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PERFORMANCE OF ONION GARLIC AND CORIANDER AS INTERCROPPING WITH CHILLI

M. A. H. KHAN[1], M. RAHMAN[2], M. A. SIDDIKY[3]
M. M. HOSSAIN[4] AND S. T. ZANNAT[5]

Abstract

An experiment was conducted at the research field of regional agricultural research station (RARS), Bangladesh Agricultural Research Institute (BARI), Cumilla during 2020-21 to find out the suitable crop combination of onion, garlic and coriander with chilli for increasing total productivity, economic return and maximizing land utilization through intercropping system. Seven treatments were viz., T_1 = Sole chilli (50 cm × 50 cm) , T_2 = Two rows of onion in between two rows of chilli (15 cm × 10 cm), T_3 = Two rows of garlic in between two rows of chilli (15 cm × 10 cm), T_4 = 100% coriander (leaf) in between two rows of chilli, T_5 = Sole onion (15 cm × 10 cm), T_6 = Sole garlic (15 cm × 10 cm), T_7 = Sole coriander. The trial was set up in a randomized complete block design with three replications. Results showed that different intercrop combination significantly influenced yield and yield contributing characters of chilli. The yield of chilli was comparatively lower in intercropping than sole chilli but total productivity was increased due to additional yield of onion, garlic and coriander. Increased total productivity in terms of chilli equivalent yield (CEY) was 14.05 to 16.88 t/ha in intercrop combination compared to sole chilli 9.13 t/ha (main crop). All the intercrop combinations showed better performance in terms of chilli equivalent yield, gross return and benefit cost ratio (BCR) over sole crops. Among the intercrop combinations two rows of onion (15 cm x 10 cm) in between two rows of chilli (50 cm × 50 cm) was found feasible and profitable intercropping system in respect of chilli equivalent yield (16.88 t/ha), gross return (Tk.675200/ha), gross margin (Tk. 526800/ha) and benefit cost ratio (4.32).

Keywords: Intercropping, Chilli, Onion. Garlic, Coriander.

Introduction

Chilli is one of the major spices crop cultivated round the year in Bangladesh with area of 2, 49,748 acres of land (both winter and summer) with a production of 1,41,177 metric tons (BBS, 2018). It is tall structure, long duration (150 – 200 days) and wide spread (60-80 cm). Chilli is rich in Vitamin-A, Vitamin-C, iron and dietary fiber. Onion, garlic and coriander also an important spices in our daily life. Intercropping is a traditional practice in Bangladesh and it increases total productivity per unit area through maximum utilization of land, labor and growth resources (Ahmed, *et al.* 2013). By judicious choice of compatible crops and

[1&5]Scientific Officer, Agronomy Division, Bangladesh Agricultural Research Institute (BARI), Gazipur, Bangladesh, [2]Scientific Officer, [3]Principal Scientific Officer, Regional Agricultural Research Station, BARI, Cumilla, Bangladesh, [4]Scientific Officer, Planning and Evaluation Wing, BARI, Gazipur, Bangladesh.

adopting appropriate planting geometry, inter/intra specific competition may be minimized resulting higher total productivity (Alom *et al.* 2013). Canopy architecture of tall stature crop regulates the availability of light on under storied crop (Faruque *et al*. 2006). Intercropping is one of the viable technologies to ensure efficient utilization of their resources for increased production and family income. Intercropping offers the possibility of yield advantage relative to sole cropping through yield stability and improved yield in tropical and sub-tropical areas (Nazir *et al*., 2002; Bhatti *et al*., 2005).

So, there is a great scope to cultivate short duration spices like onion, garlic and leafy spices (coriander) in the inter row space of chilli could be introduced as intercrop. Short duration and quick growing spices crops like onion, garlic and leafy spice coriander can be easily intercropped between two rows of chilli at early growth stage for getting higher economic return. However, the literature regarding onion-chilli, garlic-chilli and coriander- chilli intercropping is very scarce. Keeping this view in mind, the experiment was undertaken to find out the most suitable crop combination of onion, garlic and coriander with chilli for increasing total productivity, economic return and maximize land utilization through intercropping system.

