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# Intercropping of root crops with chilli in charlands of Mymensingh

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## Abstract

Adoption of intercropping may increases crop production instead of declining trend of agricultural land in Bangladesh. Thus, a field experiment on intercropping of root crops with chilli was executed at char area of Dori Bhabkhali in Mymensingh district during October 2014 to March 2015 to find out an appropriate intercrop for cultivation with chilli for higher productivity and maximum economic return. The experiment was consisted with five crop combinations viz., sole chilli, chilli + radish, chilli+ carrot, chilli + onion and chilli + garlic. Significantly the highest yield (green chilli) was obtained with sole chilli (10.26 t $ha^{-1}$). Among the intercropping treatments, the highest chilli yield (10.31 $tha^{-1}$) was obtained from chilli + garlic which were close to chilli + onion whereas the lowest (7.71 $tha^{-1}$) was found in chilli + radish combination. Intercropping reduced 3 to 48 % chilli yield but total productivity as expressed by chilli equivalent yield increased by 80-135% over sole chilli due to the contribution of companion crops. The highest chilli equivalent yield (25.01 t $ha^{-1}$), gross return (1250500 Tk $ha^{-1}$), gross margin (1133500 Tk $ha^{-1}$) and marginal benefit cost ratio (8.56) were obtained from chilli + garlic combination. Considering the experimental findings, chilli + garlic might be suitable combination for higher productivity and economic return.

**Key words:** Intercropping, root crops, chilli, charlands, Mymensingh



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## Introduction

land, intercropping could be an option as it increases productivity of crops in per unit area and per unit time. Therefore, recently intercropping has gained momentum particularly in the densely populated countries which has limited per capita land for crop production. Intercropping is a crop management system involving the growing of two or more dissimilar crops in distinct row combinations simultaneously on the same land area. Intercropping involves crop intensification in respect to both time and space dimensions (Ahlawat and Sharma, 2002). Therefore, it is one of the techniques of vertical expansion of crop production that increase cropping intensity in developing countries like Bangladesh. It increases total productivity through efficient utilization of land, labour and growth resources such as increasing utilization of solar radiation and different inputs including fertilizer and water (Ahmed *et al*., 2006). Intercropping not only reduces the risk associated with input costs but also increases profit potential (Rathi and Verma, 1979). Moreover, it provides several major advantages namely; diversification reduces risk associated with crop failure, offers greater yield stability and utilizes the available growth resources more efficiently and sustainably (Hirota *et al*., 1995 and Islam *et al*., 2006).

Greater productivity in intercropping system is commonly achieved by minimizing inter-specific competition and maximizing complementary use of

growth resources (Islam, 2002). Inter-specific competition may be minimized through judicious choice of crops (Santalla *et. al*., 2001). Usually plants differing in growth duration, height, rooting systems and nutrient requirements are considered to growth together in intercropping systems (Reddy and Willey, 1981). Better intercrop production could be achieved with the choice of the appropriate crops (Santalla *et al*., 2001), population density and planting geometry of component crops (Myaka 1995).

In Bangladesh, there are about 0.82 million hectares of char land (Ahmed *et al.*, 1987). The major char inhabited districts of Bangladesh are Jamalpur, Sirajgonj, Noakhali, Bogra, Rangpur and Mymensingh. In Mymensingh district, 5 upazilas (Mymensingh sadar, Ishwargonj, Trishal, Gaffargaon and Gouripur) out of 12 upazilas are char inhabited area containing about 0.58million hacharland areas. DoriBhabkhali in Mymensingh Sadar upazila containing 240 hectare of total land of which about 80 hectare land is under char and around 9 hectare out of 80 hectare char land are under chilli cultivation. A large number of populations are living in these char areas and maintaining their livelihood through char based farming systems. Boro rice is mainly grown in the lowland areas of *chars* with indigenous irrigation facilities while other crops (chilli, onion, garlic, coriander, mustard, potato, jute, mungbean, blackgrametc.) are grown in the medium and highland areas of the *chars*.

