http://www.pjbs.org

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): 149-152, 2003
ISSN 1028-8880

Economic Returns and Yield of Chilli as Intercropped with Varying Onion Population

I.H. Tarafder, [1]M.S. Rahman, A.K.M.M. Hossain, [1]J.A. Syeda and M.M. Rahman
Department of Soil Science, [1] Department of Statistics,
Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh

Abstract: An experiment was conducted in the Rabi seasons of 1999 and 2000 to investigate the appropriate plant population of onion as a companion crop that would not adversely affect the chilli yield and also to assess the economic benefit. The results showed that the yields of chilli decreased with the increase of onion population but the chilli yields when intercropped with 20-80% onion population were not significantly decreased. The highest average yields of dry chilli (1546 kg ha^{-1}) and onion (8042 kg ha^{-1}) were observed from their respective sole crops. Average over two years data, all intercropping treatments gave higher chilli equivalent yield and net monetary return per hectare than the sole chilli. In addition, the highest average chilli equivalent yield (2732 kg ha^{-1}), land equivalent ratio (1.34) and net return (Tk. 46,395.00 ha^{-1}) were obtained from 20% onion population intercropped with chilli indicating the practice of intercropping of chilli at different onion population was more profitable than the conventional monoculture of chilli.

Key words: Yield, intercropping, onion population, chilli equivalent yield, economic return

Introduction

Intercropping is the growing of two or more cultivars simultaneously in the same land by utilizing resources such as soil, water, nutrients and solar radiation more efficiently (Zandstra, 1979). Intercropping has been found to increase crop yields as much as 50-70% (Anonymous, 1976). With increasing pressures on agricultural land arisen out of population growth, farmers have to explore new ways to intensify production per unit area of land. Mixed cropping is one of the methods of this crops intensification. In Bangladesh, mixed or intercropping is widely practiced by the farmers, especially during Rabi season. Spatial arrangement in the intercropping is one of the most important factors for better yield advantages (Singh and Yadav, 1992). Chilli, an important spices crop in Bangladesh, is widely grown both in the Rabi and Kharif seasons, about 90% of which being in Rabi season (Anonymous, 1981). It covers an area of about 75,676 ha with total production 43550 t (Anonymous, 1983). In value added terms, chilli is the 6th most important crop in Bangladesh (Rashid, 1983) and its production greatly depends on marketing facilities. Chilli can be grown as intercrop with onion successfully. Onion is an important spices crop, which is widely cultivated throughout Bangladesh during Rabi season. Onion is short duration and shallow rooted crop and can profitably be grown intercrop with chilli to avoid competition for lands with crops. So there is a need for developing technology suitable for onion/chilli intercropping. It is reported that the use of variety, row arrangement and spacing and plant population are some of the strategies that may prompt the yield of intercrop (Herrara and Harwood, 1974). Therefore, this study was undertaken to determine the appropriate plant population for onion as a companion crop that will not adversely affect the chilli yield and also to asses the economic benefit of the system.

Materials and Methods

The experiment was conducted at Hajee Mohammad Danesh Science and Technology University Farm, Dinajpur, Bangladesh during the Rabi seasons of 1999 and 2000. The soil is a non-calcareous brown floodplain (Udic Ustocharept, USDA; Gleyic Eutric Cambisols, FAO) developed from the Himalayan Piedmont and Tista floodplain deposits. The field was medium high land and the surface soil was loam. The pH was 5.4, low in organic matter content (1.18%) and low in nitrogen (0.12%). Local chilli variety Kazli and onion variety Faridpur Bhati were transplanted on 12 and 15th January in 1999 and 2000, respectively on well tilth land. The experimental design was randomized complete block design (RCBD) with 6 treatment and 4 replications. Plot size was 3.5×3m^2. Chilli was the principal crop and spaced at a distance 30×40 cm^2 and the plant population was 82,000 ha^{-1}. The sole onion population was taken as 10,000,00 plant ha^{-1} and was spaced at a distance 10×10 cm^2 and also 4 onion populations 20, 40, 60 and 80% as a companion crop. In every alternate row of chilli with a plant to plant distance of 50, 25, 16 and 12.5 cm for 20, 40, 60 and 80%, respectively onion population were used. The land was fertilized with 80 kg N, 100 kg P_2O_5, 150 kg K_2O and 40 kg S ha^{-1} as urea, triple super phosphate, muriate of potash