Materials and Methods

A field experiment was conducted at research field of Regional Agricultural Research Station, Bangladesh Agricultural Research Institute, Cumilla during 2020-21. The treatments were; T_1 = Sole chilli, T_2 =Two rows of onion in between two rows of chilli, T_3 = Two rows of garlic in between two rows of chilli, T_4 = 100% coriander (broadcasting) in between two rows of chilli, T_5 = Sole onion, T_6 = Sole garlic, T_7 = Sole coriander. The trial was set up in a randomized complete block design with three replications. The unit plot size was 3.0 m × 3.0 m. Chilli (var. BARI Marich-3) was the main crop and onion (var. BARI Piaj-6), garlic (var. BARI Rashun-2) and coriander (var. BARI Dhonia-1) were used as intercrops in the study. Sole chilli and intercrop treatments were fertilized with 120-80-120-20-4 N-P-K-S-Zn kg/ha, respectively where sole onion, sole garlic and sole coriander were fertilized with 90-45-120-30 N-P-K-S kg/ha, respectively (BARC, 2018). For sole chilli and intercrop treatments; half N and all other fertilizers were used as basal. Rest N was applied at 20 and 50 days after transplanting. For sole onion and other sole crop; half of N, K and full dose of P, S were applied at the time of final land preparation and remaining N and K were top dressed at 25 and 50 days after transplanting followed by irrigation. The sole crop of chilli was planted at a spacing of 50 cm × 50 cm, the sole crop of onion and garlic was planted at a spacing of 15 cm × 10 cm. As intercropping system two rows of onion and two rows of garlic were planted as per treatment. Coriander seed (100%) was broadcast in between two rows of chilli. Chilli (25 days old seedling) was transplanted on 24 November 2020. Onion seedling, garlic clove and coriander seeds were

planted/sown on 26 November 2020. Irrigation were applied as per necessary. Fipronil was sprayed three times @1 ml per liter of water for controlling the infestation of thrips. One miticide Vertimec was also sprayed three times @ 2 ml per liter of water for controlling mites. The coriander leaf was harvested on 20 December at 24 days after sowing. Onion and garlic were harvested on 1 March and 5 March 2021, respectively. Chilli was harvested at three times i.e. 10 March, 22 March and &10 April 2021. For chilli, onion, garlic, and coriander at harvest the yield data was recorded plot wise. The collected data were analyzed statistically using statistix 10 package and means were adjudged by LSD at 5% level of probability. Chilli equivalent yield (CEY) was converted by converting yield of intercrops on the basis of market price of individual crop following the formula (Bandyopadhyay, 1984):

$$\text{Chilli Equivalent Yield (CEY)} = \text{Yield of intercrop Chilli} + \frac{Yi \times Pi}{\text{Price of chilli}}$$

Where, Yi = Yield of intercrops (onion/garlic/coriander) and Pi = Price of intercrops (onion/garlic/coriander).

Land equivalent ratio (LER) values were determined from the yield data of the crops according to Mian (2008).

$$\text{LER} = \frac{YiC}{\text{Y syc}} + \frac{Yicc}{\text{Ysycc}}$$

Where,

Yic= Intercrop yield of chilli

Ysyc = Sole yield of chilli

Yicc = Intercrop yield of component crops

Ysycc = Sole yield of component crops

Results and Discussion

Yield and yield attributing characters of chilli

Number of branch/plant, number of fruits /plant, single fruit weight, fruit length and green chilli yield were significantly influenced due to intercropping onion, garlic and coriander with chilli (Table 1). The maximum number of branch/ plant (7.53) was obtained from sole chilli (T_1) which was statistically similar to T_4 (7.13) and the lowest in T_3 treatment. The maximum number of fruits/plant (174.73) was recorded in sole chilli which was statistically identical to T_4 (167.80). The maximum single fruit weight (1.92 g) was obtained from sole chilli which was statistically similar with T_2 treatment. Higher fruit length (5.5 cm) and green chilli fruit yield (9.13 t/ha) was obtained from sole chilli which was statistically similar with T_4 treatment and the lowest fruit length (5.13 cm) and green chilli fruit yield (6.68 t/ha) in T_3 treatment. The maximum fruit yield was obtained in sole chilli treatment might be due to the combined effect of yield contributing characters like

number of fruits per plant and single fruit weight. Islam *et al.* (2012) also reported similar result.

Table 1. Fruit yield and yield attributes of chilli under sole and intercropping situation (2020-2021)

Treatment	Plant height (cm)	Branch/ plant (no.)	Fruits/ plant (no.)	Single fruit wt. (g)	Fruit length (cm)	Green chilli yield (t/ha)
T_1	56.80	7.53	174.73	1.92	5.50	9.13
T_2	58.93	6.47	163.47	1.88	5.17	7.52
T_3	59.73	6.20	165.60	1.55	5.13	6.68
T_4	59.63	7.13	167.80	1.71	5.30	8.3
LSD $_{(0.05)}$	NS	0.80	8.1	0.18	0.32	0.34
CV (%)	11.2	8.9	5.5	6.3	5.1	10.5

T_1 = Sole chilli, T_2 =Two rows of onion in between two rows of chilli, T_3 = Two rows of garlic in between two rows of chilli, T_4 = 100% coriander (leaf) in between two rows of chilli.