Chilli is one of the major spices crop in Bangladesh cultivated in 2, 40,000 acres of land (both winter and summer) with a production of 1, 26, 000 metric ton (BBS, 2012). It is usually grown as sole and in some cases intercrop at farmer's field in various parts of Bangladesh including Mymensingh region. Chilli is generally grown with wide row spacing about 40-50 cm, which makes it suitable for intercropping. Intercropping of chilli with different root crops offers greater scope to utilize the land and other resources to the maximum extent. The review of research work done so far indicated that growth of chilli as intercrop is more beneficial than sole chilli in many situations (Aravazhi *et al*., 1997; Sadashiv, 2004). Most intercropping research has focused on field crops (Tsubo *et. al.*, 2005 and Ghosh *et. al*., 2006) as well as vegetables (Ahmed *et al.*, 2006). However, relatively few studies have been conducted on intercropping root crops with chilli. Therefore, the present study was undertaken to evaluate the performance of the intercropping system among the farmers and to find out a suitable root crop among radish, carrot, garlic and onion for using as intercrop with chilli for higher productivity and economic return.

## Materials and Methods

The experiment was conducted at the farmers' field of Dori Bhabkhali, Mymensingh during October 2014 to March 2015. The experimental soil was a sandy Brahmaputra alluvial soil belongs to AEZ 7 (Active Brahmaputra-Jamuna Floodplain).Five intercropping combinations such as sole chilli, chilli + radish, chilli + carrot, chilli + onion and chilli + garlic were investigated. The experiment was laid out in Randomized Complete Block Design with six dispersed replications. The unit plot size was 4 m x 2 m and spacing for chilli was 40 cm x 40 cm. Fertilizers were applied in each plot at the rate of 97-66-100-1 kg $ha^{-1}$ NPKS, respectively in the form of urea, triple super phosphate( TSP), muriate of potash (MOP), gypsum and boric acid as per recommendation of Mondal *et al*. ( 2014). Cowdung @ 10 t/ha was applied as a blanket dose during final land preparation. The full amount of cow dung, TSP, gypsum, boric acid and one third MOP were applied as basal at final land preparation. The rest amount of MOP and full dose of urea were applied in three equal splits at 25, 50 and 70 days after planting (DAP). Thirty days old seedlings of chilli (var. BARI morich 1) and onion (var. BARI Peaj1) were planted in the field on 13 November, 2014. Seeds of radish (var. BARI Mula 4), carrot (var. New kuroda) and cloves of garlic (var. BARI rasun 1) were sown on the same day. One row of radish, carrot, onion and garlic was planted/ sown in between two rows of chilli. Weeding, irrigation and crop protection measures were taken as and when necessary. Radish and carrot was harvested at 55and 90 days after sowing (DAS) while onion and garlic was harvested at 119 DAS, respectively. First harvest of green chilli was done at 109 days after planting (DAP) and

continued up to 138 DAP. Yield was calculated for green chili and intercrops in ton per hectare considering the whole plot as harvest area. Five plants of chili from each plot were selected randomly to collect data on yield components. Collected data were analyzed statistically with the help of MSTATC programme (Gomez and Gomez, 1984) and mean separation was done as per Least Significant Difference (LSD) test at 5% level of significance. Benefit cost analysis was performed considering the prevailing price of green chili, radish, carrot, onion and garlic at the harvesting period in the local market. Chilli equivalent yield (CEY) was also calculated following the formula of Prasad and Srivastava (1991).