and gypsum, respectively. Half of the total quantity of N and full quantity of P_2O_5, K_2O and S were applied at the time of final land preparation and the remaining half of N was top dressed in two equal installments of 20 and 25 days of transplanting. The crop was irrigated at times. All required intercultural operations were done as and when required. Ten plants were selected randomly from each plot to collect yield contributing characters such as plant height, number of branches plant^{-1} and weight of chilli plant^{-1}. Periodical harvests of chilli were done at 124, 135, 142, 150, 166 and 180 days during 1999 and 114, 120, 128, 141, 148, 162 and 175 days of transplanting during 2000, respectively. Ripening of chilli was done when the fruit colour becomes red. Fresh weight of harvested chillies was recorded and converted into dry weight as per formula i.e. dry weight is equal to one fourth of fresh weight (Rashid, 1983). Onion was harvested at 87 and 90 days after planting during 1999 and 2000, respectively and onion yield were collected from 3.5×3m^2 area of each plot. The collected data were statistically analyzed and the differences between means were tested by Duncan's multiple range test (DMRT). Equivalent yield and land equivalent ratio (LER) were calculated to ascertain the efficiency of intercropping. Chilli equivalent yield was calculated by converting the yield of onion to the yield of chilli on the basis of prevailing market prices of the individual crops. Economic analysis on the basis of net monetary return was performed to evaluate the intercropping system.

Results and Discussion

Yield and yield components of chilli: The plant height of chilli did not differ significantly with the introduction of onion population during 1999 and 2000 (Table 1). However, it is observed that number of primary branches plant^{-1} of chilli was similar among the onion population but sole chilli significantly produced higher plant in 1999. Similarly, sole chilli produced significantly higher branches plant^{-1} compared to 80% onion population. This was ultimately reflected in weight of chilli plant^{-1}. Sole crop of chilli performed better than intercropped with onion. With the increase in onion population, yield of chilli plant^{-1} decreased (Table 1). There were no significant variations in fruit length and width among the sole chilli or with different onion population in both the years. Dry yield of sole chilli were significantly increased among the treatments that were intercropped with onion during 1999 and 2000. The yield of chilli decreased 32 to 43% in 1999 and 34 to 44% in 2000 with the increase of onion population from 20 to 80%. Highest chilli produced in sole chilli treatment during 1999 and 2000 were 1508 and 1584 kg ha^{-1} and lowest chilli 867 and 893 kg ha^{-1} during 1999 and 2000, respectively in treatment where 80% onion was used. The dry chilli yield did not significantly reduce when chilli intercropped with 20 to 80% onion population (Table 1).

Yield and yield component of onion: Single bulb weight, 10 bulb weight, number of bulb kg^{-1} and bulb diameter was not significantly influenced by different onion population in both the years (Table 2). Highest plant height was observed in treatment where 20% onion population was applied. Highest number of onion kg^{-1} was recorded from the sole crop. Hossain (1997) observed similar results in intercropped groundnut with onion. Two year's results showed that onion yield was significantly higher in the sole crop compared with other treatments. The bulb diameter of onion decreased in sole onion but increased in treatments where onion populations were decreased.

Table 1: Yield and yield contributing characters of chilli intercropped with onion during 1999 and 2000

		Treatments					
		Sole Chilli	$C_{100\%} + O_{20\%}$	$C_{100\%} + O_{40\%}$	$C_{100\%} + O_{60\%}$	$C_{100\%} + O_{80\%}$	LSD (0.05)
Plant height (cm)	1999	59.20	55.10	53.41	56.60	51.90	NS
	2000	62.04	58.03	56.52	59.76	56.37	NS
No. of primary branches plant^{-1}	1999	4.30	3.00	3.10	3.40	2.80	0.69
	2000	4.44	3.37	3.45	3.46	2.84	1.08
Wt. of chilli plant^{-1} (g)	1999	73.88	50.20	45.00	43.28	42.50	11.70
	2000	75.16	51.29	46.10	45.52	43.76	11.62
Fruit length (cm)	1999	3.70	3.80	3.90	3.60	3.80	NS
	2000	3.88	3.58	3.95	3.70	4.01	NS
Width (cm)	1999	0.82	0.82	0.82	0.89	0.86	NS
	2000	0.83	0.84	0.81	0.89	0.87	NS
Dry yield of chilli (kg ha^{-1})	1999	1508.00	1025.00	919.00	884.00	867.00	239.2
	2000	1584.00	1047.00	941.00	929.00	893.00	208.2
Average yield (kg ha^{-1})		1546.00	1036.00	930.00	907.00	880.00	226.1