Yield of component crops

The yield of onion, garlic and coriander was significantly influenced by intercrop onion, garlic and coriander with chilli (Table 2). The maximum bulb yield was recorded in onion (14.99 t/ha) in sole treatment followed by (12.49 t/ha) T_2 treatment (Two rows of onion in between two rows of chilli) and the lowest yield (4.6 t/ha) in T_4 treatment 100% coriander (leaf) in between two rows of chilli. In case of garlic and coriander the similar trend was also observed. These results were obtained might be due to the no harmful effect of onion in between chilli. Faruque *et al. (*2006*)* also reported the similar result.

Table 2. Yield of onion, garlic and coriander under sole and intercropping situation (2020-2021)

Treatment	Yield (t/ha)
T_2 =Two rows of onion in between two rows of chilli	12.49
T_3 = Two rows of garlic in between two rows of chilli	6.44
T_4 = 100% coriander (leaf) in between two rows of chilli	4.60
T_5 = Sole onion	14.99
T_6 = Sole garlic	9.37
T_7 = Sole coriander	6.46
LSD $_{(0.05)}$	1.92
CV (%)	7.2

Chilli equivalent yield (CEY)

Chilli equivalent yield is expressed in total productivity. Chilli equivalent yield were higher (14.05-16.88 t/ha) in all the intercrops than the sole crop of chilli (9.13 t/ha), onion (11.24 t/ha), garlic (11.71 t/ha) and coriander (8.07 t/ha). In intercrop combination the maximum chilli equivalent yield (16.88 t/ha) was recorded in T_2 treatment (Two rows of onion in between two rows of chilli) which was followed by T_3 treatment (Two rows of garlic in between two rows of chilli) (14.73 t/ha) and the lowest chilli equivalent yield (8.07 t/ha) from T_7 treatment (Sole coriander). Ahmed *et al.* (2013) also reported that intercrop combination increase the equivalent yield.

Land equivalent ratio (LER)

Land equivalent ratio is the most common index adopted in intercropping to measure the land productivity. It is often used as an indicator to determine the efficacy of intercropping. The highest land equivalent ratio (1.65) was recorded in T_2 treatment (Two rows of onion in between two rows of chilli) followed by T_4 treatment (100% coriander in between two rows of chilli) (1.60) and the lowest Land equivalent ratio (1.41) in T_3 treatment (Two rows of garlic in between two rows of chilli). LER of different crop combinations ranged from 1.41 to 1.65% indicating land utilization 41-65% increased by intercropping. The mean values of LER (more than one) in all intercropping treatments indicated that land was more efficiently utilized under intercropping than sole cropping of chilli, onion, garlic and coriander.

Cost benefit analysis

Intercropping combination of onion, garlic and coriander with chilli showed higher monetary return than sole crop (Table 3). The maximum gross return (Tk. 6,75,200/ha) was recorded from T_2 treatment (Two rows of onion in between two rows of chilli) which was 84% higher than the sole chilli. This treatment intercropping combination also gave the higher gross margin (Tk.5,26,800/ha) and benefit cost ratio (4.32) followed by T_4 treatment (100% coriander in between two rows of chilli) with BCR (3.81). The results of increased productivity and returns were consistent with the earlier reports of yield advantages of crop mixture compared to monoculture (Islam *et al.* 2012 and Ahmed *et al.* 2013). Though higher benefit from treatment T_2 but second highest cost of production among the treatments. All sole crops showed much lower cost of production than intercrops but lower CEY as well gross return, gross margin and BCR respectively.

Table 3. Chilli equivalent yield (CEY), land equivalent ratio (LER) and cost and return analysis of intercropping (2020-2021)

Treatment	CEY (t/ha)	LER	Gross return (Tk./ha)	Cost of production (Tk./ha)	Gross margin (Tk./ha)	BCR
T_1	9.13	1.00	365200	135250	229950	2.70
T_2	16.88	1.65	675200	156200	526800	4.32
T_3	14.73	1.41	589200	158500	448700	3.71
T_4	14.05	1.60	562000	147250	463550	3.81
T_5	11.24	1.00	449600	132100	444500	3.40
T_6	11.71	1.00	468400	135100	259700	3.46
T_7	8.07	1.00	322800	102500	186800	3.14

CEY= Chilli equivalent yield; LER= Land equivalent ratio, BCR= Benefit cost ratio.

T_1 = Sole chilli, T_2 =Two rows of onion in between two rows of chilli, T_3 = Two rows of garlic in between two rows of chilli, T_4 = 100% coriander (leaf) in between two rows of chilli, T_5 = Sole onion, T_6 = Sole garlic, T_7 = Sole coriander.

Market price (Tk./kg): Onion=30, Garlic=50, Chilli=40, Coriander leaf=50

Conclusion

The result revealed that, all intercropping were found relatively better in respect of productive and profitable than that of sole cropping. Among the treatments, two rows of onion (15 cm x 10 cm) in between two rows of chilli (50 cm x 50 cm) were more productive and profitable in respect of chilli equivalent yield and monetary return.

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