnut (30×15 cm^2) + maize (200×25 cm^2)	15911	14493	UCD

Farm price: Groundnut Tk. 13/kg, Maize Tk.8/kg, TVC: Total variable cost

Table 3: Marginal analysis of undominated groundnut-maize intercropping system

Treatments	Gross margin	TVC (Tk. ha^{-1})	MGM (Tk. ha^{-1})	MVC (Tk. ha^{-1})	MRR (%)
T_2	9770	11350	-	-	-
T_1	11501	13927	1731.00	2577	67.17
T_5	15911	14493	4410.00	566	779.15
T_4	17548	14757	1637.00	264	620.08

MGM= marginal gross margin, MVC= Marginal variable cost, MRR= Marginal rate of return

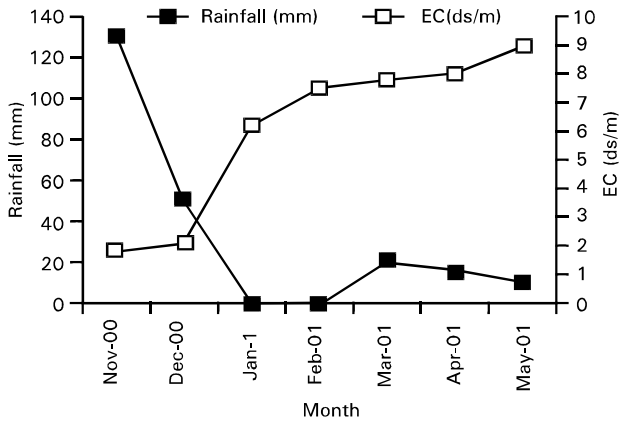

Fig. 1: Salinity and rainfall of FSRD site, Atkapalia during rabi season

income to the farmers (Table 1). Chaniyara *et al.* (1999) reported that highest land equivalent ratio (1.30) were given by the groundnut/pigeon pea intercropping system. Index of yield indicating the reduction of yield due to intercropping. Groundnut yield was reduced from 18.4 to 41.46% depending on treatment. Maximum reduction was obtained in T_3 for closer spacing of maize as a result competition for light and nutrient increased and minimum in T_5 due to wider spacing of maize. Grain yield of maize reduced maximum in T_5 (54.28%) and minimum in T_3 (26.67%) due to different spacing (Table 1).

Dominance analysis was employed to determine the most efficient marginal rate of return (MRR). Gross margin of different treatments were arranged in ascending order to identify the cost dominated (Table 2). The undominated treatments were arranged (Table 3) and indicated gross margins, total variable cost (TVC) and marginal rate of return. The result shows that the highest MRR (779.15%) was obtained from T_5 and signified that investment of an additional Tk. 100 in the production process increase return as 779.15% to the total benefit. The results showed that intercropping earn higher money return compared to sole crop.

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