NS = non significant

Table 2: Yield and yield contributing characters of onion intercropped with chilli during 1999 and 2000

		Treatments					
		$O_{20\%} + C_{100\%}$	$O_{40\%} + C_{100\%}$	$O_{60\%} + C_{100\%}$	$O_{80\%} + C_{100\%}$	Sole Onion	LSD (0.05)
Plant height (cm)	1999	47.20	45.50	43.80	45.70	44.60	3.06
	2000	49.10	47.90	42.70	47.20	45.30	4.51
No. of leaves plant^{-1}	1999	7.30	7.20	6.40	6.30	6.00	0.74
	2000	8.30	6.90	7.60	7.00	6.90	1.66
Single bulb wt. (g)	1999	18.40	18.70	16.20	17.20	18.20	NS
	2000	18.30	17.40	18.70	18.50	18.30	NS
Ten bulb wt. (g)	1999	183.90	187.10	161.50	172.20	182.50	NS
	2000	166.80	147.30	195.50	220.30	183.00	NS
No. of bulb kg^{-1}.	1999	60.30	56.30	63.30	59.00	71.30	NS
	2000	54.75	55.75	64.00	59.75	73.75	NS
Bulb diameter (cm)	1999	1.75	1.64	1.61	1.55	1.41	NS
	2000	1.88	1.65	1.58	1.59	1.50	NS
Yield (kg ha^{-1})	1999	5479.00	5396.00	4625.00	3625.00	7917.00	2192
	2000	5375.00	5187.00	4750.00	3854.00	8166.00	894.5
Average yield (kg ha^{-1})		5427.00	5292.00	4688.00	3740.00	8042.00	1341.8

NS = Non significant

Table 3: Land equivalent ratio, Chilli equivalent yield and economic analysis of different treatments

		Treatments					
		Sole Chilli	Sole Onion	$O_{20\%} + C_{100\%}$	$O_{40\%} + C_{100\%}$	$O_{60\%} + C_{100\%}$	$O_{80\%} + C_{100\%}$
LER	1999	1.00	1.00	1.37	1.29	1.17	1.03
	2000	1.00	1.00	1.31	1.22	1.16	1.04
Gross Return ('000 Tk ha^{-1})	1999						
	Chilli	60.32	---	41.00	36.76	35.36	34.68
	Onion	---	95.00	65.74	64.75	55.50	43.50
	Total	60.32	95.00	106.74	101.15	90.86	78.18
	2000						
	Chill	63.36	---	41.88	37.64	37.16	35.72
	Onion	---	106.15	69.87	67.43	61.75	50.10
	Total	63.36	106.15	111.75	105.07	98.91	85.82
Cost of cultivation ('000 Tk ha^{-1})	1999	31.08	62.30	61.50	58.10	55.00	49.50
	2000	32.00	67.40	64.20	61.00	58.00	52.30
Net return ('000 Tk ha^{-1})	1999	29.24	32.70	45.24	43.05	35.86	28.68
	2000	31.36	38.75	47.55	44.07	40.91	33.52
Benefit cost ratio ('000 Tk ha^{-1})	1999	1.94	1.52	1.73	1.74	1.65	1.57
	2000	1.98	1.57	1.74	1.72	1.70	1.64
Chilli equivalent yield (kg ha^{-1})	1999	1508.00	2375.00	2669.00	2538.00	2272.00	1955.00
	2000	1584.00	2654.00	2794.00	2627.00	2473.00	2146.00
Average Yield (kg ha^{-1})		1546.00	2515.00	2732.00	2583.00	2373.00	2051.00
Market Price:							
Chilli Tk 40.00 Kg^{-1}	1999						
Onion Tk 12.00 Kg^{-1}	"						
Chilli Tk 40.00 Kg^{-1}	2000						
Onion Tk 13.00 Kg^{-1}	"						

Intercropping efficiency:

Land equivalent ratio (LER): LER did not vary widely (1.37 to 1.03 during 1999 and 1.31 to 1.04 during 2000) among different population of onion in intercropping. Spacing 50 and 25 cm (20, 40%) of onion produced 1.37 and 1.29 in 1999 and 1.31 and 1.22 in 2000, respectively. LER reduced when onion populations were increased (Table 3). Average over two years data chilli intercropped with 20 and 40% onion had a LER of 1.34 and 1.26 indicating 34 and 26% increase over monoculture.