## Results and discussion

***Yield and yield components of chilli:*** The growth and yield of chilli was found to be affected significantly by the intercrops (Table 1). All the growth and yield parameters in sole chilli showed better performance over different intercropping combination except plant height. The number of branches per plant showed significant differences due to the effect of treatments. The sole chilli produced the highest number of branches (12) while it was lowest in chilli + radish and chilli + carrot treatment (8) at final harvest stage. It might be due to the fact that sole chilli had minimum inter-specific competition for space and growth resources compared to intercropped chilli. The result is in agreement with the findings of Suresha *et al.* (2007). Significantly the highest number of fruits plant$^{-1}$ was observed in sole chilli (244) and lowest was in chilli + radish (213) combination. This was might be associated with the number of branches plant$^{-1}$. The maximum weight of fruits plant$^{-1}$ was obtained from sole chilli (340.71 g) whereas the lowest was also in chilli + radish (310.1 g) intercropping system. Yield of chili varied from 7.71 to 10.62 t ha$^{-1}$ due to influence exerted by different treatments. Sole chilli produced significantly the highest fruit yield of 10.62 t ha$^{-1}$ which was very close to chilli + garlic (10.31 t ha$^{-1}$) and chilli + onion (10.20 t ha$^{-1}$) combination. Better yield of chilli intercropped with garlic and onion compared to radish and carrot might be due to their small root and shoot system that poses advantageous for growth and development of chilli. The chilli yield was lowest (7.71 tha$^{-1}$) in the chilli + radish treatment might be due to the large canopy and root system which hampered the growth and yield of chilli. Similarly Varghese *et al.* (1979) reported the negative effects of intercropping on yield of cabbage. Quayyum and Maniruzzaman (1995), Islam *et al.* (2006) and Santalla *et al.* (2001) also reported that seed yield was higher in monoculture as compared to their corresponding intercropped yield.

Intercropping significantly reduced chilli yield by 3 to 48 % (Figure 1) might be due to inter-specific competition for space, solar radiation, nutrients and water. Chilli + radish intercropping system reduced 38% chilli yield followed by carrot (21%) while the minimum yield loss of chilli was found in chilli + onion (3%) followed by chilli + garlic (4%) combinations.

**Table 1**. Yield and yield contributing characters of chilli under different intercropping system

| Treatments | Plant height (cm) | Branches plant$^{-1}$ (no) | Chilli plant$^{-1}$ (no) | Chilli wt plant$^{-1}$ (g) | Green chilli yield (t ha$^{-1}$) |
|---|---|---|---|---|---|
| Chilli (sole) | 38.00 | 12 | 244 | 340.71 | 10.62 |
| Chilli + radish | 36.50 | 8 | 213 | 310.1 | 7.71 |
| Chilli + Carrot | 37.75 | 8 | 217 | 316.16 | 8.81 |
| Chilli + Onion | 38.25 | 9 | 231 | 320.13 | 10.2 |
| Chilli + Garlic | 39.50 | 10 | 229 | 323.4 | 10.31 |
| LSD (0.05) | NS | 0.933 | 3.22 | 3.77 | 1.03 |
| CV(%) | 4.70 | 6.55 | 8.37 | 9.77 | 9.59 |

NS= Not significant

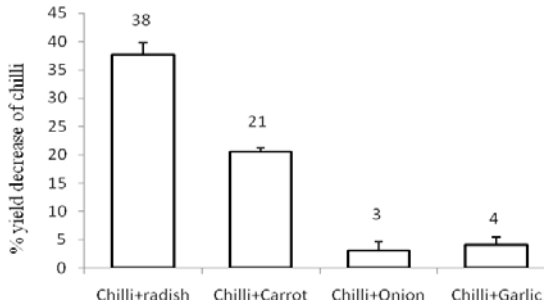


**Figure 1.** Percent yield decrease of intercropped chilli over sole chilli in different intercropping system.The error bars are the standard deviation of the means (n=4)

The yield loss due to intercropping also reported by Ahmed *et al*. (2013), Muoneke and Ndukwe (2008) and Manga *et al.* (2003).

***Yield of companion crop:*** The yield of radish, carrot, onion and garlic was recorded 46.68, 18.09, 7.11 and 4.2 t $ha^{-1}$, respectively in chilli + radish, chilli + carrot, chilli + onionand chilli + garlic combinations (Figure 2). Among the intercrops, radish yielded the highest followed by carrot might be due to their large sized roots as compared to onion and garlic.