Chilli equivalent yield (CEY): Chilli equivalent yield varied among different treatments in both the years. Average over two year's data all intercropping treatments gave higher chilli equivalent yield than the sole chilli. Sole chilli produced inferior chilli equivalent yield (1508 kg ha^{-1} in 1999 and 1584 kg ha^{-1} in 2000). The highest average chilli equivalent yield (2732 kg ha^{-1}) was obtained when chilli intercropped with 20% onion population (Table 3).

Economics: In this study the total yields of intercropping were higher as compared to monoculture. The yield of chilli decreased when intercropped with onion (Table 2) because of higher competition of nutrient supply and other related growth factors between chilli and onion plants. Sole chilli and onion failed to earn higher gross return than intercropped combination (Table 3). It is also observed that increased onion population beyond 40% reduced gross return. In 1999, by 20% onion population the percent distribution of total gross return was 38.4% chilli and 61.6% onion and in 2000 it was 37.5 and 62.5% onion, respectively. On the other hand by 40% onion

population the percent distribution of total gross return was 36.3% chilli and 64.0% from onion in 1999 and 35.8% chilli and 64.2% from onion in 2000. The chilli grown as monoculture yielded 1508 and 1584 kg ha^{-1} gave a net return of Tk. 29,240.00 and 31,360.00 during 1999 and 2000, respectively. But when it was intercropped with 20% onion, the net return was Tk. 45,240.00 during 1999 and 47,550.00 in 2000, which indicated 54.7 and 51.6% increase over chilli grown alone during 1999 and 2000, respectively (Table 3). Average over two year's data all intercropping treatments gave higher net monetary return ha^{-1} than the sole chilli. Herrara and Harwood (1974) reported that changing the plant density by intercropping might increase the productivity of crops. Again, Onion grown sole gave a net return of 32,700.00 and Tk. 38,750.00 during 1999 and 2000, which were lower than the 20% onion intercropped with chilli. The highest average net return (Tk. 46,395.00 ha^{-1}) were obtained from 20% onion population intercropped with chilli. Therefore, from the result it is found that the practice of intercropping of chilli at different onion population is more profitable than the conventional monoculture of chilli in respect of chilli equivalent yield and net return. Chilli as sole crop showed higher benefit cost ratio (1.94 and 1.98) than sole onion and intercropped with onion. Similar agro-economic performance was observed in intercropping at multi location testing site Ali *et al. (*1993). But farmers are reluctant to grow chilli as sole crop. In this situation, intercropped onion with chilli would be viable. Besides, chilli grows as sole crop in homestead area; it is profitable to grow intercropped onion with chilli.

References

Ali, M.O., M. Shahidullah, M. Ahmed, M. Kalimuddin and A.K.M.H. Rahman, 1993. Trial on potato intercropped with maize. Research Report (1992-93), On-Farm Research Division, BARI, Bogra, pp: 24-27.

Anonymous, 1976. Annual Report for 1975. International Rice Research Institute, Los Banos, Philippines.

Anonymous, 1983. Oil seeds. In: Agricultural Research in Bangladesh. BARC, Air port Road, Farm Gate, Dhaka-15, Bangladesh, pp: 49-51.

Anonymous, 1981. Year Book of Agricultural Statistics of Bangladesh. Statistical Division, Ministry of Planning, Govt. Bangladesh.

Herrara, W.A.T. and R.R. Harwood, 1974. The effect of plant density and row arrangement on productivity of corn rice intercrop. Paper presented at the 5th Annual Convention of the Crop Society of the Philippines, Naga city, May 16-18, 1974.

Hossain, M.A., 1997. Effect of intercropping groundnut with onion at varying planting arrangement. Bangla. J. Agril. Res., 22: 23-30.

Rashid, M.M., 1983. Sabjir Chas (cultivation of vegetables). Ist ed. Begum Sahela Rashid, BARI residential area. Jaydebpur, Gazipur, Banglades, pp: 183.

Singh, D.K. and D.S. Yadav, 1992. Production potential and economics of chick based intercropping systems under rain fed condition. Indian. J. Agron., 37: 424-429.

Zandstra, H.G., 1979. Terminologies in cropping systems definitions Parameters. Lecture note of six month cropping systems programmed at IRRI, 14th September.