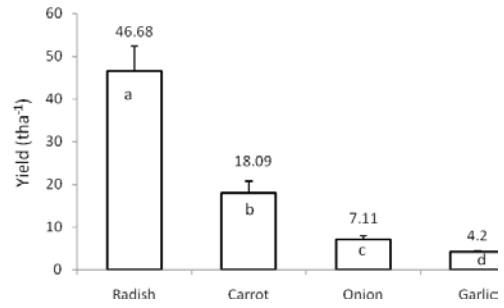


**Figure 2**. Yield of radish, carrot, onion and Garlic with chilli based intercropping systemThe error bars are the standard deviation of the means (n=4). Means with different letters are significantly different at $P<0.05$)

***Chilli equivalent yield*:** Total productivity was expressed in chilli equivalent yield (CEY). The chilli equivalent yield was influenced in response to different intercropping systems (Figure 2). All the intercrop combinations produced higher CEY over the sole chilli. The maximum chilli equivalent yield was obtained from chilli + garlic (25.01 t $ha^{-1}$) followed by chilli + radish (24.05 t $ha^{-1}$) and chilli + carrot (22.38 t $ha^{-1}$) combination. Intercropping increased total productivity by 80 -135% over sole chilli (Figure 2). Among the treatments, CEY in chilli + garlic combination was 135% higher over the sole chilli. Similar results were also reported by Suresha *et al.* (2007) in different chilli based intercropping systems.

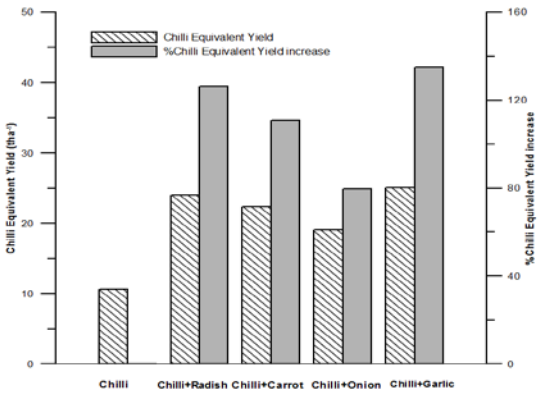


**Figure 3.** Chilli equivalent yield (CEY) and % CEY increase over sole chilli in different intercropping system

***Economic performance of different chilli based intercropping system*:** Considering the economics of intercropping, chilli + garlic combination was found to be the best with highest gross return (1250500 Tk. $ha^{-1}$), net return (1133500 Tk. $ha^{-1}$) and MBCR (8.56). Higher economic return was obtained in all intercropped treatments compare to sole chilli (Table 2). The varied returns obtained from different intercropping system were mainly due to different in market prices.

## Conclusion

Considering the experimental findings, it may be concluded that cultivation of garlic with chilli was found to be the best option for higher productivity and maximum economic return of the selected area. Intercroppingincreased total crop productivity as well as crop diversity. It is also found more profitable

than the sole cropping and risk of cultivation of one crop can be reduced by intercropping.

**Table 2.** Economics of different chilli based intercropping system

| Treatments | Gross return(Tkha$^{-1}$) | Cost of production (Tkha$^{-1}$) | Net return (Tkha$^{-1}$) | Marginal benefit cost ratio (MBCR) |
|---|---|---|---|---|
| Chilli (sole) | 212400 | 80000 | 132400 | - |
| Chilli + radish | 168324 | 85625 | 82699 | 0.62 |
| Chilli + Carrot | 335717 | 105000 | 230717 | 1.74 |
| Chilli + Onion | 477188 | 88600 | 388588 | 2.93 |
| Chilli + Garlic | 1250500 | 117000 | 1133500 | 8.56 |

Price of input and output (Tk kg$^{-1}$): Urea: 16, TSP: 23, MOP: 16, Gypsum: 10, Zinc sulphate: 180, Boric acid: 320, chilli seed: 600, radish seed: 250, carrot seed: 4000, onion seed: 900, garlic seed: 90
Selling price (Tk kg$^{-1}$): Chilli: 20, radish: 7, carrot: 15, onion: 25, garlic: 70

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